Landowners' management of riparian forest in far north Queensland, Australia: A social psychological perspective

Thesis submitted by

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DECLARATION ON ETHICS

The research presented and reported in this thesis was conducted within the guidelines for research ethics outlined in the National Statement on Ethical Conduct in Human Research (2007), the Australian Code for the Responsible Conduct of Research (2007), the James Cook University Statement and Guidelines on Research Practice (2001) and the Queensland Health Research Management Policy (revised 2010).

The research methodology presented in this dissertation received clearance from James Cook University's Ethics Committee (Approval Number: H3159) and Queensland Health's Cairns and Hinterland Health Service District Human Research Ethics Committee (Approval Number: HREC/08/QCH/5-542).

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ABSTRACT

The threat to north Queensland's waterways from terrestrial runoff pollutants has been recognised for some time (Brodie, 2002; Brodie, Lewis, Mitchell, Bainbridge, & Waterhouse, 2009; Russell & Hales, 1994; Russell, Hales, & Helmke, 1996; Webb & Erskine, 2003; Werren & Arthington, 2002). It poses a special danger to the survival of the Great Barrier Reef (Great Barrier Reef Marine Park Authority, 2001a). Increased nutrient and chemical loads are directly related to clearing of riparian vegetation in the adjacent catchment regions (Brodie et al., 2012; Fabricius, 2005). The present study is a social psychological exploration of the factors that influence landowners' management of these riparian forests. The theory of planned behaviour (TPB) (Ajzen, 1991) provided the theoretical, conceptual and analytical framework to investigate the impact of attitudes, subjective norms, perceived impediments, and underlying beliefs on the landowners' intentions and actual practices to manage their riparian areas.

The investigation was conducted in three parts. The first was an open-ended interview study with 11 retired farmers (Study 1) which supplied salient ideas and themes for the formulation of the TPB questionnaire and contained an intervention leaflet to test for a possible priming effect. Most interviewees had positive attitudes toward riparian forests, strong feelings of stewardship, believed the water in their creeks to be pristine, and that help from government agencies should be in the form of financial and technical support. Surprisingly, the majority did not believe that agricultural practices ever threatened the health of the Great Barrier Reef. A brochure with scientific facts about riparian forests presented during the interview as an intervention did not influence most interviewees' beliefs about riparian forest

management practices and they felt no need for this kind information. The results were published (Flick, Caltabiano, & Bentrupperbäumer, 2010).

The second part, postal Survey 1 consisted of an extensive questionnaire sent to 540 addresses of landowners with riparian forests (123 returns, 22.7% return rate). The respondents were sugarcane growers (55.3%), tropical fruit growers and cattle graziers (24.4%), and non-farmers (20.3%). Standard and hierarchical regression analyses were used in the investigation of interval data and logistic regression analyses for dichotomous data. The TPB was shown to be an effective model that predicted 52% of variance in intentions to engage in riparian forest management. While direct attitudes were the strongest variable with 28% unique contribution (*Beta* = .61), direct subjective norms were only significant for younger landowners and those that considered traditional knowledge most relevant. Direct perceived behaviour controls showed a small but significant contribution. The data are comparable to other TPB studies and meta-analyses (Ajzen, 1991; Armitage & Conner, 2001; Beedell & Rehman, 1999, 2000; Fielding, Terry, Masser, Bordia, & Hogg, 2005; Sutton, 1998). Furthermore, the intention construct predicted one behaviour indicator within the TPB model, namely, having newly planted trees on the streamside (24%). The amount explained increased when some external factors were included: the source of knowledge from own experience through trial and error (28.7 to 42.6%), workshop attendance (19.8 to 29.4%), and having learned from workshops (20.5 to 30.3%). The perceived behaviour control variable of needing technical help to bring riparian forest up to scratch was found to be the major factor in explaining the behaviour indicator of reporting a loss of

trees on the streamsides, bypassing intentions. It represented an insurmountable impediment to some landowners.

Belief-based attitudes explained 40.4% of the variance in intentions based on beliefs pertaining to the evaluation of riparian benefits and of understanding the environmental importance of riparian forests. Subjective norming beliefs explained 21.4% of variance in intentions based on normative beliefs in the approval by people whose opinion one respects. Perceived control beliefs explained 38.5% of variance based on being able to pay the financial costs and to afford to lose a 10m strip of cropland to a riparian forest.

Survey 1 also found that younger landowners were significantly more likely to have stronger intentions while being motivated by expectations and approval. However, landowners who managed land according to traditional practices handed down had weaker intentions (β = -.16, p = .02) and showed significant norming behaviour. Whatever they and respected others practiced was adequate for them implying that other more reliable sources of knowledge were not considered (Flick et al., 2010; Kraack, 2000). Another finding supports this: almost twice as many attendees of riparian workshops reported to have learned nothing or very little compared to land management workshop attendees. This failure may reflect entrenched beliefs and resistance to new and possibly contradictory information and was also found by Curtis, Byron, and MacKay (2005), Dutcher, Finley, Luloff, and Johnson (2004) and others.

The third part of the research study was the postal Survey 2 sent to 465 addresses. It yielded 75 returns (16.1% return rate). The matched cases of this survey

with Survey 1 were too few to find a priming effect. However, qualitative data from the open-ended questionnaire revealed that the majority of respondents agreed with the scientific facts and the aesthetic and ecological values of the riparian forests and perceived considerably fewer impediments to their riparian management.

The research study identified variables that significantly impact landowners' intentions and practices of riparian management. Changes to these variables especially to the beliefs of attitudes, subjective norming and behaviour controls should flow on to generate changes in intention and behaviours. Having knowledge of these beliefs represents a tool for managers and educators when formulating new educational information to engage landowners' cooperation in establishing and managing riparian forests.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

CHAPTER 1.

INTRODUCTION

This thesis reports on a research study into social psychological aspects of land management by landowners of the diminishing and disappearing riparian forests in the lowlands of far north Queensland, Australia. The research set out to explore social psychological factors that influence landowners of riparian (streamside) forests in the way they use and manage this landscape, and which could lead to intentions to practice appropriate riparian forest management, as well as predict the actual practices. The research process was underpinned by a social psychological model of behaviour prediction, the theory of planned behaviour (TPB) Ajzen (1991).

The basis for this study was the global importance of the area of study which comprises the lowland catchment of the Great Barrier Reef (GBR) in far north Queensland, Australia, and the fact that current riparian and land management practices have been found to represent a serious threat to the health of that marine ecosystem (Australian Productivity Commission, 2003; Brodie, 2002; Brodie et al., 2012; Brodie & Mitchell, 2005; Devlin & Brodie, 2005; Gilbert & Brodie, 2001; Queensland Department of Local Government and Planning, 2008; Rasiah et al., 2003; Werren & Arthington, 2002).

1.1 The Global Significance of the Area

Far North Queensland in Australia is an area of global biological significance. It contains two World Heritage areas that were listed for their natural attributes alone and fulfilled all four World Heritage criteria. The Great Barrier Reef (GBR) is the largest

reef system in the world (Haynes, 2001). It was declared World Heritage in 1981 and the Wet Tropics in 1988 (World Heritage List, 2009).

1.2 Geographical Description of the study area

This study was undertaken in the tropical north-east of the state of Queensland, Australia (Far North Queensland, FNQ) (see Figure 1.1), in the lowland floodplain area adjacent to the Great Barrier Reef Marine Park (GBRMP). In some areas it is surrounded by a complex mosaic of forests of the Wet Tropics World Heritage Area (WTWHA). The main rivers in this part of the catchment area are the Mossman, Barron, Mulgrave, Russell, North Johnstone and South Johnstone Rivers. These and their tributaries flow directly into the GBR Lagoon. The rivers discharge most of their freshwater across the landscape and into the GBR lagoon during heavy rainfall that cause floods 2 to 3 times per year in the wet season between November to April (Kroon et al., 2012). The Great Barrier Reef is dependent on the water in these streams and the subsequent discharge being pollutant free (Brodie, Lewis, Bainbridge, et al., 2009; Great Barrier Reef Marine Park Authority, 2001a).

The study area is situated between the Mossman River to the north and the South Johnstone River to the south, covering approximately 150kms of coastline to the east. In the west the area is bordered by the Atherton Tableland escarpment leaving a strip of lowland which ranges from 1 to 20kms in width. These lowlands of the GBR catchment are comprised almost entirely of private land that is largely farmed and urbanised (Fenton, 2004; Gilbert & Brodie, 2001).

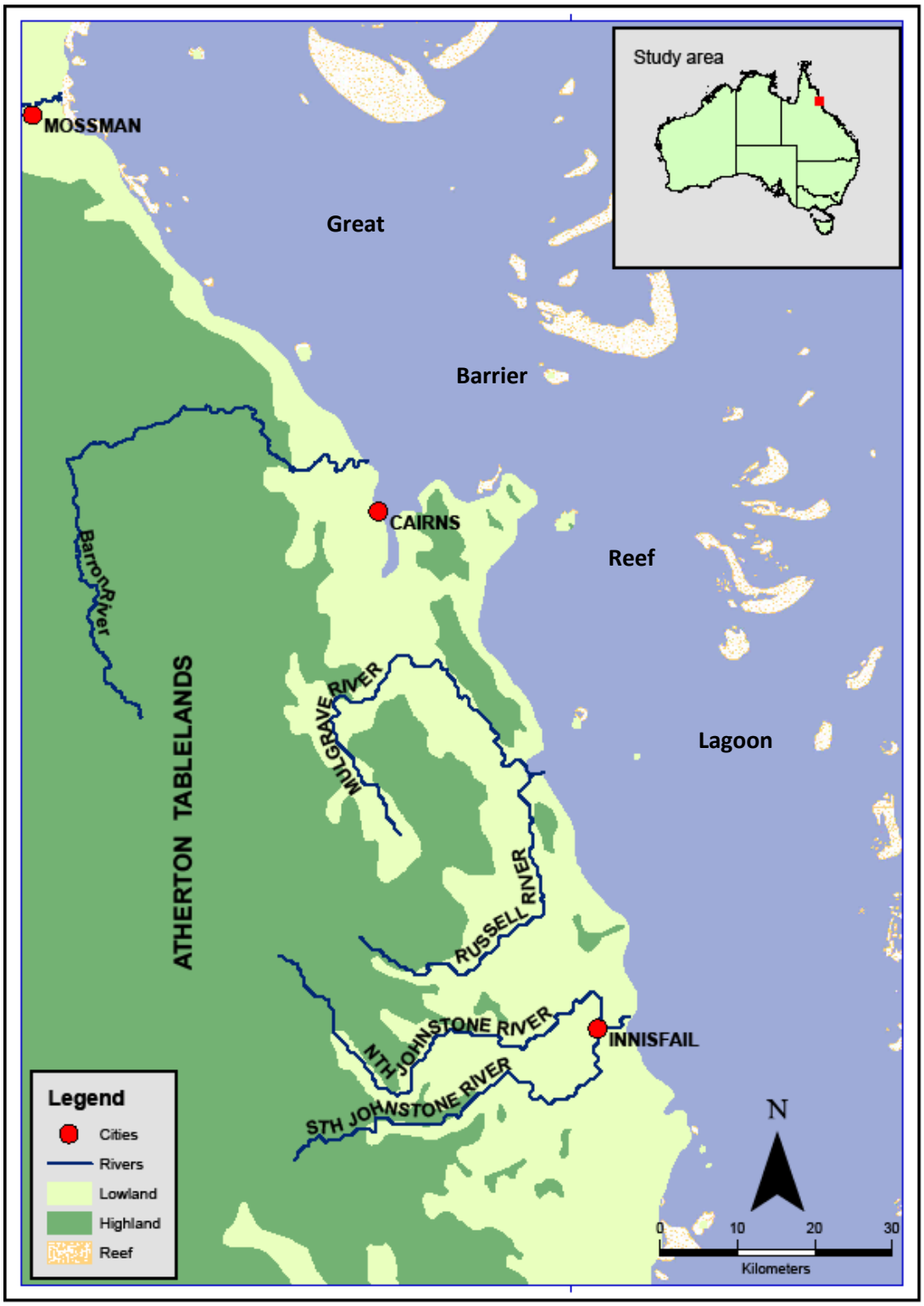


Figure 1.1 Map of the study area.

The climate in this region is characterised by mild and relatively dry winters from May to October, and hot humid summers from November to April. The natural vegetation varies from complex tropical rainforest and wet melaleuca forests (Goosem & Tucker, 1995), to vegetation specific to riparian (streamside) forests (GHD, 2008).

1.3 Riparian forests and water quality

Riparian forests, that is those areas adjacent to and including the waterways and wetlands, in their most pristine state are comprised of native trees, shrubs, grass and vines. In some areas these forests contain a mix of both native and exotic species. These areas need to be intact to adequately perform their biophysical functions: bank stabilisation, retention of sediment and agricultural chemicals, uptake of excess nutrients, minimisation of water energy during floods, and habitat for land and water fauna (Bjornsson et al., 2002; Brodie, 2002; FNQ NRM Ltd & Rainforest CRC, 2004; Land and Water Australia, 2004; Lovett & Price, 2007; McKergow, Prosser, Grayson, & Heiner, 2004; Suszkiw, Lee, Lyons-Johnson, & Adams, 1998; Webb & Erskine, 2003; Werren & Arthington, 2002).They provide shade, shelter and food for native fauna and moderate the water temperature to allow the aquatic ecosystem to flourish (Hobbs, Hussey, & Saunders, 1990). Rocks and debris from the forest located in the waterways are beneficial as they slow down the flow of water during heavy rainfall in the tropical wet summer (Webb & Erskine, 2003).

Vegetation along these rivers and creeks therefore plays an essential role in the preservation of water quality (Brodie, Lewis, Mitchell, et al., 2009; Webb & Erskine, 2003; Werren, Hunt, & Brodie, 2002). The retention as well as removal of agricultural and other chemicals from surface run-off is part of the biophysical functions performed by intact riparian vegetation (Bjornsson et al., 2002; Klapproth & Johnson, 1999b;

Siwan Lovett & Phil Price, 2007; McKergow et al., 2004; Werren & Arthington, 2002). This important function has been severely compromised by the removal of much of the native vegetation and by farming methods that include extensive use of fertilisers (Australian Productivity Commission, 2003; Brodie, 2002; Brodie & Mitchell, 2005; Devlin & Brodie, 2005; Gilbert & Brodie, 2001; Queensland Department of Local Government and Planning, 2008; Rasiah et al., 2003; Werren & Arthington, 2002).

High loads of nitrogen and phosphorous used in modern farming practices have been found in the river plumes (Devlin & Brodie, 2005; Devlin, Brodie, Lewis, & Bainbridge, 2008; Rasiah et al., 2003; Werren et al., 2002), and are considered a great threat to the GBR. The reef is not able to tolerate large amounts of nutrients and silt, and polluted water in the catchment has become a major concern to the researchers and managers of the Great Barrier Reef Marine Park (Armour, Cogle, Rasiah, & Russell, 2004; Great Barrier Reef Marine Park Authority, 2001b). Intact and functioning streamside forests are therefore necessary and have been found to be a key factor in the preservation of the GBR (Brodie, Lewis, Bainbridge, et al., 2009; Brodie, Lewis, Mitchell, et al., 2009; Webb & Erskine, 2003; Werren & Arthington, 2002).

1.4 The research problem

Since European settlement of far north Queensland around 1870 (Bolton, 1963; Dixon, 1991), 40-80% of the native vegetation of this lowland region has been cleared, and the streamside forests have been diminished or destroyed (Australian Productivity Commission, 2003). Thus the important biophysical functions of the once intact riparian forests are severely compromised by this removal together with the extensive use of fertilisers in farming activities (Australian Productivity Commission, 2003; Brodie, 2002; Brodie et al., 2001; Brodie & Mitchell, 2005; Devlin & Brodie, 2005;

Gilbert & Brodie, 2001; Queensland Department of Local Government and Planning, 2008; Rasiah et al., 2003; Werren & Arthington, 2002)

Today the catchment area is extensively cultivated mainly with sugarcane and tropical fruits, which has contributed significantly to reduce the forest cover (Armour et al., 2004; Gilbert & Brodie, 2001). These changes in the landscape and land have a cumulative impact on water quality in the creeks and rivers that flow into the Great Barrier Reef Lagoon (Brodie, 2002; Brodie & Mitchell, 2005; Emtage & Reghenzani, 2008; Kroon et al., 2012; Queensland Department of the Premier and Cabinet, 2009; Rasiah et al., 2003; Werren & Arthington, 2002). Woolridge, Brodie, and Furnas (2006) estimate that since European settlement the nutrient load has increased in the region by a factor in the region of 10 to 20 times, pre-European settlement. The agricultural chemical run-off which is largely responsible for the increased fertilizer and nutrients load of nitrogen and phosphorous in the Great Barrier Reef lagoon (Bell, 1992; Bell, Lapointe, & Elmetri, 2007; Furnas, Mitchell, Skuza, & Brodie, 2005; Schaffelke, Carleton, Skuza, Zagorskis, & Furnas, 2012) leads to eutrophication and causes phytoplankton bloom (Furnas et al., 2005). Thus, the impact of European agricultural practices has been shown to be contributing significantly to the deterioration of the health of the Great Barrier Reef (Bjornsson et al., 2002; Brodie, 2002; Great Barrier Reef Marine Park Authority, 2001b; Rasiah et al., 2003; Schaffelke et al., 2012; Woolridge et al., 2006), and this may well be linked to landowners' ignorance about or disregards for the ecological importance of maintaining intact riparian zones.

Contrary to the physical evidence, studies have repeatedly found that landowners believe they are responsible stewards of their land including the riparian forests (Barr & Carey, 2000; Corbett, 2002; Dutcher, 2000; Klapproth & Johnson,

2001; Kraack, 2000; Thompson & Pepperdine, 2003; Vanclay, 1992b; Wilson, Jansen, Curtis, & Robertson, 2003). General education background and understanding of scientific information have been identified as unreliable factors in predicting positive environmental attitudes or environmentally sound agricultural land care practices (Ingram, 2008; Klapproth & Johnson, 2001). But economic concerns, insistence on property "rights", and grievances that have to do with feelings of not being listened to can become the main force in cognitive decision making in regard to land preservation and restoration (Fenton, 2004; Kraack, 2000; McKenzie-Mohr, 2000; Thompson & Pepperdine, 2003). The landowners, especially the farmers' experiences and local knowledge were not perceived to be given due consideration in the preparation of education and information material for the public (Fenton, 2004; McKenzie-Mohr, 2000). The stakeholders expressed strong skepticism and disbelief in scientists' objectivity and in the applicability of scientific findings.

The strength and saliency of accessible memories together with embedded core beliefs has been found to bias the individual's attitudes (Eagley & Chaiken, 1993; Teel, Bright, Manfredo, & Brooks, 2006). Sometimes new information will override these influences as found in a study in England about sustainable soil management, where farmers' knowledge of their own situation needed to be combined with enough scientific knowledge to lead to adoption of beneficial practices (Ingram, 2008).

1.5 The importance social psychological research

The problem of anthropogenic degradation of coral reefs is by no means restricted to the Australian coast of the Coral Sea. It is found globally, and is acknowledged as one of the major stresses in addition to natural factors such as earthquakes and global warming (Wilkinson & Salvat, 2012). It has been compared to the situation of the

"tragedy of the commons" (Harding, 1968), where social responsibility is diminished and the common resource is degraded despite awareness and understanding that the solution to the problem is to prevent overgrazing or overuse of the commons (Wilkinson & Salvat, 2012).

The story of the commons illustrates that even when the solution of an environmental problem is obvious it will not result in the adoption of beneficial land management practices to rectify the problem. Thus, the simple presentation of scientific facts that show the importance and necessity to preserve riparian forest will not change many landowners' riparian management practices. However, designing environmental programs for this purpose requires insight into the landowners' motives, values or attitudes involved in their decision-making process. To find this information is not the domain of biological scientists, or economists but of social psychologists (McKenzie-Mohr, 2000). McKenzie-Mohr, 2000), Burton (2004), and Fenton (2004) were some of the social psychologists calling attention to this situation, and Curtis, Byron and MacKay (2005) wrote:

> "…most major Australian government NRM research and development agencies have established social research programs. At the same time, there appears to be little evidence that watershed plans in Australia are being underpinned by social research, or that substantial progress has been made in methodological approaches to integrating social, economic, and biophysical data to underpin watershed management." (p.550).

As recently as 2012, Wilkinson and Salvat repeated the call for input from social science in their article about coastal degradation in the tropics, stating: "We have written this paper from the perspective of marine ecologists …but as ecologists, we

consider that we are unable to propose many solutions. Such solutions will require the input of, and cooperation from, people covering many different areas, such as social, economic, legal and political disciplines" (p. 1096).

It seems obvious that contrary to these recommendations most studies involving riparian land owners in Australia that included social psychological components, such as attitudes, have been undertaken by ecologists and economists (Bohnet et al., 2011, Bjornsson et al., 2002; Cleary & Amprimo, 1995; Curtis et al., 2005; Curtis & Robertson, 2003; Good & Burston, 1997; Greiner et al., 2009; Terrill, 1999). In fact, investigating methods for behavioural approaches in agricultural studies have shown that "the overwhelming emphasis on *attitude* as a main motivational determinant of behaviour and the almost total ignorance of social and cultural influence are distinct weaknesses and a common problem with behavioural studies whether the studies originate from geographical, economic, or sociological literature" (Burton, 2004, p.361). A good example is a report prepared for the sugar industry in Far North Queensland. It says "clearly one of the most frequently offered impediments [to better management]… was associated with landholder attitudes" (Bjornsson et al., 2002, p. 24). The term "attitude" seems to refer to landowners' negative associations with streamside forest. However, in social psychology *attitude* is a concept representing the product of influences of cognitive stimuli about the object or action according to salient memories, thoughts, and deep-seated beliefs, as well as external stimuli of social and cultural factors (Eagley & Chaiken, 1993). But more importantly, a measure of attitudes as the determinant of behaviour is considered unreliable in social psychology which cannot disclose a relationship with behaviour (Eagley & Chaiken, 1993).

The literature contains little in the way of systematic quantitative investigations of riparian landowners in Australia. The exceptions are those by Fielding (Fielding et al., 2005; Fielding, Terry, Masser, & Hogg, 2008) of cattle farmers in the Fitzroy Basin in south west Queensland. They employed a social psychological model of the theory of planned behaviour (TPB) (Ajzen, 1991) to assess their intentions and behaviour of adopting environmentally sustainable riparian zone management with insightful results.

The theory of planned behaviour (TPB) (Ajzen, 1991) is a well-established social psychological model in attitude-behaviour research. The theory has been successful in predicting behaviour in a variety of contexts. Meta-analyses found the TPB to be efficacious in predicting intentions and behaviour particularly in health behaviour. Sutton (1998) analyzed nine studies of meta-analyses, and Armitage and Connor (2001) analyzed 185 independent studies. The TPB is a quantitative model that considers the influences of beliefs that underlie attitudes, normative influences (desire to fulfil expectations,) and perception of impediments preventing intentions to engage in a specific action, and therefore the actual behaviour.

This thesis describes research that employed the systematic quantitative approach of the TPB, investigating and assessing the contribution of all TPB variables and external factors to actual and intended riparian management behaviour by land owners of riparian forests in the Great Barrier Reef catchment area. It was a study to provide insight into landowners' beliefs, attitudes, motivations, and perception of impediments about riparian forest maintenance and preservation that would find practical application in the design of environmental programs on riparian forest.

1.6 The study design

The theory of planned behaviour (TPB) required preliminary research into salient ideas and themes specific to the attitudinal object, the riparian forests. This study commenced in July 2005 using open-ended semi-structured interviews with 11 retired farmers with riparian forests. Study 1 yielded information about attitudinal beliefs and outcome evaluations in regards to riparian forest management, about the farmers' norming behaviour, and their perceptions of impediments in regards to riparian management as well as perceived needs to put controls into place (Flick et al., 2010). These insights informed the construction of relevant and specific items of the TPB questionnaire for Survey 1.

In October 2006 Survey 1 was mailed to landowners with riparian areas. It contained a 63-item TPB questionnaire, and 29 additional questions, as well as a 1-page survey of general environmental worldview, the New Ecological Paradigm (NEP) (Dunlap, Van Liere, Mertig, & Jones, 2000). 123 landowners responded. In November 2006 the second survey, Survey 2 was mailed to the same landowners. This consisted of a small booklet with five information seeking questions about the importance of riparian forests for clean water in the streams accompanied by full page photos, followed by 11 questions identical to the TPB questionnaire in Survey 1. 76 landowners responded of which 24 remembered their personal secret code that allowed comparison of the responses to the questions between the surveys. Survey 2 was conceived as a test for cognitive involvement, that is, if the respondents had thought about the subject of riparian forest since they engaged with Survey 1, or had been primed (priming effect) by the five photo-information items in the first part of the Survey 2 booklet. This would

have manifested itself by significant changes of responses to the 11 items on the following pages of the survey booklet.

1.7 The research questions

Since Study 1 represented an elicitation study for concepts in the theory of planned behaviour which was the framework for this study, the research questions addressed the TPB constructs of attitudes towards riparian forests, subjective norming and perceived behaviour control and the underlying beliefs of these concepts. Furthermore information from available literature in the fields of social psychology and riparian ecology were also considered in the development of the research question, as was information from discussions with three contacts who had worked with riparian landowners and resource managers (Garry Werren, Vito Musomecci, Bill Sokolich).

Thus, the research questions for the interview study were formulated as follows.

Concerning attitudes:

1. How were retired farmers using the riparian areas, and did they like them?
2. Did the interviewees feel as responsible stewards of the land including riparian areas?
3. Do they accept scientific information about land management as pertaining to their land?
4. How much do interviewees know about the biological and physical functions of riparian forests?
5. Do interviewees know that the health and well-being of the Great Barrier Reef is dependent on clean water from their streams?

6. Do interviewees believe in the benefits of riparian forest?

Concerning subjective norms:

7. Do interviewees feel as part of an agricultural community?

Concerning perceived behaviour controls:

8. What are the opinions on rules and regulations that are in place in regards to riparian forests?

Survey 1 contained the TPB questionnaire and items of external variables such as demographics, knowledge questions and general environmental attitudes (NEP score). The research questions will be as follows:

1. Is the TPB an efficacious model for predicting intentions to engage in and to practice good riparian forest management?
2. Are direct attitudes, subjective norms and perceived behaviour controls predictive of intentions and of behaviour indicators (such as newly planted trees on the banks, turning the tractor around on the streamsides, etc.)?
3. Are the beliefs in the model underpinning the direct TPB measures of attitudes, subjective norming and perceived behaviour control?
4. What are the contributions of beliefs in the prediction of intentions to engage in riparian forest maintenance, and of behaviour indicators?
5. Are there external variables that offer additional explanation of variance in intentions and variation in behaviour in the model?
6. Is the New Ecological Paradigm (NEP) influencing the variables in the model?

Survey 2 addressed the qualitative part of the survey consisting of requests for short answers about the biophysical role of riparian forests accompanied by photos. Five items were investigated to answer the following four questions:

1. Do respondents accept the important biophysical functions of riparian forests?
2. Do respondents describe riparian management practices that are environmentally acceptable?
3. Do respondents appreciate riparian forests for places of recreation and relaxation?
4. Do the responses in the questionnaire differ from those in Survey 1 indicating a priming effect due to the visual and cognitive engagement with the subject of riparian forests in the first part of the booklet?

1.8 The Aims

The aims of this investigation using social psychological principles for the study of human behaviour is to give some insight into what beliefs, attitudes, social norming behaviour and perception of impediments as well as external influences are associated with landowners' riparian management activities. Since there has been no reported study in the wet tropics that targets the population of landowners as the most important agents in the protection of the water quality of the rivers and the Great Barrier Reef Lagoon the findings will be of interest to policy makers and designers of environmental programs concerning riparian management.

Another obvious benefit flowing from this research will be the findings of the effectiveness of environmental education measures undertaken by government agencies through public meetings and workshops about land management and riparian forest.

The landowners' uptake and application of information will be evident to some extent from their responses and give insight into the beliefs that underpin their attitudes, norming behaviour and perceptions of impediments. These variables are the key factors in the decision making process, and represent the place where intervention has to be undertaken to lead to long lasting outcomes, in this case the uptake of appropriate riparian management practices (Ajzen, 2001; Ajzen & Fishbein, 2005; Bamberg, 2003; Hardeman et al., 2002).

1.9 The structure of the thesis

The thesis consists of 11 chapters, as follows:

- Chapter 1 is the introduction.
- Chapter 2 is the literature review.
- Chapter 3 outlines the background and history of the framework of the attitude-behaviour model underlying this study, the theory of planned behaviour. The components of TPB model are described in detail.
- Chapter 4 lays out the research study design and method of Study 1, Survey 1 and Survey 2. It includes the interpretation of Study 1.
- Chapter 5 covers the descriptive statistics of Survey 1 and contains analyses of the demographic, social and situational items.
- Chapter 6 reports on the selection of the TPB constructs and variables from Survey 1.
- Chapter 7 reports the results of statistical analyses of the TPB variables predicting intentions in the Survey 1.

- Chapter 8 reports the results of statistical analyses of the TPB variables predicting behaviour indicators in Survey 1.
- Chapter 9 reports the results of statistical analyses of the impact of variables in Survey 1 that are external to the TPB model.
- Chapter 10 reports analysis of Survey 2 and comparison of the results with Survey 1.
- Chapter 11 reports the overall conclusions, implications and recommendations, and limitations of the present study.

CHAPTER 2.

LITERATURE REVIEW

2.1 Introduction

Riparian zones encompass the biophysical environment of waterways, shorelines, wetlands and the associated vegetation on the banks. In this study these landscapes are designated the term riparian forests, and not only represent the transition zone between terrestrial landscapes and aquatic environments but includes both. As important functional ecosystems riparian forests facilitate maintenance of water quality in streams, control of erosion, provision of habitat for a diversity of plant and animal species, and act as habitat corridor that link fragments of native vegetation in developed or altered landscapes (Brodie & Mitchell, 2006; Werren, 2002; McKergow et al., 2004; Lovett & Price, 2007; Hobbs et al., 1990).

While riparian forests can represent a place of peace and tranquility, and provide areas for recreation such as swimming and fishing, stream sides have also been the preferred location of human settlement, part of which has included agricultural development. Since European settlement and the introduction of various mechanised and fertilizer-dependent agricultural practices these activities have impacted on the status of riparian forests in Australia (Armitage & Conner, 2001; Brodie, 2002; Brodie & Mitchell, 2005; Fabricius, 2005). Continued loss and degradation of riparian vegetation and subsequent decline in stream water quality impact the ecological well-being of the river systems themselves as well as the Great Barrier Reef in far north Queensland (Brodie et al., 2001; Brodie et al., 2012; Brodie, Lewis, Bainbridge, et al., 2009; Fabricius, 2005).

A United Nations Environmental Program assessment report outlines water quality concerns and shortages that are predicted to beset the world with human population increases in the future (Frick, Kaiser, & Wilson, 2004). It reports that the main impact on water availability and quality will come from human activity, through unregulated land-based activities such as building along stream sides, inappropriate agricultural practices, and deforestation (Manstead, 2000).

In Australia, landowners of riparian regions, especially farmers, are under pressure to consider how their land use impacts on riparian forests and the waterways, and to adopt appropriate farming practices that assure the survival and in many cases rehabilitation of these environmentally significant areas (Brodie & Mitchell, 2006; Brodie, Wolanski, Lewis, & Bainbridge, 2012; Fenton, 2004).

This chapter will describe in more detail the composition and biophysical functions, thereby establishing the environmental importance of riparian forests, the need for their continued existence, preservation and rehabilitation. An overview of the literature on landowner's relationship to riparian forests in Australia and other countries will be provided. The focus will be on the conflict arising from recommendations regarding the environmentally appropriate use of these areas. Basic questions of who owns riparian forests, who is responsible for them, and who benefits from the maintenance of the intact bio-functioning capacity of these ecosystems will also be considered.

Most information in this chapter will concentrate on riparian forests of the lowland catchment of the Great Barrier Reef in far north Queensland, Australia. Other information is drawn from national and international sources.

2.2 The Riparian forest

2.2.1 Composition and Function

Riparian regions are composed of common and site-specific plant communities that line water courses, the body of water, and the flora and fauna within the watercourse and its banks (Klapproth & Johnson, 2001; Werren, Hunt & A. Brodie, 2002; Greening Australia website, 2012; Lovett & Price, 2007; WetlandCare Australia, 2008). In the terrestrial zone streamside vegetation typically consists of a variety of vegetative structures such as trees and associated epiphytes, bushes, grasses, ferns and different ground cover species. In the aquatic zone a variety of water tolerant and hydrophilic plants can be found (see list in GHD, 2008).

The only intercept between the terrestrial and aquatic nutrient flow is the riparian forest. This vegetative buffer reduces available fertiliser load which can originate in nearby agricultural lands. It does this by holding it back long enough for soil organisms to act on and thereby reduce its pollution potential (Brodie, Wolanski, Lewis & Bainbridge, 2012; Klapproth, 1999b; Rasiah et al. 2003). The forests' ability to filter out naturally occurring silt and sediment loads especially during floods, and to retain as well as remove agricultural and other chemicals from contaminated surface run-off is also well established (Bjornsson et al., 2002; Klapproth & Johnson, 1999b; Siwan Lovett & Phil Price, 2007; McKerkow, Prosser, Grayson, & Heiner, 2004; Rasiah et al., 2003; Werren & Arthington, 2002). Therefore the role of plants in this area is in maintaining water quality by intercepting pollution in the form of excess nutrients, chemicals and sediment from reaching the water courses, and in the case of the present study area, from reaching the Great Barrier Reef lagoon (Brodie, 2002; Brodie, Lewis, Mitchell, et al., 2009; Fabricius, 2005). In addition, intact gravel beds in

waterways filter seepage to the groundwater and underground streams (Klapproth, 1999c; Johnson et al., 1999).

The biophysical function of riparian forests also includes the stabilization of streamside banks by the roots of trees and bushes, and natural debris, gravel and rocks (Lovett & Price 2007). The protective role of riparian forests includes providing shade and shelter for native fauna, and moderating the water temperature allowing aquatic ecosystems to flourish (FNQ NRM Ltd & Rainforest CRC, 2004; Herron & Hairsine, 1998; Hobbs et al., 1990). Natural woody debris in waterways is beneficial, slowing down water flow during heavy rainfall events in the tropical wet summer, and providing shelter for fish, crustacean and other aquatic animals (Webb & Erskine, 2003). Interference in the form of clearing or "cleaning" of riparian forests is detrimental to its function (Brodie, 2002; Klapproth & Johnson, 1999d; Werren & Arthington, 2002).

A further important function of riparian forest is in intensively cleared areas where the vegetation strips become the only and therefore essential habitat corridors for wildlife. These provide safe passage for native animals between feeding grounds and connect breeding populations (Hobbs et al, 1990, Lovett & Price 2007, Lawson et al. 2007).

2.2.2 Status of riparian forest in far north Queensland

Riparian forests in far north Queensland have been compromised by the removal of 40 – 80% of native streamside vegetation associated with European settlement and farming activities (Australian Productivity Commission, 2003; Brodie, 2002; Brodie & Mitchell, 2005; Devlin & Brodie, 2005; Gilbert & Brodie, 2001; Queensland Department of Local Government and Planning, 2008; Rasiah et al., 2003; Werren &

Arthington, 2002; Woolridge et al., 2006). While pollution from publicly-owned spaces such as urban streets and parks, and from commercial factories and hotels, as well as from residential developments in the form of drainage of household poisons, oils and pesticides are large contributing factors to the degradation of riparian zones, farming activities still represent the largest non-point sources of stream pollution in the study area (Armour et al., 2004; Brodie & Mitchell, 2005 and 2006).

Brodie (2002) reports that agricultural land use is considered to be the greater contributor to the sediment, nutrients and pesticides in the runoff than what can be assigned to industrial and urban development. Whoever is contributing to the problem, the continuance of the riparian forests is in jeopardy due to human activities such as extensive clearing of plants and debris, cultivation of the riparian land, and the introduction of non-native plant species (Johnson, Ebert, & Murray, 1999).

2.2.3 The mainland water catchment and the Great Barrier Reef

Coral reefs worldwide, particularly those adjacent to mainland regions containing human settlements and agriculture, are under threat from terrestrial run-off and agricultural chemical pollution (Wilkinson & Salvat, 2012). The Australian Great Barrier Reef is particularly vulnerable due to the proximity of the reef to the mainland of from 15km to 150km (Great Barrier Reef Marine Park Authority, 2012) and the linear spread of the marine ecosystem of 2000km of coastline (Brodie et al., 2001). The extensive nature of agricultural activity together with urban use along the coastal fringes is also responsible for removal of a large amount of fresh water wetlands (Brodie, 2002; Brodie & Mitchell, 2005; Fabricius, 2005; Risk, 1999; Wilkinson & Salvat, 2012; Woolridge et al., 2006).

Additionally, the GBR catchment in the far North Queensland region is extensive with mountain regions in close proximity to the narrow coastal lowlands. This landscape topography includes substantial altitude change within short distances leading to very fast flowing river systems. Other factors influencing volume and speed of terrestrial run-off include climatic factors such as cyclones and regular floods (Brodie, 2002; Brodie et al., 2001; Devlin et al., 2008); Klapproth & Johnson, 2001; Queensland Department of the Premier and Cabinet, 2008).

Concentrations of chemical pollutants from agricultural, industrial and urban land sources have vastly increased in the last 50 years (Brodie, 2002; Brodie et al., 2001; Brodie & Mitchell, 2005), and in many places the breaking down of the stream structure has caused erosion of the banks (Brodie et al., 2001; Kapitzke et al., 1998). The concurrent loss or reduction of riparian buffer zones has weakened the efficiency of the system that is designed to maintain good water quality (Haynes, 2001; Willams & Cary, 2002; Woolridge et al., 2006). Agricultural land use is not sufficiently supplemented by proper riparian management practices to effectively counter the negative impact of water pollution from agricultural chemicals. The extent of the consequences of inappropriate land management of crop land and riparian forest in the catchment of the GBR reaches far beyond the borders of the cultivated fields of the land (Great Barrier Reef Marine Park Authority, 2001b).

Because riparian zones connect terrestrial and aquatic systems, their presence, extent and condition are powerful indicators of water quality (Rapport et al., 1998). Their intact state and functioning are the key factors in the preservation of the GBR (Brodie, Lewis, Mitchell, et al., 2009; Webb & Erskine, 2003; Werren et al., 2002). The inappropriate riparian management practices in the GBR catchment have resulted in

increased nutrient and chemical stress loads which have been shown to be directly related to the clearing of the vegetation (Fabricius, 2005).

2.2.4 Agricultural practices and the riparian forest

It is estimated that 40-60% of lowland freshwater wetlands of the floodplains of the Mulgrave, Russell, Johnstone, Tully and Murray Rivers, which includes riparian forest have been cleared for agricultural purposes, mainly sugarcane (Brodie, 2002; Brodie & Mitchell, 2005; Brodie & Mitchell, 2006; Russell & Hales, 1994; Russell et al., 1996).

The continued tilling of the soil and the repeated application of fertilisers throughout the growing season of most crops is considered necessary in modern economically sustainable agriculture. Plants benefit from a ready supply of nitrogen, phosphorous and other minerals contained in fertilisers and will produce optimal crops when all nutrient requirements are met during the growing cycle. But most of the artificial nitrogen in fertilisers is highly bio-available (Brodie, 2002; Brodie & Mitchell, 2005; Harris, 2001; Lewis et al., 2008), roots only take up what the plants require for growth at the time, the rest being left in the soil where only a fraction of it will be fixed. A study on nitrate retention in the soil conducted in the Johnstone River Catchment established that substantial quantities of nitrate are not absorbed in the root-zone of sugar cane cultivation (one of the main agricultural crops) (Rasiah et al., 2003), and these enter the water ways and end up in the GBR lagoon. From there the nutrient load will reach the Reef (Fabricius, 2005; Brodie, Wolanski et al., 2012; Devlin et al., 2008).

The amount of agricultural fertiliser and chemicals used by growers has been reported to have been reduced but is still too high (Brodie, 2002; Masters, Rohde,

Gurner, & Reid, in press; Queensland & Australia, 2003). Despite some reduction in chemical loads due to recommendations by fertilizer companies and the Cooperative Research Centre for Sustainable Sugar Production (Bjornsson et al., 2002) the water quality has not improved (Brodie, E.C. Wolanski, et al., 2012; Queensland Department of the Premier and Cabinet, 2009; Queensland. Department of the Premier and Cabinet, 2008). This is due to continuing excessive terrestrial pollutant runoff exacerbated by further loss of riparian forest.

There is a need to establish if the agricultural chemicals can be further reduced without compromising crop yields, and also to what extent land-users follow best recommendations for fertiliser and pesticide use (WetlandCare Australia, 2008). Nevertheless, the destruction or neglect of riparian forests will still be the main obstacle in obtaining pollution free streams in the catchment of the GBR. The role of the government and the landowners, especially the farmers will have to be defined to establish their responsibilities in this endeavour and to bring about a change (Ewing, 2005; Fenton, 2007). It is essential and timely that the barriers hindering the effective management of these riparian zones are investigated.

2.3 Landowners' relationship to riparian forests

2.3.1 Economic aspects

Economic incentives in the form of financial compensation for loss of use of land have certainly been found to play an important role in the adoption of recommended management practices (e.g., Curtis et al., 2005; Curtis & Robertson, 2003; Klapproth & Johnson, 1999c; Kraack, 2000). However, a willingness-to-pay for environmental assets in the community was found in a study that surveyed a sugarcane-growing community

in north Queensland (Mallawaarachchi, Ebert, Byron, & Johnson, 1999). The research reported that 52% of respondents valued riparian forests highly and were willing to pay environmental protection in the form of a levy. This was to be used to compensate sugar cane growers for the loss of income due to not being able to use all arable land on their farms. However, 70% of the respondents thought the government could not be trusted to spend the levy on preservation of riparian forest.

2.3.2 The role of landowners

One of the main issues in the preservation of riparian forests is the unclear ownership status of riparian areas. The areas clearly lie at the interface between public and private land (Klapproth & Johnson, 1999c), and landowners are not convinced that they can actually facilitate the protection of riparian forests. They also believe that there is still a debate about the best recommended management of riparian forest which is to a certain extent admitted by researchers in a 2012 paper which concludes that "future research will have to be better coordinated, synthesized and also focused on social and collective learning" (J. E. Brodie, F.J. Kroon, et al., 2012, p. 91). Some of the contentious issues include the optimal width of the riparian buffer, the kind of vegetation required for this area, the climate, and geological issues (Kraack, 2000; Quereshi & Harrison, 2001). For instance, while grass is effective in controlling runoff problems, only trees and shrubs will hold the creek banks together and perform the contaminant removal and retention functions (McKergow et al., 2004).

Despite these obstacles, the chance of a communal effort of total riparian protection and maintenance occurring is not an impossibility. The number of riparian landowners in the GBR catchment area is not too large (Gilbert & Brodie, 2001) to foster a cohesive group occurrence through identification as members of a social group

(Hogg, 2007). This would allow group dynamics to take place such as behaviour that advances the group's social standing in the eyes of the wider society, for example, as described in studies in France (Michel-Guillou & Moser, 2006) and Canada (Atari, Yridoe, Smale, & Duinker, 2009). The landowners would need to be clear about the role they could play in riparian regeneration and maintenance that would become a national and global showcase.

2.3.3 Attitudes and actions of landowners in regard to riparian forest

Landowners' relationship with riparian forest expressed as general attitudes has been found in most studies to be very positive. The attitudes mostly represent a biospheric and non-egocentric value orientation, such as obligation to preserve the environment for its own sake or for future generations, implying a general theme of pro-environmental attitudes (Dunlap et al., 2000; Kellert, 1996; Stern, Dietz , & Kaloff, 1993) .

An example is a survey in the sugarcane growing area of Australia where two-thirds of agricultural support personnel believed that the farming community would endorse the retention of riparian forest as valuable (Bjornsson et al., 2002). The same survey also found that despite these positive attitudes the riparian forests were severely degraded or non-existent. This discrepancy between positive attitudes toward riverfront conservation and the adoption of recommended management practice was confirmed with riparian landowners in the south west of Australia (Curtis & Robertson, 2003) and were also the norm with US farmers according to several studies and polls reviewed by Klapproth and Johnson (2001). Story and Forsyth (2008) aptly concluded "pro-environmental attitudes, at least for [watershed] residents of the US, stand in stark contrast to actual environmental engagement" (p. 312).

It is equally difficult to engage landowners and farmers in good land management despite the fact that they express strong internalised notions about caring for the land, of good stewardship, moral obligation to look after the land, and a strong sense of responsibility for the land (Atari et al. 2009; Mallawaarachichi et al., 1999) (Atari et al. 2009; Beedell & Rehman, 1999; Dutcher, 2000; Fenton, 2004; Grasby, Lockie, & McAllister, 2000; Klapproth & Johnson, 1999c; Kraack, 2000; Mallawaarachichi et al., 1999; Michel-Guillou & Moser, 2006; Reeve & Black, 1993; Terrill, 1999; Vanclay, 1992b). Curtis and DeLacy (1998) interpreted the statements as more to do about group identity, with the idea that the individuals feel they belong to the group of conscientious landowners. Subjective norming processes can be decisive in determining intentions of pro-environmental riparian landcare as it was in a study in Belgium (Michel-Guillou & Moser, 2006). A recent study in Canada also confirmed the importance that farmers gave to group belonging when they listed the chance to publicise positive farm stewardship practices as the most important reason to participate in an environmental farm planning scheme (Atari et al., 2009).

The uptake of recommended environmental practices may be hampered very simply by the landowner's convictions that their riparian forest is in very good shape. This problem is due to the fact that landholders have been found to consistently overestimate the condition of their riparian forests, and therefore they cannot see the necessity for improvement (Dutcher, 2000; Wilson et al., 2003). Landowners often do not believe that their land or riparian forest is in need of improvement or they interpret land degradation as a natural occurrence (Barr & Carey, 2000; Corbett, 2002; Dutcher, 2000; Klapproth & Johnson, 1999c; Wilson et al., 2003).

2.3.4 Landowners evaluation of riparian forest

By valuing riparian forests highly, a higher level of protection would be expected, and the willingness to preserve it should be increased. This was investigated in a choice modeling study of riparian forest valuation in the sugarcane-growing Herbert River District (north Queensland) (Mallawaarachchi et al., 1999). The survey explored the community's evaluation of tea-tree woodlands and riparian forests in financial terms. It was found that these natural areas were very highly valued, and it was concluded that "… the community as a whole will benefit economically from protecting riparian and wetland areas from further conversion to cane growing." (Mallaawaarachchi et al., 1999, p. 4).

In a study on environmental assets in north Queensland (Quereshi & Harrison, 2001) farmers, sugar mill staff, fishermen, local community members and environmentalists were asked to value riparian areas and their revegetation in terms of cost and type of plants. The majority of interviewees valued the riparian forests very low and only as areas of recreation. The loss of crop land to riparian forest was rated very high by farmers, and very low by local community members and environmentalists. Farmers (sugarcane, bananas, and cattle) did not give high value to protection of land or stream habitats nor to surface-water quality, but they considered protection of human health as a separate entity and rated that very highly. This separation of environmental health from human health indicates that their interconnectedness is not understood. Nevertheless, awareness, knowledge, and even good understanding of the importance of the environment do not consistently or directly influence the practice of appropriate land management (Cotching & Sims, 2000; Dutcher, 2000; Dutcher et al., 2004; Earles, Rose, & Brownlea, 1979; Vanclay, 1992a).

To provide at least the basics for understanding the ecological principles of the link between environment and human health, good information and environmental education opportunities are essential for the general public. In the case of the farming community, where compliance with good land management practices is expected, this educational base also needs to be present (Clarke, 2008; Gunningham, 2007; Wilson et al., 2003).

2.3.5 Landowners' understanding and acceptance of scientific information

While experts in the biological and environmental fields have a scientific understanding of the importance of riparian forests, the level of factual knowledge of the land users in the area is not well recorded. Investigations into the psychological (using attitude-behaviour research) and social aspects that mediate between the provision of scientific facts, and the farmers' acceptance of and compliance with recommended riparian management practices are not numerous. One interesting qualitative social science study summarised a number of factors that sugarcane farmers consider when making decisions regarding land management practices. It listed among others that scientific information needs to be consistent, applicable to their area and come from several quarters, such as the other growers, face-to-face meetings with agricultural extension personnel or the industry (Kraack, 2000). Another study by Allan and Curtis (2005) in southeastern Australia which compared the outcomes of different regional watershed management strategies also found that farmers wanted certainty about the outcomes of recommended practices seeing scientists as the providers of these certainties. On the other hand some farmers and groups found it hard to change entrenched beliefs even denying that they had learned anything from new practices as if they needed to preserve their comfort. This reaction has been explained as the result of threats to one's self-

esteem (Goleman, 1996). Similarly, strong beliefs based on their own observations of positive outcomes of riparian management are difficult to resolve for farmers when their practices are not recommended, such as grass on the streambanks instead of trees (Fenton, 2004). The presentation of new and possibly threatening ideas needs to take heed not to denigrate some cherished belief, and to integrate new learning with existing understanding and knowledge. Fenton (2004) advises 'participatory processes with farmers … to address these issues' (p. 68).

Believing in science can bypass the actual understanding and acceptance of biophysical and ecological facts. This is a blind faith in science as the provider of new technical inventions that will solve the problem without the farmer's input of land conservation practices (Kraack, 2000). It was a strongly represented item in a qualitative interview study with sugarcane farmers in far north Queensland (Kraack, 2000). This finding illustrates that scientific information has to be geared to actively increase the farmers' capacity to recognise and understand the environmental problem by realising the ecological principles behind it which need to be addressed by management practices.

Strong belief in the environmental outcome of good riparian forest management is mostly based on acceptance of scientific information (Wilson et al., 2003). The farmer's practical experience would mainly extend to erosion of the creek banks and might then lead to planting or not cultivating the banks. But the pollution of the water would not be so obvious because it would not impact on the landowner's stretch of riparian forest. Should there be a problem it would be attributed to somebody else's pollution upstream (Dutcher, 2000). Better knowledge and acceptance of riparian

function has been confirmed as a factor in the willingness to adopt best riparian management practice by graziers in Victoria (Wilson et al., 2003).

There are several studies that found that landowners are not convinced of the scientific facts or don't trust the assessors' or advisers' competence when they seem to be scientists only. Farmers are much more willing and able to accept the recommendations if the advisor or assessor can demonstrate that they are also 'working on the land' (Barr & Carey, 2000; Corbett, 2002; Dutcher, 2000; J. C. Klapproth & Johnson, 2001; Kraack, 2000). But the assistance and availability of Government extension or field officers was generally appreciated by farmers especially to give technical assistance (Fenton, 2004).

A significant knowledge-intentions relationship can be present even when the farmer does not recognise the need of improvement on his own land. This was the case in an early Australian interview survey. Earle, Rose and Bronlea (1979) found that acknowledgement and recognition of erosion problems in the region was a significant variable. The farmers described their intention to act if erosion on their land ever occurred while they did not see that they had this problem already. Another Australian survey found evidence for participants with better scientific knowledge and belief in its efficacy to more readily adopt river frontage protection measures (Curtis & Robertson, 2003). At the same time general positive attitudes towards conservation did not predict land conservation behaviour. In an Austrian study successful pro-environmental land management practices correlated strongly with variables that represented learning from a life-time of experience (Vogel, 1996). This is an example of the rare situation where the farmers developed the most environmentally appropriate land management practices by observation, and trial and error.

In a paper that evaluated whether Australia's coastcare program achieved meaningful community participation, Clarke (2008) recommended that to facilitate acceptance of scientific facts a media campaign to increase awareness and minimise backlash from sceptical landowners was needed. This was the case for landowners who were already in contact with government agents and had a chance to collaborate in identifying problems. This finding reflects Kraak's (2000) recommendations of face-to-face work with farmers to facilitate the capacity to recognise and understand the environmental problem.

The majority of studies that tested the impact of presentation of scientific information by itself or existing knowledge of the problem found that it was not sufficient to lead to adoption of recommended management practices (Cotching & Sims, 2000; Dutcher, 2000; Dutcher et al., 2004; Earles et al., 1979; Fenton, 2004; Vanclay, 1992a). However, the belief or confidence in the efficacy of the outcome was found to correlate with the actual practice of recommended riparian management (Curtis & Robertson, 2003; Wilson et al., 2003). These findings point to the problem of accepting the information as useable, or correct, or possible to implement in their particular situation.

2.3.6 Sociodemographic considerations

Sociodemographic factors and political orientation are considered as mediators in attitude-behaviour relationships of adoption of recommended land management practices (Fenton, 2004; Fielding et al., 2005; Tarrant & Cordell, 1997). A US study found that less experienced landowners were more inclined to replant riparian vegetation (Hagan, 1996 cited in Klapproth & Johnson, 2001), but other factors such as outside income was considered a mediator.

A postal survey by Curtis and Robertson (2003) of graziers in Victoria (Goulbourn Broken) revealed some key variables that limited the adoption of recommended riverfront management practices. These included the level of environmental knowledge of riparian function, and recreational and economic value of river frontages. Landowners with off-farm incomes were more likely to participate in riparian preservation and revegetation programs, especially when they had higher confidence in the recommended practices. The economic constraint that prevented adoption in some cases was the very real lack of funds and was independent of the motivation in taking up the recommended practices. Similarly, the strong influence of social and family obligations (which were linked with the age of the farmer) in decision making strategies of Australian farmers in questions of biodiversity conservation were identified in a study by Farmar-Bowers and Lane (2009). These are variables that need to be considered when developing policies.

The dilemma of who pays for the establishment and maintenance of the riparian forest, an area that is considered privately owned land but also a public resource, is not seen as a responsibility by many landowners. This represents the basis of the conflict of voluntary participation in riparian forest management which requires investment of time and money. The benefits of well-managed riparian zones are rarely clear to the landowner who has paid little attention to the vegetation or water quality of the area. In his paper about evaluating whether Australia's Coastcare program achieved "meaningful community participation" (p. 891) Clark (2008) points out that the coast is mainly publicly owned and the waterways are usually in private hands. The involvement of riparian landowners is therefore essential in any programs implemented by government groups because they have a financial and social stake in it. The general community on

the other hand needs to acknowledge the landowners' limited resources of money and time for reconstruction of riparian areas.

The landowners' decisions about adopting and implementing riparian forest conservation practices invariably involve questions about the costs and profits. The influence of financial consequences due to loss of income from the inability to use the riparian zone for agricultural purposes, has been found to be a controlling factor in several studies (Cable, Fox, & Rivers, 1999; Curtis & Robertson, 2003; Klapproth & Johnson, 1999c; Wilson et al., 2003). Fielding, Terry, Bordia and Hogg (2005) found that motivated farmers were quite aware of the costs involved in good riparian management but intended to participate in riparian management because they believed in the potential benefits of it. In this context even recompensing landowners for attending workshops on riparian forests should be considered and has been tried in Babinda (north Queensland) (Vito Musimeco, personal communication). Fenton (2004) found that many community members felt that compensation for landowners was in order when their contribution to the public good also benefitted the government.

Justification for financial outlay on grounds of beliefs in the environmental benefits was also found in studies investigating landowners' willingness to establish forestry tree plantations in Australia (Herbohn, 1999). The respondents did not rank economic and commercial reasons at the top, but gave higher ranking to personal satisfaction of knowing that tree planting is beneficial for the environment. Recognition of water as "more than an economic good" (Bohnet & Kinjun, 2009, p.1180) also emerged as an important factor in landowners' evaluation of water quality. Similarly, landowners in Scotland were willing to pay more for electricity if the funds were used for improvement of biodiversity around an hydroelectric dam (Spash et al., 2009) citing

that environment and environmental biodiversity have an absolute right to exist. Kahneman and colleagues (Kahneman, Ritov, Jacowitz, & Grant, 1993; Kahneman, Ritov, & Schkade, 1999) had postulated this willingness-to-pay to be an attitude expression, and DeYoung (2000) described such concepts as intrinsic satisfaction and as the motives for environmentally-responsible behaviour. The support of the general public in the environmental benefits of riparian forests also needs to be fostered to assure their input in land care groups and also funding from tax payers. Such insights provide useful information for government agencies when designing and proposing policies and programs.

2.4 The role of Government in riparian forest management

Acknowledgement of the role of local government in the protection of wetlands has been mentioned (Berwick, 1997 cited in Bjornsson et al., 2002), but is not a point commonly included in stream pollution discussions. While the main polluters are identified as the farmers along the waterways and the problem is discussed and investigated with these farmers (Kraack, 2000), their refusal to accept sole responsibility for good water quality is often attributed to economic factors and ignorance of scientific facts (Herbohn, 1999).

Despite extensive initiatives by government and non-government groups there is still "a decline in the quality of the water entering the Reef" (Queensland Department of the Premier and Cabinet, 2009, p. 7). The provision of information and support for the conservation and replanting of riparian forests in the lowland GBR catchment area to reverse water pollution does not seem to have worked. The riparian environment is not in a healthy state and efforts may need to include social studies in order to find a way to halt the trend (Brodie et al., 2012).

The survival of riparian forests is dependent on the management practices of every land user along the water courses in the catchment area. Support and help in the form of resources and management instructions is to a great extent in the hands of landcare groups who need substantial support by the government to be effective (Curtis, Shindler, & Wright, 2002). There has been agreement on the fact that a successful policy depends on the involvement of landowners. As pointed out by Clarke (2008), government alone cannot bring about the changes that are needed in catchment and river protection by only providing funding for natural resource programs. Engagement with landowners has to be pursued to an effective level which includes the opportunity to have an input into the decision-making process. The responsibility of Government agencies is to find the best way to convince landowners to participate. As some empirical studies suggest, this can be achieved by tapping into the existing belief and value structures that have been found in the population (Atari et al., 2009, Bohnet et al., 2011, Carr & Tait, 1991; Fielding et al., 2005; Larson & Lach, 2008; Mallawaarachchi et al., 1999. Furthermore, there needs to be some scrutiny of the information delivery of scientific facts (Curtis et al., 2002; Brodie et al., 2012).

The necessary capacity building on the human, physical, social and financial level appears to be the way forward (Cotching & Sims, 2000; Dutcher, 2000; Fenton, 2004). It has been suggested that the capacity of a rural community to preserve and maintain their riparian forest is dependent first of all on the opportunity to learn about the need in such a way that it is understood, and, secondly by empowering the landowner group that has the responsibility to keep a natural resource healthy (Fenton, 2004). If landowners have the knowledge and understanding of riparian function and they believe in the efficacy of recommended best management practice, they will be

capable of doing so to a certain extent. In addition, there is still the need for a supportive social network and for financial support.

A further urgent point about policy development has emerged concerning the bewildering variety of policy providers that apparently exist in fresh water management. This is illustrated by McKay's comments at a conference in 2005: "Australian water management is drowning in a complex array of providers, user groups, management boards and trusts, and policy organisations, and there is a considerable need to rationalise this into a more workable system" (McKay, 2005, p. 74).

In order to meet this need insights gained from research studies on water management, riparian forest function, and especially on adoption of management practices should be considered. A synthesis of the findings in the fields of biology, ecology, psychology, social sciences, politics, and economics would be a way to arrive at an overall picture of the problem and the best possible solution.

2.5 The role of social psychology in management of environmental resources

Social-psychological studies about attitudes and behaviours of landowners, especially in relation to riparian forest issues and the well-being of the GBR are not numerous. Most research literature covering the social aspects are not easily converted into riparian forest management program development. A quote from Curtis, Byron and MacKay (2005) reflects on this situation in Australia: "…social researchers in Australia and overseas need to move beyond readily available census data that have limited usefulness in watershed management" (p. 550). Thus, established social research programs within most major Australian government research and development

programs need to integrate social data with available economic and biophysical information.

During workshop discussions in 2003 with representative land users, researchers and resource managers in the GBR catchment (Pearson & Werren, 2003), science based land management recommendations were mentioned repeatedly. Sugarcane farmers voiced disconcerting opinions that ranged from "we acknowledge that the [sugar] industry needs improvement" to "[sugar] industry remains unconvinced by science in the GBR health debate", and "there is a 'religion' dimension to this issue" (Pearson & Werren, 2003, p. 7). These statements indicate that the presentation of scientific information to the cane-growing community is clearly not finding acceptance by the target population. Similar findings were encountered by Fenton (2004) in his investigations of capacity and capacity-building requirements with community members in the far north Queensland. The best modes of delivering scientific information already reported and recommended by Kraack in 2000 and again by Fenton in 2004 did not seem to have been noted and implemented.

Among farmers, where beliefs of practical experience and traditional practices are considered far more valuable than any findings from empirical studies and investigations (Fenton, 2004; Kraack, 2000), acceptance of scientifically-based advice is not easy. Such beliefs impede the adequate adoption of recommended management practices or interfere with them when the functional importance of riparian forest is misunderstood or reinterpreted by farmers so as to comply with their own ideas (Curtis, Lockwood, & MacKay, 2001; Wilson et al., 2003).

2.6 Importance of riparian forest to Indigenous culture

The importance of riparian forests as a place for recreation and relaxation has already been mentioned but the riparian landscape as a cultural resource for Aboriginal people is another significant aspect of riparian rehabilitation and management and should not be overlooked. Traditional Owners of areas which include riparian forests have expressed their interest in participating in riparian management together with farmers, and to have access to the streamsides (Fenton, 2004).

Aborigines have used these waterways for millennia (Dixon, 1991; Jackson, 2005), and such use of riparian forest resources needs to be protected for traditional fishing and gathering of plants, ensuring continuity of Aboriginal culture. But the inclusion of Aboriginal interests is not apparent in land and water management decisions except as an interested group of stakeholder but no further description of their involvement (Queensland Department of the Premier and Cabinet, 2009).

Clearly the return of riparian forests to a state that has some semblance to that of pre-intensive agricultural times would not only benefit the environment but also enable Indigenous cultural activities (Hill, Clarke, & Wet Tropics Management Authority, 2004). The preservation of native vegetation and clean water in the area would be an asset for the Great Barrier Reef, the waterways and all people who use them for recreation and traditional cultural practices.

2.7 Summary

This review of literature on riparian forest lays out the importance of their environmental function in regard to water quality in the rivers and subsequently for the Great Barrier Reef, and the roadblocks that have to be removed before the riparian areas

can be pronounced preserved and maintained. The role of the landowners of riparian forest as the stewards of clean waterways entails their adoption of best land management practice to minimise destruction of the vegetation and prevent agricultural chemicals and silt entering the water. The 'behaviour' of landowners, that is how do they use and maintain their riparian areas, has not been found to depend on their general environmental beliefs and attitudes, or biospheric world views. Intentions to adopt good management practices was found in some situations to correlate with group norms but a strong group cohesion has not been uniformly pointed out.

Some major issues that prevent this good riparian management adoption such as the lack of belief in the efficacy of riparian forest function and therefore management have been found in empirical studies. This is based partly on mistrust of science and of the agents that promote the scientifically-based practices, and not understanding ecological principles. An additional complication is the question of ownership of the riparian forest resource and who profits from its intact presence.

In conclusion, this literature review has highlighted the essential need for a social psychological analysis of riparian landowners' understanding and beliefs in regards to their riparian forest. Having insight into what guides their management practice of this highly important ecological landscape could provide ways and means that would lead to its preservation and also the re-establishment of riparian forests.

CHAPTER 3.

THE THEORETICAL FRAMEWORK

3.1 Introduction

Developing an understanding of landowners' management decisions in regards to the riparian forest on their land is a key aim of this research. As discussed in Chapter 2, management decisions about land use in the Great Barrier Reef terrestrial water catchment region in particular need to take into consideration the ecological significance of vegetation buffers along water courses, the riparian forests. While it has been established that riparian zones need to be preserved, maintained and rehabilitated for both ecological and agricultural purposes, evidence suggests that riparian forests continue to be degraded or destroyed (Australian Productivity Commission, 2003; Brodie, 2002; Brodie et al., 2012; Brodie & Mitchell, 2005; Devlin & Brodie, 2005; Gilbert & Brodie, 2001; Queensland Department of Local Government and Planning, 2008; Rasiah et al., 2003; Werren & Arthington, 2002). Understanding reasons for land use practices undertaken by farmers that cause loss and degradation of these ecosystems is an important research question.

A theoretical perspective that offers insight into understanding human behaviour is the attitude-behaviour approach, the time-honoured social psychological model that some identify as the core objective of social psychology (Eagley & Chaiken, 1993). This perspective focuses on psychological constructs such as attitudes, personal values and motivations, as well as external factors such as economic issues, as a means of investigating intended and actual behaviour.

This chapter outlines the background and history of the attitude-behaviour theoretical framework underlying this study, namely, the theory of planned behaviour (TPB) (Ajzen, 1991). The descriptions of the TPB components refer to findings from the research literature on attitude-behaviour relationships. The chapter focuses, where available, on studies of farmers and land owners, and their land and water management practices. Also discussed is the applicability and operationalising of the concepts in the present study. Other predictive and explanatory variables that have been identified in the literature as influencing decision making are discussed and compared with those in the TPB. Since social psychological studies on riparian forest use and management are limited in number, relevant studies involving landowners or farmers and adoption of environmentally sound land management practices in general are explored.

This chapter also reviews and discusses the revised New Ecological Paradigm scale (NEP) (Dunlap et al., 2000), a 15 - item measuring instrument which has become "the most frequently used measure of environmental concern" (Stern, Dietz, Kalof, & Guagnano, 1995, p. 723). It has been employed in studies with landowners and farmers to gain an understanding of how broader worldviews influence conservation practices (Curtis & Robertson, 2003) .

3.2 The history of attitude research

3.2.1 Background

To gain insight into people's motivations to behave in a certain way, social psychologists have used the construct of attitude as one of the basic tools in the field (Eagley & Chaiken, 1993). Since observable behaviour is seen as the outcome of an internal process during which a decision was made to perform the behaviour or action,

these decisions must have involved the evaluation of the desirability of the behaviour. In social psychology this model involving an inferred evaluating antecedent for behaviour is universally assumed in attitude studies (Eagley & Chaiken).

3.2.2 The psychological construct of attitude

In social psychology attitudes are evaluations of attitude (or attitudinal) objects. These can be an event, behaviour, or any cognitive entity. The process, state or psychological location of the evaluation is a psychological construct to denote a place between the environmental and internal stimuli and the eventual behaviour, and is called an 'attitude'. Eagley and Chaiken (1993) in their book on the psychology of attitudes define attitude in the following terms "…[a] psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor … and evaluating refers to all classes of evaluative responding, whether overt or covert, cognitive, affective or behavioral" (p.1). The term 'tendency' here may imply a short term internal state but it does not exclude the idea of something long-lasting or entrenched. Thurstone, in 1931 (as cited in Ajzen, 2001), had already defined attitudes as affect for or against a psychological object, thus implying an evaluation.

The process underlying the psychological construct of attitudes is unobservable but its inferred existence explains the changing nature of people's decisions to behave in certain ways. In other words, an internal state is presumably formed by the outcome of evaluations of the attitudinal object which then influences and directs observable behaviour. This explanation of the existence and nature of attitudes has been challenged by some social psychologists who prefer to define attitudes as associative learning and therefore a memory construct, which interprets behaviour in terms of automatic recall of aspects of the behavioural object (Eagley & Chaiken, 1993; Fazio, 1989; Zanna &

Rempel, 1988). Eagley and Chaiken point out that the memory theory does not account for attitudes and behaviours that have not been encountered before. It also restricts methods of measuring attitudes if the construct is not seen as a separate process. Nevertheless, the influence of previous learning, of automatic recall, and of habitual behaviour in an evaluative process is obviously considerable, and would explain the strength of entrenched attitudes. Such embedded attitudes would be very salient to the person and have been shown to be strongly related to intentions toward preservation of the environment (Prislin & Oulette, 1996).

Strong attitudes can be relatively stable over time, be resistant to persuasion and predictive of behaviour (Eagley & Chaiken, 1993). Readiness to change attitudes of social issues has been found to be influenced by education and gender, while only the very young and the very old in age correlated well with attitude change (Visser & Krosnick, 1998). But Ajzen's (2001) review of this attitude issue showed that operationalisation of the concept in the studies was controversial and the different measures led to conflicting findings. Eagley and Chaiken also added that temporary beliefs, motives, habits, values, and ongoing evaluations among other factors, moderate the process of attitude formation itself and subject attitudes to changes. As will be discussed in the section on the theory of planned behaviour (Ajzen, 1991), attitudes and the psychological constructs of social norm and perceived behavioural control interact and cross-mediate in that model.

3.2.3 The quantitative measurement of attitudes

The psychometric measurement of attitudes was already in use in the early 1930s. It was first based on Thurstone's (1931, as cited in Ajzen & Fishbein, 1980) sliding scale that measured attitudes from responses to items along a gradient from favourable to

unfavourable or positive to negative. The 'attitude' was the final score from the sum of scores of each item measure, but only represented an "affect for or against a psychological object" (Ajzen & Fishbein, 1980, p. 14). To devise an internally consistent instrument using this method was also very cumbersome. Later this was simplified with the introduction of a 5-point scale invented by Likert (1932, as cited in Ajzen & Fishbein, 1980).

However, the representation of an attitude as a uni-dimensional single score based on affect did not acknowledge the complexity of the attitude concept and did not aid in the search for a reliable predictor of behaviour. It merely yielded descriptive data about different groups based on preferences of opinions. This approach allowed respondents to be grouped according to their liking or disliking an attitude object and it thus predicted behaviour to a certain extent. However, the attitude of the individual was not further defined nor was the behaviour explained.

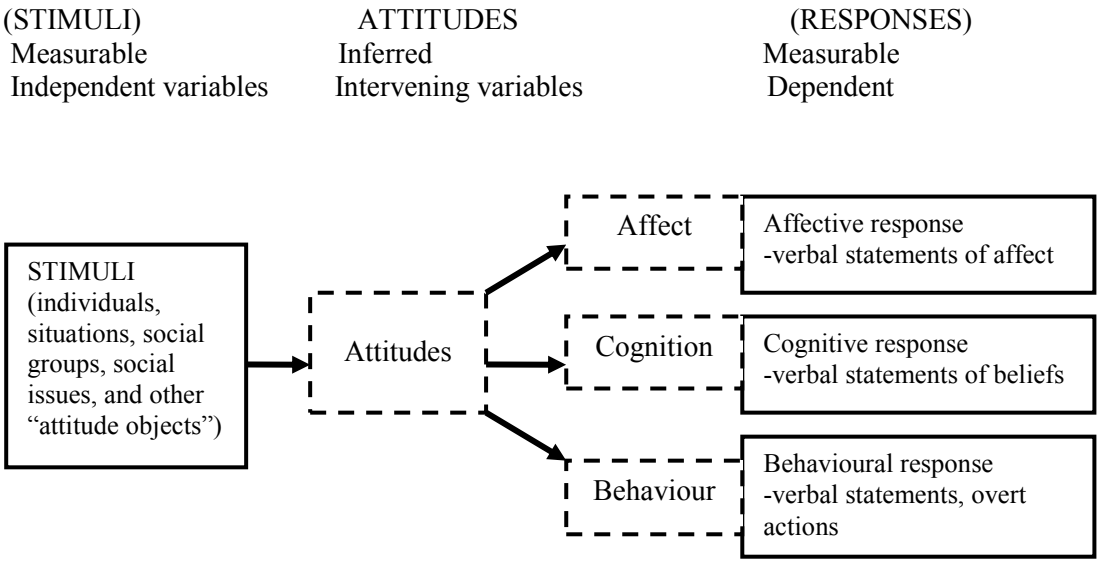
The problem of seeing an attitude as uni-dimensional was realised by Allport in1935 (as cited in Ajzen & Fishbein, 1980). He proposed that the attitude construct has other evaluative domains beside the affective level and must therefore be multidimensional. This set the scene for research on theoretical perspectives of the structure of attitudes that would guide the attitude-behaviour research into considering a multi-component view of attitudes. The understanding was furthered in the late 1950s with the development of semantic measurement scales (Osgood, Suci & Tannenbaum, 1957, as cited by Ajzen & Fishbein, 1980) which simplified measurements in all domains.

This advancement in measurement set the scene for theoretical perspectives that would guide research into the construct of attitude, and then further into the attitude-

behaviour relationship. The first model discussed here is the tripartite model of attitudes.

3.2.4 The tripartite model of attitude

During further research into attitudes it became clear that there is more to attitudes than affect. By the late 1950s attitude-behaviour research had found a more inclusive attitude description. "Katz and Stotland (1959)… conceptualized attitudes in the framework of the age-old trilogy of cognition, affect, and conation" (Ajzen & Fishbein, 1980, p. 19). In this model the role of attitudes is in moderating the responses to stimuli by processing them on the affective, cognitive and behavioural level leading to different behaviours or actions according to the domain. This concept of a tripartite view of attitudes was published as a schematic representation by Rosenberg and Hovland (1960, as cited in Ajzen & Fishbein, 1980) and was universally accepted.



(From Rosenberg and others1960, based on Katz & Stotland, as cited in Ajzen & Fishbein 1980)

Figure 3.1 The tripartite model of attitudes.

Attitudes were now viewed as a complex construct encapsulating an individual's feelings toward the attitude object, their beliefs about and understanding of it, and the most likely behavioural tendency toward it. It provided a useful framework for the operationalisation of attitude measures.

To assess attitudes in this model toward the attitudinal object in the system one determines the degree of liking or disliking (affect), the degree of understanding and belief in the benefit or uselessness (cognition), and the tendency to intend to act based on outcomes of previous actions (conation, behaviour). The combination of the three response types represents the multi-component structure of the attitude toward an attitudinal object.

The tripartite view of attitudes advanced the understanding of attitude generation and formation as a psychological model, but attitudes measured in this way did not explain behaviour any better. It was realised that the process of evaluation during formation of attitudes necessarily includes input from the affective, cognitive and conative (behavioural) domains (Rosenberg et al., 1956, as cited in Eagley & Chaiken, 1993). Ajzen and Fishbein (1980) also understood "that separate assessment of all three components is unlikely to lead to improved behavioral predictions" (p.21). Nevertheless, all domains needed to be tapped for responses to arrive at a representative attitude (Ajzen & Fishbein, 1980; Eagley & Chaiken, 1993; Kaiser, Woelfing, & Fuhrer, 1999; Olson & Zanna, 1993). To find an attitude measure that could be used in the prediction of behaviour, more knowledge was needed to explain the function of attitudes in arriving at intentions and decisions regarding a behaviour.

3.2.5 The expectancy-value model

Rosenberg and colleagues started to explore another approach to attitude structure and processes. This was the expectancy-value model of attitudes and was based on insights from earlier research by the group (Eagley & Chaiken, 1993). It focused on beliefs that must be driving the evaluative process of attitude formation. The model assumed attitudes "to be a function of the subjective probability that the attitude object leads to good or bad consequences (i.e., instrumentality) and the evaluation of the anticipated consequences (i.e., satisfaction)" (Eagley & Chaiken, 1993, p. 107). It was expressed by the following equation:

Attitude = Σ Expectancy x Value
(attitude = sum of the strength of the behavioural beliefs by evaluation)

Attitudes in the expectancy-value model therefore represent the sum of the products of belief strength and level of evaluation. As Ajzen and Fishbein (1980) expressed it: "evaluation of an object is strongly related to [his] expectations or beliefs that the object furthers or hinders the attainment of valued goals" (p. 21). Attitudes are a combination of beliefs that take into account the weights of two corresponding belief aspects.

With this formula the multitude of different attitudes that exist between people who may agree to have the same knowledge, experiences, but different expectations and valuations about the attitude object, could be explored. It allowed investigation of attitudes by elucidating the weights of expectation and evaluation that individuals have assigned to their beliefs.

3.3 The belief-based concept of attitudes

In the 1970s Fishbein and Ajzen built their studies into the prediction and understanding of human behaviour on the expectancy-value and the tripartite models of attitudes. They formalised the concept of behavioural beliefs as antecedents of attitudes according to the expectancy-value equation (Eagley & Chaiken, 1993), and thus described attitudes as based on a person's salient beliefs. Fishbein and Ajzen (1980) concluded that the attitudes towards the behaviour correspond to the evaluation of the outcomes (consequences) of a behaviour and the strength of belief in these outcomes.

The formula was expressed as follows:

$$\mathbf{A_o} = \sum_{i=1}^{n} \mathbf{b_i}\, \mathbf{e_i}$$

A person's attitude toward the attitudinal object $\mathbf{A_o}$ is the sum of the products from the belief in the likelihood of the outcome or consequence of the behaviour (b) and the level of evaluation of the outcome (e).

According to the expectancy-value principle of this view of attitude construction two persons may have different attitudes even though they believe equally strongly in the likelihood (behavioural beliefs), but since they do not evaluate the outcome on the same level they have different attitudes. Equally, they may show the same attitude when the behavioural beliefs and the evaluative beliefs have opposite scores which leads to the same product. This system can explain the multitude of attitude variations that exist between people who may agree to have the same understanding, experiences and beliefs about an attitude object.

3.3.1 Cognitive, affective, conative responses to attitude objects

At this point one might wonder what happened to the tripartite view of attitudes which is one of the cornerstones in the history of attitudes. The issue had been considered by Ajzen and Fishbein (1980) and they came to the conclusion that the different domains of evaluative response types are already a basic integral part of the evaluation process which concerns itself with any attributes of the object or behaviour. This view was challenged by some researchers and especially by Zajonc's affective primacy hypothesis (Zajonc, 1980) which asserts that affect has precedence over cognition. Indeed, a study found that an affective evaluation is made much faster than a cognitive evaluation (Verplanken, Hofstee, & Janssen, 1998) as measured by the response time (reminiscent of the expression 'I know what I like'). However, this does not necessarily mean that it is a more predictive attitude measure but just one that is arrived at much more quickly.

It has now been generally accepted that a multi-component view of attitudes is inevitable when evaluations are made and that measures reflect both cognition and affect, and also behavioural tendencies (Eagley & Chaiken, 1993; Van der Pligt, Zeelenberg, Van Dijk, De Vries, & Richard, 1997). Ajzen and Fishbein (2005) make clear that the TPB relies on beliefs in all domains. They reiterate that the component of attitude toward performing a specific behaviour has to be composed of "aggregates of attitude measures on all levels and in all domains to give it predictive power" (Ajzen & Fishbein, 2005, p.179).

Nevertheless, the contribution of three response types of the tripartite model of attitudes, - affective, cognitive and conative - was considered in the construction of the present survey questionnaire. There are aspects in each domain about 'riparian forest'

that can theoretically be seen to influence the person's decision to preserve, maintain and/or rehabilitate riparian forest. For instance, affect toward it may refer to going there and fishing in the creek, or enjoying the peaceful setting and should be reflected in a positive salient belief about the area. A positive belief on the cognitive level should be based on an understanding of the need to preserve water quality or the nitrogen-retention ability of riparian vegetation. A positive response in the conative (behavioural) domain may stem from a positive experience of tree planting or erosion control in the past. Any such responses may have led the landowner to 'have taken to heart' the riparian cause in the region. Such a salient feeling would most likely influence all predictors in the TPB by automatically being considered in every evaluation process.

A positive affect such as 'experiencing a thrill' was reported as a powerful predictor of speeding behaviour (Manstead & Parker, 1995). But they detected a strong moderator in the form of personal and moral norming that interfered in this relationship. This type of norm based on individual values is discussed later in the chapter.

3.4 The history of attitude-behaviour research

3.4.1 The background

The early research into attitudes as predictors of behaviour yielded unreliable results. The most convincing evidence of the almost non-existing attitude-behaviour relation came from a review of empirical laboratory studies by Wicker (1969, as cited in Eagley & Chaiken, 1993). It revealed a predictive attitude-behaviour relationship only in some surveys of voters (Eagley & Chaiken, 1993). This indicated that possibly the behaviour in question had to be highly relevant to generate salient beliefs leading to attitudes.

Nevertheless, in the 1970s Fishbein and Ajzen expanded their research into the role of attitudes as determiners of behaviour (Eagley & Chaiken, 1993), and with the insights gained from the newly formulated belief-based model of attitudes, the researchers constructed two attitude-behaviour models, the theory of reasoned action and the theory of planned behavior. The approach used in these social psychological attitude-behaviour models has been very successful and has led to their wide application in various fields today. Each theory is described in the following sections.

3.4.2 The theory of reasoned action

3.4.2.1 Subjective norm

Ajzen and Fishbein's (1980) attitude-behaviour model of the theory of reasoned action (TRA) (see Figure 3.2) applied the expectancy-value idea and was based on the assumption "that human beings are usually quite rational and make systematic use of the information available to them" (Ajzen & Fishbein, 1980, p. 5) when deciding on whether to perform or not perform an action or behaviour. The optimal way to investigate and determine attitudes which are assumed to influence behaviour was seen in assessing the attitudes toward the behaviour, and also on an additional second predictor variable, subjective norm (SN) (see Figure 3.2). This was included to take into account the impact a social environment can have on behaviour decisions. The individual will not only engage in evaluating the benefits and the consequences of the behaviour expressed as attitudinal beliefs but will also reason about the expectations of others (normative beliefs) and the perceived need to comply with their expectation (motivation). The equation expresses it as:

$$SN = \sum_{i=1}^{n} n_i m_i$$

The formula of the subjective norms follows the expectancy-value model in the same way that attitudes did. The normative beliefs (n) are multiplied by the corresponding motivation to follow expectations (m) and the sum of the products represents the subjective norm component of the TRA.

3.4.3 Intention

Ajzen and Fishbein (1980) also introduced the component of intention to precede the behaviour component and following the predictors of attitudes and social norms. The intention component is therefore mediated by the attitudes and by social influence and represents the closest determinant of behaviour (see Figure 3.2).

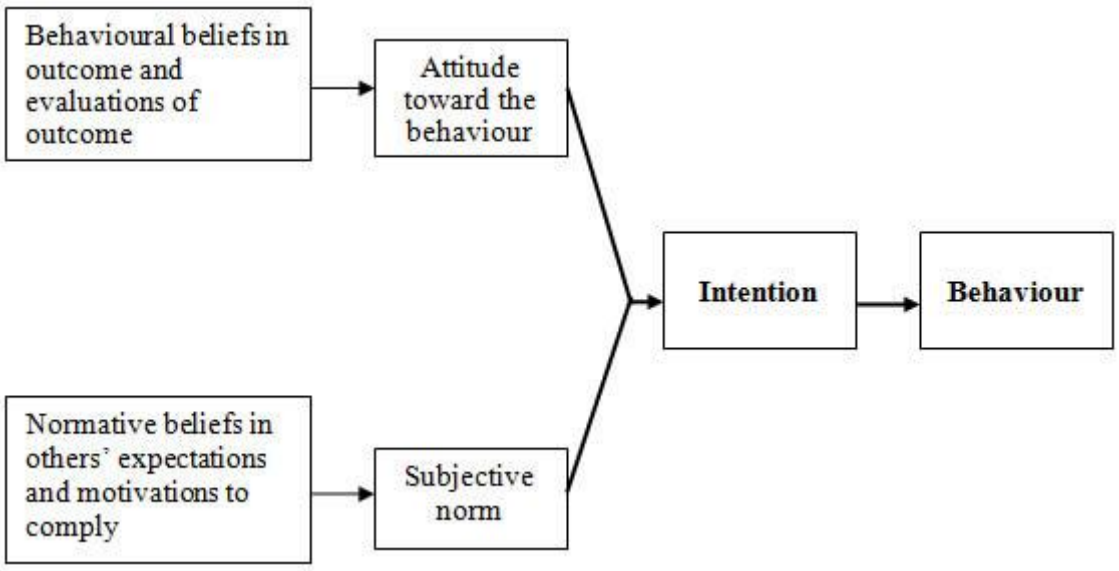


Figure 3.2 The theory of reasoned action and the relations among beliefs, attitude, subjective norm, intention, and behaviour (Ajzen & Fishbein, 1980).

The prediction of the behaviour component as the end goal of the TRA required a clear description of its construct in order to formulate corresponding constructs for the other components. This was stressed by Ajzen and Fishbein (1977, 1980) who based their attitude-behaviour model of the TRA on the 'principle of compatibility'. It stated that the statistical relation between two entities will be the stronger the more they correspond in their target, action, context and time elements (TACT). This means that the elements must also correspond in all the variables (attitude, subjective norm, intention, and behaviour).

More details about the constructs is outlined in the following section dealing with the theory of planned behaviour (TPB), since they differ little from those in the TRA. The ideas and concepts are retained in the TPB but have been finalised into the end product of an advanced model for understanding the human attitude-behaviour relation.

3.5 The Extended Theory of Reasoned Action: The Theory of Planned Behaviour

The theory of planned behaviour (TPB) is an extended theory of reasoned action (TRA) model. It was formulated by Ajzen (Ajzen, 1991) with the addition of a new variable, perceived behaviour control (PBC). The TPB therefore superseded the TRA. Its goal was not only to predict behaviour but also to offer an explanation for human behaviour. This model (Figure 3.3) retained the idea of beliefs as antecedents of the attitude and subjective norm variables and extended it to the new variable of perceived behaviour control based on the expectancy-value principle.

3.5.1 Perceived behaviour control

The TRA had been criticised for presupposing volitional control in the attitude-behaviour relationship. This was seen as limiting the application of the model (Liska, 1984, as cited in Eagley & Chaiken, 1993). The inclusion of a perceived behaviour control component now implied that the person would be better able to evaluate their capacity to perform the behaviour by including salient control beliefs, "which are beliefs about the likelihood that one possesses the resources and opportunities thought necessary to execute the behaviour" (Eagley & Chaiken, 1993, p. 187). In that way, it influences the intention component of the TPB. The beliefs were formulated according to the expectancy- value model as sets of salient control beliefs. The perceived strength (c) of each control belief was weighted by its perceived power (p), and the products were summed to yield an aggregate that represents the PBC.

The formula of perceived behaviour control is expressed in the equation as:

$$PBC = \sum_{i=1}^{n} c_i p_i$$

An additional pathway for PBC was introduced as a direct link from PBC to the behaviour bypassing intention. This acknowledged that the presence of actual prohibitive behavioural control when recognised by the person could make the behaviour impossible despite the best of intentions. It can therefore become the only predictor of behaviour.

3.6 The model of the Theory of Planned Behaviour

The components in the TPB were considered a theoretical construct that represented a "hypothetical or latent variable" (Ajzen, 2002a) and had to be inferred from responses or observations. The TPB model stressed the mediating effects between the three pre-intention variables (indicated by connecting arrows) which were seen as the predictors of intentions.

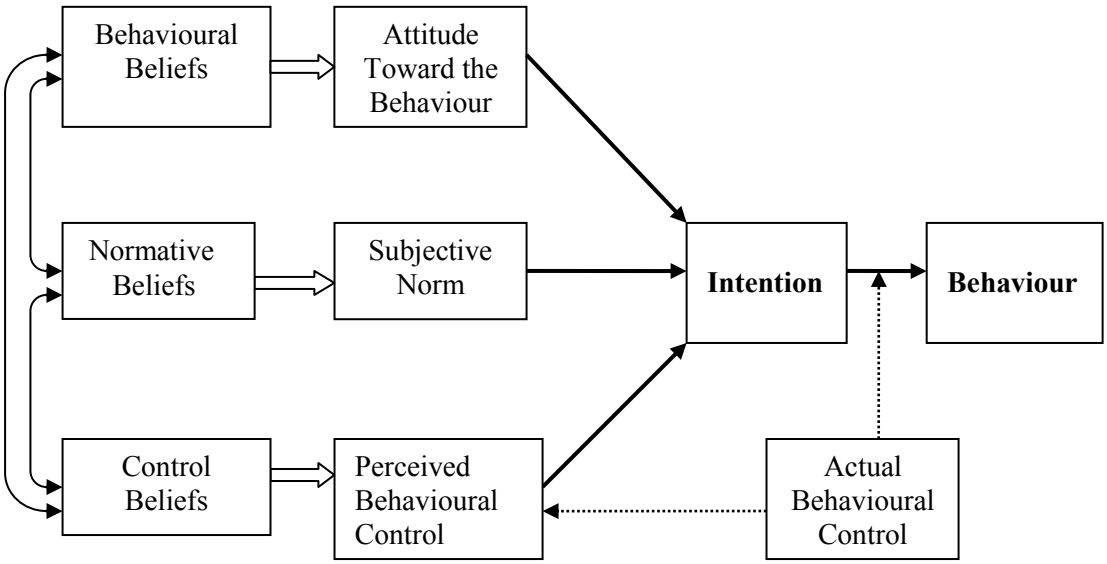


Figure 3.3 The theory of planned behaviour (according to Ajzen, 2002)

3.6.1 The components of the theory of planned behaviour

As outlined at the beginning of the chapter the theory of planned behaviour encompasses concepts of internal variables and external factors that one can expect to play a role in the decision making process of landowners in regard to riparian forest management. Therefore, the TPB offered an optimal framework for the planned survey of landowners to investigate these components and their relationship to intentions and behaviour in regards to riparian forest use and management. The psychological model

encompasses the belief structure that leads to the formation of the attitudes, subjective norms and perceived behavioural control variables, considered the determinants of intention and behaviour. Exploring these antecedents of the predictors can illuminate the underlying motives that drive the intention and behaviour of the person.

In addition, the theory allows external factors which are deemed important to be investigated as to their moderating role on attitude, subjective norm and perceived behaviour control. This will expand the basic framework of the theory so that it can be suited to the exploration of the particular sample of riparian landowners in the study.

In the following sections the TPB constructs are further described and discussed in the context of the present study. Other factors that have emerged from relevant research employing the TPB or not are also investigated and their possible application in the present study considered.

3.6.2 The behaviour construct

The behaviour component in the theoretical model of the TPB (see Figure 3.3) is the only component that can be observed and therefore described by the researcher. As the end goal in the TPB it requires a clear description of the construct in order to formulate corresponding compatible constructs for other TPB components. This has been stressed early on by Ajzen and Fishbein (1977) who based their attitude-behaviour model in the TRA on the 'principle of compatibility'. It states that the statistical relationships between two entities will be stronger the more their target, action, context and time elements (TACT) correspond in their level of specificity (Ajzen, 1991; Eagley & Chaiken, 1993). In the TPB, this means that the elements must correspond within all the variables (attitude, subjective norm, perceived behavioural control, and intention).

In this survey study for example specificity is assured in the following way - the target is the 'riparian forest', the action is 'using, preserving and maintaining riparian forest', the context is 'the important ecological need for riparian forests'. The time element is included to a certain extent in the intention items (e.g., 'I plan to maintain my riparian forest in the next year"). Since there were no plans for a survey in the following year to check if the action had taken place, this is purely a theoretical inquiry of intentions.

3.6.2.1 The assessment of behaviour

In the present study, the behaviour component was assessed and quantified from self-reports of the respondents. Because it was an anonymous postal survey the researcher had no way of investigating the riparian forests. Instead, several items enquired as to the use, management, agricultural practices, the plant cover of the creek banks, and the practice of removing debris from those areas including the waterways.

3.6.3 The intention construct

In the TPB, intentions (see Figure 3.3) are conceptualized as the 'proximal measures of behaviour' (Ajzen, 2002a, p.8). According to Ajzen (1991),

> Intentions are assumed to capture the motivational factors that influence a behavior; they are indications of how hard people are willing to try, of how much of an effort they are planning to exert, in order to perform a behaviour (p. 181).

Intention represents the central factor in the theory that predicts behaviour. The intention component is composed of the sum of direct measures from expressions of intentions to perform the behaviour and of the weighted contributions of the pre-intention components of attitudes, subjective norms and perceived behaviour control.

Intention functions as a predictor of behaviour (independent variable, IV) as well as the product of predictors (dependent variable, DV).

3.6.3.1 The assessment of intentions

Direct expressions of intentions were elicited by questions about the specific behaviour that covered all actions connected with it, as well as the context and a time scale when possible. These intention items should show high internal consistency.

The intention score is expressed as the degree of probability to engage in a given behaviour. In the TRA Ajzen and Fishbein (1980) generated this component on the basis that "most behaviours of social relevance are under volitional control and are thus predictable from intentions", and that "intention is the immediate determinant of behaviour" (Ajzen & Fishbein, 1980, p.41). Intention to perform a specific behaviour reflects the strength of the motivation, effort, and the willingness that would drive the person to perform the behavior. In meta-analyses of the TPB the intention component has been found in some cases to be a small but mostly significant predictor of behaviour (Armitage & Conner, 2001; Sheeran, 2002).

Intentions are easily destabilized when changes in the situational setting of the behaviour occur or when volitional control over the behaviour is a problem. Actual behaviour control is an additional factor in the TPB that bypasses all other predictors (see Figure 3.3) and becomes the most important moderator of behaviour.

3.6.3.2 Intention and actual behaviour control

The only predictor variable in the TPB that can bypass intentions is *actual behaviour control.* In contrast to *perceived behaviour control,* it represents a factual presence of some impediment that is insurmountable, such as complete lack of funds to perform a

very desirable behaviour. If the behaviour is not fully under the control of the person the intention component becomes a proportionately weaker predictor of behaviour to the point of being irrelevant (see Figure 3.3). In that case, the control factor as a function of the presence of non-motivational factors (actual) such as money, skills, lack of opportunity or cooperation of other people, will simply not allow the performance of the behaviour. This by-pass of intentions only happens in the case of actual behaviour control not perceived behaviour control (see Figure 3.3).

3.6.3.3 Intentions, willingness-to-pay and willingness-to-participate

In economic research intentions have been measured as willingness-to-pay. An example is a study by Spash and colleagues (2009) on willingness-to-pay for biodiversity in the catchment area of a hydro-electric power generator in the Scottish Highlands. They found that the three TPB predictors (attitudes, subjective norms and perceived behaviour controls) explained 53.6% of the variance of willingness-to-pay with a strong representation of ethical and conservation items. In contrast to that the contingent-valuation-method that tries to assign monetary values to commodities such as quality of life, biodiversity, and water quality, did not yield significant or meaningful results.

Willingness-to-participate is another variable that has been reported in non-TPB research as a measure of intentions with the overtones of perceived behaviour control. An example is a US survey that investigated landowners and their willingness to participate in a land management program aimed at establishing riparian vegetation. This study found that part-time or hobby farmers were more likely to agree to establish riparian vegetation (Hagan, 1996 as cited in Klapproth & Johnson, 1999c). They did not have to consider loss of income as much as the full-time farmers who perceived loss of

income as a control factor. Full-time farmers could actually assign a monetary value to their use of riparian areas.

The impact of the monetary control factor or loss of income from non-use of riparian forest for agricultural purposes or from upkeep of fences was not a clear determinant in a TPB study with cattle farmers in Queensland, Australia (Fielding et al., 2005). But it was a major factor in non-TPB studies in Victoria, Australia and in Kansa, US (e.g., Cable et al., 1999; Curtis & Robertson, 2003).

These examples point out the dilemma of 'who pays', as a basis of many conflicting beliefs and decisions about adopting riparian forest conservation practices. Riparian forest is after all a public resource that is also in private ownership and preserving it benefits both sides. The most obvious benefits for farmers is the protective function of riparian forest when it comes to erosion of the creek banks, and the public good is derived also from the biophysical functions of riparian forest, the retentions and removal of excess agricultural chemicals.

3.7 Direct and indirect predictors of intentions in the theory of planned behaviour

Up to now the measure of the three determinants of intention in the TPB (attitudes, subjective norms, perceived behaviour controls) has been described as a *belief-based* construction. There is however also a direct, global or overall measure for each predictor that involves assessment from separate questions. In this section, the necessity for and advantages of using both measures is discussed and the method of elicitation for each variable described.

Direct (global or overall) attitude, subjective norm and perceived behaviour control variables can be sufficient predictors of intention and behaviour, and will give an idea of the contribution and strength of each predictor (Ajzen, 1991, 2010). But to gain an understanding of the cognitive basis for the constructs of the pre-intention variables, indirect (belief-based) measures of behavioural beliefs (attitudes), normative beliefs (SN) and control beliefs (PBC) have to be obtained. The beliefs are considered to be the direct antecedents of each corresponding TPB predictor construct.

Generally, a weak correlation between direct and indirect (belief-based) measures has been found in research (Ajzen 1991), and the small magnitude has not been explained fully. Ajzen stated that in most studies a lack of saliency of the beliefs was the reason. But direct questions are also believed to be answered with less deliberation and thoughtful evaluation than indirect belief items (Ajzen, 1991; Ellen & Madden, 1990). Thus, salient belief-based measures should be more representative of the construct because they are better supported by the individual's thought processes.

Manstead and Parker (1995) reported the contrary in their review of the TPB that belief-based measures of attitude were not found to be more predictive of behaviour. They contended that automatic (direct) attitude responses could be more representative of relevant evaluation of the behaviour because of their greater impact on intentions, while belief-based perceived behaviour control measures may often not have a simple response available due to deliberation about situational, memories, and other factors. Therefore, different assumptions are made about the underlying cognitive process of a person's formulation of predictor variables when responding to direct or indirect items.

Despite the controversy as to the merits of direct over indirect measures of predictor variables, measurements of both types are recommended by Ajzen (1991) and Francis et al. (Francis et al., 2004a, 2004b) in their manuals for constructing a TPB questionnaire, as this can provide a better understanding of the building blocks of the constructs. In the present survey study the predictor variables were constructed of multi-item direct and indirect (belief-based) evaluative measures following Ajzen (2002a, 2010) and Francis et al. (2004a, b). A broad range of items ensures the representativeness of the measures.

While the direct items should show acceptable internal consistency (high Alpha values), this reliability criterion cannot be applied to the indirect belief-based items since a person can show contradictory but salient beliefs. Only the reliability of the products of the sets of belief-based items can be appraised with a pre-test on a representative population sample. It is important to remember that by eliminating belief-items with low correlation one can lose important information. For example, in the present study the landowner may believe that re-vegetating riparian areas would be a good thing but also believe that it is not worth the trouble. Examining the responses may show that the landowner does believe in the efficacy of riparian functions but does not want to pay for it or put in the effort of maintaining or re-establishing the forest.

As Francis et al. (2004b) put it:

> Therefore, unless there are overwhelming reasons not to do so, it is good practice to include both types of measures in TPB questionnaires. It is also likely that in so doing, it will be possible to explain more variance in intentions than by using only one type of measure. A further reason why it

> is advisable to use both direct and indirect measures is that the correlations between them can be used to establish convergent validity. (p.47).

Ajzen (2002a) also recommends that a construct validity test be performed between the direct and the indirect measures of all components.

3.7.1 Direct attitudes

Direct attitudes are obtained from items about qualitative aspects of evaluation using semantic adjective scales. The adjective pairs focus on an overall evaluation (good—bad) or other aspects of the behaviour or object which Ajzen (2002a) calls 'instrumental' (valuable—worthless, harmful-beneficial) and 'experiential' (pleasant—unpleasant*)*. These are comparable to the cognitive and affective responses to stimuli of the tripartite model (Rosenberg et al. 1960 as cited in Ajzen & Fishbein, 1980).

This type of direct attitude measure is in use in unstructured attitude research studies that rarely allow conclusions to be drawn because it does not consider other influences that are predictors of behaviour (Eagley & Chaiken, 1993). Nevertheless, attitude measures on their own can yield interesting insights which point the way to further more fruitful research into attitudes. For example, Larson (2009) conducted a survey of the local community (north Queensland) for the School of Business on "common attitudes to well-being" in the Great Barrier Reef catchment (the same locality and in the same year this survey was conducted). He found that the general public was not greatly concerned with the quality of their natural surroundings or water pollution in regard to the GBR, and riparian forests were not seen as very important or endangered. The connection between a healthy environment and functioning ecosystems seems not to have been understood. An exploration of the underlying

beliefs would be likely to pinpoint the reasons for this non-concern for water pollution in their surroundings. Of particular interest would be to investigate if the riparian landowners understood the importance of the riparian ecosystem. The participants were only described as including an overrepresentation of "agriculture and trade and other private sector employment categories" (Larson, 2009, p.655). Despite the basically sound methodology of this study, the results termed 'attitudes' represent in reality social and personal needs that people think are important for their well-being.

3.7.2 Direct subjective norm

A direct subjective norm (SN) construct is elicited by asking the individual questions about the probability that important others would approve of them performing the behaviour. In non-TPB studies this component is accessed by separate concepts, such as 'personal and moral norms'. In the TPB all external and internal norming factors that a person is exposed to are assumed to be involved in the formation of subjective norms.

3.7.3 Direct perceived behaviour control

Direct perceived behavioural control (PBC) items should contain questions about perceptions of capability (e.g., have knowledge and funds to manage riparian land), and about perceptions of being in control of the behaviour or situation (e.g., perceive few legal constraints on the management of riparian forest). The closely related concept of self-efficacy should be examined with different items aiming at the person's perception of their ability to overcome obstacles (Ajzen, 2010).

In a situation where the behaviour control is an actual overwhelming obstacle such as physical incapacity or financial inability, this direct measure can be the sole

predictor of behaviour. Clearly, in that case the person's perception of not having control over the behaviour reflects the actual state.

Items for the direct PBC component in the present study included measures of the person's self-efficacy as the confidence in their ability and the actual capability to perform the behaviour.

3.7.4 Indirect belief-based measures as predictors of intentions

In the TPB the components of attitude, subjective norm and perceived behavioural control (see Figure 3.3) are assumed to be generated from beliefs about various aspects of the attitudinal object or behaviour (Ajzen, 1991; Ajzen & Fishbein, 1980; Eagley & Chaiken, 1993). Beliefs are based on the associations that an individual makes between the behaviour or object and the evaluation of the various aspects that are perceived.

The strength of the saliency and accessibility of beliefs will be determined by any direct engagement or encounter with the attitude object, and even repeated expressions of attitudes or opinions, or knowledge about it. These events would be remembered as an experience and increase accessibility of beliefs (Eagley & Chaiken, 1993). Investigators found proof of this for attitudinal beliefs (e.g., Fazio & Powell, 1997; McCleery, 2009). The more accessible the information was, the more salient it became, and the faster it was retrieved and could influence a person's evaluation of the attitudinal object. Having never thought about the specific attitude object (for example, riparian forest) may nevertheless evoke related thoughts of experiences (for example, erosion on creek banks). These considerations are true for all belief-based measures in the theory of planned behaviour (TPB).

As a final point in regards to the importance of employing belief-based measures, is its importance in intervention studies. Successful interventions affecting intentions and behavior are assumed to be based on changes in the predictor variables; and these can be traced through the theoretical antecedents, the beliefs, thus verifying the predictive nature of these (Ajzen, 1991; Bamberg, 2003; Hardeman et al., 2002).

In the present study, the formulation of the TPB questionnaire belief items rely on relevant and salient schemes about the behaviour identified from Study 1. This qualitative exploratory interview survey with persons from the intended target population uncovered ideas and opinions as well as expressions of beliefs about the attitudinal object.

3.7.5 Indirect (belief-based) measures of attitude

The indirect belief-based attitudes in the TPB (see Figure 3.3) are a function of the sum of the products of salient behavioural (b) and evaluative beliefs (e) (Ajzen, 1991; Ajzen & Fishbein, 1980, 2000). It is the same construct and follows the same equation as in the theory of reasoned action.

$$IA = \Sigma\ b_i\, e_i$$

The strength of the belief is the subjective probability that the behavior will produce the outcome in question (b) is weighted (multiplied) by the subjective evaluation of the outcome (e) (Ajzen, 1991, p. 191).

The sets of beliefs in the theory are the antecedents of the attitude component and according to the equation, the two evaluative beliefs in each pair contribute with equal weight. In the present study, the strongest beliefs underpinning a positive attitude

were based on the belief pair of positive evaluation and strong belief in the usefulness of good riparian management. A positive attitude is expected to be predictive of stronger intentions to perform the behaviour and of the actual behaviour.

Multiplication of scores in each set of belief pairs can produce attitudes that do not reveal the underlying belief combinations. Thus, in the proposed study two landowners could hold positive attitudes when only one strongly believes in the outcome but does not value the outcome highly, while the other has the opposite belief valences. Equally, different indirect attitudes can come about when both strongly believe in riparian management but only one believes in the efficacy of it and the other believes that their efforts are useless because others cause the pollution not them, or their efforts will be negligible when taking into account the many non-performers.

The seeming ambivalence in attitudinal beliefs is in itself an interesting point to investigate because it can provide a valuable insight into the person's attitude composition by investigating the behavioural beliefs and the outcome evaluations separately. Castro, Garrido, Reis and Menezes (2009) explored this in a TPB study with people's conservation behaviour of recycling metal cans. Individuals were found to weigh the saliency of their beliefs in the benefits of recycling (the outcome beliefs) against the beliefs that it will be meaningful only when a significant number of other people do the same (the efficacy or behavioural beliefs). The value of the recycling of metal cans seemed to be a strong belief but the efficacy of doing so was not.

A study with graziers also showed that outcome evaluations were rated significantly more positively by subjects with strong intentions (Fielding et al., 2005).

Through the saliency weighting of beliefs the multitude of attitude variations that exist between people who may agree to have the same knowledge, experiences and evaluative attributions of an attitude object can be explained. There are also additional moderating factors that underlie attitudes and influence direct attitudes. These are discussed later in the chapter.

3.7.6 Indirect (belief-based) measures of subjective norms

The belief-based measure of subjective norm (SN) (Figure 3.3) has been described in the theory of reasoned action as the "perceived social pressure to engage or not to engage in a behavior" (Ajzen, 1991, p. 188). The indirect subjective norm is composed of the sum of the products of sets of beliefs analogous to the attitude component. Here a person's perception of expectation by important others to perform the behaviour (n) is weighted by the person's motivations to comply (m).

$$ISN = \Sigma \; n_i \, m_i$$

Important others are understood as salient referent persons, which can be neighbours or family members, or a group such as Landcare or technical support agencies.

Subjective norms (SN) have been found to be a separate concept from attitudes and to be predictive of intention (Ajzen, 2001). Armitage and Connor's meta-analysis of the TPB (2001) found SN to have very low predictive value but reported that the type of measure of the factor was inadequate in many studies they reviewed. In contrast SN as a significant predictor of intentions of academic achievement ahead of attitudes has been reported by Manstead and van Eekelen (1998), and by Finlay and colleagues (1999) in relation to health behaviour. The practical applicability of the behaviour in

question and a better measurement of SN may have played a role in the discrepancy of findings.

This was confirmed in rural studies. Subjective norming factors can be decisive in determining intentions of pro-environmental landcare as reported in a study in Belgium (Michel-Guillou & Moser, 2006). The researchers found that farmers committed to pro-environmental practices were more influenced by social pressure based on concern for public image than by their awareness of the environmental problem: "the adoption of pro-environmental behaviors by farmers seems to be linked more to the necessity of protecting the public image of their profession, and consequently their own social identity, than to protecting the environment itself" (p. 234).

A further confirmatory finding comes from a recent study in Canada where the farmers listed the chance to publicise positive farm stewardship practices as the most important reason to participate in an environmental farm planning scheme (Atari et al., 2009). Membership in pro-conservation farmers' groups in England was also found to increase perception of social pressure in preserving hedges. In combination with strong and positive beliefs about the conservation aspects of hedge management and preservation, subjective pro-conservation norming actually corresponded with positive behaviour (Beedell & Rehman, 1999). One obvious advantage of those farmers who belonged to an environmental group was better access to knowledge that could also lead to more informed and therefore more positive beliefs about the attitudinal object. In the study of riparian management decisions by graziers (Fielding et al., 2005) it was found that those with strong intentions were more motivated to comply with expectations from among others including those from government departments and urban Australians.

The strength of the normative beliefs is totally dependent on subjective assessment and is not necessarily a reflection of the real situation. This should not be seen as falsifying the outcome but a representation of the salient beliefs in the likely consequences of a behaviour and the expectations of important others. It also means that the person's beliefs in what is morally right and their feelings of belonging and identification with a group play a role in this norming process. They could be moderators of all three predictor variables or be an additional mediator of intentions. How much variance is explained by other types of norms in addition to the TPB predictor variables has been the subject of a number of studies and this will be discussed later in the chapter.

3.7.7 Indirect (belief-based) measures of subjective norms

The perceived behavioural control (PBC) component (see Figure 3.3) was the last variable to be added to create the theory of planned behaviour. It is composed of the sum of the products from a set of beliefs analogous to the attitude, and subjective norm components. Perceived behaviour control represents people's beliefs in their ability to perform the behaviour. The strength of each control belief (c) is weighted by the perceived power (p) of the corresponding control factor.

$$\boldsymbol{IPBC} = \boldsymbol{\Sigma}\ \boldsymbol{c}_i\,\boldsymbol{p}_i$$

When the perception of the actual control is accurate, increasing PBC will decrease the probability of behavioural performance (Ajzen, 1991). Interfering circumstances can impact on the PBC component to a greater extent than on the other more stable determinants, because external control factors are more likely to occur (financial, climate, etc.). The dominating effect of actual prohibitive control factors on

behaviour can be assessed reliably by observation or investigation. Self-reports in a survey may not be as accurate but certainly reflect the person's perception of control.

The proportion of explained variance in intentions due to perceived behaviour control should be indicative of the likelihood that the actual behaviour can be performed since it spells out the hurdles that would prevent the person from performing the behaviour. Armitage and Conner (2001) in their meta-analysis found lower PBC rates correlated with high intenders who performed the behaviour but not those high intenders who did not perform. This suggested that beliefs in the perceived behavioural controls were quite accurate.

3.8 The need for background factors

There is a considerable variety of cultural, personal, situational and many other factors that are encountered in any population and in every study on behaviour. To identify each and test its impact on behaviour is impossible. Ajzen and Fishbein (1980) did consider background factors such as personality (authoritarianism, introversion or extraversion), the need for achievement, demographic factors (i.e. gender, age, social class), social role, economic status and knowledge when they formulated the theory of planned behaviour. These factors had already been identified as influencing attitudes and behaviour from research evidence in the first comprehensive review of attitude studies by Gordon W. Allport in 1935 (as cited in Ajzen & Fishbein, 1980). The authors of the TPB realised that to include the multitude of possible factors as variables would greatly impede the scientific process of investigating attitudes. Ajzen and Fishbein's earlier model of the theory of reasoned action with its small number of concepts seemed to accommodate these external factors. In the theory of planned behaviour the addition

of perceived behaviour control was considered as encompassing the dominant determinant of behaviour (Ajzen, 1991).

The theory of planned behaviour is based on the assumption that the variables that determine intentions and behaviour in their model are ultimately a function of underlying behavioural, normative, and control beliefs which are influenced by a wide range of background factors (Ajzen & Fishbein, 2005). These beliefs in turn will influence each other with every performance of the behaviour, because new information will have become available about the outcome of the behaviour, the approval of salient others, and the experience of power controls. Thus, a feedback loop is established between all components when an attitude is formed or a behaviour is performed that takes into account the new information learned and other external factors found pertinent to the new situation. The more inclusive the measures of the proximal determinants of intentions are, the more variance of intention and behaviour will be explained. When the model's predictor variables are properly operationalised they will include background factors and thus single background factors will no longer add anything to intention that is unaccounted for already. In the present study the background factors are referred to as 'external variables'. They are described and explored in Chapter 9.

3.8.1 Background factors as influences on predictor variables and intentions

In the TPB the decision making process was assumed to take place within the predictor variables of attitude, subjective norm and perceived behaviour control. These variables were determined by behavioural, normative and control beliefs which are their respective antecedents. Cultural, personal and situational factors will influence the beliefs which "can vary as a function of a wide range of background factors" (Ajzen &

Fishbein, 2005, p.194). The researchers included the following list of background factors that were acknowledged as influences:

Table 3.1

Background factors acknowledged as influences

Individual	Social	Information
Personality	Education	Knowledge
Mood, emotion	Age, gender	Media
Intelligence	Income	Intervention
Values, stereotypes	Religion	
General attitudes	Race, ethnicity	
Experience	Culture	

The involvement of some of the individual factors (e.g., experience, general attitudes) has already been mentioned in the earlier section about the attitude concept and its formation. The social and information factors are discussed later in the section.

There are other individual factors that represent the moral domain (e.g., personal and moral norms) and some that appear to be extensions of the subjective norming component in the TPB (self-identity and social-identity), and the perceived behaviour control component (e.g., self-efficacy). The meanings and definitions of these extra factors seem to overlap but it was thought prudent to persist in reporting the research insights in those terms, grouping them accordingly, and identifying the overlaps.

There are few studies involving landowners and fewer with riparian forest as the attitudinal object, which makes the present study particularly salient. Nevertheless,

insights that seem to indicate additional moderators in the above sense have to be sufficiently exclusive of concepts within the TPB in order to be considered separately.

3.8.1.1 Personal and moral norms (individual values)

The influence of personal and moral norming factors on environmental attitude and behaviour have been extensively studied in non-TPB research (e.g., Dunlap et al., 2000; Schwartz, 1992; Stern, 2000a; Stern, Dietz, & Guagnano, 1995). They have also been considered as additional factors in TPB studies (Manstead & Parker, 1995). It seems therefore important to discuss them as items that may surface in the present study.

Personal norming (based on one's own moral and ethical beliefs) is distinct from subjective norming (based on beliefs about expectations of others) in that the referent (i.e., the 'important other') is oneself. Important others in the SN beliefs may nevertheless already be selected on the basis of personal norms. However, there is room for the case in which important others have ethical and moral standards that clash with one's own but the motivation to comply may still be there.

Support for the importance of the influence of personal norms according to Schwartz's moral norm-activation theory (Schwartz, 1992, 1994) in the biospheric, altruistic and egoistic value orientation in environmentally relevant consumer behaviour came from Harland and colleagues (1999). They tested personal norming in regard to four behaviours and found it contributed to the prediction of intention and behaviour. Furthermore, a review of TPB studies on recycling behaviour in Denmark (Thogersen, 1996) concluded that environmentally relevant behavior (e.g., recycling) belongs in the moral domain and has little to do with cost and benefit considerations of economics. People made decisions in terms of right or wrong when recycling. Thogersen's view of

the moral underpinnings in norming processes were supported with further studies about people's decisions in situations of environmentally responsible consumer behaviours (Thogersen, 2004, 2006).

In a review of empirical studies employing the TPB, Conner and Armitage (1999a) noticed that a number of them included personal norms as one of their measures. They concluded their inclusion as variables in the TPB was justified. The reviewed TPB studies all had a strong moral component to them (e.g., sales ethic, health behaviour of smoking, drug use, food choice, safe sex). Beck and Ajzen (1991) had already made a case for moral values predicting dishonest behaviour in college students. But they concluded that the behaviour under consideration has to have a clear moral dimension such as lying, in order to add any meaningful explanation.

A meta-analysis of 185 independent studies conducted by Armitage and Conner (2001) reviewed the evidence of moral and personal norms as additional variables within the TPB. They were not convinced that the evidence was sufficient and recommended further research. Ajzen and Fishbein (2005) also doubted that a personal or moral factor would increase the proportion of explained variance based on the empirical evidence. The main reason was that the new variable would be applicable only in certain situations where a clear moral dimension is present. Manstead (2000) also concluded this in a review of studies with moral dilemmas.

This moral or ethical dimension may have significant influence on certain behaviours, but it is doubtful that environmentally sensitive land management falls in that category. It may nevertheless moderate attitudes and subjective norms if the farmer or landowner has moral beliefs about land management or riparian forest preservation. Possibly, such ethical or moral considerations could be a factor for farmers that apply

biodynamic principles. There are no rural studies in the existing research literature and meta-analyses that could shed light on the applicability of personal or moral norm variables in intention formation or behaviour decisions.

3.8.1.2 Guilt feelings as expressions of personal norms (individual values)

Studies that investigate environmentally responsible behaviours are mainly concerned with recycling, consumer, and driving-related behaviour, and do not involve management decisions on a larger scale like sustainable farming. The findings from these studies nevertheless point out the importance of personal values in the formation of attitudes and social norms and their influence on intention, and are therefore informative for this study.

Research employing regret and guilt feelings as measures of personal norms (Manstead & Parker, 1995) did show that adding these variables to the standard TPB significantly "improved the predictive utility" (p. 76) of the model in their study on driving behaviour. Another study investigating the influence of personal norms in addition to the TPB conducted by Bamberg, Hunecke and Bloebaum (2007), with people's decisions to use public transport could show that personal norm beliefs predicted pro-social behaviour in the form of public transport use. The researchers followed the definition of Schwartz's personal norm concept as representing an "individual's personal internalised conviction that acting in a certain way is right or wrong and is driven by avoidance of negative self-related feelings such as regret or guilt after having broken her/his personal norms" (Bamberg, Hunecke, & Bloebaum, 2007, p.191). This concern with avoidance of regret based on personal norms means that there are internal norming behaviours that do not only consider how one appears to others but

also how one personally perceives "the moral correctness or incorrectness of performing a behaviour" (Conner & Armitage, 1998, p. 1441).

When moral responsibility as a determinant of environmental behaviour (recycling, consumer behaviour, public transport use) was investigated as a norming factor in addition to social expectations of responsibility (subjective norms) Kaiser and Shimoda (1999) found that "guilt feelings [of self-assigned personal moral values] determine about 44 per cent of a person's moral-related responsibility feelings, which, in turn, predict 45 per cent of self-ascribed moral responsibility for the environment" (p.251). This was a considerable portion of the variance of environmental behaviour. Moral norms were also found to moderate attitudes in a TPB study (Kaiser & Scheuthle, 2003). Subsequently, Kaiser (2006) tested the impact of 'anticipated guilt feelings' on environmental behaviour as a separate variable within the TPB. The results confirmed anticipated guilt feelings based on moral responsibility as significant contributors to intentions of environmental consumer behaviour. Kaiser then recommended inclusion of this new variable to increase the power of the TPB model in similar studies.

In the publication of the TRA in 1980, Ajzen and Fishbein wrote that they had investigated the inclusion of personal norm beliefs but found them redundant. They did however not exclude the possibility that future research may prove otherwise. Neither the meta-analyses of TPB by Armitage and Conner (2001) nor the literature review by Sutton (1998) mention Schwartz's (1992) personal or moral values or discuss Stern's values (Stern, 2000a; Stern, Dietz, Kalof, et al., 1995) that have been explored as additional variables or intention predictors.

The inclusion of a new factor on guilt feelings as expressions of moral or personal norms in the TPB is difficult to justify taking into consideration the types of research objectives in the reported studies. But any items in the planned survey questionnaire that may elicit moral norm responses such as attitudinal expressions of obligation and responsibility will be given attention in the data analysis. These factors would be included in Ajzen's background factor of the individual or social type.

3.8.1.3 Obligation and responsibility (individual personality or social culture factors)

Expressions of moral responsibility by farmers seem to be internalised notions of caring for the land, good stewardship, moral obligation to look after the land, and a strong sense of responsibility for the land. These have been repeatedly isolated and reported, and their predictive validity as an additional separate determining factor in the TPB tested (Beedell & Rehman, 1999; Curtis & Robertson, 2003; Dutcher, 2000; Grasby et al., 2000; Klapproth & Johnson, 2001; Michel-Guillou & Moser, 2006; Newhouse, 1990; Vanclay, 1992a). But correlations with landowners' management practice were found to be no better than the consistently low ones with general environmental attitudes. This can be partly attributed to the different meanings given to the expressions by the individual respondent (Carr & Tait, 1991; Dutcher, 2000).

Thus, while an Australian study found that farmers rejected the idea of receiving any rewards from stewardship or custodianship (Reeve & Black, 1993), Vanclay (1992a) had reported the opposite. He had included nine items on stewardship in an attitude scale, and found that his population sample of Darling Downs farmers rated highly on positive expressions of stewardship which correlated well with acceptance of conservation issues. Nevertheless, this was not reflected in the reality of their land

management. Recognition of erosion problems on their land and soil conservation management was very low. In the minds of these farmers, stewardship is encapsulated in the ”ideology of working with the land [as] being a natural, pure, wholesome, and best way of life for humans” (Vanclay, 1992a, p. 42) and be part of farming culture. Vanclay concluded that “stewardship may not in fact be correlated with conservation or with actual adoption of soil conservation practices,” (p. 42). Similar conclusions were drawn by Curtis and DeLacey (1998) for Landcare and nonLandcare participants in Australia, and by Dutcher et al. (2001) on the basis of findings from their study in Virginia, US.

Perhaps the notions of obligation and responsibility are more effectively classed as group statements (implying subjective norming) with a strong affective and personal moral component. In the TPB they would moderate subjective norms and according to the assumed interaction in the model would impact on attitudes and perceived behaviour control.

While not related to environmental specific behaviour a study of college students in the US tested if the addition of a variable of “perceived moral obligation” to the TPB model was profitable (Beck & Ajzen 1991), the results are informative. The factor was found to increase explained variance and add significantly to the prediction of intention to engage in unethical behaviour. The realisation and acceptance of one’s intended unethical behaviour was the most important point coming from that study.

3.8.1.4 Self-identity and social-identity (individual personality factor, social cultural factors, or subjective norm moderator)

Self-identity and social-identity are understood as an individual's identification with the many social roles available to them. Hogg and Smith (2007) explored the influence of social identity on attitudes. They concluded that when self-identification takes place it automatically becomes an important moderator of attitudes. Their description of self-identification is a continuum that extends from identifying with a group to identifying with the personal self (Terry, Hogg, & White, 1999). When there is a conflict between identities the most salient one in the situation will take precedent and influence attitudes. Castro and Lima (2001) found that they could explain additional variation with social identity information in a study about environmental beliefs and science with a general population sample in Lisbon, Portugal. In the TPB the attitude component is assumed to interact with the two other pre-intention variables, the subjective norms, and the perceived behavioural control, and therefore self-identity processes would influence all three components. Social structure and socialisation is an acknowledged factor in value orientation in social psychology (Stern, Dietz, Kalof, et al., 1995), that influences people's understanding of the world and their norming behaviour (Eagley & Chaiken, 1993).

Some health and eating behaviour studies using measures of self-identity have found for example that it is the principal determinant of intentions in food choice (Armitage & Conner, 1999b), of predicting the intention to consume organically grown produce (Sparks & Shepherd, 1992), or foods low in animal fats (Sparks & Guthrie, 1998). Also, rural studies employing the TPB have found evidence for this factor. In England (Beedell & Rehman, 1999, 2000) members of pro-conservation farmer groups

that showed good hedge management also reported increased perception of social pressure to practice hedge preservation. This is an example of group identification and the farmer's motivation is to be seen as a representative member.

Similarly, the strength of in-group identification was investigated in an Australian study (Fielding, Terry, et al., 2008) undertaken on riparian forest management of cattle farmers. Their specific conclusion was that farmers with high intentions to engage in sustainable practices identified strongly with their in-group's norm of support for the management practice. This indicated that the perceived expectation to comply and the need to affirm self-identity was influencing motivation in the underlying normative beliefs of the subjective norm component in this TPB study.

This 'public image' consideration of farmers also showed in a Belgian study (Michel-Guillou & Moser, 2006) that did not employ the TPB. The researchers concluded that intentions to take up pro-environmental practices could be linked to the desire for social approval within their rural community which led to intentions to follow pro-environmental land management. The SN in the TPB accounts for this notion in the normative beliefs of expectations and motivation to comply. A non-TPB study in Canada also reported a similar finding (Atari et al., 2009). Farmers considered that a chance to publicise their good farm stewardship practices (a type of seeking social approval) was the most decisive factor in their intention to participate in an environmental farm planning scheme.

Despite the support by these studies for the additional variable of self-identity in the TPB it leaves the question as to why it is not already represented in the components of the model. The subjective norm component of the TPB is based on the person's salient referents, that is, people of social groups the person feels to be a member of,

such as family, neighbours, and farming community. Thus, self-identity is necessarily part of the process of deciding what the expectations of these referents are, how important they are, and how strongly they motivate compliance with those expectations.

The answer may lie in a lack of proper operationalising of the subjective norm measure. Armitage and Connor (2001) found SN to be the weakest predictor in their meta-analysis of TPB studies but were not convinced that this was actually the case. The types of SN questionnaire items were most likely the problem. They found most of the subjective norms were not sufficiently defined and recommended optimally operationalised SN measure to be used.

The subjective norm component in the TPB is assumed to account for external societal values. But personal values and self-identity beliefs cannot be discounted in the decision making process. Indeed, the subjective norm beliefs are representative of a person's self-identification as believing in salient referents' expectations and desire to comply with them.

Ajzen and Fishbein (2005) viewed the construct of self-identity together with other proposed additional measures as represented in behavioural intentions with which it was found to highly correlate. On their authority it appears that the inclusion of a self-identity factor in a properly operationalised TPB questionnaire would add little to explaining the variance in intention and behaviour.

In the present study, group or social identity will not be directly targeted in the TPB questionnaire but it will be implied in several items of the components. The demographic data should also disclose group identity of a professional community. It

should provide enough information to allow some insight into the self-identity beliefs of the sample.

3.8.1.5 Motivation or intrinsic satisfaction (subjective norm extension factor)

The subjective norming beliefs in the TPB model include the concept of motivation to comply with the perception of social pressure, an external force. De Young (2000) reported a different kind of motivation as a separate variable in a review of nine non-TPB studies on environmentally responsible behaviour. Regardless of the fact that such behaviour has multiple antecedents, he focused on intrinsic satisfaction as one of them. He found that participants with a high level of positive environmental attitudes also had a strong sense of intrinsic satisfaction from gaining competence by practising responsible environmental behaviour, and from "being effective at making a difference in one's community" (p. 522). De Young believed such extra variables are important and should be included in the TPB. He also made a case for the great diversity of motives that people find acceptable and empowering in the multitude of environmentally responsible behaviours that can be imagined.

The addition of intrinsic satisfaction items presumes that the behaviour in question is understood as giving such feelings of contentment. This was the case for the studies in De Young's review of responsible ecological living. In the present study the behaviour is much more demanding (managing riparian forests and preserving them) than recycling and living frugally. Receiving satisfaction from fulfilling intrinsic motivations by managing riparian forest is certainly imaginable. It would require a strong affective connection for the area, or a very strong conviction that the work is going to lead to the efficient functioning of the riparian forest and will make a difference to the environment especially the Great Barrier Reef. These notions will be

already considered in the direct measure and in the composition of the belief-based attitude component of the TPB, in particular the exploration of the underlying cognitive and affective processes of attitudinal and norming beliefs which influence intentions and behaviour.

In the present study it is not expected that the active pursuit of riparian care for the aim of achieving intrinsic satisfaction is at all common among the landowners. The altruistic act of doing something valuable for the community presupposes a group feeling and especially a community that values riparian forest. Nevertheless, believing that the behaviour will make a difference to the surrounding community of landowners or the population in the area of the GBR catchment could be a powerful incentive to some individuals.

The data from the planned TPB study might indicate landowners' satisfaction from partaking in environmentally responsible acts as part of outcome evaluations reflected in their attitudes, but also what they think these acts are in regard to riparian preservation. Equally important would be to know if landowners feel they receive any or have a need for more acknowledgment from the community for preserving and maintaining riparian forests. The subjective norm items in the question may at least show if landowners admit to being aware of expectations and if that represents a motivation for conservation of riparian forest.

3.8.1.6 Self-efficacy as a moderator in perceived behaviour control

Sheeran (2002) in a meta-analysis of 10 studies, including Armitage and Conner's (2001) did not find support for perceived behaviour control (PBC) as a predictor of greater consistency between intentions and behaviour. One explanation postulated was

that all research studies in these meta-analyses were concerned with health-related topics and the perceived behaviour control beliefs would be about controllable behaviours rather than perceived external impacts. This control factor could be described as beliefs in self-efficacy which would include personal efforts in other behaviours such as participating in examinations at college. Manstead and van Eekelen (1998) tested this kind of self-efficacy as an external factor in the TPB model, defined as 'confidence in ability to achieve behavioural outcome in examinations'. Regression analysis showed this factor as being highly correlated to intentions and more predictive of the outcome than intentions. It would seem logical to include this self-efficacy item in the operationalization of the PBC construct to achieve the same outcome. In the prediction of college examination results it is evidently sufficient to have a strong belief in one's self-efficacy and be certain of one's knowledge. These beliefs were accurately reflecting the student's scholastic ability and confidence.

The notion of self-efficacy is considered in the planned survey as part of the PBC items, treated as an intrinsic part of control beliefs. Further explorations of self-efficacy in the context of the TPB construct of the direct perceived behaviour control is in Appendix D.

3.8.1.7 Economic control factors as moderators in perceived behaviour control

The cost of riparian forest management and maintenance through non-use should represent a negative factor in adopting recommended practices. This was indeed reported by Klapproth (1999c) in the US. She found that economic constraints were the main disincentive to preserving riparian land because the landholder could earn more by producing cash crops on it. This was especially prominent with full-time farmers who had no outside income. They also thought that they should not have to bear the cost of

producing benefits for others through improvement of water quality. Nevertheless, the author also found that landholders with very strong positive attitudes toward the goals of a proposed conservation program (belief in efficacy) were more likely to join regardless of the funds available.

Australian farmers' non-adoption of recommended erosion management was based on their inclination to rely on 'farming culture and good farm management' to prevent land degradation according to their own experience and opinion, than on economic assistance which may not cover the costs anyway (Vanclay & Cary, 1989 as cited in Vanclay, 1992b). This of course indicated that the farmers did not quite realise the extent of salt and erosion damage on their land. Nevertheless, the recommendation was that government-sponsored education campaigns about land management could do better than stress economic benefits as the most important incentive but instead should focus on supporting farmers' ideas about what constitutes good stewardship.

Reeve and Black (1993) also concluded that Australian farmers did not base adoption of sustainable practices wholly on financial considerations. Rather, problems of equity were raised and any compliance was strongly dependent on freedom from outside interference into their decision making.

Wilson, Jansen, Curtis and Robertson (2003) concluded that economic factors were not the most important impediment to the adoption of riparian forest rehabilitation. In their survey the farmers did not believe there was any need for change in their usage of the areas on their cattle properties. The one major impediment was that they did not believe in the effectiveness of recommended riparian management practices since they already had their own.

These examples of research results show the ambivalent place of economic factors in land and riparian forest management investigations. In the TPB the financial constraint should be sufficiently addressed in the perceived behaviour control component. The questionnaire will include items that give insight into financial considerations, and they will be statistically weighted against other factors such as level of belief in riparian forest function and beliefs in efficacy management according to farming culture.

3.8.1.8 Social-demographic factors

Klapproth and Johnson (1999c) reported results of rural surveys in Virginia, US, that adoption of riparian buffer establishment program was more likely with younger landowners who were more educated and had less farming experience. But in other studies socio-demographic factors as mediators in the attitude-behaviour relationship have not been found to be consistent. They are nevertheless, assumed to influence behavioural beliefs especially when representing political and religious orientations (Fielding et al., 2005; Nooney, Woodrum, Hoban, & Clifford, 2003; Tarrant & Cordell, 1997). One recent non-rural study on mode of travel (Hunecke, Haustein, Böhler, & Grischkat, 2010) using the TPB did not find socio-demographic variables predictive of behaviour or intentions.

In the present study social-demographic information is collected and its predictive power checked. In addition to theoretical testing such information is useful in this research as it will inform the application of strategies aimed at changing landowner behaviour.

3.8.1.9 Knowledge and understanding of scientific information

The provision of information that outlines environmental benefits based on scientific research should be expected to increase the adoption of land care practices by land holders that would minimize harm to the riparian forests. Nevertheless, only a few studies found awareness, knowledge, and even good understanding of the environmental problem a factor that consistently or directly influences intention or the actual practice of alleviating the problem of land deterioration (Cotching & Sims, 2000; Dutcher, 2000; Dutcher et al., 2004; Earles et al., 1979; Vanclay, 1992a). When Curtis and Robertson (2003) found knowledge as a significant factor in the adoption of riverfront management (prevention of erosion) by graziers, the clue to this contrary finding is that it is easy to see when cattle are damaging creek banks and how it is not beneficial in the long run.

Knowledge of scientific facts is represented by the strength of the belief in the outcome of the behaviour (i.e., the efficacy of the recommended riverfront management) which in the TPB becomes an important behavioural belief contributor to the intention and behaviour components. The first step for this belief to become salient is to accept that the land or riparian forest is in need of improvement and that the observed land degradation is not a natural occurrence (Barr & Carey, 2000; Corbett, 2002; Dutcher, 2000; Klapproth & Johnson, 2001; Wilson et al., 2003). A case in point is illustrated in a very early Australian interview survey (Earles et al., 1979) that found acknowledgement of erosion problems in the district was significantly correlated with intentions to adopt erosion management practices. The farmers only intended to act when they saw any need on their own land. According to the researcher there were already visible signs of degradation on their land.

The next step is to be able to understand the biophysical background to good land management principles which lead to the amelioration of environmental degradation. When these are applied appropriately the practical experience will influence intentions and behaviour positively (Vogel, 1996), or negatively if inappropriate management is adhered to, which is often a continuation of traditional agricultural practice (Curtis et al., 2002; Wilson et al., 2003).

Knowledge and understanding of the scientific information are clearly factors that have to be considered in the formation of corresponding attitudes. For that purpose education and information opportunities for landowners have been found to be essential in achieving wide adoption of good management practices (Gunningham, 2007). Well-informed landowners will have the capacity to evaluate the promoted outcome of the management changes which would be a strong positive factor if the outcome was believed as being beneficial. Ignorance therefore cannot be used as an excuse.

The survey questionnaire of the present study included questions based on knowledge and understanding scientific facts about riparian forest as part of the attitude component.

3.8.1.10 Experience and past behaviour

Entrenched attitudes have been interpreted by some social psychologists as proof that the formation of attitudes is a form of associative learning and therefore a memory construct (Eagley & Chaiken, 1993; Fazio, 1989; Zanna & Rempel, 1988). But a memory theory does not explain new attitudes that are not based on previous experience and behaviour. Nevertheless, the evaluative process is obviously considerably influenced by past behaviour, automatic recall and also by exposure and learning.

The addition of past behaviour as moderator or mediator of intentions in the TPB has been recommended by several researchers (Brickell, Chatzisarantis, & Pretty, 2006; Rhodes & Courneya, 2003). It has been found to predict, for example health behaviour (Hagger, Chatzisarantis, & Biddle, 2002; Norman & Conner, 2006), recycling behaviour (Knussen & Yule, 2008), and driving behaviour (Forward, 2009). Ajzen summarises his conclusions on the matter of past behaviour thus : "A review of existing evidence suggests that the residual impact of past behavior is attenuated when measures of intention and behavior are compatible and vanishes when intentions are strong and well formed, expectations are realistic, and specific plans for intention implementation have been developed" (Ajzen, 2002b, p. 107).

In the present study the question of past behaviour is at the heart of the research question, because the lack of riparian forest management and preservation behaviour is what has caused the destruction of these areas. If there has been such behaviour in the past it must have been abandoned by the landholder. The survey questionnaire will include investigative questions about the state of the riparian forests in the present and in the past. If landholders have always managed the area environmentally appropriately the reasons may be revealed in their responses in the environmental value domains or response level. Thus, a landholder may report a strong belief in the intrinsic value of riparian forest (as an area that should be preserved for its own sake), or an extraordinary affection for this area.

3.8.1.11 Environmental values

Environmental attitudes defined as such by their behavioural object, are aspects of the environment. There is evidence that environmental behaviour is strongly influenced by a person's particular value system (Stern & Dietz, 1994; Stern, Dietz, Kalof, et al.,

1995; Stern et al., 1993). In this value-based theory of attitudes or concerns, three clusters of value systems can be grouped into the categories of egoistic, social-altruistic and biospheric (Schultz, 2000; Schultz & Zelezny, 1998). The idea of altruism as a prerequisite for positive or negative environmental attitude has its source in Schwartz's theory of moral norm-activation, which stresses the awareness of adverse consequences to others, and the belief of personal responsibility in averting this (Schwartz, 1977 as cited in Widegren, 1998).

These worldview categories are determined using scores of the New Ecological Paradigm (NEP) scale which is entirely concerned with beliefs and values of a global environmental nature (Dunlap & Van Liere, 1978; Dunlap et al., 2000). In the NEP the broader 'worldviews' or community based value systems are measured using environmental vignettes that test egoistic, altruistic and biospheric values in regard to the environment. The answers identify the persons who are only concerned with their own personal well-being (egoistic) when confronted with the environmental scenario, or with the well-being of other humans (altruistic), or with all living entities on earth (biospheric).

But worldviews or personal environmental values are not necessarily predictive of the behaviour. For instance, groups with any worldview could perceive an environmental threat such as polluted water, with equal saliency but for different reasons. A very strong threat could make all groups behave in a very pro-environmental way. Thus, when the motivation for pro-environmental behaviour is the object of research, behaviour will only be an indicator in situations where environmental problems do not directly impact on the individual. To determine the value system of

research participants in surveys the questions need to indicate that there is a reason for the person's stance on environmental issues.

Environmentally significant behaviour depends on the impact the behaviour has on the environment. For example, a direct action such as cutting down a tree can have significant or minor consequences depending on the environmental importance of that tree. In a proximal action such as voting for environmental policies the impact can be local or global (Stern, 2000a). The attitude strength is not necessarily reflected in the impact of the behaviour but rather in the type and persistence of the behaviour in different contexts and under different time frames (Ajzen & Fishbein, 1980). The intentions that precede most behaviours are the other factors that determine the significance of the action. These are mediated by knowledge and practical experience that provide accessible beliefs. Beliefs in the benignity of an action do not have to be realistic and lead to environmental damage, or may have no impact at all, as in the example reported by Stern (2000b) where many Americans avoid spray cans believing they still contain fluorocarbons, which has not been the case at least for a decade. Considering that attitudes are not stable entities it is not surprising that environmental attitudes are so dependent on the attitudinal object at hand (Eagley & Chaiken, 1993).

3.9 The New Ecological Paradigm (NEP)

The present study was designed around the framework of the theory of planned behaviour. This social psychological model has at its core the compatibility between all predictor components, intention and behaviour. This means a narrow specificity that relates to the attitudinal object had to be observed. Therefore, there was no place in the model for a measure that provided insight into general environmental beliefs that could be an overarching element underlying all beliefs in the TPB. Such an additional

measure in the present study was expected to give an indication of common ground on the basis of ecological beliefs. This would provide a valuable insight into influences from deeply held and salient beliefs stemming from a certain worldview.

To this end the revised New Ecological Paradigm (NEP) scale (Dunlap et al., 2000) is included in the survey as a separate but commonly used measure of environmental attitudes or environmental belief systems. The data will be compared with survey results from all over the world. The meta-analysis by Hawcroft and Milfont (2010) endorses the use of this instrument as a general environmental attitude measure that represents a worldview based on beliefs.

3.9.1 The background of the revised New Ecological Paradigm (NEP)

The first NEP called the New Environmental Paradigm scale devised by Dunlop and Van Liere in 1978 consisted of 12 items that were to measure "fundamental views about nature and humans' relationship to it" (Dunlap et al., 2000, p. 427). It explored three dimensions in the form of belief statements: balance of nature, limits of growth and anthropocentrism. The instrument using the Likert scale was tested with a large postal survey of the general population in Washington State US and of known environmentalists. It became a widely used measure of environmental orientation and concern in the social sciences (Stern, Dietz, & Guagnano, 1995).

In 1990 Dunlap and colleagues revised and augmented the NEP and renamed it the revised New Ecological Paradigm Scale (revised NEP). This 15-item questionnaire was tested in a postal survey in Washington State with 676 respondents comparable to the original 1978 population sample. The result was presented in 1992 at the Annual Meeting of the Rural Sociological Society at The Pennsylvania State University and

published in the proceedings. In 2000 the researchers published it in the Journal of Social Issues (Dunlap et al., 2000).

The revised NEP added items that tap into two more facets of ecological belief: exemptionalism (humans are exempt from the constraints of nature, as discussed in Dunlap and Catton 1994), and ecocrisis (triggered by the emergence of knowledge about ozone depletion, climate change, and human induced global environmental changes and including items that focus on the likelihood of potentially catastrophic environmental changes). Social psychologists have considered the NEP scale as a mechanism to access environmental attitudes, beliefs, and values, by tapping into "primitive beliefs about the nature of the earth and humanity's relationship with it" (Dunlap et al., 2000, p. 427). It essentially measures beliefs about "negative consequences of human interactions with the environment" (Stern, Dietz, Kalof, et al., 1995, p. 1614). These beliefs should influence attitudes concerned with environmental issues (Dunlap et al., 2000; Stern, Dietz, & Guagnano, 1995). Thus respondents with strong environmental awareness such as members of environmental groups score high on the NEP Scale (Widegren, 1998), and so do schoolchildren who enjoyed nature (Bogner & Wiseman, 2002). General environmental attitudes do not predict specific environmental behaviour and thus the NEP has not been found to be predictive of environmental behaviour (Nooney et al., 2003).

3.9.2 The NEP in rural studies

The NEP has been used extensively in studies on recycling and consumer behaviour with students, but studies on land management with landholders and farmers are rare. An Australian survey by Curtis and Robertson (2003) used the NEP as a general environmental attitude measure and reported that most respondents (cattle farmers) had

a positive attitude to conservation. But there was no relationship between the attitudes and the adoption of current recommended land management practices. This is not surprising considering that values expressed in a positive ecological worldview do not guarantee environmentally sound behaviour that is specific to land management (Ajzen & Fishbein, 2005; Stern, 2000b; Tarrant & Cordell, 1997). Pro-environmental behaviour is influenced by personal and contextual factors as well as value-based variables. Thus the NEP score is too broad a measure for specific behaviour such as fencing river frontage to save it from erosion by cattle.

3.10 Summary

The theory of planned behaviour is a structured social psychological model of intention and behaviour prediction that has proven its applicability in many empirical studies. The research using the TPB has been critically reviewed in meta-analyses (e.g., Albarracin, Johnson, Fishbein, & Muellerleile, 2001; Armitage & Conner, 2001; Hagger et al., 2002; Manstead & Parker, 1995) and the TPB model found to be efficacious. The complexity of the model allows taking into account the varying degrees of saliency and the valence of beliefs within the pre-intention variables and between them. When applying this model design as the framework in the proposed research study, it is anticipated to provide insights into the underlying belief structure that leads to the decisions made by landholders in regard to riparian forests and their management. The present study aims to elucidate the relationship between landowners' beliefs about riparian forest, its management and importance (the independent variables), and the intentions (as the independent and dependent variable) and behaviour to practice environmentally sound management of the areas (the dependent variable).

The TPB is seen as a suitable framework to undertake this assessment of the independent variables and the statistical testing of the data to explain the variance of the dependent variables. It will enable the realisation of the aims of the present study and provide answers to verify or discard the proposed hypotheses.

3.11 The Aims

The main aim of the study was to explore the factors that influence landholders of riparian forests to have intentions follow environmentally sound land and water management practices of riparian forests and to actually act on these intentions. To enable that aim the TPB questionnaire construction followed the instructions by Ajzen (2002a) and Francis et al. (2004a, b). These were based on the predication that the determinants of intention and behaviour are composed of a sufficient number of relevant direct and indirect measures. It posits that the predictive and explanatory power of the components of the TPB lay in the appropriate inclusion of salient beliefs and their compatibility with the intention and the behaviour components. In addition, information from various empirical and theoretical sources reviewed in this chapter was selectively incorporated.

The aims were:

- To establish the efficacy of the theory of planned behaviour (TPB) as a research instrument for the present study by
    - examining direct measures of attitudes, subjective norms and perceived behaviour controls as predictors of intentions
    - examining the strength of intentions as predictors of behaviour indicators of good riparian forest management, considering time (within the year), action (planting forest), and cooperation (with agencies)

  - examining if any perceived behaviour controls represent actual controls that prevent behaviour

- To explore the contribution of belief based (indirect) measures of attitudes, subjective norms and perceived behaviour controls in the prediction of intentions and behaviour indicators
- To identify and establish the contribution of attitudinal beliefs from the different domains (biospheric, egocentric, altruistic) and levels (affective, cognitive, behavioural).
- To identify and establish the contribution of norming beliefs.
- To identify and establish the contribution of control beliefs
- To examine the usefulness of behaviour measure which are indicators of good riparian management practices:
  - State of the creek sides (kind of vegetation),
  - Usage of the banks (cultivation distance from the waterway),
  - Maintenance of creek banks (planting)
- To examine background factors as potential moderators or predictors of intentions and behaviour indicators.
  - Social factors from demographic information on education, age, gender and family situation.
  - Knowledge and intervention factors from asking what information was available and has been accessed by the subject, such as workshops on land management.
  - Respondents' ratings of their scientific understanding of riparian forests in comparison to scientists to assess scepticism of science.
  - Respondents' NEP scores.

CHAPTER 4.

METHODS OF THE RESEARCH STUDY INCLUDING INTERPRETATION OF STUDY 1 AND THE PRE-TEST

4.1 Research Study Design

The main objective of the research project was to explore attitudes that would be predictive of landowners' riparian forest management practice. The social psychological model of the Theory of Planned Behaviour (TPB) (Ajzen, 1991) was selected as the theoretical, conceptual and analytical framework for this research (see Chapter 3). The model required an elicitation study (Study 1) to ascertain the salient beliefs that are assumed to underlie attitudes as described in the previous chapter. The main survey questionnaire (Survey 1) was based on insights gained from Study 1, using the TPB as a guideline. This main survey questionnaire was pre-tested and modified as a result of this pre-test. An overview of the structure of the research design is summarised in Table 4.1.

This methods chapter will also include interpretation of the results of Study 1 which were instrumental in the formulation of the TPB questionnaire of the main survey. These results are outlined following the description of the procedure of Study 1. A summary of the contribution of information from the study to the questionnaire of the main study concludes the report. The results of the pre-test are also reported following the description of the testing procedure.

The materials and procedures of surveys 1 and 2 of the main study are then reported and conclude this chapter.

Table 4.1

Overview of the research design

	Study 1	Main Study		
		Pre-Testing of Questionnaire	Survey 1	Survey 2
Participants	11 Retired farmers	9 Testers	Mail-out of 540 Returns N=123 (22.7%)	Mail-out of 454 Returns N = 75 (16.5%)
Material	31 item questionnaire with brochure	108 item questionnaire including 84 TPB items	92 item questionnaire including 63 TPB items 15 item NEP questionnaire	Brochure with 5 information-seeking statements, 12 item TPB questionnaire
Survey Methodology	Face-to-face semi-structured interview	Hand delivered survey – Self-administered questionnaire, forced-choice	Mail Survey - Self-administered questionnaire, forced-choice	Mail Survey - Self-administered questionnaire, comments and forced-choice

4.2 Study 1

4.2.1 The Objective and Format of Study 1

Study 1 (also called formative study) was undertaken to comply with the recommendations of Ajzen (2001) when constructing a questionnaire using the theory of planned behaviour (TPB). This study explored the salient beliefs about the targeted attitude object or behaviour (in this study the maintenance and preservation of a riparian forest) from a representative respondent group which would inform and guide the formulation of questions in the main survey questionnaire. According to the TPB,

beliefs about and evaluations of an object, together with respective subjective normative beliefs (the need to comply with expectations of significant others) and perceived behaviour control beliefs (the feeling of being able to perform the expected behaviour), underlie attitudes and are predictive of intentions and ultimately the behaviour. An open-ended questionnaire format was employed to explore these constructs. It allowed the interviewees to talk at length about anything that they thought pertained to the question.

Ethics approval Category 1 was given for this study by the James Cook Ethics Committee (Ethics Approval Number H 2005).

4.2.2 The sample population

The sample of interviewees of Study 1 consisted of 11 retired farmers. They had cultivated the land for at least 10 years (range 10 to 45 years), and had lived on the farm or close to it for an average of 46 years (range 27 to 73 years). This group was chosen because of their management experience with riparian forest during years of association with the area. This would have provided the context which would allow them to develop attitudes toward riparian forests that were well formed, highly salient, and would be indicative of how an important group of landowners would feel. They were also expected to voice their views explicitly and confidently and therefore provide cogent and valid ideas for the TPB questionnaire components – and the study on the whole.

4.2.3 The recruitment process

All interviewees were recruited by personal communication through acquaintances who provided a letter of invitation to prospective interviewees together with an information

sheet (Appendix A). This identified the title of the study ("The streamside forest: What retired farmers think of it"), and explained its purpose, the names and contact details of the persons in charge, a short description of the study and of the interview questions.

When the prospective interviewees decided to accept the invitation they contacted the interviewer (principal investigator) by telephone and arranged a meeting at their house. It was decided to conduct the interview in the interviewees' homes where they would feel relaxed and in control. An interview only occurred if the person initiated contact with the principal investigator and extended an invitation.

4.2.4 Demographics of the sample population

Eleven retired farmers (one female and ten males) were interviewed. Their ages ranged from 43 to 74 years, with an average age of 66.4 years. Leaving out the youngest participant who was 17 years younger than the next oldest, the average age was 68.7 years. On average, the farmers had been retired for seven years (range 1 – 22 years).

Eight of the interviewees had been sugar cane farmers and three mainly cattle farmers. All had farmed the land throughout their working life. Only one started with fully forested (uncleared) land, six had cleared additional land for farming, and four took up previously cleared and cultivated land. The education level was reported as from "no school at all" (one interviewee) to "tertiary agricultural college" (one interviewee), and nine had attended school to grade 10. Four interviewees had sold their farm, six had their sons farming the land and one lived on the farm but did not cultivate the land anymore.

4.3 Materials of Study 1

4.3.1 The semi-structured interview questionnaire

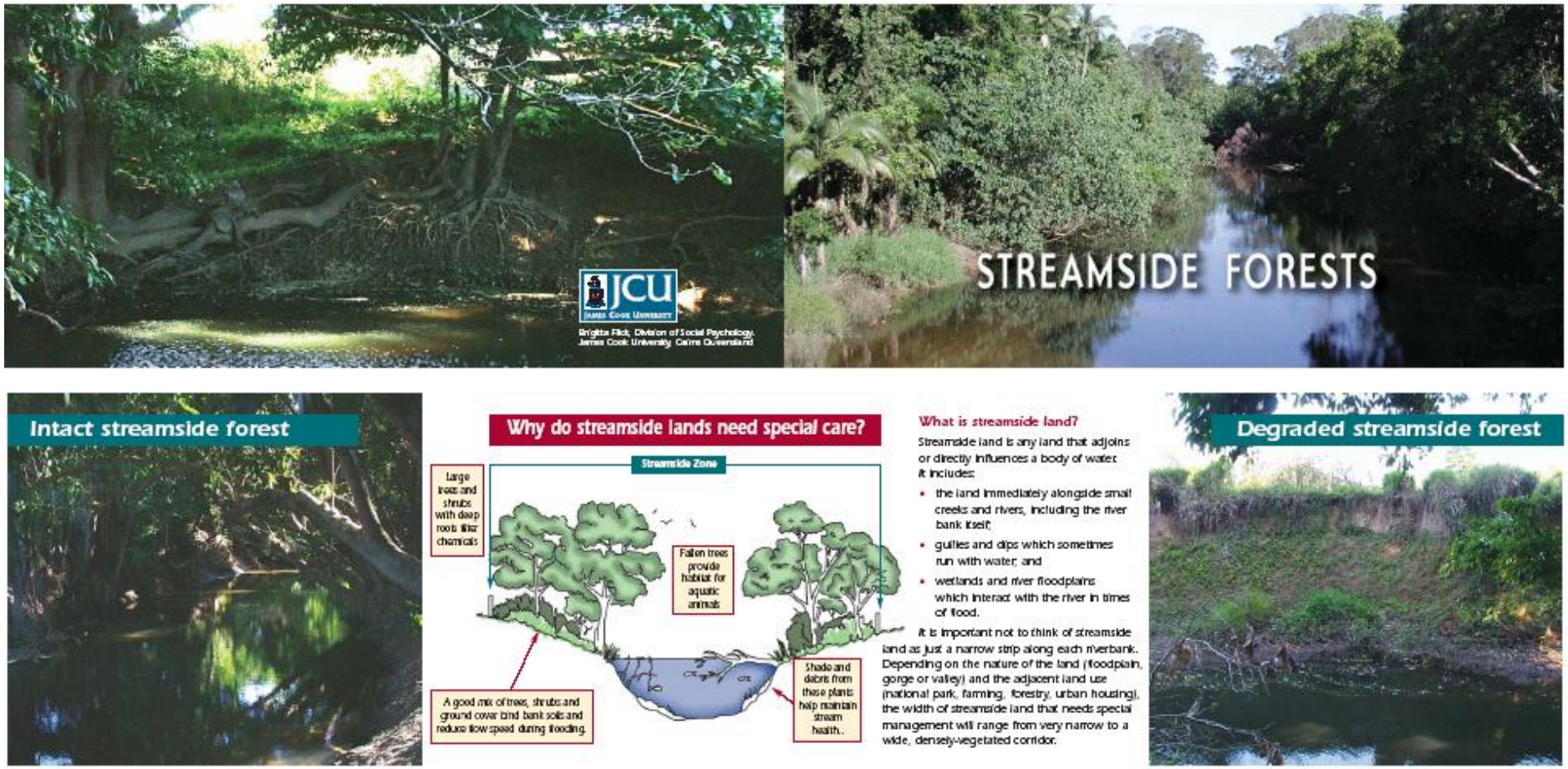
The goal of the semi-structured interview was to elicit information for the concepts of the TPB. Attitudes, subjective norms and perception of behavioural control would be elicited as direct statements or in the form of beliefs about role and efficacy of riparian forest, as expressions of normative beliefs, and of control factors in regards to the attitudinal object of riparian forests. A coloured brochure (see Plate 4.1) was presented in the middle of the interview to augment the elicitation process and to assess if an information sheet in this form had any influence on the interviewee's perspective. The open-ended 31 - question interview (Appendix A) focused on the interviewees' evaluation of aspects of riparian forest and knowledge about it (attitudes), their perception of other people's expectations in regard to their management of riparian forest (subjective norm), their perception of control over the management of riparian forest and their beliefs in the barriers and the impact of those controls (perceived behaviour control). The interview was presented in six parts:

Part 1 – Demographic information: The interview commenced with four demographic inquiries (Questions 1a,b,c) to provide information about the interviewees' farming background. Question 2 ("What was the land like when you came here?) allowed for an opportunity to reminisce about their early days on the land, at the same time giving an evaluative description of the land at the time they came to farm it.

Part 2 – Theoretical and conceptual assessment: Twenty-two items (questions 3 to 25) based on theoretical and analytical concepts as outlined and listed in Table 4.2 were presented (questions 3 to 16 before and questions 17 to 25 post intervention).

These are described in detail under the concept headings in the section following the table.

Part 3 - Intervention: An embedded intervention in the form of an information brochure (see Plate 4.1) was handed to the interviewee once Part I was completed. The brochure was included to test the interviewees' understanding of what they thought a riparian forest is and to compare their understanding of its functions with those of empirical research findings. The brochure contained colour photos of intact and degraded streamside zones, a diagram and text describing a riparian forest and its biophysical functions.



The information brochure printed as a two-sided double page. (Pages displayed here from top left to bottom right: Page 4, page 1, page 2, page 3.)

Plate 4.1 Streamside forests information brochure

The diagram and the written material for this brochure were based on information from the Fact Sheets on the Land and Water Australia 'River Landscapes' website (Price & Lovett, 2002). The photographs were taken in the actual study area. The theme of the information concentrated on the function and ecological importance as well as visual images of intact riparian areas. The interviewer and the interviewee looked at the brochure together and the interviewer read the text aloud. Before proceeding on to part 4 the interviewer waited for the interviewee to indicate that they had perused enough, and then verified that all had been understood. The interviewees kept the brochure.

Part 4 - Post intervention: Following the intervention, the interview continued with questions that gave the interviewees the opportunity to compare and relate their level of knowledge after having just read the facts about scientific findings regarding the riparian forest's biophysical functions, and importance for water quality and erosion control, and habitat preservation (Questions 17, 18, 19, 20, 21, 24a-c, 25). Further questions in this section concerned the interviewees' ideas about the government's and land care agencies' involvement and their expectations about support from them (Questions 22, 23a-g). These questions were again based on theoretical and analytical concepts as listed in Table 4.2.

Part 5 – Interview and brochure assessment: At the end of the interview questions were asked that gave the interviewees the opportunity to discuss their reaction to the things that were discussed and to give their evaluation of the brochure (Questions 26, 27a, b, c, d, e, f: "What do you think about the leaflet? Is the information interesting, relevant and easy to understand? Do you like the layout of the leaflet? Is

there enough/ too much information on the leaflet? Is it easy to read? Do you like it? Are the pictures good for what I want to show?"). The answers were to allow the researcher to assess how this group of former riparian landowners considered the interview in general and if the questions in particular, were acceptable. This was thought to be useful when constructing the questionnaire for the main survey. It was hoped that any hidden annoyance these interviewees might have experienced could be detected in their responses.

Part 6 – Socio-demographic information: The interview drew to a close with some socio-demographic questions (28a, b, c, 29, 30) about age, educational background, main sources of information (newspaper, TV/ radio, neighbours/ Friends, books, professional newsletters), and the number of years in retirement. The question about ownership status of the land ("Have you sold your land, or is it managed by relatives or by others?") was also included to find out if the interviewees' land ownership and land management situation would have an influence on their responses.

The final question insured that the interviewee had not missed out on providing any other comments and final thoughts on the subject of riparian forests and on the interview in general ("Would you like to add any other comment about anything we have discussed here?").

4.3.2 The theoretical and analytical concepts underlying the interview

The items in the questionnaire were formulated with certain theoretical and analytical concepts that needed to be considered to arrive at an overall representation of the issues that were to be explored. Table 4.2 lists the overarching themes and the concepts, and

the question numbers of each. Following, each item will be described and justification for inclusion in the questionnaire given.

Table 4.2

The theoretical and analytical concepts underlying the questions

Concepts underlying the questions	Question numbers
1. Indirect attitudes toward riparian forest and the land in general:	
Feelings of responsibility	3, 11, 13
Beliefs, appreciation, concerns, values	4a,b,c, 5, 12
Knowledge about riparian forests and the Great Barrier Reef	9a,b, 10, 11, 17,18
2. Direct attitudes toward riparian forest	6, 8, 14a,b,c, 25
3. Subjective norms	7, 24c
4. Perceived behaviour control	23a to g
5. Experience with land management agencies	15, 16
6. Understanding and acceptance of the biophysical role and importance of riparian forest	12, 17, 18, 19, 20, 21a, b, 24a, b
7. Belief in scientific information	11, 17, 24a, b
8. Government's role in riparian forest issues	22,
9. Importance of establishing and preserving riparian forests	19, 20, 21, 23a-g

4.3.2.1 Indirect attitudes about riparian forest and crop land

Feelings of responsibility were explored with the question "Do you feel responsible for this land?" (Question 3). It was included to investigate if the feeling of responsibility extended beyond the utilitarian agricultural value of the land, and if the former farmers

would also feel and express responsibility toward their land in terms of its role as part of the natural environment. Thoughts about the future of the riparian forests could include feelings of responsibility and these were sought with question 13 ("Have you thought what will happen to your land and the streamside areas?").

Question 11 ("Do you believe that water pollution in the creeks and rivers affects the Great Barrier Reef? Have you heard about this connection?") addressed the wider responsibility of private land owners for the survival of the Great Barrier Reef. In short, this means accepting the impact of detrimental land management.

Questions of *beliefs, appreciation, concerns and values* (Questions 4a, b, c, 5 and 12) focused on the river or creek on their land. The interviewees' thoughts and observations of change were sought about that part of their land, and its use at the present time and in the past. These items were to yield free expressions of appreciation and concerns of the waterways, beliefs about their importance and best use, and also of their environmental values in general. The interviewees' insight of human impact on waterways was given an opportunity to be expressed here.

To gain insight into the level of environmental *knowledge about riparian forests, and the connection with the Great Barrier Reef* that these retired farmers had in regards to the importance of clean water and to the environment in general, seven items were included. Three inquired about their thoughts on the water quality in their streams, and if it had changed, and about the quality of other streams around them (Question 9a, b "What do you think of the water quality of your stream?", "Has the water quality changed?", Question 10 "What do you think of the water quality of other streams around here?").

No stream in the local catchment of the Great Barrier Reef lagoon has been found to have the best quality water (Armour et al., 2004; Haynes, 2001). The acceptance of these findings would be elemental in acknowledging the fact that the riparian environment has not been managed properly but is further deteriorating and therefore a threat to the Great Barrier Reef (Brodie, Lewis, Mitchell, et al., 2009). Question 11 was concerned with this fact and in particular with the threat to the Great Barrier Reef ("Do you believe that water pollution in the creeks and rivers affects the Great Barrier Reef? Have you heard about this connection?"). Acceptance of the fact that all the waterways in the area flow into the Great Barrier Reef lagoon, should mean that riparian forest owners feel a certain responsibility toward the Reef. Its non-acceptance would show a serious failure to believe scientific facts that in turn would influence their attitudes toward riparian forests.

Two other questions were included to verify the interviewees' knowledge and the level of belief in scientific information after the intervention with the brochure containing scientific information (Question 17: "Is there anything in this leaflet that is new to you? Can you explain exactly what?" and Question 18: "Do you think the information in the leaflet is generally known?").

4.3.2.2 Direct attitudes about riparian forest

Questions 6 and 8 were to access the interviewees' direct attitudes reflected by affective, cognitive and behavioural based statements ("What is it about your river/ creek that you like?" and "Have you enjoyed having a river/ creek?"). They were to elicit like/ dislike evaluative statements. After the intervention (presentation of the brochure) an additional question was included to elicit evaluative direct attitude

statements (Question 25: “Do you believe that we should keep the streamside forests just for the pleasant surroundings they provide?”).

4.3.2.3 Subjective norms

Question 7 was a *direct subjective norm* inquiry: “Do your neighbours and friends think the same?” that exploited the train of thought from the previous direct attitude question. This question was formulated to access “*descriptive norms*” (Ajzen, 2002a) that indicate what the interviewee thinks and if important others act or think the same, rather than measuring their perception of expectations by important others .

Question 24c represented another item of subjective norming in this context of belief in scientific findings in regard to riparian functions: “Do you know what your neighbours and friends think?” It is almost identical to Question 7 but is concerned here with a cognitive topic (belief in scientific findings) rather than an affective one (liking, enjoying the river/ creek).

4.3.2.4 Perceived behaviour controls

To find out if the interviewees had some thought on what would hinder and what would support riparian forest establishment and protection, a set of questions was posed about what would make it easy for farmers to establish and preserve riparian forests (Question 23: “Have you any suggestions that would encourage the establishment and protection of streamside forests?” followed by prompts). The answers may allow some conclusions to be made about what practical assistance would be considered helpful.

There were seven prompts (23a to g) to be given when comments were not forthcoming: a and b suggested ‘technical assistance only’, and ‘technical assistance

plus cost". Prompts 23c, d, e, f suggested 'a 10-year covenant on the riparian land, purchase of 15m of riparian forest by the government', 'voluntary donation', and 'strict zoning laws'. The last item (g) suggested 'tax incentives to landowners who keep and maintain streamside land, such as tax rebate and tax reduction".

Two other questions focused on perceived behaviour control. It was hoped these would yield some ideas to be included in the main survey. These two items are discussed next.

4.3.2.5 Experience with land management agencies

Questions 15 and 16 inquired about the interviewees' information from agencies about land-management practices ("Has anyone contacted you in the past with information about land-management practices?"), and what they think land care agencies are all about ("Land care agencies place a great importance on streamside forests. Why do you think they consider them so important?"). The responses were to provide an insight into the interviewees' level of interest on the subject of land management and riparian management in particular, and their acceptance of the information. Any expressions about perceived interference from outside groups may also come up and constitute salient ideas about perceived behaviour control.

4.3.2.6 Understanding and acceptance of the biophysical role and importance of riparian forests

The importance of riparian forests to the interviewee was explored with Question 12 ("Is the streamside land important to you and in what way? Do you see it as a problem?"). An understanding and acceptance of the role of riparian forests and its

importance was expected to be commented on in no specific terms. Since this was asked before the intervention with the information brochure, the biophysical role was not expected to be elaborated on here but in the questions asked afterwards.

The concept of understanding and acceptance in this category was also explored with two items (Question 17: "Is there anything in this leaflet that is new to you? Can you explain exactly what?" and Question 18: "Do you think the information in the leaflet is generally known?"). These were expected to yield information about knowledge of and belief in scientific information.

In addition, questions 19, 20, 21a and b ("Do you think it could change some people's ideas about streamside forests?", "Do you think one should encourage establishing and keeping streamside forests?", "Can you suggest ways to do this?", Can you think of ways of how not to do this?") focused on the interviewee's ideas of promoting riparian forests to others. The answers would also indicate a certain level of acknowledgement of the importance of riparian forests.

4.3.2.7 Belief in scientific information

Before the intervention a question was asked to determine the level of the interviewee's knowledge in regards to water pollution on the Great Barrier Reef ("Do you believe that water pollution in the creeks and rivers affects the Great Barrier Reef? Have you heard about this connection?"). Following the intervention Questions 24a and b ("Do you believe that the scientific findings presented in the leaflet in regard to streamside forests, and water quality are correct?" and "Do scientific findings influence your opinion?") were to directly scrutinise the interviewee's scientific knowledge and beliefs in scientific findings in regard to riparian forest, and their confidence in the

scientific facts. It would examine the level of acceptance of scientific findings about riparian forests which are offered to interested parties in brochures and websites as well as in workshops. A further question was then asked to establish the interviewees' level of knowledge and belief in scientific findings (Question 17: "Is there anything in this leaflet that is new to you?").

4.3.2.8 Government's role in riparian forest issues

To explore what the interviewees thought about riparian forest establishment and maintenance, and who should undertake it, a question was asked that set the scenario of government-owned riparian areas (Question 22: "If the government owned the land along the streams, would you expect them to establish and maintain the streamside forest?"). If the answer was yes, it would indicate that the interviewees feel that government-owned land should be an example of good riparian management, and that they know what that entails.

4.3.2.9 Importance of establishing and preserving of riparian forests

Three questions were to explore the interviewees' thoughts about the efficacy and power of the information presented in the brochure in changing people's ideas and encouraging establishment and retention of streamside forests (Question 19: "Do you think it [the brochure]could change some people's ideas about streamside forests?". Question 20: "Do you think one should encourage establishing and keeping streamside forests?". Question 21: "Can you suggest ways to do this?") . These items were included to again assess the general acceptance of the brochure information and possibly find some cognitive engagement by suggesting their own ideas on riparian management and revegetation. Question 20 again tested if the interviewees agreed with

and cognitively engaged with the scientific information in the brochure and therefore the importance of riparian forests.

Further ideas of the interviewees in regards to establishing riparian forests were elicited in a set of questions (Question 23a to g) (Appendix A) which were included mainly to provide information about the interviewees perceived behaviour control.

4.3.2.10 The state of the riparian forests

At no time was direct information about the state of their riparian forests in the present or the past elicited. It was decided that the interviewees' reports of how they used and maintained it were most appropriate items to reveal enough detail to ascertain what the riparian area looked like. (This was the case for most interviewees who gave information on the subject whenever it fitted into their narratives as part of other responses.)

4.4 Procedure of interviews

As mentioned above (4.2.3 Recruitment process) the interview took place in the interviewees' homes. The principal investigator conducted all interviews. The interviews were tape recorded as well as recorded in writing. The protocol for the interview (Appendix A) outlines how the interview was to be conducted: After a short introductory talk to establish rapport an information sheet was given to the interviewee. It essentially contained the same information given in the letter of invitation (Appendix A). This sheet was retained by the interviewee.

Next, the interviewee was handed the consent form (Appendix A). It included a paragraph on the rights of the participants to information about the study and to

confidentiality of the interviewee's answers, and mentioned the right of the interviewee to stop the interview at any time or decline to answer specific questions. Permission was also sought to tape record the interview for which the respondent had to tick a box on the consent form.

The principal investigator found that reading these documents aloud while the interviewees had the document in front of them was the best way to ensure that all information was attended to. A short time was allowed for pondering the information and then the interviewee was invited to ask for clarification before they signed and ticked the consent form.

The tape recorder was then turned on and the interview started. The interviewees were encouraged to give extensive and detailed answers. The written protocol was followed meticulously in every interview. The average length of time for the interview was one hour.

At the conclusion of the interview the principal investigator expressed her appreciation to the interviewee for their commitment and participation. A letter thanking them for the interview was sent out within a week (Appendix A) and another letter of thanks including a summary of the results was sent to each of the interviewees two months later (Appendix A).

The interview answers were transcribed from the tapes and the hand-written notes. A content analysis was performed by reviewing the transcripts (Silverman, 2000). The small number of respondents and the manageable amount of answers and comments allowed the analysis to be performed without the help of an analysis software

package for qualitative data. The insights gained from Study 1 were invaluable in determining and refining the content of the TPB questionnaire for the main survey.

4.5 Results and interpretation of Study 1

As can be expected in a summary of an open-ended interview transcript, expressions and statements organised by theme or category in this analysis did not necessarily originate from the answer to a particular question but were embedded and extracted from the discourse associated with various questions. Several categories emerged such as: expressions of belief in regard to attitudes on the affective, cognitive and behavioural level; subjective norms and perceived behaviour control; and environmental value statements in the egocentric/ altruistic, and biospheric domains according to Stern, Dietz and Guagnano (1998), and aesthetic/ utilitarian and moralistic domains according to Kellert (1996).

4.5.1 Direct evaluation of the riparian forest

Direct attitude questions were formulated to elicit direct attitudinal evaluations of the object or behaviour on the cognitive, affective or behavioural level. Together with indirect attitudinal beliefs they incorporate the attitude toward the object or behaviour according to the TPB. In this study the interviewees were asked direct attitude questions about the waterways (creeks, rivers, swamps) directly associated with the riparian forest on their land, and separate questions about the stream sides, the part of the riparian zone that has vegetation on it. Following are the responses as interpreted by those topics.

4.5.1.1 The waterways of the riparian forest (Questions 4a, b, 5, 6, 8)

The answers to direct evaluations of the waterways (river or creek) show processing on the cognitive, affective and behavioural level, and signify egocentric/ altruistic, aesthetic/ utilitarian, moralistic and biospheric values (Kellert, 1996; Stern et al., 1998). The first direct attitude items which focused on cognitive engagement with the river or creek on their land, elicited value statements on all three levels with a preponderance of negative statements on the cognitive level (6 times, 55%) (e.g. "important … as a drain; only wetlands; no permanent running water"). Statements on the positive affective level were given three times (33%) (e.g. "beautiful little creek"), and once on the behavioural level (e.g. "rubbish … remove and burn").

Value statements in the three domains (egocentric, altruistic and biospheric) were associated mainly with the biospheric domain (5 times, 45%) (e.g. "valuable for the catchment; clean fresh water; cattle still find water"). The predominant direct use of the waterway (utilitarian value) not surprisingly, was for irrigation, but also as a water supply for the household and for agricultural cultivation (five responses, 45%). The aesthetic/ utilitarian recreational use of the creek for fishing, boating and swimming was mentioned eight times (73%). These evaluations in the egocentric and utilitarian domains would be expected to contribute to a positive attitude toward the waterways of the riparian area but not necessarily include the streamside forest. There was only one (9%) mention of the shade at the creek, and that it is much enjoyed by the cattle.

When asked directly as to their liking or disliking of the river/creek eight interviewees (73%) gave a clear positive evaluation, one (9%) did not like it, and two (18%) liked its use for irrigation or drainage. But when asked if they had enjoyed the

river/creek one of the latter interviewees agreed strongly, two did not enjoy it and one only remembered the rubbish in it. The eight interviewees enjoying it agreed that it was a beautiful and peaceful place, adding tranquility and that observing the flowing water was enjoyable. The evaluative affective attitude statements made in response to these two direct questions were predominantly positive affective evaluations (17 out of 22 responses) based mainly on aesthetic appreciation of the waterway (e.g. "pure clear water; pristine; peaceful, beautiful"). Seven egocentric/utilitarian value statements were also given (e.g. "drainage; cattle love it; irrigation, fishing") and one biospheric one ("for the whole ecosystem it is the bloodline").

4.5.1.2 The streamsides of the riparian forest (Question 25)

The question that came closest to inviting an evaluation of the streamsides of the riparian forest was asked after the embedded intervention of the brochure, which had detailed and explained the importance and benefits of this area. The items were worded so as to elicit liking or disliking of streamside forests on an affective level.

Eight interviewees (73%) did answer clearly in the positive with affective/ aesthetic responses (e.g. "beautiful; I like that"), only one responded clearly in the negative but four (36%) admitted the strong biospheric value (e.g. "no, (but) for health of stream yes, - as ecological environment and aesthetics alone, no, but for economic value"). Two other respondents added statements of direct biospheric values ("not just for the pleasant surround but for some benefit such as water quality"; "has a right to be there"), and four (36%) added direct non- biospheric values that contradicted the recommendation from the brochure (e.g. "okay, if it is there – [but] not to plant; for drainage of the land; 5 m is desirable").

One has to acknowledge that these interviewees were still thinking like farmers whose livelihood was bound to productivity of their land. Therefore, it was surprising that some were evaluating this area of potentially agricultural land in affective/aesthetic and biospheric terms.

4.5.1.3 Beliefs about the farmland (Questions 2, 3, 15)

Beliefs in the desirability of an outcome and the evaluation of the outcome of an action or behaviour underpin the attitude toward the object according to the TPB. In this study the interviewees were asked about their beliefs on the subject of farm land, waterways and riparian land in open-ended questions. Salient memories, feelings of responsibility and knowledge will generate the beliefs about it. The following interpretation of the responses is framed by the themes that emerged from responses.

Most of the interviewees reported that the land was fully or partly cleared when they started farming, five cleared more, and only one started with uncleared land (he called it "virgin land"). Several descriptive answers included negative value terms such as "50% scrub; 100 acres cleaned" and positive ones such as "(it was) virgin land".

The connection with the land was strongly expressed by all interviewees as 'feeling responsible for the land'. Additionally, four interviewees (36%) expressed affect and regret "sorry to give it [farming] up; love the land; [I] looked after it", and two (18%) linked this with egocentric values, "for the family; to give to son". Responsibility for the land was most likely not understood as pertaining to conservation but to the agriculturally sustainable use of the land, as evident in the statements: "[it is]necessary for a farmer; [it is in the] background of farming". That is, the soil was ploughed and fertilised according to best known methods and not exploited with crops

to the best of their knowledge. Their confidence in their responsible land use was expressed in responses to the question about land management information during their active farming life: e.g. "we always knew how to look after the soil; Queensland Cane Growers land management practices (were) followed; we carried on as we thought best". The expressions of their responsible use of the land in the past imply positive attitudes toward the land on the affectionate and on behavioural level in the egocentric/utilitarian domain.

4.5.1.4 Beliefs about the waterways and streamsides (Questions 5,9a,9b,10)

The changes of the river or creek over the years were reported as observations of floods, siltation, or erosion, and memories of activities they undertook such as diverting the creek, draining the wetlands, erecting a rock wall, and planting grass and shrubs. Some embedded erroneous beliefs voiced here recurred throughout the interview such as "[a stream has to flow fast to be] self-cleaning" so that no "poisonous build-up" occurs, and "rubbish holds back the flow". These observations and memories will feed into the beliefs about the role of riparian forests which comprise the waterway and the banks (stream sides). They will be the ones that are the hardest to influence by new information from scientific findings. There was an overrepresentation of negative images and words in the answers which can be partly explained by the saliency of memories of hardship with watercourses over the years such as erosion, tree falls, and damaging floods.

Notably, this topic provided the only instance of a name for the waterway on the person's land ("Middle Creek is a permanent tributary of Cairns Inlet"). No other creek was ever referred to by name in the interviews by anyone.

In response to the questions about the water quality of their river/ creek the interviewees pointed out that pollution is a thing of the past, or is done by others. All but one of the interviewees (91%) were convinced that the water quality in their streams was "very good; pristine; 100% pure", only one responded with "don't know". As proof they cited: "spring on the land; myriads of small fish and other water life; always trashed cane (instead of burning it); good to drink; DPI tested it, the best water in the area; only pollution is from pigs". When asked if there had been a change in water quality two interviewees (18%) alluded to occasional pollution from upstream. In answer to two further inquiries into their thoughts on the water quality of other streams around them, four interviewees (36%) actually made more suggestions of pollution: "sugar mills were the culprit before; upstream and below runoff of chemicals occurred; due to banana farming"). One interviewee (9%) hinted at still more pollution that was too sensitive an issue to talk about freely: "If you turn the tape recorder off I tell you, – don't ask this question."

4.5.1.5 Beliefs and knowledge about riparian forests (Questions 12, 13, 14a, b, c, 17, 18)

Knowledge about an object allows one to evaluate an object with more accessible information about it (Eagley & Chaiken, 1993). If the object is known and believed to have beneficial attributes, the evaluation of it would be more positive. The beliefs in one's knowledge can be based on factual information and on practical experience. Thus, beliefs about the functions of riparian forest were also expected to be reflecting familiarity with riparian areas and engagement with riparian forests on some level.

Study 1 revealed many incorrect beliefs about what riparian forests should look like according to familiarity and experience that leads to a non-acceptance of scientifically based recommendations. There was the recurrent theme in the responses of keeping streams and riverbanks "clean" as the desirable management practice for riparian forests. This was based on the beliefs that a stream has to flow fast to be "self-cleaning" and that it should not have any vegetation matter (debris) in it ("rubbish holds back the flow; cannot clean it out, is a place for rats and vermin"). This leads to clearing the area of native vegetation and replacing it with non-native grasses (e.g. "creeping grasses best"), thus suppressing appropriate plant cover, and ultimately promoting the occurrence of erosion. But one interviewee was aware of the fact that stone walls (a council project!) replacing natural banks had caused the build-up of sandbanks in the river leading to undesirable changes in the river. Another interviewee believed that at least one of the causes of erosion was learnt by practical experience: "In all honesty, most cane farmers wanted the land up to the creek banks, stuffed it up and had bad erosion, lost the land and learned from it."

The role and importance of riparian forests was mainly perceived in the utilitarian value domain because most likely the interviewees had not given that area of the land any thought other than in terms of its usefulness and its erosion problems (e.g. "important for recreation; drainage mechanism"), but four biospheric value statements were also made (e.g. "it is natural, and [we] nurture it; for wildlife"). In summary, the interviewees were using more in positive words and expression than negative ones when talking about riparian forest in this context, indicating that there is an awareness of the importance of the areas even if the beliefs are not based on scientific facts.

Affective expressions were elicited with a question on wildlife in the riparian forest. Wild animals were listed and talked about in predominantly positive terms (e.g. "cockatoos are a problem and a pest, but we love them"). All respondents expressed a liking for the animals indicating a positive attitude toward riparian forests from that perspective.

The interviewees did not have concerns about the future of the land and the riparian forests. Since the general belief was that the water quality was very good and the life in the waterways had never been disturbed by farmers the only mention of something negative happening concentrated on subdivisions taking over. That idea did elicit statements about the need for government to sustain the agricultural activity (sugar cane growing). Also, the RiverTrust group as a watchdog, and an information source was mentioned with great appreciation of the role it has played in the past.

4.5.1.6 Knowledge about riparian biophysical functions and reaction to scientific information (Questions 17, 18, 24a,b)

To examine how much knowledge interviewees had about the functions of riparian forests and if they were convinced of the usefulness and efficacy of these functions, an intervention in the form of the brochure was embedded after 16 items in the questionnaire had been discussed.

The brochure prompted very few comments while it was read. When asked, essentially everybody but one interviewee agreed they knew it all (91%), voiced their reservations, and added their own perceived 'correct' beliefs on the matter. Objections and disbelief were voiced over the information about debris in the creek, the filter function of tree roots, and trees on the banks in general. One interviewee went so far as

to claim that this information was not for farmers since it benefited the fish but not the farmer in his opinion.

This mixture of disbelief and misunderstanding was confirmed for the majority of the interviewees when asked if they thought that the scientific findings presented in the leaflet in regard to streamside forests and water quality were correct. Only three interviewees (27%) answered with an unreserved "yes"; three others (27%) agreed with some hesitation ("think so; basically yes; fairly correct"), the other five interviewees (45%) voiced only reservations about the width of the forest ("1m of bank is enough"), about debris in the creek, the filter function of tree roots, and trees on the banks. Still, these responses show slightly more agreement with the brochure than those responses immediately after the presentation of the brochure when 10 interviewees did agree but only with major reservations.

All interviewees thought that the information in the brochure was generally known by farmers at least to the "younger ones", but the older ones "know the kind of damage but will not acknowledge it". This last statement was actually supported by narratives of the two oldest interviewees who were obviously aware of riparian mismanagement resulting in erosion ("[information is] not for farmers; banks collapse … restored [by the farmer] to its natural state"). Farmers will look after the problem, when it happens, in their own way. Their own observations do not agree with the scientific information in the brochure and they obviously did not accept the information.

Nevertheless, six interviewees (55%) agreed that scientific findings influence their opinion, while at the same time "comparing it with practical experience and

knowledge" or "reserving agreement". The other five either repeated their personal beliefs or admitted disbelief. The reaction could be indicative of disbelief in scientific information in general or of misunderstanding the information in the brochure which is less likely.

The impression that these responses evoked for the interviewer was one of politeness, and that the interviewees actually held back their more candid views. The subject of science versus practical experience seems too sensitive in a face-to-face interview where the interviewee considers the interviewer to represent the scientific side. When it comes to accepting scientific facts one has to put them into action to show it, and also one has to admit that one's former beliefs were wrong. Relying on one's own experience is for many interviewees the safer and more trustworthy option.

4.5.1.7 Beliefs about the connection with the Great Barrier Reef (Question 11)

In the context of all the above questions the Great Barrier Reef was never mentioned in the responses of any interviewee. A separate question was part of the interview that explicitly concerned itself with the connection of the creeks and other waterways with the Great Barrier Reef. When enquiring about their beliefs regarding the connection between the Great Barrier Reef and good water quality in the catchment of the Great Barrier Reef lagoon, the elicited responses were in line with their belief that their creek would not cause any harm because it was clean. But additionally, the majority of responses also showed a non-acceptance of the fact that there is a problem and that the riparian landowners are effectively the guardians of the Reef as far as the water quality is concerned. Disbelief in this scientific fact would influence the beliefs of the

interviewees in the ecological importance of riparian forests and thus their attitude towards them.

Three interviewees (27%) responded to this question with a categorical "no (connection)". One of them believed that

> …there is no substantial evidence, I heard of the accusations, (they are) unsubstantiated, the Great Barrier Reef is as healthy as ever, not blinded by my attitudes when I form my opinion.

The same person had also claimed in regard to water quality in the catchment that there are "various opinions, lots are exaggerated and not substantiated". Another interviewee opined: "Heard about that, but clean water now; 100 years ago the same." The other eight interviewees (73%) believed the connection but four (36%) were convinced that their creek was not involved in pollution. A strong belief in the substantial pollution by the cities and non-agricultural run-off was voiced by six of the interviewees. This means that 8 out of 10 interviewees (73%) have a serious issue with accepting the fact that the creeks and the Great Barrier Reef lagoon are directly connected and that water quality will inevitably affect the Great Barrier Reef.

There are several messages in this finding: The scientific information about the health of the Reef and its dependence on the water quality of the waterways in the catchment is not accepted by all landholders. This may reflect a general mistrust of scientific facts or misinterpretation of scientific information, especially, when there are seemingly contradictory messages that can make it easy not to dwell on one's own contribution to the problem. Various information bits about the external factors that lessen or overwhelm the hazard from agricultural chemicals were mentioned, such as

global warming, crown-of-thorn starfish invasions, magnitude of urban runoff, and the dilution of creek runoff with the sea water in the Great Barrier Reef lagoon. The valid scientific information about these items is certainly disseminated and thus available to the landowners, but the landowners' contribution from creeks and rivers in the catchment needs to be emphasised to strongly put their role as water polluters into perspective.

4.5.2 Reaction to the brochure as a source of information (Questions 19, 20, 21, 23)

The interviewees' thoughts on the efficacy of the information were explored in four questions. The responses were expected to reflect some cognitive engagement in the subject of riparian forest. If the interviewees thought the brochure effective i.e. that it could change some people's ideas, it may mean that they also valued riparian forests in the way it was explained in the brochure. Their suggestions on how to encourage protection and establishment of riparian forest were also sought.

Only three interviewees (27%) thought the brochure could change some people's ideas about streamside forests, one of them with the provisos, "long-time farmers have their own ideas, have practical experience". But six interviewees (55%) agreed in the sense that the brochure should make an impact but doubted its effect especially on the older generation, "possibly, but takes more than a leaflet; depends on the generation of farmers, younger ones are more open".

Three interviewees (27%) referred to the farmers' reliance on their own methods and stressed that there is no need for an information brochure, "mainstream farmers …

would take remedial action; long-time farmers have their own ideas, have practical experience; there is voluntary tree planting".

In answer to another question only three interviewees (27%) were clear about their positive evaluation of the riparian forest and definitely thought establishing and keeping it should be encouraged, "or it will be gone tomorrow". The other eight interviewees did not disagree (out of politeness?) but voiced various qualifiers and prerequisites that had to be met first: "there are already forests; … shading and roots take nutrients, you have to be prepared to lose 2 or 3 rows of plants; some farmers don't have enough land; not where branches damage the vehicles; Landcare is doing that now; not expect farmer to foot the bill".

Suggestions on how to encourage riparian forest included different venues to disseminate information through farmers' meetings and newsletters, Landcare agency and education sessions in the shire hall (n = 5). Three interviewees understood the question as an invitation to give their own opinion on how to take care of riparian areas which either showed good understanding of proper management ("not to plant trees on steep banks") or not ("cattle would be good with the forest").

These responses give no indication that the brochure had any impact on the way the interviewees understand riparian forest. Rather, that they thought their personal beliefs about the subject already coincided with the correct facts.

4.5.3 Experience with government agencies and understanding the role of land management agencies (Questions 15, 16, 22, 23a-g)

The role of landcare agencies was generally well understood and appreciated. It indicates that the landcare agencies' mission statements about the importance of good land management practices had reached their target in recent years. In contrast, management of riparian forests separate from agricultural land had not. Eight interviewees (73%) had never been personally contacted by landcare agencies about riparian forests. Information was instead gathered at Queensland cane growers' meetings or received from fertiliser companies.

Six interviewees (55%) did remember that land management agencies had stressed the importance of riparian forest but the consensus was that "experience has taught that the management of stream banks is extremely important". The biophysical functions performed by the riparian forest on the ecological level were not the issue but practical matters of preventing erosion of the banks.

The interviewees did not offer any ideas on how to go about promoting the establishment and protection of riparian forests. In fact the suggestions mainly repeated earlier beliefs ("should be up to the farmer; some farmers are doing something already; "trees come up by themselves; all in good order by my observations"), but when prompted with examples extensive comments were made.

When asked if they expected the government to establish and maintain riparian forests if they owned them, all interviewees answered in the affirmative and added very vigorous expressions of distrust of government agencies: "they would ruin the farm, cannot trust them; World Heritage is taken over by pigs; owners … are better

custodians; government does not manage as well as a private person; (it) cannot maintain public streams now; what I can see is DPI or DNR and EPR take over and after 6 months they do not maintain it anymore".

Technical assistance and costs in maintaining riparian forests was uniformly endorsed even though one interviewee thought that "trees come up by themselves". According to the answers this willingness to participate was contingent on financial compensation for "assistance and expenses" but if this included time and equipment in the minds of all interviewees is not clear. Only one suggested "the farmers would get everything free but provide the equipment".

A 10-year covenant or government purchase of the riparian land and voluntary donation to government of environmental groups did not meet with universal approval. Concerns were voiced about the price that would be paid for a 15m wide strip of riparian land and the restrictions that would be put on the farmer's use of the area. The interviewees mistrusted the government's and landcare groups' ability to take care of the area any better than the farmers do now. Stricter zoning laws were not considered necessary. Only tax incentives were considered a good idea. The public would benefit from uncultivated land and this was seen as a fair exchange for a rate rebate to farmers who would maintain and keep riparian forests. It is not clear if the interviewees saw the contradiction in their responses, that is that they would accept money for maintaining riparian land which most of them did not think important or in need of maintenance.

4.6 Subjective norming (Questions 7, 24c)

Subjective norm in the context of the TPB means that the people appreciate and seek approval by persons important to them, and that the thought of approval motivates them

to evaluate the object positively. Two items in the questionnaire of Study 1 fitted this component of the TPB. The first one addressed the liking or disliking of the river/ creek by the interviewees' neighbours and friends (Question 7). The second asked if their neighbours' or friends' beliefs in scientific findings about riparian forests were the same as their own (Question 24c).

Only four clear affirmative responses (36%) were given to the first question. The other seven were non-committal ("don't know; I don't speak for them") or made assumptions ("don't hear adverse comments; they probably do"). These results seem to indicate that social pressure is not evident in this group. Nevertheless, there are strong indications of a group-solidarity expressed in the elaborate comments that sound like defensive statements, such as: "it is part and parcel of having the land; the older generation used to look after their creeks pretty well; few farmers don't look after their land, little money is the problem; most friends are fishermen and are for preserving the creeks; new (land care) techniques are used, all use less poisons than before".

The second question about scientific findings believed by their neighbours did not yield any clear answers. The most definite responses were: "say so; think so; to a big extent; yes 75%; yes, one neighbour", others circumvented a direct answer by saying "a successful farmer must have an open mind; not blind to all; we are responsible", and "nobody sees anybody degrade their land" and "not for me to tell". These answers were vague because most likely the interviewee was not convinced by the scientific findings.

The responses did not show a large amount of social norming taking place but rather a deliberate obfuscation of their beliefs and defense of their autonomy when it

comes to having opinions. The questions lead to uneasy answers that either indicated the interviewees were not comfortable by suggesting that others shared their beliefs, or that they genuinely did not know.

4.7 Perceived behaviour control (items 13, 21, 23a to g)

In the TPB feelings of being in control are expected to contribute to a positive attitude toward the object or the behaviour. In Study 1 financial help by government agencies was first mentioned in response to a question about the future of their land and streamside forest (item 13). The interviewee's suggestion was that agricultural activity should be supported with government help in producing ethanol from sugar cane. The financial consideration as a control factor surfaced in other items (items 21 and 23a to g) about encouraging the establishment and maintenance of riparian forests. Financial hardships were referred to repeatedly as factors that diminish control over one's ability to maintain the land but other restrictions were seen in the regulations by government agencies. They provoked comments such as, "farmers need permission to do anything; the Water and Irrigation Board is controlling enough; government should support it; biggest problem is … housing subdivision".

Strong feelings of being in control were also mentioned in expressions of group solidarity in responses such as: "we always knew how to look after the soil"; "maintenance of creeks … few people would find it not important"; "we carried on as we thought best".

4.8 General comments about the interview

The main theme of the responses to the interview was that the interviewees felt relaxed. This fact adds credence to the responses. Comments on the interview content and process ranged from "okay" to "pleased to contribute" to "[it] did bring out my thoughts". One interviewee thought it very funny that these conservation promoting ideas are suddenly everywhere indicating that at least one interviewee showed a certain level of saturation with environmental information.

One other idea also surfaced: "[I have] not discussed streamside forests before, always talk about erosion" which expressed the interviewee's surprise that there are positive things about the streamside land. It might be of interest to find out in the main survey what percentage of participants were ever asked about riparian forests or have thought about it as a separate area from their agricultural land. The brochure itself was rated very favourably by the interviewees. The only changes suggested were that more detail would be a good thing.

4.9 The contribution of Study 1 to the Main Survey

4.9.1 TPB concepts arising from Study1

The responses of the semi-structured interview that were addressing components of the social psychological model of the theory of planned behaviour in Study 1 were invaluable in guiding the construction of the questionnaire for the main survey of the overall study.

The TPB predicts human action (behaviour) by taking into consideration beliefs in the likely outcome and evaluation of the outcome of the action, beliefs in subjective

norms in regard to the action, and beliefs in control factors that would impede the action. In Study 1 the action in question was essentially represented by environmentally appropriate management of riparian forest. However, the interviewees were not actively involved in any land management anymore. But their salient beliefs in and evaluation of the efficacy of riparian forests were expected to indicate any engagement with these areas revealing their beliefs in the management of the area. The aim of this study was therefore the elicitation of (1) evaluative ideas and salient beliefs about riparian forests (the attitudinal object) of retired farmers, (2) their normative beliefs, and (3) their beliefs in the presence and strength of control factors.

4.9.1.1 Salient attitudinal beliefs and outcome evaluations in regards to riparian forest management and preservation

The following point list summarises the relevant attitudinal beliefs about riparian forests identified in Study 1:

- The waterways were appreciated mainly for their utilitarian and recreational value (73%), and less for their biospheric value (45%).
- Riparian forests were evaluated positively by all interviewees on aesthetic and additional biospheric grounds, but also on utilitarian grounds as drainage.
- All but one (91%) believed the water quality of their creek to be pristine.
- Water pollution was considered a thing of the past never caused by them, but this was contradicted by one interviewee who mentioned recent pollution events but would not elaborate on it.

- 73% did not accept the fact that their creek was directly connected to the Great Barrier Reef Lagoon. Therefore, it could not pollute the sea.
- The biophysical functions of riparian forests explained and depicted in the brochure were not fully accepted. All but one (91%) claimed to have known it all before but then disputed basic information such as the width of the vegetation strip and the benefits of debris in the creek.
- Personal practical experience and beliefs were mentioned repeatedly as more efficient than the scientific information.

4.9.1.2 Normative beliefs and motivations to comply

The normative concept in terms of normative beliefs and motivations to comply was not found in Study 1. Instead, there was a tendency to deny any norming behaviour by the majority of the interviewees who claimed that they did not know what their neighbours thought or did in regards to riparian forests. But the interviewees talked in terms of belonging to a farming community that had always been taking care of the land and the creeks as well as they could. This group belonging indicates a strong norming component. It also was apparent that many interviewees did not believe in the importance of riparian forest management and had therefore no incentive to seek out their neighbours' stance on this subject.

4.9.1.3 Beliefs in the strength and power of control factors

The following point list summarises the relevant perceived behaviour control beliefs in regards to riparian forest management and preservation:

- Most interviewees believed that riparian forests were managed properly and therefore no rules or regulations were necessary. The farmers know best and trees come up by themselves, and there are enough environmental restrictions already.
- Governmental ownership or covenants of riparian forests was believed to be undesirable because of documented incompetence in managing any natural area. But technical and financial assistance was uniformly believed to be a good idea.
- Tax incentives brought up the idea that the public benefits from riparian forests and therefore in a fair exchange the farmers should be paid for not cultivating the area.

4.10 The main survey

4.10.1 Pre-testing the survey questionnaire

The generation of the first formal TPB questionnaire of this main study was guided by the diverse and recurring opinions, evaluative ideas, and beliefs of the interviewees from the qualitative data of Study 1. As a consequence it incorporated the additional TPB components of 'intentions of good management practice of riparian forests' (intention component), and 'reporting of actual condition and present use of the riparian forest' (behaviour component). The writing of the questionnaire items followed the instructions from the TPB author's website (Ajzen, 2002a), as well as a manual for researchers (Francis et al., 2004b) recommended by Ajzen (2007), and a meta-analysis of TPB research studies (Armitage & Conner, 2001).

The pre-testing of the questionnaire was undertaken to gauge the clarity of the material as well as the appropriateness of the questions. The pre-test results were analysed according to the recommendations in the literature on research methods provided by Thorndike (1997) Groves (2004), Fowler (1995), and Mangione (1995). The questionnaire was also corrected for measurement errors that were due to wording, comprehension or order of items.

4.10.2 The test participants

The testers were recruited from academic staff in the Department of Psychology at the James Cook University, and from a circle of acquaintances of the researcher. These were people with various backgrounds, but all were or had been landowners with riparian forests. From a total of twelve participants, nine completed questionnaires were useable for analysis (6 females and 3 males). The age ranged from 43 to 81 years, with an average age of 57.6 years.

4.10.3 The test questionnaire

The test survey was designed in easy to fill out format of yes/ no answers and the use of a 5-point Likert scale for other items (except for some demographic items). Comments were also sought from the participants about the letters of invitation and information, and the consent form.

The pre-test questionnaire was constructed in the form of a simple stapled booklet consisting of 14 pages, in A4 format, printed double-sided. It contained a total of 109 questions. The title *A Social Psychological Perspective of Streamside Forest Management by Landowners in far North Queensland* was used at this stage. On the

first page below the title the terms *waterway*, *streamside/zone/ forest*, and *riparian zone/ forest* were explained as representing the same thing. In Study 1 the researcher found that most interviewees were familiar with some of these terms. The term 'streamside forest' was selected to be used throughout the questionnaire and the correspondence. The main Survey 1 questionnaire was very similar to the test questionnaire except for minor amendments and changes to the response formatting as reported in the results section below. The complete Survey 1 questionnaire with the incorporated amendments is found in Appendix B.

4.10.4 Procedure

The test participants received an envelope containing the questionnaire, a letter of invitation, an informed consent form, and a return envelope. The return envelopes with the filled out questionnaires were collected again by the researcher when notified.

The testers were encouraged to provide comments on anything about the questionnaire in order to gain valuable feedback as to the clarity of the questions and also their general reaction to the questionnaire's style and presentation.

4.10.5 Results

Because of the small number of testers it was not thought prudent to undertake extensive statistical analyses nor to attempt to prove that the TPB model works. The evaluation of answers and comments provided led to minor changes for additional demographic items such as including the number of children and grandchildren.

In section C containing the TPB items the answer format was changed from a 5-point scale to a 7-point scale. The endpoints were selected to suit the answer (examples:

Definitely true – definitely false; extremely pleasant – extremely unpleasant). The 7-point scale was employed in the construction of the main questionnaires to maximise reliability as recommended by Thorndike (1997). This meant a forced choice situation for the respondent by indicating an answer as a number on the scale rather than one represented in words on each point of the scale.

The layout was changed so the scale appeared below the item and both were enclosed in a box. The number of TPB items was reduced from 83 to 63: direct attitudes from 17 to 10, indirect attitude beliefs from 28 to 24; the direct subjective norm from seven to three, the indirect subjective norm beliefs from seven to four; the direct perceived behavioural control from nine to eight; the intentions from seven to six.

In order to elicit more detail on where the respondent's information on riparian and land management comes from more options were included in the test section for the item about information source.

4.11 Main Study - Survey 1

4.11.1 Introduction

The main surveys were conducted as anonymous postal survey correspondence. No personal contacts with the addresses were made at any time. The addressees were assured of complete anonymity by not writing any identifying marks on the questionnaire itself and no return address on the return envelope. The returns were numbered sequentially as they arrived. It was felt that the subject matter might be something the respondents felt strongly about and their candid answers needed to be assured by preserving anonymity. The kind of design in which the responses are kept

completely anonymous was chosen to maximise the probability of eliciting genuine answers (Thorndike, 1997). It has not been shown to improve the return rate of surveys (Mangione, 1995).

4.11.2 Participants and Sample Selection

The participants for the main survey were selected by the location of their properties, all of which abounded on a waterway in the catchment of the Great Barrier Reef Lagoon between the Barron and the South Johnstone Rivers. The lot numbers were identified from the Geographic Information Service (GIS) database of the area (accessed through James Cook University who is a subscriber). The geographical map showed the waterways and a cadastral map overlay contained the lot numbers. The matching property numbers and addresses were extracted from digital data (Location 2004, Queensland) purchased as a CD from the Department of Mining and Industry. The number of identified properties in the Cairns City and Johnstone Shires were 1174.

The Cairns City and Johnstone Shire Councils were then approached to supply the addresses of the owners of the properties. Both councils supplied the addresses free of charge.

After removing the doubled up addresses of multiple landowner and the crown land industrial properties from the list, the number of potential participant addresses was reduced to 569 addresses (287 in the Cairns City Shire and 282 in the Johnstone Shire). Every address thus selected was included in the first mail-out list. (The final number of valid addresses of respondents amounted to 540.)

4.11.3 Materials – Survey 1 Questionnaire

The survey questionnaire and the procedure followed closely the guidelines for survey methodologies (Dillman, 1978; Dillman, 2000, Fowler, 2002; Groves et al., 2004). The following describes in detail how the questionnaire was prepared and distributed. A copy of the original questionnaire is in Appendix B.

The mail out version of the survey questionnaire was in A4 size paper (22.7 x 29.7cm), 20 pages long, printed double-sided, with yellow first and last pages and alternating grey and white question/ item boxes. The final mail out version contained 92 questions/ items divided into four sections marked as A, B, C, D, each beginning with a short explanatory note. The first page contained the title: "Landowners' view of streamside forests" and a box with an explanation that the terms "waterway", "streamside/zone/ forest", and "riparian zone/ forest" were representing the same thing in this survey.

Section A was introduced with an item that established the landowners as having a creek or other waterway on their property before they proceeded with the survey. Page two started with a request of providing a secret code which would be used to match this survey with survey 2. This had also been explained in the letter of information. The survey proper then proceeded with 12 questions about the number and flow conditions of the creeks (three options), the use of the property (seven options), the steepness of banks (four options), the vegetation on banks (seven options), observation of animals in the riparian zone (three options), distance of cultivation from the waterway (four options), condition of streamsides' vegetation in the present and the past (nine options), length of creek frontage, and number of years living on the property

and number of years of the land being in the family. Section B contained four demographic questions about age, gender, number of children, education level (six options), and one item about plans to leave the property in the next year (4 options).

Section C was introduced by informing the respondent that the following section was concerning their views, observations, feelings and ideas on the subject of streamside forests and an example was given of how to mark their answers by circling a number on a 7- point Likert scale. The adjective anchors of items were adapted to agree with the meaning of the statement. The questions were not in any particular order. The 63 items were constructed according to the theory of planned behaviour and were selected from the items in the pre-test. Ten items assessed the respondent's direct attitudes toward riparian forest and 24 (twelve pairs) indirect attitude beliefs; three items assessed the direct subjective social norms and four (two pairs) indirect subjective social norm beliefs; eight items focused on the direct perceived behaviour control and eight (four pairs) the indirect perceived behaviour control beliefs. The items pertaining to intentions to preserve, establish, or maintain riparian forests numbered six. Additionally three items were included to assess the respondent's level of need to give socially desirable answers (social desirability) (Nederhof, 1985; Strahan & Carrese Gerbasi, 1972).

In Section D two questions investigated if the respondents had participated in any workshop on land management in general and on riparian land management in particular (yes/ no) and satisfaction with the information and usefulness of the information (on a 7- point Likert scale) about streamside and land management. Two questions addressed the respondent's sources of knowledge about land (ten options) and riparian forest (11 options) management. The next question used a scale from 1

(Definitely more) to 7 (Definitely less) to ask about the respondent's level of belief of their own knowledge of streamside forest as more or less correct compared to what scientists have found. The last three items used Yes/ No answers and enquired about any instance of contact by someone in regard to riparian forest offering information or help, recall of any mention of riparian forest on television, radio or in the paper, and involvement in any river rejuvenation project. The last two pages were blank and respondents were invited to write their comments on them.

An additional questionnaire was included in the survey, the revised *New Ecological Paradigm Scale* (Dunlap et al., 2000). This is a test of environmental awareness that has been widely used to gain information on the subject from many different groups of subjects all over the world. The purpose here was to compare the test scores of the riparian landowners of the region with those of other groups and to correlate it to the attitude scores of the survey. In effect it took advantage of the pool of respondents to this survey. The test with the 15- item revised *New Ecological Paradigm Scale* (Dunlap et al., 2000) consisted of one loose page. A paragraph on the top of the page explained the test and asked the respondents to fill it out as an extra favour. The sheet was inserted in the back of the survey booklet (Appendix B).

4.11.4 Procedure of Survey 1

The mail-out of survey 1 (16 October 2006) consisted of a large yellow envelope (23 x 32.5cm) with the University logo, franked with a special edition postage stamp and containing the information sheet, the consent form, the questionnaire booklet, the NEP on a loose page, and a return envelope (marked for free postage) folded in half around the material for easy removal. Two weeks later one reminder letter was sent to all valid

addresses (Appendix B). Reminder letters have been found to always improve the return rate (Mangione, 1995). The address list was reduced to 540 after unclaimed, returned and doubled-up surveys were removed.

The total number of complete returns amounted to 123. This represents a response rate of 22.8 %.

4.12 The Main Study – Survey 2

4.12.1 Introduction

As explained in the introduction at the beginning of the chapter this second survey was undertaken to test if a 'sleeper effect' had taken place in survey 1 respondents. Of special interest was the possible sleeper effect of items about biophysical functions and environmental importance of riparian forest, the riparian landowners' assessment of their role in preserving good water quality, and one item about the importance of natural debris. Also the landowners' perception of their assessment in their ability to take care of their riparian forests was included.

Therefore, this second survey contained a brochure-style booklet with five descriptions of biophysical functions of riparian forest accompanied by colour photos to engage the respondent with the subject of riparian forest (Appendix C). This was followed by a short questionnaire with 10 attitude items and one direct perceived behaviour control item. The items were identical with those from the survey 1 questionnaire in order to assess any changes that might occur in attitudinal and control measures.

4.12.2 Participants and Sample Selection

The participants for this survey came from the revised address list of landowners of survey 1. The address list had been further reduced to 465 addresses by elimination of more unclaimed surveys of Survey 1. It was hoped that the 123 respondents of Survey 1 who had provided a secret code in the first survey would answer this second survey and allow a comparison of the answers. This could not be done because only 32 (42.7%) respondents of the 75 who returned completed surveys remembered their secret code.

4.12.3 Materials – Survey 2 Questionnaire

The survey 2 questionnaire was constructed as an A5 sized booklet of 13 pages (Appendix C) with the title *Landowner's Views on Streamside Forests – What Do Streamside Forests Do?* Page 1 explained the content and thanked the respondents for taking the time to share their thoughts.

Five colour photos appear on pages 2, 4, 6, 8 and 10 depicting the major roles that a riparian forest fulfills. These roles are described in short statements either above or below the photo on the same page. The facing pages 3, 5, 7, 9 and 11 show one Yes/No question (Do you agree with these statements?) at the top and space to explain the answer. Further down a question is posed asking about the experience the respondent has had in regard to the particular riparian role (for example: What is your experience with stream bank erosion?) and space to answer. A third question followed with space for the answer (for example: How do you deal with it?)

Pages 12 and 13 contained an 11-item questionnaire preceded by a short paragraph with instructions. The selected questions were identical to those in survey 1:

The two direct attitude items focused on the role of landowners as keepers of the waterways and the connection with the Great Barrier Reef. Eight items measured indirect (belief-based) attitudes. Four pairs of questions asked for evaluation of belief in the outcome of a riparian function, and the corresponding belief in the likely outcome. One item assessed the respondents' confidence in their knowledge of proper management of riparian forests (TPB perceived behaviour control factor).

4.12.4 Procedure of Survey 2

The survey was sent out in white half-sized (23 x 16cm) envelopes containing the questionnaire booklet, the letter of invitation and information, the consent form, one sheet on which to register the secret code, a franked return envelope, and one teabag of local Daintree tea (as an incentive). The package was provided with a special edition postage stamp and posted by ordinary mail. It was posted on 7 December 2006. The first reminder letter (Appendix C) was sent 20 days later and the second one two months later (Appendix C). The total number of complete returns amounted to 75. This represented a response rate of 16.1 %.

This concludes the description of methods and analysis of Study 1 and the methods of the two survey studies. The following chapter reports on the statistical descriptives of survey 1.

CHAPTER 5. DESCRIPTIVE STATISTICS OF SURVEY 1

5.1 Analyses of demographic, social and situational items

In this chapter items that were not central to the theory of planned behaviour (TPB) questionnaire but nevertheless provide critical background and contextual information about the Survey 1 participants will be analyzed and described. It will also discuss the data in the context of this research, and compare them to those of similar studies elsewhere. The analysis will be of a descriptive nature which allow for a broad and general understanding of the demographic, social and situational profile of respondents. Bivariate and multivariate analyses of the relationships between a selection of variables will also be included allowing for the likelihood of statistically significant links or differences between variables to be determined.

First, descriptive statistics of gender, age, and education levels of the respondent sample will be presented, followed by their categorization into land use groups and establishment of that group's demographic characteristics. Management of riparian forests by these land use groups will then be investigated using items from the questionnaire that reported on the state and change of riparian forest over time, and the cultivation of the area. Sources of knowledge about land management and riparian forests by the land use groups, and the role of meetings and workshops attended, will be explored. Items about the relevance of scientific findings, and exposure to contact and information about riparian forests will be investigated. Nonparametric statistics will be employed throughout to examine if differences between groups are significant.

5.1.1 Demographic characteristics of gender, age and education level

Survey 1 yielded a total of 123 questionnaire returns with various items missing in 19 of them. Table 5.1 lists the age and gender distribution, and the education level of the respondent sample (Table 5.1), and Table 5.2 the age and education level of males and females (Table 5.2).

Table 5.1

Gender, age, and education level frequency and distribution

Gender (*N* =123)			Age (years) (*N* =122)[a]		Education Level (*N* =123)		
	n	*%*				*n*	*%*
Male	95	77.2	Mean	55.8	Primary	13	10.6
Female	28	22.8	SD	12.5	Secondary	59	48.0
			Range		Tertiary	51	41.5
			(min-max)	32-85	- University	24	19.5
					- TAFE	6	4.9
			32-49	34.1%	- Apprenticeship	21	17.1
			50-64	33.6%			
			68-85	31.3%			

[a] Whenever the total differs from n=123 it is due to missing data.

A Chi-square of independence test was performed with education and gender variables. It showed no significant association, $\chi^2(2, n = 123) = 3.20, p = .20$.

Table 5.2

Age and education level distribution by gender

	Age distribution by Gender (*N* =122) [a]		Education Level distribution by Gender (*N* =123)		
	M (SD)	Range(Min-Max)		*n*	*%*
Males (*n* =95)	56.4 (12.11)	53 (32-85)	Primary	12	12.6
			Secondary	42	44.2
		32-49 31.9 %	Tertiary	41	43.2
		50-64 35.1 %	- University	18	19.0
		65-85 33.0 %	- TAFE	4	4.2
			- Apprenticeship	19	20.0
Females (*n* =28)	53.8 (13.62)	43 (32-75)	Primary	1	3.6
			Secondary	17	60.7
		32-49 42.8 %	Tertiary	10	35.7
		50-64 28.6 %	- University	6	21.4
		65-75 28.6 %	- TAFE	2	7.1
			- Apprenticeship	2	7.1

[a] Whenever the total differs from n=123 it is due to missing data.

5.1.2 Demographic characteristics by land use groups

Table 5.3 reports the gender and age distribution, and education level of the survey respondents across four land use groups. Most notably, sugarcane farmers comprised the largest group of land users (55.3%), and non-farmers, respondents who did not report any farming activity on their land were the second largest land use group (20.3%), in both groups males were predominant. Cattle farmers (10.6%) were almost equal in gender representation.

To establish if there were significant differences according to land use group, Chi-square tests for independence were performed with gender, age and education variables. The cross-tabulation of land use groups and gender not surprisingly, yielded a significant chi-square value, $\chi 2(3, n = 123) = 10.05$, $p = .02$, Cramer's $V = .02$. The small number of female respondents limits the use of the gender variable. Nevertheless, some analyses in this chapter will test responses by gender differences.

The results of the Chi-square test of independence of age distribution (using the same three age groups as in Table 5.2) across the land groups showed that there was no significant association, $\chi^2(6, n = 122) = .30$, $p = .30$. The level of education between the land use groups was also not significantly different, $\chi^2(6, n = 123) = 2.74$, $p = .84$.

Table 5.3

Demographic characteristics of land use groups (N=123)

Land use groups	Gender	*n*	%	Age *M (SD)*	Education level[a]	*n*	%
Sugarcane growers				58.1 (12.5)	Prim	9	13.2
n=68				Missing 1	Sec	32	47.1
55.3%					Tert	27	39.7
	Male	59	86.8	57.4 (12.3)			
	Female	9	13.2	60.9 (12.1)			
Other tropical crops[b] growers				54.1 (10.9)	Prim	2	11.8
n=17					Sec	8	47.1
13.8%					Tert	7	41.2
	Male	13	76.5	52.9 (10.1)			
	Female	4	23.5	57.8 (14.3)			
Cattle farmers							
n=13				51.8 (11.6)	Prim	1	7.7
10.6%					Sec	5	38.5
					Tert	7	53.8
	Male	7	53.9	54.7 (10.9)			
	Female	6	46.2	48.3 (12.5)			
Non-farmers[c]							
n=25				52.8 (13.2)	Prim	1	4.0
20.3%					Sec	14	56.0
					Tert	10	40.0
	Male	16	64.0	54.9 (12.5)			
	Female	9	36.0	49.1 (14.3)			

[a] Prim = primary school level, Sec = secondary school level, Tert = tertiary level including university, TAFE, and apprenticeship. [b] Includes bananas, vegetable and flowers.
[c] Respondents did not report any farming activity.

5.1.3 Summary and discussion of demographic characteristics of the sample

The demographic characteristics in this sample of landholders provide an interesting insight into this survey respondent profile. In summary, land use activity is predominantly sugarcane farming. It is undertaken by men between 50 and 60 years of age, the majority of whom have secondary /tertiary level of education.

In addition, this respondent sample was not very different from those of other research studies of rural areas. The mean age of 55.8 (age range 32 to 85) was comparable with Fielding et al.'s (2005) sample of 53.9 (age range 19 to 105) but higher than a random sample from the electoral role in a survey in far north Queensland which was 48 years (Mallawaarachchi et al., 1999). The mean age in US survey studies of riparian landowners was 57 (range 26 to 99)(Corbett, 2002); 57 (range 24 to 92) (Dutcher, 2000), and 56 (Cable et al., 1999). The age of farmers has been found to affect decision making in regards to the land (Farmar-Bowers & Lane, 2009), and so, age will be considered in later analyses.

The gender distribution in this sample of landholders was not very different from Fielding et al. (2005) with cattle graziers, 73% male and 22% female (5% did not disclose) compared to 77% male and 23% female in the present sample. In contrast, in this study the gender of cattle farmers was more evenly matched (54% male, 46% female). Since there were only 13 cattle farmers in this sample the gender distribution in this land use group cannot be compared with confidence. Mallawaarachchi et al. (1999) also reported a predominance of males (63%) in a comparable sample in rural far north Queensland which they attributed to the fact that males in the household are more likely to fill out surveys. This could also be the case in the present study. Dutcher (2000) in a

US survey also explained the predominance of males of 79% in his study in that way. But the main reason has to be seen in the fact that the gender role of farmers which make up the largest percentage of respondents (79.7%), is considered to be a masculine one.

The education levels of secondary and above of the present sample were relatively high with 89% compared with other studies (79% in Fielding et al., 2005). This survey did not ask about outside income, or the size of the agricultural enterprise, if they had one. Such information would then have disclosed the number of respondents in the sample who did not rely on the farm for their income. A higher level of education is most often a reflection of respondents with outside professional jobs that require higher levels of education. This is substantiated in the group of non-farmers where only one out of 25 reported primary education, indicating that the rest make a living from outside jobs. Being a non-farmer means you have to have an income from another source.

5.2 Riparian forest status, management and use

To investigate if the land use groups have different ways of managing and using the riparian forest, responses to questions about vegetation type, management style and use of riparian land were compared. These are called ‘behaviour indicators’ in other chapters.

Questionnaire items reflecting the state, management and use of riparian forests were as follows:

State - *Type of vegetation in the riparian forest* :"What kind of plants grow on the land alongside the stream?" Ticked responses to: "trees; shrubs; grass; agricultural crop; declared noxious weed; very little or nothing" (Tables 5.4, 5.5, 5.6).

Management - *Natural or human-made changes to the vegetation in the riparian forest*: Ticked responses to "Have your streamsides - always looked the way they look today? – had more trees on them some time ago? – more trees and shrubs on them than ever before? – grass on them now and had trees removed? – newly planted trees on them? – tree seedlings on them that are left to grow? – had all weeds removed? – been kept clean by you?" (Tables 5.7, 5.8).

Use - *Use of creek banks and riparian zones*: "How close to the edge of the waterway do you crop or cultivate the land?" Ticked responses to: "More than 10 metres away; close enough to turn a tractor around; up to the top of the bank" (Tables 5.9, 5.10, 5.11, 5.12).

Each item in these three multi-component questions underwent *Chi-square* tests of independence with each land use group. All cross tabulations in this section violated the minimum expected cell frequency. This arises from the fact that only those respondents who agreed with the item ticked the box next to it. This resulted in a data set with a lot of empty boxes representing disagreement or non-response. The results of the *Chi-square* test is therefore only an indication of differences that will be taken into consideration when interpreting the land users' overall reports concerning the condition of the riparian forest on their land.

5.2.1 Vegetation types in riparian forests and differences reported by land use groups

The majority of respondents reported trees on their creeks. Shrubs were reported next, followed by agricultural crops, noxious weed, grass, and very little or nothing (Table 5.4). Grass is not considered an effective riparian vegetation on its own. Only the roots of trees and shrubs can perform the needed biophysical actions (McKergow, Prosser, Hughes, & Brodie, 2004).

Table 5.4

Frequency of responses to questions about the type of vegetation on the land alongside the stream

Kinds of plants growing alongside the stream	Reported[a]		Not reported[b]		Total	
	f	%	*f*	%	*f*	%
Trees	115	93.5	8	6.5	123	100.0
Shrubs	66	53.7	57	46.3	123	100.0
Grass	82	66.7	41	33.3	123	100.0
Agricultural crops	32	26.0	91	74.0	123	100.0
Declared noxious weeds	32	26.0	91	74.0	123	100.0
Very little or nothing	2	1.6	121	98.4	123	100.0

[a]Ticked the box next to the question indicating agreement.
[b]Did not tick the box next to the question indicating disagreement or a non-response..

Significant differences between the land user groups were found in the responses to two items: use of streamsides for agricultural crops, and having declared noxious weeds growing on land alongside the stream. Table 5.5 lists the distribution of frequency and percentage of landuser groups reporting growing agricultural crops alongside the stream.

Table 5.5

Frequency distribution by land use groups growing agricultural crops on the land alongside the stream

Landuse	Growing agricultural crops alongside the stream?					
	Reported[a]		Not reported[b]		Total	
	f	%	*f*	%	*f*	%
Sugarcane	28	41.2	40	58.2	68	100.0
Tropical crops	1	5.9	16	94.1	17	100.0
Cattle[c]	1	7.7	12	92.3	13	100.0
Non-farming[cd]	2	8.0	23	92.0	25	100.0
Total	32	26.0	91	74.0	123	100.0

[a]Ticked the box next to the question indicating agreement.
[b]Did not tick the box next to the question indicating disagreement or a non-response.
[c]Cattle farmers' and non-farmers' responses are listed here for the purpose of showing the the complete data set. They are not expected to grow agricultural crops.
[d]Respondents did not report any farming activity.

Sugarcane growers represented the highest percentage of any land user group growing agricultural crops alongside the streams (Table 5.5). This represented a significant difference, $\chi^2(3, n=123) = 18.2$, $p < .001$, Cramer's V = .38, large effect size.

Table 5.6 lists the frequency and percentage of the 32 respondents that reported growth of declared noxious weeds along the stream.

Table 5.6

Frequency distribution by land use groups of reporting declared noxious weeds in their riparian forest

Landuse	Declared noxious weed growing alongside the stream?					
	Reported[a]		Not reported[b]		Total	
	f	%	*f*	%	*f*	%
Sugarcane	14	20.6	54	79.4	68	100.0
Tropical crops	2	11.8	15	88.2	17	100.0
Cattle	7	53.8	6	46.2	13	100.0
Non-farming[c]	9	36.0	16	64.0	25	100.0
Total	32	26.0	91	74.0	123	100.0

[a]Ticked the box next to the question indicating agreement.
[b]Did not tick the box next to the question indicating disagreement or a non-response.
[c]Respondents did not report any farming activity.

Only 20.6% of sugarcane growers and 11.8% of tropical crop farmers reported noxious weeds, while more than half of the cattle farmers (53.8%) did so, and more than a third of the non-farming landowners (36.0%). The regular weed-killer spraying by farmers may be the reason which would eliminate any weeds around the crops, or cattle farmers may be more alert to noxious weeds which can harm the animals. Nevertheless, the small numbers of respondents do not allow these conclusions to be relied upon.

The higher percentage of cattle farmers reported having noxious weeds growing alongside the stream represented a significant difference, $\chi^2(3, n = 123) = 9.36$, $p = .025$, Cramer's V = .28, medium effect size.

5.2.2 Vegetation changes in riparian forests and differences reported by land use groups

Another approach to defining the riparian management style of the respondents was by eliciting yes or no responses to questions about changes to the vegetation of the area (Table 5.7).

Table 5.7

Frequency of responses to questions about observed changes of vegetation on the land alongside the stream

The streamsides have :	Reported[a]		Not reported[b]		Total	
	f	*%*	*f*	*%*	*f*	*%*
Always looked the way they look today	59	48.0	64	52.0	123	100.0
Had more trees on them some time ago	41	33.3	82	66.7	123	100.0
More trees and shrubs on them now than ever before	31	25.2	92	74.8	123	100.0
Grass on them now and had trees removed	14	11.4	109	88.6	123	100.0
Newly planted trees on them	30	24.4	93	75.6	123	100.0
Tree seedlings on them that are left to grow	46	37.4	77	62.6	123	100.0
Had all the weeds removed	10	8.1	113	91.9	123	100.0
Keep them clean	50	40.7	73	59.3	123	100.0

[a]Ticked the box next to the question indicating agreement.
[b]Did not tick the box next to the question indicating disagreement or a non-response.

The only significant association - between land use groups and responses to changes of vegetation in their riparian forest – analysed using *Chi-square* test of independence was to the question "Have your streamsides more trees and shrubs on them now than ever before?" A total of 31 respondents ticked this item (Table 5.8).

Table 5.8

Frequency distribution by land use groups of reporting more trees and shrubs in their riparian forest than ever before

Landuse	Have your streamsides more trees and shrubs on them now than ever before?					
	Reported[a]		Not reported[b]		Total	
	f	%	*f*	%	*f*	%
Sugarcane	25	36.8	43	63.2	68	100.0
Tropical crops	2	11.8	15	88.2	17	100.0
Cattle	3	23.1	10	76.9	13	100.0
Non-farming[c]	1	4.0	24	96.0	25	100.0
Total	31	25.2	92	74.8	123	100.0

[a]Ticked the box next to the question indicating agreement.
[b]Did not tick the box next to the question indicating disagreement or a non-response.
[c]Respondents did not report any farming activity.

A *Chi-square* test of independence found this to be a significant difference among the land user groups ($\chi^2(3, n = 123) = 12.44$, $p = .006$, Cramer's V = .32, large effect size). A significantly higher percentage (80.6%) of sugarcane growers reported an increase in trees and shrubs on their streamsides than ever before.

5.2.3 Use of creek banks and differences reported by land use groups

The majority of land users cropped more than 10 m away from the edge of the waterway (Table 5.9). Very few landowners reported cultivating up to the top of the bank (Table 5.9).

Table 5.9

Frequency of responses to questions about uses of land alongside the stream

Do you crop or cultivate:	Reported[a]		Not reported[b]		Total	
	f	%	*f*	%	*f*	%
more than 10m from edge of waterway?	76	61.8	47	38.2	123	100.0
close enough to turn tractor around?	35	28.5	88	71.5	123	100.0
up to the top of the bank?	10	8.1	113	91.9	123	100.0

[a]Ticked the box next to the question indicating agreement.
[b]Did not tick the box next to the question indicating disagreement or a non-response.

Agreement regarding cropping land more than 10m from waterways was obtained mainly from sugarcane growers. More than half of all respondents cultivated the land no closer than 10 m from the waterway (Table 5.10). The differences between the land user groups were not significant, $\chi^2(3, n = 123) = 3.62$, $p = .31$.

Table 5.10

Frequency distribution by land use groups of cropping more than 10 m from the edge of the waterway

Land use	Do you crop or cultivate the land more than 10 m away from the edge of the waterway?					
	Reported[a]		Not reported[b]		Total	
	f	%	*f*	%	*f*	%
Sugarcane	43	63.2	25	38.8	68	100.0
Tropical crops	13	76.5	4	23.5	17	100.0
Cattle	8	61.5	5	38.5	13	100.0
Non-farming[c]	12	48.2	13	52.0	25	100.0
Total	76	61.8	47	38.2	123	100.0

[a] Ticked the box next to the question indicating agreement.
[b] Did not tick the box next to the question indicating disagreement or a non-response.
[c] Respondents did not report any farming activity.

Of the 35 respondents who used the streamside close enough to turn a tractor around 29 were sugarcane growers. Tropical crop growers, cattle farmers and non-farmers were represented by two respondents each (Table 5.11).

Table 5.11

Frequency distribution by land use groups of cultivating the riparian land close enough to the edge of the waterway to turn a tractor around

Land use	Do you crop or cultivate close enough to the edge of the waterway to turn a tractor around?					
	Reported[a]		Not reported[b]		Total	
	f	%	*f*	%	*f*	%
Sugarcane	29	42.6	39	57.4	68	100.0
Tropical crops	2	11.8	15	88.2	17	100.0
Cattle	2	15.4	11	84.6	13	100.0
Non-farming[c]	2	8.0	23	92.0	25	100.0
Total	35	28.5	88	71.5	123	100.0

[a] Ticked the box next to the question indicating agreement. [b] Did not tick the box next to the question indicating disagreement or a non-response. [c] Respondents did not report any farming activity.

The *Chi-square* test of independence confirmed the large discrepancy in the numbers of landuser, $\chi^2(3, n = 123) = 15.28$, $p = .002$, Cramer's V = .32 (large effect size). Sugarcane growers employ tractors for cane cultivation extensively while other landusers would not. Only 10 respondents reported growing crops up to the top of the banks (Table 5.12). These were mainly non-farming landowners.

Table 5.12

Frequency distribution by land use groups of cropping the land up to the top of the stream bank

Land use	Do you crop or cultivate the land up to the top of the bank?					
	Reported[a]		Not reported[b]		Total	
	f	%	*f*	%	*f*	%
Sugarcane	3	4.4	65	95.6	68	100.0
Tropical crops	0	0	17	100.0	17	100.0
Cattle	2	15.4	11	84.6	13	100.0
Non-farming[c]	5	20.0	20	80.0	25	100.0
Total	10	8.1	113	91.9	123	100.0

[a] Ticked the box next to the question indicating agreement.
[b] Did not tick the box next to the question indicating disagreement or a non-response.
[c] Respondents did not report any farming activity.

The *Chi-square* test of independence confirmed that significantly more non-farmers cultivated the land up to the top of the bank, $\chi^2(3, n = 123) = 8.40, p = .039$, Cramer's V = .26, medium effect size. Since the question does not specify agricultural crops, these non-farmers were most likely cultivating the land with decorative plants or vegetables and fruit for their own use, and not planting recommended riparian vegetation. But the small number of responses of agreement (ticked boxes) does not give much credence to the significant result.

5.2.4 Summary and discussion of the results about vegetation management of riparian forest by land user groups

The responses to the questions what kinds of plants grow in the land alongside the stream (trees, shrubs, grass, weeds, very little) yielded an insight into the management and preservation of the riparian forest. The findings are based on self-assessments which have been shown in other studies to be overly positive (e.g., Dutcher et al., 2004; Klapproth & Johnson, 1999c).

Nevertheless, elicitation of agreement with statements indicating the vegetation state of the streamsides at present and in the past allowed some deductions to be made about the true state of the riparian forests. This can also be gleaned from other responses to the question if the riparian zone is used for agricultural crops which showed this misuse of the land by a quarter of the respondents (Table 5.4). The same indication comes from the direct questions of how close to the edge of the waterway the land is cropped or cultivated, reported as more than 10m by 61.8%, and if the tractor was was turned around close to the waterway, which could be less than 10m from the creek edge, reported by more than a quarter (Table 5.9).

Almost all respondents (93.5%) reported trees alongside the stream (Table 5.4) but this was somewhat contradicted by 11.4% of the respondents who had trees removed and now had grass in the riparian zone (Table 5.7). More than half (53.7%) indicated having shrubs, and 66.7% grass, while only 1.6% ticked very few or no plants (Table 5.4). According to this, most of the riparian forest should be in a reasonably well vegetated and managed state. This assessment was strengthened by reports of a substantial percentage of landusers (61.8%) who cropped or cultivated more than 10m away from the edge of the water (Table 5.9). While just about a quarter of respondents (26%, Table 5.4) had agricultural crops alongside the stream (presumably more than 10m away), cropped close enough to turn the tractor around (28.5%, Table 5.9), and only 8.1% cropped up to the top of the banks (Table 5.9).

Sugarcane growers represented the largest percentage (41.2%) of any land user group who reported growing agricultural crops alongside the stream (Table 5.5). This was statistically significant at $p < .001$. This response seems to be contradicted by the large percentage of cane growers (42.6%) who reported they went close enough to the edge of the waterway to turn a tractor around (Table 5.11) but is probably explained by the interpretation that the crops are not directly on the stream banks but far enough away to allow for a tractor to turn-around. This explanation was confirmed by the majority's agreement (61.8%) with the statement that they crop more than 10m away from the edge of the waterway (Table 5.10). Unfortunately this desirable practice is negated by turning the tractor around close to the creek. The tractor would cause compaction of the land between the sugarcane field and the creek, exactly the riparian land needed as a buffer to intercept high agricultural chemical loads and flooding.

Cane growers did not crop or cultivate to the top of the bank but they could be using that land to turn the tractor around. Possibly they thought the question referred to steep creek banks, too steep to have cane on it. It could also be too steep for the tractor, and leaving 10m between bank and tractor would be avoiding a situation in which they could break through the bank with the tractor and fall into the waterway.

When reporting noxious weeds in the riparian zones cattle farmers were significantly different (p = .025) from the other land use groups. More than half (53.8%) reported noxious weeds in their riparian zones (see Table 5.6). This may be entirely due to the cattle trampling or eating suitable riparian vegetation. The weeds will then take over and prevent native riparian plants from growing there (Australian Government - Land and Water Australia, 2005; Brodie, 2002).

The questions about the state of the vegetation on the streamsides brought up a significant difference between the land use groups. This was the significantly higher percentage of sugarcane growers (36.8%, Table 5.8) than any other land use groups that reported an increase in trees and shrubs on the streamsides (p = .006). The finding conflicts with other responses of the sugarcane growers to similar questions. For example newly planted trees were only reported by a quarter (26.5%) of the sugar cane growers, and leaving tree seedlings to grow on the streamsides by 45.6% (Table 5.8). Considering that almost half (Table 5.11) of this group used the riparian land to turn the tractor around which causes compaction of the soil and prevents appropriate vegetation to take hold (Herron & Hairsine, 1998; Land and Water Australia, 2004), the conclusion can be drawn that a significant number of the cane growers do not follow best management practice when it comes to riparian forest preservation. Their perception that more trees and shrubs are present now in the riparian zones could mean

that this is the case in small areas that are left undisturbed, or that there was very little or no vegetation before, or this land use group considered fewer trees and shrubs as representing more when compared with the other land groups.

The verification of these responses is not possible because the survey was anonymous to the extent that the location of the land and the corresponding responses cannot be collated. Nevertheless, the study area containing the location of the land of the respondents is known, and the extent of riparian forests could be assessed from aerial photographs or satellite imagery. This method has been employed to assess riparian rainforest vegetation changes in an area in north Queensland (Lawson, 2007) but outside the study area.

Respondents who reported newly planted trees on the streamsides (31 or 25.2% ticked this item, Table 5.7) would be expected to have a high regard for riparian forests and know the benefits of their preservation. Together with two other items in this set of questions that reflect a similar idea ("have more trees on the streamsides now than ever before" and "trees and seedlings are left to grow on the streamsides") ticked by 31 (25.2%) and 46 (37.4%) respectively, these responses could be employed as an indicator of positive "behaviour" in regard to riparian management. Indeed, Curtis and Robertson (2003) in a study on river frontage land in the Gouldburn Broken catchment in Victoria used the planting of trees and shrubs as an indicator of the adoption of "current recommended practices" (CRP). They reported:

> Our analyses also suggested that the values attached to river frontages had contributed to differences in the adoption of CRP. There was a significant positive relationship between higher scores on an index measuring the importance of a range of environmental values and adoption for trees/shrubs planted… (p. 50)

These behaviour indicators will be further explored in regard to the respondents' attendance of meetings or workshops about land management and riparian forest (see Chapter 10).

Finally, it has to be mentioned that the items in this set of questions may not have been interpreted in the same way by all respondents as some responses allow for an ambiguous interpretation. For example, the non-farming group reported that they crop or cultivate the land up to the top of the bank more than the other land use groups. But since these respondents did not report any agricultural activity anywhere in the questionnaire, it is not clear what they cultivated on the banks. Perhaps their responses meant they planted some ornamental plants or vegetables for their own use.

5.3 Meetings and workshops attendance

To establish an insight into levels of attendance at meetings and workshops about land management and riparian forests by the survey respondent sample two questions requiring Yes/ No responses were asked in the survey. The responses are listed in the following two tables (Table 5.13 and Table 5.14).

5.3.1 Attendance at meetings or workshops about land management

Seventy-five respondents reported having attended meetings or workshops about land management (Table 5.13). More than half of the landowners in each land user group had attended one.

Table 5.13

Frequency distribution by land use groups of attendance of meetings or workshops about land management

Landuse	Attended meetings or workshops on land management					
	Yes		No		Total[a]	
	f	%	*f*	%	*f*	%
Sugarcane	45	68.2	21	31.8	66	100.0
Tropical crops	10	58.8	7	41.2	17	100.0
Cattle	7	53.8	6	46.2	13	100.0
Non-farming[b]	13	56.5	10	43.5	23	100.0
Total	75	63.0	44	37.0	119	100.0

[a] Whenever the total differs from n =123 it is due to missing data.
[b] Respondents did not report any farming activity.

A *Chi-square* test of independence revealed that no land use group was more likely to have attended land management meetings or workshops, $\chi^2(3, n = 119) = 1.77$, $p = .62$.

5.3.2 Attendance of meetings or workshops about riparian forests

The number of respondents who attended meetings and workshops about riparian forests was less than half of those that had attended general land management workshops (Table 5.14).

Table 5.14

Frequency distribution by land use groups of attendance of meetings or workshops about riparian forests

Landuse	Attended meetings or workshops about riparian forests					
	Yes		No		Total[a]	
	f	%	*f*	%	*f*	%
Sugarcane	20	30.8	45	69.2	65	100.0
Tropical crops	3	17.6	14	82.4	17	100.0
Cattle	4	30.8	9	69.2	13	100.0
Non-farming[b]	7	30.4	16	69.6	23	100.0
Total	34	28.8	84	71.2	118	100.0

[a] Whenever the total differs from n =123 it is due to missing data.
[b] Respondents did not report any farming activity.

A *Chi-square* test of independence showed that no land use group was more likely to have attended riparian forest management meetings or workshops, $\chi^2(3, n = 118) = 1.21$, $p = .75$.

5.3.3 Attendance of meetings or workshops about land management and riparian forests combined

To determine if any land use group was more likely to have attended any workshop about land management or riparian forests the attendances of both items were added. Table 5.15 shows the number of respondents who attended no meetings or workshops, or one meeting or workshop about land management or riparian forest, or attended both land management and riparian forests workshops.

One third of all land users had not attended any meetings or workshops. This comprised almost half of the cattle farmers (Table 5.15), and almost a third of the sugarcane growers (Table 5.15). More than a third of tropical crop growers and non-farmers had attended one.

Table 5.15

Frequency distribution of land use groups' attendance of meetings or workshops on land management and about riparian forests

Land use	Attended meetings or workshops about land management and riparian forests: attended none		attended one		attended both		Total of group	
	f	%	*f*	%	*f*	%	*f*[a]	%
Sugarcane	19	28.8	30	45.5	17	25.8	66	100.0
Tropical crops	6	37.5	7	43.8	3	18.8	16	100.0
Cattle	6	46.2	3	23.1	4	30.8	13	100.0
Not farming[b]	9	39.1	8	34.8	6	26.1	23	100.0
Total	40	33.9	48	40.7	30	25.4	118	100.0

[a] Whenever the total differs from n =123 it is due to missing data.
[b] Respondents did not report any farming activity.

A *Chi-square* test of independence found no significant differences, $\chi^2(6, n = 118) = 3.27$, $p = .78$.

5.3.4 Attendance of meetings or workshops and the state, change over time, and use of the riparian forest

To investigate if respondents who had attended meetings or workshops on land management or riparian forests reported differently on their riparian land's vegetation, a change of vegetation over time, or their use of the stream banks, cross-tabulations were performed. Firstly, the attendance of none, or one, or of both kinds of workshops was checked for association with all items of vegetation status and change, and use of riparian land. Did the attendance of the number of workshops result in different reports? Cross-tabulations were performed with the attendance level as the independent variable and the vegetation alongside the stream, the changes of vegetation over time, and the use of the stream bank as the dependent variable.

The results showed no differences in the type of vegetation in the respondents' riparian forests according to their workshop attendance about land management or riparian forests. But in regard to vegetation changes over time in their riparian forest, a

significantly larger percentage of respondents who had attended both kinds of workshops reported "newly planted trees on the streamsides" (Table 5.16).

Table 5.16

Frequency and significance of attendance of meetings or workshops about land management and riparian forests, and reporting newly planted trees on the riparian land

Attended meetings or workshops about land management and riparian forests	Reported newly planted trees						
	f[a]	%	χ^2	*df*	*n*[b]	*p*	*Effect size*
Attended both Yes (*n* =31)	13	41.9	8.44	2	118	.015	small Cramer's V = -.27
Attended one Yes (*n* =46)	11	23.9					
Attended none Yes (*n* =41)	5	12.2					
Attended one about land management Yes (*n* =75) No (*n* =44)	24	32.4	4.03	1	119	.045	small *phi* = -.20
Attended one about riparian forests Yes (*n* =34) No (*n* =84)	14	28.8	5.90	1	118	.015	small *phi* = -.25

[a] Number of attendees that reported newly planted trees in their riparian forest.
[b] Whenever the total differs from n=123 it is due to missing data.

Of those having attended one (either about land management or about riparian forests), 23.9% reported newly planted trees, and only 12.2% of respondents who had not attended any workshops did so (Table 5.16). The *Chi-square* test of independence revealed that attendance of one land management workshop was significantly associated with having newly planted trees on the riparian land, $\chi^2(1, n = 119) = 4.03$, $p = .045$, *phi* = -.20 (small effect size), and the same was found for attendance of one meeting or workshop about riparian forests, $\chi^2(1, n = 118) = 5.90$, $p = .015$, *phi* = -.25, small effect size.

Attendance also made a significant difference with the practice of turning the tractor around on the streambanks, $\chi^2(2, n = 118) = 6.92, p = .03, phi = .24$, a small effect size (no table). More than half of the 33 respondents who confirmed that they did use the banks in this way had attended a workshop on land management but not about riparian forests. No other items about vegetation status, reports of change or use of the respondents' riparian forests were found to be related to attendance of workshops.

5.3.5 Summary and discussion of attendance of meetings and workshops about land management and riparian forests

Meetings and workshops about land management and riparian forests are one way to build capacity of the land users to sustainably manage their land and the natural resources (Fenton, 2004). The presentation of knowledge and skills should give the land users the ability to make informed decisions and motivate them to follow the recommendations. The answers to items about the state, use and perceived change of riparian forests in the questionnaire may be an indication of the landowner's capacity in these matters. It may also reflect entrenched ideas that will be challenged by new and contradictory information (Allan & Curtis, 2005), and, therefore impact on the responses of attendees as to the usefulness of the meetings or workshops.

The respondents who reported beneficial plants (trees, shrubs, grass) growing on their riparian land were not the ones who had attended meetings or workshops. But reporting of newly planted trees was significantly related to attendance. Even having attended one showed this effect. The conclusion can be drawn that these respondents had learned about the benefit of trees on riparian land and had been motivated to plant some. For a significant number of respondents the workshops seem to have fulfilled

their purpose in capacity building and provided them with understanding of natural resources and the motivation to rehabilitate and preserve them.

The use of riparian land to turn the tractor around showed a relationship with attendance of meetings or workshops. Sugarcane growers especially follow this tradition, which does not seem to be overly influenced by awareness of how detrimental the nature of soil compaction can be to these riparian zones. Information about this would certainly be on the agenda of any meeting or workshop about land management and riparian forest since it is included in any website about river management (e.g., Land and Water Australia, 2008, Australian Government, 2008; Australian Government - Land and Water Australia, 2005). It seems that this destructive use of stream banks is considered necessary by farmers to retain as much arable land as possible. When it comes to economic considerations, the farmers would rather increase income than preserve riparian land. Fenton (2004) when researching participation in sustainable agricultural practices programs, also found a similar change in farmer priorities.

5.4 Meetings and workshops – level of satisfaction

Level of "satisfaction" with the meetings or workshops attended was also examined. The "satisfaction level" was deduced from responses rated on a 7-point Likert scale to the questions: "Did you learn anything?"(nothing to a lot) and "Did you find it useful?" (not useful at all to very useful).

Responses were re-categorized as follows: A, representing "having learned nothing or very little" and "found it not useful at all" (Likert scale 1,2,3); B, representing "having learned something" and "found it useful" (Likert scale 4); and C,

representing "having learned a lot" and "found it very useful" (Likert scale 5,6,7). The data are listed in Table 5.17 and Table 5.18.

The majority of respondents (over 60%) who attended meetings and workshops on land or riparian management thought they had learned a lot or something, and found the information useful or very useful (Likert scale 4,5,6,7). But a larger proportion of attendees of riparian forest workshops compared with land workshops thought they had learned nothing or very little (21.2% compared to 12.2%) (Table 5.17), or nothing useful (30.3% compared to 16.4%) (Table 5.18).

Table 5.17

Frequency distribution regarding the amount learned by respondents that had attended land management or riparian forest meetings or workshops

Meetings and workshops about			How much did you learn?					
			A nothing[a]		B something[b]		C a lot[c]	
	M	*(SD)*	*n*	*%*	*n*	*%*	*n*	*%*
Land management *n* =74	4.85	(1.47)	9	12.2	17	23.0	48	64.9
Riparian forests *n* =33	4.67	(2.00)	7	21.2	6	8.2	20	60.6

[a] 1,2,3 on a 7-point Likert scale. [b] 4 on a 7-point Likert scale. [c] 5,6,7 on a 7-point Likert scale.

A *Chi-square* test found a significant difference between having learned nothing (category A) in riparian forest workshops compared with those in land management workshops (Table 5.17), $\chi^2(4, n = 30) = 45.55$, $p < .001$, *Cramer's V* = .87, large effect size. This discrepancy is even larger in category B (having learned something) between attendees of the two kinds of workshops (land management 23.0%, riparian forest 8.2%). At the same time a majority of attendees reported having learned a lot from

workshops about land management and almost an equal percentage of riparian forest management (Table 5.17).

The same picture emerges for the levels of satisfaction about the usefulness of the workshops (Table 5.18).

Table 5.18

Frequency distribution regarding the level of usefulness reported by respondents that had attended land management or riparian forest meetings or workshops

Meetings and workshops about			How useful was it?					
			A not useful at all[a]		B useful[b]		C very useful[c]	
	M	*(SD)*	*n*	*%*	*n*	*%*	*n*	*%*
Land management *n* =73	4.85	(1.65)	12	16.4	13	17.8	48	65.8
Riparian forests *n* =33	4.60	(2.06)	10	30.3	3	9.1	20	60.6

[a] 1,2,3 on a 7-point Likert scale. [b] 4 on a 7-point Likert scale. [c] 5,6,7 on a 7-point Likert scale.

A *Chi-square* test of independence found that a significantly higher percentage of attendees of riparian forest than land management workshop reported the workshops as not useful at all (category A), $\chi^2(4, n = 29) = 53.04$, $p < .001$, *Cramer's V* = .96, a large effect size. Again, this discrepancy is even larger in category B (having found it useful) between attendees of the two types of workshops (land management 17.8%, riparian forest 9.1%). But the majority of attendees reported having found workshops about land management and about riparian forest very useful (category C, Table 5.18).

On the whole a large percentage of respondents had learned something or a lot in land management meetings or workshops (87.9 %) and in meetings and workshops about riparian forest (68.2%). An equally large percentage of respondents also reported

that they found meetings and workshops about land management useful or very useful (83.6%). This was also the case for riparian forest workshops (69.7%).

5.4.1 Satisfaction with meetings or workshops between land use groups

To determine if there were differences in satisfaction levels ("having learned something" or "found the workshop useful") between land use groups, *Kruskall-Wallis* tests were performed. For the purpose of these tests it was necessary to assign the satisfaction variables continuous measure status by assuming that the intervals on the Likert-scale measure are equal. Thus, the data of satisfaction with land management workshops (1-7 Likert-scale), and with riparian forest workshops (1-7 Likert-scale) were used as the DV, the continuous test variable, and land use group variable as the IV, the categorical grouping variable.

The *Kruskall-Wallis* tests revealed that the land use groups did not differ in their satisfaction levels with meetings and workshops on land management or riparian forests in regard to having learned something (land management, $\chi^2(3, n = 74) = 2.98, p = .39$; riparian forests, $\chi^2(3, n = 33) = .87, p = .83$). The groups also did not differ in their ratings of the usefulness (land management, $\chi^2(3, n = 74) = 2.98, p = .39$; riparian forests, $\chi^2(3, n = 33) = .87, p = .83$).

The land user groups did not react differently to the workshops in what they thought they had learned or found useful. This was the case for meetings and workshops about land management and riparian forests.

5.4.2 Level of satisfaction of having learned something at meetings or workshops and the state, change over time, and use of the riparian forest

To further explore the associations with riparian forest vegetation and use, *Chi-square* tests of independence were performed with the satisfaction levels of having learned something or nothing at workshops. For this purpose the responses were categorized into "having learned a lot" (4 to 7 on the Likert scale) and "having learned nothing" (1 to 3 on the Likert scale). The level of learning from workshops was employed as the independent variable, and vegetation type and vegetation changes in the riparian forest, and use of stream banks as the dependent variables.

More than half of the respondents who had learned a lot reported having shrubs growing alongside the stream, $\chi^2(2, n = 30) = 6.30$, $p = .04$, $phi = .46$, a medium effect size. No other item about the riparian vegetation status was associated with levels of satisfaction with learning. Learning satisfaction from workshops and reported changes over time in the vegetation of the riparian forest, and the use of the stream banks were not associated.

5.4.3 Level of satisfaction of having found meetings or workshops useful and the state, change over time, and use of the riparian forest

To explore the associations of reported levels of usefulness of meetings or workshops about land management and riparian forests with the respondents' reports of the vegetation status and change, and the use of stream banks, *Chi-square* tests of independence were performed. For this purpose the responses were categorized into high (4 to 7 on the Likert scale) and low usefulness ratings (1 to 3 on the Likert scale). In the cross-tabulation the levels of usefulness of workshops represented the

independent variable and vegetation type and vegetation changes in the riparian forest and use of stream banks the dependent variable.

Almost all reports of having shrubs growing alongside the stream were from respondents who had found the workshops very useful (93.3%), $\chi^2(2, n = 29) = 6.88$, $p = .03$, $phi = .49$, a medium effect size. No other item about the riparian vegetation status was associated with usefulness rating. Vegetation changes in the riparian forests were also shown to have no association with usefulness rating of workshop about land management or riparian forests.

The same was found for the items on the use of stream banks which did not associate with usefulness ratings. Nevertheless, cropping 10m or more from the edge of the waterways was nearing significance, $\chi^2(2, n = 29) = 5.82$, $p = .06$, $phi = .45$, and so was the item about turning a tractor around close to the waterway, $\chi^2(2, n = 29) = 5.60$, $p = .06$, $phi = .40$.

5.4.4 Summary and discussion of satisfaction ratings with meetings and workshops about land management and riparian forest

The largest percentage of respondents reported that they had learned a lot or something in workshops about land management and riparian forests. And not dissimilar numbers were obtained for usefulness of the workshops about land management and riparian forests. However, dissatisfaction expressed as having learned nothing or having found it useless was significantly stronger for participants of workshops about riparian forests. The four land use groups did not show any differences in their satisfaction ratings.

The dissatisfaction with the meetings or workshops for some people in the group could have some explanation according to findings by Fenton (2004). He reports that in

his group of interviewees several participants believed that all skills for "on-ground conservation" (p. 72) were already available but many also mentioned that there was a "need for extension and field officers provid[ing] the necessary skills and training to implement these actions" (p. 72). The same report revealed a pervading belief that government agencies "no longer placed a value on farming" (p. 78) and that previous "changes in land use practices and implementation of management actions" (p. 79) had not been recognized by the agencies. This belief that not knowledge but help and encouragement was needed and the almost defeatist perception of farmers that no support or recognition can be expected may have been in the mind of the workshop participants of the sample who had learned nothing about land management and had found it useless; and of those who had learned nothing about riparian forests and had found it useless.

These attendees may also have had entrenched beliefs and were feeling outside their "comfort zone", as Allan and Curtis (2005) reported, who found that "individuals and groups maintained their comfort by denying that they had learned" (p.521).

Another explanation can be the well-reported fact (e.g. Corbett, 2002; Klapproth et al., 2001; Wilson et al., 2003; Barr & Cary, 2000; Cotching & Sims, 2000; Dutcher et al., 2004; Earle, Rose & Bronlea, 1979; Vanclay, 1992) that information provided in meetings and workshops has to be directly applicable to the participants' land and riparian forest situation. When the information being provided is using examples of severe degradation of land or riparian forest, the participant may easily conclude that his areas do not look like that and therefore do not need attention. Therefore, the meeting or workshop would be rated useless and as having learned nothing.

The only significant association with reporting of having learned something in meetings or workshops and any item of riparian forest vegetation state, use or vegetation change was found with the growth of shrubs alongside the stream. The correlation is not clear and cannot be explained by information gained from workshops. Shrubs would represent the plant cover of most riparian land that has no trees on it and has been left alone.

At the same time, the exposure of landowners to information about appropriate land and riparian forest management can only lead to the persons' engagement and resulting in adoption or rejection/non-action, assessed from self-reports about riparian forests in this study. Some decision making process must have taken place in the past that resulted in the condition of the riparian forest. The non-adoption of best practices is also dependent on factors other than purely cognitive ones, such as perceived or real financial and time constraints, and beliefs in personal and public benefits, and the presence of entrenched beliefs (Allan & Curtis, 2005). Further investigations could be undertaken with high- and low- satisfaction groups and their responses to items in the TPB that explore the notions of social norming and of personal control factors.

5.5 Sources of knowledge about land management and riparian forests

To find out where the respondents thought their most and least reliable information about land management and riparian forest comes from, the survey contained questions about their sources of knowledge. An insight into the respondents' most relied upon sources of information on how to manage land and riparian areas could reveal the trust they put into these sources. It would be useful to know if information provided by government agencies and disseminated through pamphlets, websites, media, or

workshops is accepted and utilized, or if the respondents do not regard those sources as relevant as other sources such as personal experience.

Two multi-component questions ("From where do you get your knowledge about land management?" and "From where do you get your knowledge about streamside forests?") addressed respondents' sources of knowledge about land management and riparian forest. The data were collected using a 7-point Likert scale, and the responses were re-categorized as follows: A representing "nothing or very little" (Likert scale 1,2,3), B representing "some" (Likert scale 4), and C representing "a lot to most of it" (Likert scale 5,6,7). The responses are listed in Table 5.19.

The respondents rated several sources equally highly for knowledge about land management and riparian forests, and of these the two most common ones are relying on own experience through trial and error and observation of other people's practices. Other sources such as public media, and to some extent government agencies among others were considered as providing little knowledge.

Table 5.19

Frequency distribution in response categories about the sources of knowledge about land management and about streamside forests

Sources of knowledge	Response Category A 'nothing or very little' [a]		B 'some' [b]		C 'a lot to most' [c]		Total [d]	
	f	%	*f*	%	*f*	%	*f*	%
a) Agricultural journals	30 L [e]	27.3	22	20.0	58	52.7	110	100.0
	37 R [f]	33.6	24	21.8	49	44.5	110	100.0
b) Newspapers	54 L	51.4	21	20.0	30	28.6	105	100.0
	58 R	56.3	13	12.6	32	31.1	103	100.0
c) Television	48 L	44.9	17	15.9	42	39.3	107	100.0
	63 R	59.4	11	10.4	32	30.2	106	100.0
d) Radio (wireless)	48 L	47.5	17	16.8	36	35.6	101	100.0
	57R	54.8	18	17.3	29	27.9	104	100.0
e) Own experience by trial and error	9L	8.0	16	14.3	87	77.7	112	100.0
	17R	15.5	21	19.1	72	65.5	110	100.0
f) Observation of other people's practices	14L	12.8	15	13.8	80	73.4	109	100.0
	18R	16.5	19	17.4	72	66.1	109	100.0
g) Traditional practices handed down	35 L	32.4	17	15.7	56	51.9	108	100.0
	37 R	34.9	22	20.8	47	44.3	106	100.0
h) Scientific journals	54 L	54.0	14	14.0	32	32.0	100	100.0
	64 R	62.1	12	11.7	27	26.2	103	100.0
i) Meetings and workshops	43 L	41.7	9	8.7	51	49.5	103	100.0
	49 R	48.0	10	9.8	43	42.2	102	100.0
j) Government agencies	56 L	52.3	12	11.2	39	36.4	107	100.0
	52 R	51.0	18	17.6	32	31.4	102	100.0
k) Agricultural college [g]	70 R	66.7	13	12.4	22	21.0	105	100.0

[a] 1,2,3 on a 7-point Likert scale. [b] 4 on a 7-point Likert scale. [c] 5,6,7 on a 7-point Likert scale.
[d] Whenever the total differs from *n* =123 it is due to missing data. [e] L = about land management.
[f] R = about riparian forests. [g] This was only asked about riparian forest.

5.5.1 Sources providing most of the knowledge

The most common source of knowledge (response category C:"a lot or most of it") about land management and about riparian forest was from the respondents' "own experience through trial and error" and "through observation of other people's practices" (Table 5.19). There were 87 respondents who rated own experience through trial and error as the most important source for land management and 72 for riparian forests; 80 listed observation of other people's practices as the source for land management and 72 for riparian forest. The idea of knowledge from observation indicates that landowners will adopt a practice that works well for others. It does not exhibit a capacity to predict long-term consequences of that management practice, but may have strong overtones of quick fix solutions and short-term financial gains. It is also reminiscent of the diffusion theory (Rogers, 1962) which predicts that sufficient exposure will result in adoption of practices. Barr and Carey (2000) however, reported that landowners are far more discriminant, and adoption of sustainable practices depends among other factors on their role "as social agents within the social and economic constraints of local communities and the broader structural constraints of Australian agriculture" (p. 1). This mindfulness of their role in the community would predispose them to rate local knowledge about riparian forests above that from outside sources (e.g. from meetings, workshops and government agencies) no matter how correct it may be.

The very often, entrenched beliefs in the sources of individual knowledge may give the person a false sense of comfort and in order to avoid stress arousal they avoid accepting or even considering new knowledge from other sources. Allan and Curtis (2005) reported on this phenomenon of denial and self-deception in a watershed

management study with rural landowners and cited Goleman (1997) who "suggests that modern humans are most at risk from psychological pain, in the form of affronts to self-esteem, and apprehensions" (p. 421). The implications of this are that new information has to be presented in such a way that personal beliefs are not totally dismissed but are built upon or integrated and modified to make acceptance of new management practices easy for people.

According to this information about sources of knowledge, the respondents that get most of their knowledge about land management and about riparian forests from their own experience through trial and error or from observation of other people's practices will be investigated in regard to land and riparian management behaviour.

5.5.2 Sources providing no or very little knowledge

A surprisingly high percentage of respondents found that they got no or very little knowledge from "meetings and workshops" about land management and riparian forests (41.7% and 48.0% respectively) and from "government agencies" (52.3% and 51% respectively) (Table 5.19). This result differs sharply from the distribution of reports in regard to having learned nothing about land management (12.2%) and about riparian forests (21.2%) (Table 5.17); and having found it not useful (16.4% and 30.3% respectively) (Table 5.18). Looking at the number of respondents represented by these percentages it shows that in regard to land management meetings and workshops only nine attendees reported having learned nothing and 12 attendees found it useless. For riparian forests the numbers are seven learned nothing and 10 found it useless. But in answer to the question where the respondents get their knowledge about land management and riparian forests 43 and 49 respectively, regarded meetings and workshops as providing nothing or very little. There were 75 respondents who had

attended events about land management (Table 5.13) but only 34 about riparian forest (Table 5.14).

It can be said with confidence that 15 respondents who answered this question never attended meetings or workshops about riparian forests. They judged such venues outright as not providing knowledge without having experienced one. This may be a reflection of their distrust in anything provided by official agencies, an observation which has been mentioned before (Fenton, 2004).

On the other hand, 43 respondents reported meetings and workshops provided a lot or most of their knowledge about riparian forests. Here again are 10 more respondents than the 33 who had attended workshops on the subject and only 20 of those rated them highly. It is not clear what the 10 extra non-attendees meant to say. Did they benefit from the knowledge of others that had attended workshops and had imparted the information to them?

5.5.2.1 Traditional practices handed down providing no or very little knowledge

A special finding in this set of responses about sources of knowledge is that "traditional practices handed down", was reported as supplying "little or no knowledge" by a surprisingly large percentage of respondents (32.4% about land management and 34.9% about riparian forest). This is a very high proportion compared to the responses to "own experience through trial and error" (8.0% and 15.5%, respectively) and to "observation of other people's practices" (12.8% and 16.5%, respectively). From Study 1 we know that a number of retired farmers admitted that the management practices about riparian forests have changed in their lifetime, and farmers have learned that inappropriate practices lead to erosion of stream banks and loss of soil. These early riparian

management practices are most likely what the 37 (34.0%) respondents in this survey considered as traditional practices handed down and rejected as a source of knowledge. Nevertheless, more respondents (47 or 44.3%) still thought of them as providing a lot or most of their knowledge about riparian forests. The distribution of data is similar for knowledge about land management. These findings are discouraging in light of the efforts by land care agencies to change traditional land and riparian forest management practices to more appropriate ones. Similar findings have been gathered from other studies such as Kraack (2000) who found that sugarcane growers rated their "own on-farm experience as more significant in decision making than that of industry 'experts'" (p. 8).

5.5.3 Differences in the sources of knowledge about land management and riparian forests by land user groups

Before this section about sources of knowledge is concluded the responses to the questions of sources of knowledge about land management and riparian forest will be examined for differences across the land use groups. The resulting ramifications will be discussed. The calculations are based on responses to the 7-point Likert rating scale described earlier.

Kruskal-Wallis tests were performed to find out if there were differences in the sources of knowledge about land management across the land use groups. The outcome of the tests revealed significant differences for agricultural journals as sources of knowledge, $H = 19.08$ (3, $n = 110$), $p < .001$; for traditional practices handed down as sources of knowledge, $H = 8.28$ (3, $n = 108$), $p = .04$; for meetings and workshops as sources of knowledge, $H = 9.19$ (3, $n = 103$), $p = .03$; and for government agencies as sources of knowledge, $H = 8.05$ (3, $n = 107$), $p = .05$. These results underwent *Mann-*

Whitney U tests to determine which land use groups differed significantly from the others.

Because there are six groups being compared the Bonferroni correction to the alpha value had to be applied to avoid Type I error for significant results. The six groups in the multiple comparison were: (1) sugarcane growers x tropical fruit growers; (2) sugarcane growers x cattle farmers; (3) sugarcane growers x non-farmers; (4) tropical fruit farmers x cattle farmers; (5) tropical fruit farmers x non-farmers; (6) cattle farmers x non-farmers. In this case the stricter alpha value was established at $p = .008$ (.05/ 6 = .008). Following are the outcomes of *Mann-Whitney U* tests of each item that were identified as showing significant differences across the land use groups. The criteria of Cohen (1988 cited in Pallant 2007) were used throughout to calculate effect size *r* which is reported for each test with a significant outcome.

5.5.3.1 Agricultural journals as a source of knowledge about land management

Significant differences below *alpha* .008 were found between sugarcane growers and non-farmers ($Md = 5.00$, $n = 62$). Sugarcane growers were significantly more likely to consider agricultural journals as sources of knowledge for land management than non-farmers ($Md = 3.00$, $n = 23$), $U = 286$, $z = -4.29$, $p < .001$, $r = .47$. This represents a medium effect size.

Also, significantly more tropical crop growers ($Md = 5.00$, $n = 12$) found that agricultural journals provided them with knowledge about land management than did non-farmers ($Md = 3.00$, $n = 23$), $U = 52$, $z = -3.05$, $p = .002$, $r = .52$. This represents a large effect size. No other significant differences were found.

5.5.3.2 Traditional practices handed down as a source of knowledge about land management

None of the *Mann-Whitney U* tests found significant differences between the land use groups. Only sugarcane growers (*Md* = 5, *n* =60) versus non-farmers (*Md* = 3, *n* =24) came close to being significant in this item of finding traditional practices handed down a source of much of their knowledge about land management, *U* = 470 *z* = -2.52, *p* = .012, *r* = .28. But the alpha value here was higher than the *Bonferroni* corrected *alpha* of *p* = .008 and the result can therefore not be considered significant.

5.5.3.3 Meetings and workshops as a source of knowledge about land management

According to the *Mann-Whitney U* mean ranking test significantly more sugarcane growers (*Md* = 5, *n* =56) than non-farmers (*Md* = 1, *n* =23) found meetings and workshops a source of much of their knowledge about land management, *U* = 392, *z* = -2.78, *p* = .006, *r* = .31. This represents a medium effect size. No other significant differences were found.

5.5.3.4 Government agencies as a source of knowledge about land management

According to the *Mann-Whitney U* mean ranking tests two comparisons reached significance but in both cases the alpha values were higher than the Bonferroni corrected alpha of *p* = .008 and the results can therefore not be considered significant. These uncorrected and therefore not significant results showed that more sugarcane growers (*Md* = 4, *n* = 59) found government agencies to be a source of much of their knowledge about land management than non-farmers (*Md* = 2, *n* =23), *U* = 432, *z* = -2.60, *p* = .009, *r* = .29, and more tropical crop growers (*Md* = 4.5, *n* = 12) reported

this than non-farmers (*Md* = 1, *n* =23), *U* = 79.5, *z* = -2.13, *p* = .03, *r* = .02. No other significant differences were found.

5.5.4 Sources of knowledge about riparian forest of land use groups

Kruskal-Wallis tests were also performed to evaluate differences of sources of knowledge about riparian forest across the land use groups. Differences were revealed for agricultural journals as sources of knowledge, *H* = 10.14 (3, *n* = 110), *p* = .02, for traditional practices handed down as sources of knowledge, *H* = 9.82 (3, *n* =106), *p* = .02, and for meetings and workshops as sources of knowledge, *H* = 8.34 (3, *n* =102), *p* = .04. These significant results underwent *Mann-Whitney U* tests to determine which land use groups differed significantly from the others.

As was the case for the item on sources of knowledge about land management, the *Bonferroni* correction to the alpha value had to be applied to avoid *Type I error* in significant results. The six groups in the multiple comparison (combinations of the four landuser groups), and the stricter *alpha* value was established at *p* = .008 (.05/ 6 = .008).

5.5.4.1 Agricultural journals as a source of knowledge about riparian forest

According to the *Mann-Whitney U* mean ranking test significantly more sugarcane growers (*Md* = 5, *n* =63) than non-farmers (*Md* = 3, *n* =23) found agricultural journal a source of much of their knowledge about riparian forest, *U* = 405, *z* = -3.16, *p* = .002, *r* = .39, which is a large effect size. No significant differences were found.

5.5.4.2 Traditional practices handed down as a source of knowledge about riparian forest

A significant difference was found between sugarcane growers ($Md = 5$, $n = 60$) and non-farmers ($Md = 3$, $n = 24$), $U = 447$, $z = -2.74$, $p = .006$, $r = .30$, which is a large effect size. According to the *Mann-Whitney U* mean ranking test, significantly more sugarcane growers than non-farmers found traditional practice handed down a source of much of their knowledge about riparian forest. No other significant differences were found.

5.5.4.3 Meetings and workshops as a source of knowledge about riparian forest

According to the *Mann-Whitney U* mean ranking test significantly more sugarcane growers ($Md = 5$, $n = 55$) than non-farmers ($Md = 1$, $n = 24$), found meetings and workshops a source of much of their knowledge about riparian forest, $U = 438.5$, $z = -2.42$, $p = .016$, $r = .27$, which is a small effect size. But the alpha value here is higher than the *Bonferroni* corrected *alpha* of $p = .008$. No other significant differences were found.

5.5.5 Summary and discussion of significant differences in the sources of knowledge between land use groups

Significant differences between the landuse groups were found with only three sources of knowledge (Table 5.20):

1. Agricultural journals were considered a good source of knowledge about land management and about riparian forests by significantly more sugarcane growers than non-farmers. Significantly more tropical crop farmers than non-farmers found them as a good source of knowledge about land management only (Table 5.20). It can be safely assumed that the significant differences are simply due to the fact that sugarcane growers and tropical crop farmers subscribe to agricultural journals but non-farmers do not because they have no need for that particular information.

2. Traditional practices handed down were considered a good source of knowledge about riparian forests but not about land management by significantly more sugarcane growers than non-farmers (Table 5.20). The explanation of this result can be sought in the fact that non-farmers would not have any tradition of land management handed down because they presumably do not cultivate the land for profit. The non-farming group also included people who only reside on the land and do not manage it in any particular way.

3. Meetings and workshops were considered a good source of knowledge about land management but not riparian forests by significantly more sugarcane growers than non-farmers (Table 5.20). This was not the case in the responses in regard to satisfaction ratings (having learned something and having found it useful) with meetings and workshops, where no differences were found between the land use groups.

These findings have to be reconsidered in light of the discrepancy of workshop attendance between the land use groups. For example, 45 sugarcane growers attended land management meetings while only 13 non-farmers did so. In regards to meetings about riparian forests the numbers were 20 sugarcane growers and seven non-farmers.

Table 5.20

Significant differences in sources of knowledge about land management between land use groups

Source of knowledge	About	
	Land management	Riparian forests
(1) Agricultural journals	Sugarcane more than non-farmers U = 286, z = -4.29 p < .001, r = .47 medium effect size Tropical crop farmers more than non-farmers U = 52, z = -3.05 p = .002, r = .52 large effect size	Sugarcane more than non-farmers U = 405, z = -3.16 p = .002, r = .39 large effect size
(2) Traditional practices handed down		Sugarcane more than non-farmers U = 447, z = -2.74 p = .006, r = .30 large effect size
(3) Meetings and workshops	Sugarcane more than non-farmers U = 392, z = -2.78 p = .006, r = .31 medium effect size	

5.6 Landowners' belief in their own correctness of knowledge of riparian forests compared with scientists' findings

Respondents were asked whether they thought their knowledge about riparian forests was more or less correct than what scientists have found. The 121 responses showed that 48 respondents (39.7%) thought their knowledge about riparian forest was on par

with what scientists had found by indicating the midpoint of 4.00 (*SD* = 1.6) on the 7-point Likert scale. Thirty five landowners (28.9%) thought their knowledge was less correct, and 38 (31.4%) indicated more correct knowledge.

A *Kruskal-Wallis* test was performed on the responses to find out if the four land use groups differed in their responses. There was no significant difference between the groups, $\chi^2(3, n = 123) = 3.38, p = .34$.

This finding underlines the results in the earlier section that the landowners' most important sources of knowledge about riparian forests are their own experience through trial and error and observation of other people's practices. It does not exclude the notion that the respondents of this survey would also consider scientific information they are familiar with and which they think they learned already on their own. When the majority (about 66%) believes that trial and error and observation is the most important source of information it can be said that scientific information is not really sought but needs to be made more acceptable and credible to landowners. This is a case of lacking capacity through scientific ignorance and doubt.

Kraack (2000) reported similar findings from a sample of sugarcane growers in the far north of Queensland. She also found that these farmers did consider the specific sugarcane research findings and recommendation in their decisions regarding land management options. But at the same time they relied strongly on other farmers' opinions. They were more persuaded by technical personnel when these could show that they were also working on the land.

The responses to this item can be used to divide the sample into two groups - into those who think their knowledge about riparian forests is more correct than what scientists found and those who think they are definitely less correct. The aspect of believing in scientific findings in regard to riparian forests will be further explored with the data from the TPB questionnaire which has items about scientific information.

5.7 Contact with and exposure to information about riparian forests

To explore the respondents' awareness about riparian forests the survey questionnaire contained several items. It inquired with yes/ no responses whether the respondents had ever been asked anything about their riparian forests, or whether anybody or any agency had ever contacted them and offered help with riparian forests, whether they had seen a TV program or a talk on the radio or an article in a newspaper about streamside forests, and whether they were involved in any river rejuvenation project.

Kraack (2002) called these types of contact or exposure questions 'awareness triggers' (p.16). Because it was thought that they may influence the responses to the TPB items in this survey they were included at the end of the questionnaire.

The majority of respondents answered with "no" to all these questions (Table 5.21). In regard to the question on media reports (television, radio, newspaper), only 31 (25.2%) of the survey respondents remembered something about the media reports, 89 did not comment and two remembered nothing. Less than one third were involved in a river rejuvenation project. *Chi-square* analyses of the responses to each of these questions across the four land use groups showed that there were no significant differences.

Fielding et al. (2005) reported that their sample of cattle graziers included "landholders who indicated they were currently engaging in activities to manage their riparian zone" (p. 15) (yes 60.7%, *N* = 122; no 39.3%, *N* = 79). They decided that this was "indicating past behaviour [that] did not unduly influence the likelihood of responding to the questionnaire" (p.15).

Table 5.21

Frequency of responses to questions about contact with and exposure to information on riparian forests by all land use groups (n=123)

Contact or exposure	Yes		No		Total	
	f	%	*f*	%	*f*	%
Has anybody asked you about streamside forests before?	32	26.4	89	73.6	121	100.0
Has anybody or any agency ever contacted you and offered information or help with streamside forests?	32	26.4	89	73.6	121	100.0
This year have you						
seen any programs on TV	30	27.0	81	73.0	111	100.0
heard a talk on the radio	39	34.5	74	64.5	113	100.0
read an article in any newspaper about streamside forest?	43	37.4	72	62.6	115	100.0
Are you involved in any river rejuvenation project?	29	24.2	91	75.8	120	100.0

In the current sample only 24.2% (*n* = 29) reported that they were involved in any river rejuvenation project and 75.8% (*n* = 91) were not. It was surmised that landholders who were involved in a river rejuvenation project practice good riparian

management. This was not the case in this survey. No relationship between riparian vegetation and streamside use was found according to the *chi-square* analyses.

The relationship between these descriptive variables (external to the TPB model) and the TPB constructs were assessed and are described in Chapter 9.

CHAPTER 6.

SELECTION OF TPB VARIABLES

This Chapter describes the selection process of identifying the most representative constructs for statistical analyses of the theory of planned behaviour model (TPB), the attitude-behaviour model used for this research. The data set included responses from 63 items of the Survey 1 questionnaire that theoretically and analytically addressed the core constructs of the TPB, and three questions that estimated the level of social desirability expressed by respondents.

6.1 The method of measurement of the TPB constructs

A 7-point Likert scale was used for all the constructs represented in the TPB, yielding interval data. The endpoints were (1) and (7). The higher value represented the highest degree of intentions, most favourable attitudes, strongest subjective norming and highest perception of being in control of the behaviour. The behaviour constructs were dichotomous (yes/no) responses. The data set of this construct was therefore categorical when used as a separate behaviour indicator or as interval variables when summed.

6.1.1 The validity of the constructs

According to Ajzen (2002a) all direct measures in the TPB (direct attitudes, direct subjective norms, direct perceived behaviour controls, intentions and behaviour) should show high internal consistency. Thus, the items of the direct predictors (attitudes, social norms and perceived behaviour controls) and of the intention construct were examined for internal consistency and those items with the best fit selected where necessary. In the cases of deletions the reasons are discussed.

Where the Cronbach alpha coefficients of the attitude, subjective norm and perceived behaviour control items were unacceptably low, the correlation coefficient with intentions was used as an indication of reliability as recommended by Francis et al. (2004b). The premise is that the TPB has been shown to be a "robust" (p. 3) model. The intention criterion is therefore acceptable in the model for validation of direct TPB measures.

The indirect (belief-based) measures underpinning the direct measures were calculated according to the theory's requirements and validity- tested by correlating the belief composites with the direct measures (Ajzen, 2010). Good correlations between direct and indirect items of the construct are considered a test of convergent validity (Francis et al. 2004b).

6.2 Intentions

6.2.1 Descriptive statistics of intention items

The *mean* Likert score of the sum of six intention items was 5.04 (Table 6.1). This indicated a generally high degree of intentions evidenced by 90 respondents. Only 22 respondents recorded a score below the *mean*, but eight respondents answered 7 on all items.

Table 6.1

Frequency distribution and descriptive statistics of the six intention items

Intention items	*n*[a]	*M*	*SD*	Median	Below Median (Weak intenders)[b]		Above Median (Strong intenders)	
					n	%	*n*	%
Int 1	119	5.14	1.89	6.00	54	45.4	65	54.6
Int 2	121	4.56	2.00	4.00	37	30.6	84	69.1
Int 3	121	5.47	1.40	6.00	52	43.0	69	67.0
Int 4	121	4.80	1.88	5.00	43	35.5	78	74.5
Int 5	117	4.72	1.98	5.00	49	41.9	68	58.1
Int 6	116	5.30	1.66	6.00	52	44.8	64	55.2
Mean of Intentions	111	5.04	1.27	5.17	57	51.4	53	48.6

[a] Whenever the total differs from *n* = 123 it is due to missing data.
[b] Includes the median.

6.2.2 Reliability of the intention construct

High internal consistency is required for the construct of intentions to be applicable in the TPB. The six items were significantly correlated above .3 except for Int 3 with a weak but significant relationship below .3 with Int 1, 2 and 5 (Table 6.2).

Table 6.2

Pearson's product-moment correlations between intention items (n = 112)

Intention items	Int 1	Int 2	Int 3	Int 4	Int 5	Int 6
Int 1	-					
Int 2	.51**	-				
Int 3	.26**	.29**	-			
Int 4	.60**	.41**	.39**	-		
Int 5	.43**	.30**	.27**	.44**	-	
Int 6	.42**	.36**	.36**	.45**	.48**	-

** $p < .001$ two-tailed

The Cronbach alpha was determined for the set of six intention items from the TPB questionnaire and found to be acceptable at .81. All corrected item-total correlations were above .3. The item-total statistics showed all six variables to

contribute to the alpha value, that is, if deleted no item increased the combined alpha value.

The construct of intentions was checked for outliers, and four cases were found. None of these were extreme points according to Pallant (2005) and the 5% trimmed mean value showed only a small increase from $M = 30.26$ to 30.53. It was decided not to exclude the outliers.

Therefore, all six intention items from the TPB questionnaire comprised the TPB construct of intentions. The six intention items are:

Int 1. If Government agencies contacted me, I would work with them on planting or maintaining my streamside forests.
Int 2. Streamside forests are on my list of priorities.
Int 3. If my creek sides needed improvement, I would do something about the streamside forest.
Int 4. Streamside landowners like me would donate their time to work with Land Care agencies to maintain my streamside forest if there was a need.
Int 5. I will plant streamside forests on my waterways this year if there is a need.
Int 6. I am planning to maintain my streamside forest.

The construct derived from the six intention items will be used as the dependent variable in regression analyses with the following predictors as independent variables: Direct attitudes, direct subjective norms, and direct perceived behaviour control. In the TPB model the intentions construct becomes the independent variable when predicting behaviour:

Intention predictors (IV) --------> Intentions (IV and DV) ------> Behaviour (DV)

(Direct attitudes)

(Direct subjective norms)

(Direct perceived behaviour controls)

6.3 The intention predictors and their antecedents in the TPB model

The TPB predictor constructs are represented by direct (also called global, standard or overall) measures and indirect (belief-based) measures of attitudes, subjective norms and perceived behaviour controls. In the TPB the belief-based measures are the antecedents of the direct measures. These direct measures should be used as the only appropriate predictors of intentions (Ajzen, 2002a). However, valuable information is gained from the additional contribution of the indirect (belief-based) measures assessed by hierarchical regression analyses. Following is a short discussion of the differences between direct and indirect measures. These have a bearing on analyses that can be performed to give valid answers to the research questions when using the TPB model. (Much of the information is also described in Chapter 3.)

6.3.1 Direct measures and indirect (belief-based) measures

Direct measures in the TPB attempt to establish how positive or negative the respondent's attitude is toward the behaviour (DA), or how strong the person feels subject to social norming or pressure (DSN), or how strong impediments are perceived in regards to the performance of the behaviour (DPBC). Direct measures establish the valence and extent of the construct.

While direct measures are used to predict intentions, indirect measures are estimations of the beliefs about the behavioural object or performance of the behaviour in question. The TPB assumes that beliefs "capture the underlying determinants" of the direct constructs (Ajzen, 2010).The attitudinal beliefs for instance, are assumed to underlie the direct attitude concept and "provide insight into the reasons for the different attitudes" (p. 72, Ajzen & Fishbein, 1980). The same is the case for norming beliefs and

direct norming behaviour, and control beliefs and perceived behaviour control. All are considered to be a function of the weighted sum of beliefs. According to the TPB and the expectancy-value model on which it is built, the more favourable the beliefs, the more favourable will be the overall attitude (Ajzen, 2010). Thus, the correlation between indirect belief-based and direct attitude measures can be used to validate the expectancy-value model. The indirect measure represents the sum of the belief composites. These composites are given equal weight in the model but need not correlate with each other (Ajzen, 2010).

The internal consistency of indirect measures, that is, beliefs of attitude (IA), subjective norming (ISN), and perceived behaviour control (IPBC) is not a meaningful way to establish the construct or content validity of these items. Since the TPB model is based on the expectancy-value model that considers the cognitive processes about negative and positive attributes, the beliefs in the TPB cannot be expected to be internally consistent since the overall evaluation is the end product of negatives subtracted from positives. The content validity of an indirect or belief measure is only representative when all items are included no matter what valence they hold. One can have positive as well as negative beliefs about something but still come out with a positive overall attitude, subjective norm or perceived behaviour control in the case of the TPB model. When the research method allows it, the best test of reliability is a test-retest check (Ajzen, Brown, & Carvajal, 2004), but the present study was not set up in such a way. There was only the short questionnaire of Survey 2 which could have been employed in such a test for the attitudinal beliefs, but it was too small to be considered a re-test.

6.4 Direct attitudes

6.4.1 Descriptive statistics of direct attitudes

Ten items representing direct attitude questions (DA) were included in the survey questionnaire:

DA 1. I find streamside forests extremely pleasant.

DA 2. Reforesting the stream sides on my land would be extremely desirable.

DA 3. I find the native animals I see in the streamside forest very enjoyable.

DA 4. The preservation of my streamside forest is valuable.

DA 5. Walking on the banks of creeks is pleasant.

DA 6. Maintaining of streamside forests is not a waste of money and time.

DA 7. I take my role as a keeper of clean waterways very seriously.

DA 8. Since the water from my creek will end up in the Great Barrier Reef lagoon (that is the sea between the shore and the Great Barrier Reef) I am responsible for the water quality in my creek.

DA 9. I always believed that I did the right thing about my streamside forests.

DA 10. To have trees on the riverbanks on my land is extremely good.

Table 6.3 shows above average mean and median values for direct attitudes. It indicated an overall positive attitude toward riparian forest and riparian forest management.

Table 6.3

Frequency distribution and descriptive statistics of the 10 direct attitude (DA) items

Direct attitude items	*n*[a]	*M*	*SD*	*Median*	Below Median (less positive attitude)		Above Median (highly positive attitude)	
					n	%	*n*	%
DA 1	122	6.02	1.25	6.50	61	50.0	61	50.0
DA 2	118	5.17	1.97	6.00	43	36.1	75	63.9
DA 3	118	5.70	1.66	6.00	54	45.8	64	54.2
DA 4	121	6.02	1.29	6.00	60	49.6	61	50.4
DA 5	122	6.07	1.23	6.00	58	47.5	64	52.5
DA 6	122	5.73	1.58	6.00	54	44.3	68	55.7
DA 7	121	5.90	1.25	6.00	46	38.0	75	62.0
DA 8	121	4.93	1.91	5.00	57	47.1	64	52.9
DA 9	121	6.04	1.09	6.00	52	43.0	69	57.0
DA 10	117	6.15	1.32	7.00	50	42.7	67	57.3
Mean of DA	111	5.77	.90	5.90	55	49.5	56	50.1

[a] Whenever the total differs from *n* = 123 it is due to missing data.

6.4.2 Internal consistency of the direct attitude construct

The correlation matrix revealed the majority of correlations between the 10 direct attitude items to be above .3 (Table 6.4).

Table 6.4

Pearson's product-moment correlations between direct attitude items (DA)

Direct attitude items	DA 1	DA 2	DA 3	DA 4	DA 5	DA 6	DA 7	DA 8	DA 9
DA 1	-								
DA 2	.48**	-							
DA 3	.34**	.33**	-						
DA 4	.50**	.60**	.45**	-					
DA 5	.37**	.33**	.33**	.37**	-				
DA 6	.56**	.50**	.47**	.65**	.18*	-			
DA 7	.22*	.15	.08	.26**	.28**	.18	-		
DA 8	.19*	.15	.19*	.26**	.35**	.27**	.25**	-	
DA 9	.13	.08	.12	.34**	.30**	.12	.40**	.21*	-
DA 10	.39**	.47**	.29**	.64**	.38**	.46**	.33**	.24**	.41**

** $p < .001$ two-tailed, * $p < .05$ two-tailed.

The Cronbach alpha for these variables was .82, indicating a reliable scale. Nevertheless, a factor analysis deemed appropriate to establish if the set represented a unified theme.

6.4.3 Factor analysis of the direct attitude construct

Principal component analysis (PCA) using PASW Statistics 18 was used on the set of 10 direct attitude items. The Kaiser-Meyer-Olkin value reached .82, well above the recommended value of .6 (Kaiser, 1974, cited in Pallant, 2007). The Bartlett's Test of Sphericity was statistically significant, and the correlation matrix showed the majority of correlations to be above .30. Factor analysis was therefore considered appropriate. The component matrix revealed two components and some cross loadings and rotation analyses were performed to aid the interpretation. (The complete statistical data and further interpretation of the analysis are in Appendix D).

The Oblimin rotation Pattern Matrix showed five items loading strongly on Component 1, and four items on Component 2. One item loaded on both components (see Appendix D). According to the factor analysis the direct attitude construct consisted of two different components that expressed different themes.

The overarching theme of Factor 1 expressed "affection" for the area, its flora and fauna, and willingness to preserve it, because it is considered "valuable" by the person. Factor 2 expressed the individuals' acceptance of their "stewardship" of the riparian forest and also the Great Barrier Reef, and their conviction that the riparian forest has been cared for properly by them (see Appendix D).

The Cronbach alpha for Factor 1 had a value of .81 and Factor 2 of .59. Since the lowest value is .7 (Pallant, 2007) Factor 2 is not reliable. The small number of items in this component is not expected to give a reliable alpha value according to Pallant.

Since the TPB model required an attitude construct that was predictive of intentions and behaviour, the separation into two components would only be meaningful if it increased the strength of this prediction of intentions in the TPB model. Thus, before making a final decision about the direct attitude construct the correlation coefficients of all items and Factors 1 and 2 with intentions were established.

6.4.4 Correlation of direct attitudes with intentions

The correlation coefficients of all direct attitude items and of DA-Factors 1 and 2 with intentions were calculated. The results are listed in Table 6.5.

According to the significant correlation coefficient of all direct attitude items with sum of intentions (Table 6.5) every DA item contributed to the prediction of at least some intention items. The strongest correlation with the sum of intentions was with DA 10 (Table 6.5), which was the item that loaded almost equally highly on both factors (see Appendix D). DA-Factor 1 “affection” and DA-Factor 2 “stewardship” showed a significant correlation with intentions (Table 6.5). On the basis of the strong correlation of intentions with the complete 10-item set of direct attitude construct (sum 10 DA) all 10 items should be retained for analyses in the TPB model.

Table 6.5

Pearson's product-moment correlations between direct attitudes (DA) and intentions

Intentions	Direct attitudes												
	1	2	3	4	5	6	7	8	9	10	Sum 10DA	Factor 1[a]	Factor 2[b]
Int 1	.39**	.52**	.32**	.44**	.26**	.47**	.03	.16	.07	.43**	.54**	.58**	.20*
Int 2	.43**	.40**	.25**	.48**	.27**	.43**	.06	.13	.14	.49**	.52**	.57**	.20*
Int 3	.34**	.30**	.27**	.40**	.38**	.29**	.30**	.27**	.27**	.48**	.50**	.44**	.43**
Int 4	.21*	.33**	.23*	.36**	.31**	.41**	.11	.31**	.15	.38**	.53**	.45**	.35**
Int 5	.24**	.23*	.22*	.29**	.26**	.30**	.11	.20*	.23*	.33**	.39**	.35**	.28**
Int 6	.33**	.31**	.40**	.44**	.40**	.41**	.27**	.30**	.30**	.41**	.55**	.49**	.44**
Sum of intentions	.45**	.53**	.40**	.57**	.42**	.55**	.24*	.33**	.29**	.59**	.71**	.68**	.45**

** Significant at the 0.01 level (2-tailed). * Significant at the 0.05 level (2-tailed).
[a] "affection" sum of DA 1, 2, 3, 4, 6. [b] "stewardship" sum of DA 5, 7, 8, 9.

The finding that of the four DA items the two (DA 7 and DA 9) that were direct expressions of stewardship did not show a strong correlation with sum of intentions (Table 6.5). It may mean that a strong sense of stewardship precludes the formation of intentions: Landowners may feel that their obligations and responsibilities have always been met and will be met in the future. Thus, intentions are external to feelings of stewardship.

The stewardship item which incorporated the reference to the Great Barrier Reef (DA 8) showed a significant but weak association with intentions (Table 6.5) most likely for the same reason as the two items just mentioned. Thus, accepting responsibility for a healthy marine environment indicated a moderately strong increase in intentions.

6.4.5 The direct attitude construct to be used in the TPB

It was determined to use the 10-item direct attitude scale for further analyses in the TPB. This was based mainly on the correlation with the sum of intentions which was strongest with all 10 items included. Nevertheless, the two factors which are described as representing "affection" (DA-Factor 1), and "stewardship" (DA-Factor 2) were further investigated in Chapter 9.

6.5 Indirect (belief-based) attitudes

Indirect attitudes represent the underlying beliefs of the direct attitudes toward the object or the behaviour. (The 24 indirect attitude items are listed in Appendix D.) These variables are composed of responses to two corresponding belief items of outcome evaluations (e) and behavioural beliefs (b), which are multiplied to yield an aggregate in which the weighting of the two beliefs is equal. For example, if the subject

believes that the behaviour is a good thing (such as planting trees in riparian forests) it will have an impact on the subject's belief that the outcome will be unlikely to happen (such as planting trees will not facilitate retention of agricultural chemicals). Thus, for such composites "it is not appropriate to assess the reliability of indirect measures using an internal consistency criterion" (Francis et al., 2004b, p. 9). Ajzen (2010) recommends testing the correlation with corresponding direct measures.

The composites are summed to give one indirect attitude variable (IA). Testing the individual beliefs that make up each composite (the behavioural belief and the outcome evaluation) for relationships between the direct attitudes, may give insight into which belief (behavioural or evaluation of outcome) is responsible for the strength and valence of a particular direct attitude. Likewise, correlations between beliefs and intentions may provide insight as well. The IA composites are not used as a measure of attitudes but they are investigated in a hierarchical regression analysis entered in step 2 after the direct attitudes if they explain additional variance in intentions (Francis et al., 2004b).

This section on indirect attitudes first tabulates the descriptive statistics of the belief composites, followed by Pearson's product-moment correlations between direct and indirect belief-based attitudes. The correlations between direct attitudes with the individual beliefs (outcome evaluations and behavioural beliefs) are then examined. Furthermore, the correlations between attitudinal beliefs and intentions are established and discussed. The section concludes with a discussion of the decisions identifying which are relevant IA composites to include in further analyses.

6.5.1 Descriptive statistics of the indirect attitude composites

Table 6.6 shows the descriptive results of the indirect attitude composites (the products of the responses to behavioural beliefs and outcome evaluations; maximum on the scale is 49). The highest mean response was found for IA 10 which represents a strong affective evaluation of riparian forest as habitat for native animals and a belief that the streamside forest can provide a good habitat for the creatures in the creek.

Table 6.6

Frequency distribution, means and standard deviations of the indirect attitude composites (products of two responses on a 7-point Likert scale from behavioural beliefs and outcome evaluations)

Indirect attitude composites	*n*[a]	*M*	*SD*
IA 1	121	35.35	14.02
IA 2	119	33.13	14.55
IA 3	120	24.12	15.51
IA 4	117	24.14	12.09
IA 5	118	36.89	12.97
IA 6	120	32.88	14.24
IA 7	119	32.05	15.50
IA 8	119	17.33	14.29
IA 9	115	20.02	11.45
IA 10	122	38.74	11.85
IA 11	117	19.30	11.01
IA 12	120	36.67	12.75
Sum of 12 IA	106	29.28	7.47

[a] Whenever the total differs from *n* = 123 it is due to missing data.

6.5.2 Correlations between attitudinal beliefs and direct attitudes

Pearson's product moment correlations were calculated for the 10 direct attitudes and the 12 attitudinal belief composites (Table 6.7). While the sum of indirect attitude composites (sum of IA) correlated significantly with all direct attitude items, four belief composites stood out with correlations coefficients below .30 (IA 4, 8, 9 and 11). These

belief-based attitudes seemed to be unrelated to most direct attitudes. They will be encountered again in the section about the correlation with intentions where they are described. To elucidate the contribution of the individual beliefs, and belief categories (evaluations, e, and behavioural, b), they were investigated further.

Table 6.7

Pearson's product-moment correlations between direct attitudes (DA) and indirect (belief-based attitudes (IA)

	IA 1	IA 2	IA 3	IA 4	IA 5	IA 6	IA 7	IA 8	IA 9	IA 10	IA 11	IA 12	Sum of IA
DA 1	.36**	.43**	.43**	.25**	.47**	.27**	.40**	.12	.18	.44**	.26**	.57**	.61**
DA 2	.44**	.44**	.20*	.14	.45**	.38**	.26**	.06	.17	.39**	.18	.50**	.51**
DA 3	.25**	.34**	.06	.16	.54**	.29**	.36**	.18**	.07	.26**	.18	.45**	.49**
DA 4	.49**	.52**	.26**	.26**	.67**	.49**	.53**	.16	.26**	.65**	.19*	.69**	.74**
DA 5	.25**	.29**	.13	.00	.37**	.17	.41**	.03	.16	.27**	.03	.44**	.37**
DA 6	.50**	.56**	.29**	.26**	.50**	.45**	.53**	.13	.17	.49**	.14	.57**	.64**
DA 7	.09	.17	.07	.15	.15	.12	.24**	-.05	.04	.30**	.05	.22*	.38*
DA 8	.21*	.33**	.07	.22*	.21*	.19*	.28**	.06	.12	.28**	.11	.20*	.33*
DA 9	.13	.23*	.11	.05	.24**	.28**	.18	-.01	.08	.25**	-.1	.27**	.31**
DA 10	.38**	.66**	.41**	.12	.53**	.38**	.49**	.11	.09	.63**	.08	.66**	.76**
Sum of DA	.51**	.66**	.34**	.23*	.63**	.53**	.59**	.17	.23*	.60**	.19*	.71**	.79**

** Significant at the 0.01 level (2-tailed). * Significant at the 0.05 level (2-tailed).

Since the two beliefs that make up each belief composite are weighted equally in the formation of the indirect attitude composite their individual contributions are not necessarily evident. Thus, Pearson's product-moment correlations were calculated for all relationships between the 10 DAs, and all 24 behavioural beliefs. The results show that the correlations of the sum of the evaluative and of the behavioural beliefs mirror those of the composites. The composites IA, 4, 8, 9 and 11 should be excluded from the construct of indirect attitudes (IA) on the basis of none or too low correlation. Pearson's product-moment correlations were performed with the eight belief composites and the individual belief categories. Table 6.8 lists the correlations between direct attitudes and all belief variables.

Table 6.8

Pearson's product-moment correlations between direct attitudes, indirect (belief-based) attitudes, the sum of eight outcome evaluations, and the corresponding eight behavioural beliefs[a]

Direct attitudes	Sum of 8 IA composites[a]	Sum of 8 Evaluation outcomes (e)[a]	Sum of 8 Beliefs in outcome (b)[a]
DA 1	.59**	.62**	.55**
DA 2	.55**	.55**	.51**
DA 3	.44**	.43**	.35**
DA 4	.75**	.77**	.70**
DA 5	.40**	.42**	.29**
DA 6	.69**	.67**	.66**
DA 7	.27*	.26*	.19*
DA 8	.31**	.30**	.24*
DA 9	.32**	.33**	.23*
DA 10	.73**	.75**	.68**
Sum of 10 DA	.80**	.82**	.71**

[a] Belief pairs of IA 4,8,9, and 11 are not included. They did not correlate above .3.
** Significant at the 0.01 level (2-tailed). * Significant at the 0.05 level (2-tailed).

The correlations with the sum of the eight composites and the sums of their corresponding beliefs (Table 6.8) showed that direct attitudes correlated very strongly and significantly with the sum of the indirect attitude composites, the only exception was DA 7. In every case the contribution of the evaluation outcome beliefs showed a stronger correlation, indicating that landowners' attitudes to riparian forests were underpinned strongly by beliefs in the evaluation outcomes, rather than by the beliefs that the outcome can be achieved.

6.5.3 Relationship between intentions and indirect attitude composites

Pearson product-moment correlation coefficients between the indirect attitude composites and intentions showed very low correlations for composites IA 4, 8, 9, and 11 (Table 6.9). The results reflect the low correlations between direct attitudes and these same composites (Table 6.4 to Table 6.7). This confirmed the theory that direct attitudes are representations of underlying beliefs, and therefore predict intentions on the basis of beliefs. The sum of direct attitudes with IA 1 to IA 12 (Table 6.9) showed a stronger correlation than the sum of intentions with IA 1 to IA 12 (Table 6.9).

Table 6.9

Pearson's product-moment correlations between indirect attitude composites and intentions (Sum of DA variable is included for comparison)

	Indirect (belief-based) attitude composites											
	IA 1	IA 2	IA 3	IA 4	IA 5	IA 6	IA 7	IA 8	IA 9	IA 10	IA 11	IA 12
Int 1	.31**	.39**	.26**	.09	.36**	.28**	.28**	-.03	.11	.30**	.18	.45**
Int 2	.46**	.38**	.39**	.19*	.37**	.42**	.38**	.22*	.16	.28**	.21*	.56**
Int 3	.19*	.38**	.28**	.25**	.32**	.32**	.32**	.00	.11	.34**	.13	.42**
Int 4	.30**	.37**	.33**	.10	.24**	.26**	.33**	.05	.21**	.20*	.17	.38**
Int 5	.17	.20*	.14	-.03	.31**	.21*	.30*	-.08	.06	.24*	.18	.30**
Int 6	.22**	.29**	.28**	-.03	.40**	.27**	.43**	.09	.10	.37**	.19*	.40**
Sum of intents	.38**	.49**	.39**	.14	.46**	.43**	.45**	.07	.19	.41**	.27**	.59**
Sum of 10 DA	.51**	.66**	.34**	.23*	.63**	.53**	.59**	.17	.23*	.60**	.19*	.71**

**Significant at the 0.01 level (2-tailed). *Significant at the 0.05 level (2-tailed).

6.5.3.1 The indirect attitude composites with low correlation

The four belief composites that did not correlate with direct attitudes or intentions have to be considered as unrelated to either, and inclusion in the TPB as underlying belief factors has to be reconsidered. There seem to be overriding themes for these IAs that allows two groups to be formed. One group concerns itself with scientific facts and the other can be described as ambiguous in content. Here are the descriptive points that justify their exclusion.

(a) The composites about scientific facts were:

Indirect attitude composite IA 4

Outcome evaluation IA 4e:
Excess nutrients (nitrogen and phosphorous) from the water catchment are extremely bad to the marine environment.

Behavioural belief IA 4b:
It is very likely that streamside forests can remove excess nutrients (nitrogen and phosphorous) from the soil.

Indirect attitude composite IA 9

Outcome evaluation IA 9e:
To detoxify agricultural chemicals in the soil before they reach the waterways is extremely desirable.

Behavioural belief IA 9b:
The roots of plants in streamside forests are capable of converting agricultural chemicals into non-toxic substances.

These composites were allotted a high score for agreeing with the statements. Low scores would indicate a disbelief in riparian functions or a belief that there is no need for detoxification since no excess agricultural nutrients or chemicals get into their waterways. It may also indicate a belief that "nutrients" cannot be something bad, and the marine environment (composite IA 4) may not be thought of as relevant. In Study 1 two- thirds of the interviewees were not fully accepting the connection of their waterways with the Great Barrier Reef marine environment (Flick et al., 2010).

If there is little belief in the function of riparian forest in detoxification of agricultural chemicals (IA 9) then there is no reason to practice good riparian forest management on that basis. Intentions would not be related to this belief composite. Positive intention decisions in regards to riparian forests could still be possible for other

reasons, but disbelief in scientific facts would be a decisive factor in intentions and behaviour and should be investigated as such.

Describing the relationship of the composites IA 4 and IA 9 with one of the intentions in words, the following relationships can be surmised: Landowners intent to do something about their streamside forest if the creek sides needed improvement (Int 3) is positively influenced by beliefs that nitrogen and phosphorous are bad for the marine environment (IA 4) and the streamside forest can remove these excess nutrients (IA 9). And, if landowners intend to donate time to work with Land Care to maintain their riparian forest (Int 4) they are positively influenced by beliefs that the biophysical function of riparian forest can detoxify agricultural chemical in the soil before they reach the waterways.

The matter of belief in scientific information among landowners and farmers has been found to be a contentious one in other studies. Thus, Kraack (2001) in her study with sugarcane growers identified the information on the effect of nutrient on GBR as one of the environmental issues that are beset by conflicting facts according to the growers' perception. Thus, a 'trusted local' rather than the scientific facts of the information can determine a grower's beliefs. It is rather trust between agency staff and landowners that will decide if the information is accepted as found in studies on Landcare in Australia and by Watershed councils in the US (Curtis, Shindler & Wright 2002).

(b) The ambiguous indirect attitude composites were:

Indirect attitude composite IA 8

Outcome evaluation e:
A streamside forest land makes good agricultural land in the long term.

Behavioural belief b:
Agricultural crops make good long term use of streamside forest land.

Indirect attitude composite IA 11

Outcome evaluation e:
Keeping the waterways on my land free of debris such as tree branches is extremely good.

Behavioural belief b:
Streamside forests benefit from natural debris in the creeks.

Composite IA 8 is a pair of items with an ambiguous content because the creek edges of the riparian forest do make good agricultural land but should not be used for that purpose. This is because the long-term use of the land may lead to erosion and will certainly allow chemicals and nutrients to reach the waterway unhindered. Agreement with the statements was allotted low scores. Disagreement with the statements showed that the respondent can see that practicing good riparian forest management means not using the riparian land. This composite apparently tested the respondent's specific knowledge on this matter and it seems to have a positive influence on Int 2 (Table 6.9) "streamside forests are on my list of priorities". The landowner could be thinking of what agricultural crops to plant on the streamsides, but the correlation here may indicate a coincident.

The question of debris in riparian forests (the context of indirect attitude composite IA 11) especially in the waterways had been identified as contentious in

Study 1. Most interviewees thought that a fast flowing creek is a good thing and debris should be removed from the waterways and the creek edges to "keep it clean". Removing broken trees and branches are thought of as "managing" the area by some landowners, and the time and effort expended was thought to be considered prohibitive in many situations. It could become a decisive factor in riparian management decisions. References to similar findings are in Dutcher (2001).

Composite IA 11 tested the landowners' beliefs in this notion of cleaning up which would yield a low score when it was followed seriously. Riparian forests benefit from natural debris and leaving it there is recommended management practice. This composite did correlate weakly with intention items Int 2 and Int 6. This meant that the cleaning notion influenced Int 2 of having "streamside forests on the list of priorities" and of Int 6 of "planning to maintain the area". The respondents may have been thinking of doing some maintenance work in the area in the form of "cleaning" it up. This indirect attitude composite is best left out of further analyses since it does not use a valid basis for good riparian management.

6.5.4 Relationship between intentions and attitudinal beliefs

To provide an insight into the contribution of the individual beliefs (outcome evaluations and the beliefs in the outcome/ behavioural beliefs) of the indirect attitude composites, Pearson product-moment correlations were performed (Table 6.10) between intentions and the beliefs. The four composites with no or weak correlation, IA 4, 8, 9, 11 (see Table 6.9) were excluded.

Table 6.10

Pearson's product-moment correlations between intentions and indirect attitudinal beliefs of evaluation outcomes and behavioural beliefs

Direct attitudes	Sum of 8 IA composites[a]	Sum of 8 Evaluation outcomes IA e[a]	Sum of 8 Beliefs in the outcome IA b[a]
Int 1	.46**	.45**	.44**
Int 2	.57**	.54**	.55**
Int 3	.44**	.43**	.42**
Int 4	.43**	.42**	.43**
Int 5	.31**	.37**	.24*
Int 6	.46**	.46**	.41**
Sum of intentions	.63**	.63**	.59**

[a] Belief pairs of IA 4,8,9, and 11 are not included. They did not correlate above .3 with any DA.
** Significant at the 0.01 level (2-tailed). * Significant at the 0.05 level (2-tailed).

Correlations between intentions, the composites and the selected eight beliefs of outcome evaluation and behavioural beliefs were significant and strong above .3, with the exception of Int 5 and behavioural beliefs (Table 6.10). This intention Int 5 "I will definitely plant streamside forest on my waterways this year if there is a need", assumes that the respondent already believes that the behaviour or action in question is a good one, which would explain the low correlation with the behavioural beliefs. The individual seems to have already formed a strong plan of action. The belief in the outcome (outcome evaluation) and the same intent showed a lower correlation coefficient than for the other intention items (Table 6.9) which may mean that the individual's intention was also not depending on believing in the outcome to have this intention. Believing strongly or not would not impact on this decision.

6.5.5 The indirect attitudes to be used in further analyses

Relationships between attitudinal beliefs and intentions in the TPB are not assumed to be direct but indirect through their effect on direct attitudes. Nevertheless, Ajzen (1991)

and Francis et al. (2004a, b) recommend using the belief composites in the second step of a hierarchical regression to explain additional variance.

The 8-composite indirect attitude (IA sum of 8) construct will be used in analyses to estimate its relationship with direct attitudes, its additional explanation of intentions, and its impact on the other predictors' beliefs when applying the TPB. The sum of the separate beliefs of evaluation outcomes (e) and behavioural beliefs (b) will also be examined for their contribution to the explanation of variance in intentions.

6.6 Direct subjective norms

In the TPB model the construct of subjective norms represents one of the three predictors of intentions to perform a behaviour or an action. They incorporate the notion of social influences on the decision making of the person. In this survey these norms are seen to be driven by the desire to please valued people, such as friends or neighbours, and to be part of a riparian maintenance program if others are doing it too.

Therefore, the questionnaire of survey 1 contained three items that assessed direct subjective norming (DSN). The items were:

DSN 1. I think that most people whose opinion I value would recommend the preservation of streamside forests.
DSN 2. In general I care that my neighbours think I am doing the right thing.
DSN 3. I would maintain streamside forests only if other landowners did the same.

The responses were measured on a 7-point Likert scale, with 7 indicating strong agreement with the statement expressing strong subjective norming behaviour, 1, indicating disagreement and very little norming behaviour, and 4, average norming

behaviour. The descriptive statistics for this component indicated an above average norming behaviour (Table 6.11).

The median as another indicator of subjective norming strength is high for DSN 1 and DSN 2 (6.00 and 5.00, respectively) but low for DSN 3 (2.00). The median splits the DSN items into uneven groups but the mean of the sum of all three gives two groups of almost equal size (Table 6.11).

Table 6.11

Frequency distribution and statistical descriptive statistics of the three

Direct subjective norming items					Below Median (weak subjective norming)		Above Median (strong subject. norming)	
	n[a]	*M*	*SD*	Median	*n*	%	*n*	%
DSN 1	120	5.63	1.57	6.00	72[b]	60.0	48[c]	40.0
DSN 2	121	4.85	1.73	5.00	69[b]	57.0	52[c]	43.0
DSN 3	120	3.03	2.04	2.00	67[c]	55.8	53[b]	44.2
Mean of DSN	116	4.48	1.02	4.67	54[c]	46.6	62[b]	53.4

[a] Whenever the total differs from *n* = 123 it is due to missing data.
[b] These responses include the median. [c] These responses do not include the median.

6.6.1 Internal consistency of direct subjective norms

The correlation between DSN 1 and 2 items was positive but it was negative with DSN 3 (Table 6.19) indicating that the item was either wrongly scaled or did not represent the same notion of social norming as the other two items. The correlation between DSN 1 and 2 was significant (Table 6.12).

Table 6.12

Pearson's product-moment correlations between the direct subjective norm items (DSN)

	DSN 1	DSN 2	DSN 3
DSN 1	1		
DSN 2	.25**	1	
DSN 3	- .22*	- .02	1

**Significant at the 0.01 level (2-tailed). *Significant at the 0.05 level (2-tailed).

DSN 3 was negatively correlated to the other DSN items. In order to preserve internal consistency of the DSN construct, DSN 3 has to be excluded. The failure of DSN 3 in the context of a TPB component is described and discussed in Appendix D.

6.6.2 Correlations between direct subjective norms and intentions

The small number of DSN items and the weak correlation between them did not warrant a reliability test. Instead, the relationship with the intention items was assessed including DSN 3 to understand their relationship with intentions in the TPB model. A Pearson's product moment correlation was performed on the data (Table 6.13).

Table 6.13

Pearson's product moment correlation between intentions and direct subjective norming items

Intentions	DSN 1	DSN 2	DSN 3	Sum of DSN 1,2,3	Sum of DSN 1,2
Int 1	.33**	.21	-.23*	.15	.33**
Int 2	.31**	.14	-.34**	.05	.29**
Int 3	.20*	.05	-.20*	-.03	.14
Int 4	.27**	.20*	-.31**	.05	.29**
Int 5	.25**	.06	-.27**	.01	.19*
Int 6	.27**	.37**	-.27**	.16	.40**
Sum of intentions	.41**	.23*	-.39**	.10	.39**

**Significant at the 0.01 level (2-tailed). *Significant at the 0.05 level (2-tailed).

The relationship of intentions with DSN 1 was stronger than that of DSN 2. Nevertheless, this difference lessened in the correlation of the sum of DSN 1 and 2 with intentions, where they correlated significantly with all intention items except Int 3 (Table 6.13). DSN 3 yielded negative correlations with all intention items confirming that it did not fit into the DSN construct.

Following is a description of the relationships between DSN 1 and DSN 2 and the intentions with the strongest correlations Int 1 and Int 2. The direct subjective norming item DSN 1 "I think that most people whose opinion I value would recommend the preservation of streamside forests", seems to capture best the notion of subjective norming behaviour, that is, the degree to which one would like to please or be motivated by important others, or feel social pressure from people whose opinion one values to perform the behaviour. This direct SN item correlated significantly with all intention items indicating that it influenced all intentions in this model to a certain degree (Table 6.13).

The strongest relationships by DSN 1 were found for Int 1 and 2 (Table 6.13). One intention expresses a willingness to work with government agencies and the other lists streamside forests as a high priority (Int 1 "if Government agencies contacted me I would work with them on planting or maintaining my streamside forests", and Int 2 "streamside forests are on my list of priorities"). These two intentions were influenced by the landowners' direct subjective norms that refer to respected people's recommendation of preserving streamside forests.

The direct subjective norming item DSN 2 also did not specifically mention the object of the behaviour, which makes it in a sense more relevant to general subjective norming than specifically to streamside forest. The planning to maintain the streamside

forest may have a strong relationship to the expectations of the neighbours that one does so, and at the same time that one expects them to do the same. This conjecture is somewhat supported by findings in the earlier section of this chapter that showed that the majority of landowners list one of their most common sources of knowledge as coming from observation of other people's practices (see results section of descriptive statistics). This would imply that neighbours observed each other's practices, which leads to the idea that neighbours might want to impress each other. On this basis the significant relationship with intentions may be predicted to a small extent from this behaviour of landowners.

6.6.3 The direct subjective norm construct to be used in the TPB

The TPB construct of direct subjective norms will be composed of the sum of DSN 1 and 2 on the basis of their significant correlations with each other (Table 6.12) and with the sum of intentions (Table 6.13). DSN 3 will be excluded (see Appendix E.5). The underlying beliefs of the direct subjective norm construct will be explored in the following sections.

6.7 Indirect subjective norms

The direct subjective norming behaviour in the TPB is assumed to be underpinned by beliefs of the indirect subjective norms (ISN). These were normative beliefs (ISN n) about the perceived pressure coming from specific groups and motivational beliefs (ISN m) about the motivation to comply with these expectations. In the TPB the construct of ISN is the product of a pair of beliefs of each category that are multiplied. The indirect subjective norming construct is therefore a composite of the strength of the person's norming belief and their motivation to comply.

Four items of indirect subjective norms were part of the survey yielding two composites:

Indirect subjective norm composite ISN 1

Normative belief ISN 1n:
Friends and other people whose opinion I respect would approve of me maintaining streamside forests.

Motivation to comply ISN 1m:
In general I care that people whose opinion I respect think I am doing the right thing.

Indirect subjective norm composite ISN 2

Normative belief ISN 2n:
Government agencies think I should follow their recommendations about streamside forests.

Motivation to comply ISN 2m:
In general I follow recommendations from Government agencies.

6.7.1 Correlations between direct and indirect subjective norms

Correlations between direct and indirect subjective norms revealed that DSN 1 was strongly associated with ISN 1 but not with ISN 2 (Table 6.14).

Table 6.14

Pearson's product moment correlation between intentions and direct subjective norming items

Direct subjective norms	Indirect subjective norm composites		
	ISN 1	ISN 2	Sum of ISN 1, 2
DSN 1	.46**	.11	.35**
DSN 2	.48**	.26**	.45**
Sum of DSN 1,2	.58**	.25**	.51**

**Significant at the 0.01 level (2-tailed).

DSN 2 showed this strength with ISN 1 but much less so with ISN 2. The results revealed that a belief about government agencies expecting that their recommendation about streamside forests are followed and that one generally does so (ISN 2) has no relationship with the norming behaviour based on the belief that most people whose opinion one values would recommend the preservation of streamside forests (DSN 1). This makes sense since the agents to be pleased are not the same.

6.7.2 Indirect subjective norming beliefs underlying direct subjective norms

The strength of association between direct and indirect subjective norms (Table 6.14) does not reveal the contribution of the individual beliefs in each composite. To gain insight into this Pearson's product-moment correlations were performed with the DSNs and the normative beliefs (ISN 1n and 2n), and the motivations to comply (ISN 1m and 2m) (Table 6.15).

Table 6.15

Pearson's product-moment correlations between intentions and indirect subjective norm categories of normative beliefs (n) and motivational beliefs (m)

Direct subjective norms	Indirect subjective norming beliefs					
	ISN 1		ISN 2		Sum of ISN n	Sum of ISN m
	n	m	n	m		
DSN 1	.60**	.15	-.01	.15	.37**	.22*
DSN 2	.26**	.50**	.11	.27**	.25**	.49**
Sum DSN 1,2	.54**	.40**	.10	.27**	.40**	.44**

**Significant at the 0.01 level (2-tailed).

The correlations reveal that DSN 1 was exclusively underpinned by the normative belief of ISN 1n and not by motivation to comply ISN 1m (Table 6.15). This meant that landowners who "think that most people whose opinion they value would recommend the preservation of streamside forests" (DSN 1) believe that they would

receive approval for their efforts to maintain riparian forest from friends and people whose opinion they respect (ISN 1n). But they do not feel motivated to comply with this opinion to please respected others by doing the right thing (ISN 1m). The belief that involves the expectations of Government agencies to follow their recommendation (ISN 2n) are not at all underlying the direct subjective norms nor are the motivation to comply with these expectations (ISN 2m). These non-relationships are not surprising, since Government agencies do not exert social pressure the way people do.

DSN 2 was shown to be underpinned by normative belief ISN 1n but not ISN 2n, and by both motivational beliefs (ISN 1m and 2m) (Table 6.15). This suggested that landowners who "in general care that the neighbours think they are doing the right thing" (DSN 2) did believe that they would receive approval for their efforts to maintain riparian forest from friends and people whose opinion they respect (ISN 1n). Neighbours are people whose opinions are probably respected and therefore one wants them to think one is doing the right thing. As was the case for DNS 1 beliefs in Government agencies' expectations (ISN 2n) did not underlie the norming behaviour (Table 6.15).

Both motivational items correlated significantly with the direct subjective norm DSN 2, ISN more strongly than ISN 2m (Table 6.15). This suggested that landowners who "in general care that the neighbours think they are doing the right thing" (DSN 2) are motivated to comply because they "in general care that people whose opinion they respect think they are doing the right thing" (ISN 1m). The other motivational belief that one "in general follows recommendations from Government agencies" (ISN 2m), also correlated significantly. The motivation behind this compliance may lie in the possibility that the government recommendations may be connected to government

compensation and neighbours need to think one is doing the right thing and therefore be eligible for compensation by the government. This could be a possible explanation of the significant correlation.

The summing of the items covers up the insignificant correlations of ISN 1m, ISN 2n and 2m with one or both of the DSNs (Table 6.16). But this fact does not allow exclusion of any belief since the beliefs are equally weighted in the TPB composite constructs. Nevertheless, the picture of the contribution of individual beliefs gives an insight into the composition of the indirect subjective norms in the study.

6.7.3 Intentions and indirect subjective norms, and normative beliefs

The TPB construct of direct subjective norm was determined as the sum of DSN 1 and 2 (see section 6.6.3). This DSN construct correlated significantly with intentions (Table 6.13). It also showed significant correlation with ISN 1 and 2 (Table 6.14) but was mainly underpinned by ISN 1n and 1m, less so by ISN 2m and not at all by ISN 2n (Table 6.15). To examine if these relationships can be detected with intentions, Pearson's product-moment correlations were performed with the ISN composites and the individual beliefs (Table 6.16).

Table 6.16

Pearson's product-moment correlations between intentions and indirect subjective norm composites (ISN), normative beliefs (n), motivational beliefs (m)

Intentions	Composites		Beliefs				Sum of Beliefs	
	ISN 1	ISN 2	ISN 1n	ISN 1m	ISN 2n	ISN 2m	ISN n	ISN m
Int 1	.38**	.20*	.45**	.13	.03	.33**	.32**	.31**
Int 2	.41**	.17	.48**	.19*	.05	.26**	.35**	.29**
Int 3	.27**	-.06	.27**	.15	-.07	.05	.12	.11
Int 4	.44**	.16	.42**	.25**	-.01	.29**	.28**	.35**
Int 5	.22*	.15	.30**	.11	.14	.20*	.28**	.20**
Int 6	.38**	.18	.35**	.29*	.08	.23*	.28**	.33**
Sum of intentions	.50**	.19*	.55**	.28**	.06	.33**	.38**	.38**

** Significant at the 0.01 level (2-tailed). * Significant at the 0.05 level (2-tailed).

The sum of intentions was significantly correlated with indirect subjective norm composites ISN 1 and ISN 2 (Table 6.16). Correlation with ISN 2 was significant but weak and based on only one significant correlation with Int 1.

When inspecting the correlations of intentions with normative beliefs the pattern of correlations reflects that of the sum of DSN with normative beliefs (Table 6.15). ISN 1n and 1m, and ISN 2m show significant correlations with intentions while ISN 2n was unrelated, and the sum of ISN n and m was again significantly correlated (Table 6.16).

This meant that individuals with high intentions strongly believed that friends and other people whose opinion are respected would approve of maintenance of streamside forests (ISN 1n) but did not let their intentions be influenced by a belief that government agencies expect that their recommendations be followed (ISN 2n) (Table 6.16).

These individuals with high intentions were motivated to comply with the expectation of respected others in doing the right thing (ISN 1m) but only if streamside forests were on their list of priorities (Int 2), and they intended to donate time to work with Land Care agencies (Int 4), and plant a streamside forest this year if there was a need (Int 5) (Table 6.16).

High intentions were also associated with the motivation beliefs of ISN 2m. This was the case for all intentions except for Int 3. This suggests that motivation to comply with recommendations from Government agencies (ISN 2m) was not at all associated with Int 3 of doing something about the streamside forest if the creek sides needed improvement (Table 6.16).

Int 3 was the only intention item correlated with a single beliefs item out of four resulting in negligible coefficients with the sums of normative beliefs (sum n) and motivations to comply (sum m). Willingness to do something about the streamside forest if the creek sides needed improvement (Int 3) would only become a strong intention if the individual also believed (among many other beliefs not included in the study) that friends and other people would approve of this maintenance (ISN 1).

6.7.4 Decision for inclusion of subjective norm beliefs in further analyses

The normative belief composite ISN 1 correlated strongly with the sum of direct subjective norms (DSN) and the sum of intentions indicating a strong role in the formation of subjective norms. The ISN 1 construct was composed of normative belief ISN 1n that significantly correlated with all intentions items, while the motivation to comply ISN 1m correlated significantly with three out of the six intentions (Table 6.16).

Composite ISN 2 was significantly correlated with the sum of DSN (Table 6.14) but was solely based on the relationship with DSN 2 not DSN 1 which was negligible. The correlations with the individual beliefs revealed that the normative belief ISN 2n had no relationship with intentions but the motivations to comply ISN 2m was significantly correlated with five out of the six intentions. ISN 2m could be employed as an individual belief measure in further analyses.

In a study involving landholders, Fielding et al. (2005) also found that the motivations to comply had stronger correlations (r = .46) with intentions than normative beliefs (r = .29). Their study's norming behaviour was concerned with land care and government agencies, and urban Australians which would be more comparable to the ISN 2 composite in this study. But no correlation was found for the normative beliefs in the present study. The other indirect subjective norm composite ISN 1 in the present study was concerned with friends' and neighbours' expectations and here the normative belief ISN 1n correlated more strongly (r = .55) than the motivation to comply ISN 1m (r = .28) (Table 6.16). When it comes to friends and neighbours the different norming behaviour may be based more on social norming and group behaviour.

6.7.5 The DSN construct to be used in the TPB

The sum of two direct norming items DSN 1 and 2 were selected to represent the TPB construct on the basis of their acceptable inter-correlation showing internal consistency (Table 6.12) and their significant correlation with intentions (Table 6.13).

The sum of indirect subjective norms ISN 1 and ISN 2 correlated above .3 with the DSN construct (Table 6.14) and will be included in the indirect subjective norm

construct in further analyses. Consideration will be given when necessary to the fact that ISN 2n did not correlate with DSN (Table 6.15).

6.8 Direct perceived behaviour control

Study 1 found that questions concerning the costs of riparian management were the most salient in the context of perceived control. Other control factors mentioned were the lack of trustworthy technical information and the environmental regulations ruling everything that one is allowed to do on one's land. Time required for the maintenance was not such a salient item. There was a willingness expressed to donate one's own equipment if the time and other materials were paid for. This also seemed to be the opinion of subjects who did not think there was anything wrong with their streamside forest and/ or did not believe in the important environmental functions of streamside forests.

These personal accessible beliefs were incorporated in the PBC items of the main survey. The interviewees in Study 1 were not asked to list factors that they "believe could make it easier or more difficult for them to perform the behaviour". Rather, the beliefs were deduced from comments to the questions about what they thought would encourage establishment and protection of streamside forests (questions 23a - 23g. in Study 1).

The "most commonly mentioned factors (modal accessible beliefs)" (Ajzen web) in regard to PBC in Study 1 were:

1. cost (spending and compensation such as tax relief)
2. technical information (in regard to trustworthiness, practicality and accepting of farmers' experience)
3. environmental regulations
4. time (minor)
5. equipment (but also willingness to make it available)

Items about the strength of these control beliefs (the perceived likelihood or frequency of the control factor being present), and the power of the belief factor (its ability to facilitate or impede performance of the behaviour) provided the content of the PBC items in the main survey.

6.8.1 Direct perceived behaviour controls –descriptive statistics

There were eight items included in the questionnaire that addressed direct perceived behaviour control (DPBC). These were:

DPBC 1. I can maintain a streamside forest on my land even if I am not compensated for it.
DPBC 2. I know how to take care of my streamside forest.
DPBC 3. It is patronising of other people telling landowners what to do with their streamside forests.
DPBC 4. If my streamside forests needed to be brought up to scratch I would not need technical help.
DPBC 5. All landowners can take care of their streamside forests.
DPBC 6. It is extremely easy for me to maintain good streamside forest.
DPBC 7. It is in the hands of the landowners like me to control the water quality in the waterways.
DPBC 8. Financial help would not be necessary to improve everybody's streamside forest.

The responses were measured on a 7-point Likert scale. A score of 7 represented a high degree of control over the behaviour and a score of 1 a strong perception of impediments, while 4 would represented perception of mild impediments. A high score therefore meant that the person was confident to have the capability of performing and overcoming external controls or requirements.

The descriptive statistics of the direct perceived behaviour control items show that the sum of the DPBC items had a mean score very close to the median (Table 6.24). Landowners showed awareness of impediments that were perceived to inhibit total control to a certain extent but allow some confidence in overcoming them. No respondent scored 7 on the 7-point Likert scale, meaning that none of them felt in total control or had the highest confidence in being able to perform the behaviour.

Table 6.17

Frequency distribution and descriptive statistics of the eight direct perceived behaviour control (DPBC) items

Direct perceived behaviour control	*n*[a]	*M*	*SD*	Median	Below Median (not feeling in control)		Above Median (feeling in control)	
					n	*%*	*n*	*%*
DPBC 1	120	3.88	2.16	4.00	53	44.2	67[b]	55.8
DPBC 2	120	4.74	2.00	5.00	54	45.0	66[b]	55.0
DPBC 3	123	4.76	1.94	5.00	53	43.1	70	56.9
DPBC 4	120	3.32	2.03	3.00	54	40.8	66	59.2
DPBC 5	121	3.91	2.00	4.00	45	37.2	76	62.8
DPBC 6	121	4.12	1.70	4.00	45	37.2	78	62.8
DPBC 7	121	4.92	1.79	5.00	50	41.3	71	58.7
DPBC 8	118	1.69	1.03	1.00	69[b]	58.5	49	41.5
Mean of DPBC	115	3.93	1.88	4.00	54	47	61[b]	53

[a] Whenever the total differs from *n* = 123 it is due to missing data. [b] Includes the median.

Of the eight items of direct perceived behaviour control listed in Table 6.24 six rate at about average (Likert scale of 1 to 7) or a bit above. DPBC 4 and 8 are the exceptions. This meant that landowner generally felt

- in control and knew how to take care of their streamside forest (DPBC 2),
- they did not need other people telling landowners what to do (DPBC 3),
- that in general all landowners can take care of their streamside forests (DPBC 5),
- that it is easy to maintain good streamside forest (DPBC 6),
- that it is up to landowners to control the water quality in their waterway (DPBC 7) (Table 6.24).

But the result of DPBC 4 and 8 indicated that landowners did not feel so strongly in control in regards to having the technical wherewithal (DPBC 4) and even less so in regards to the costs involved (DPBC 8). This confirms the findings from Study 1 and other research (Flick et al., 2010, Fielding et al., 2005, and others), where technical and financial help was found to be essential when farmers were expected to maintain the riparian forests.

6.8.2 Internal consistency of direct perceived behaviour control

According to the correlations between the eight items of perceived behaviour control there is no internal consistency (Table 6.18). Reliability analysis showed a *Cronbach alpha* value of .51, too low to be acceptable. Since the scale consists of only the small number of eight items which "it is sometimes difficult to get a decent Cronbach alpha value" p.98 (Pallant, 2007), a factor analysis were undertaken (Appendix D). No clear separate factors were found.

Nevertheless, there were four significant correlations (Table 6.18): Respondents who reported that "they can maintain a streamside forest without getting compensated for it" (DPBC 1) were associated with those who " know how to take care of their

streamside forest" (DPBC 2) and found "it easy to maintain good streamside forests" (DPBC 6). Those who thought "that all landowners can take care of their streamside forests" (DPBC 5) also found it easy to maintain the riparian area (DPBC 6). However, these respondents also thought that "financial help would be necessary to improve everybody's streamside forest" (DPBC 8).

Table 6.18

Pearson's product-moment correlations between the direct perceive behaviour control items (DPBC)

DPBC	Direct perceived behaviour control							
	1	2	3	4	5	6	7	8
1	-							
2	.34**	-						
3	-.07	-.15	-					
4	.10	.02	.04	-				
5	.11	.05	.14	.17	-			
6	.41**	.17	-.01	.18*	.31**	-		
7	.14	-.05	-.01	.20*	.09	.16	-	
8	.09	-.10	-.03	.21*	.10	.26**	.12	-

** Significant at the 0.01 level (2-tailed). * Significant at the 0.05 level (2-tailed).

The TPB allows the correlations with intentions to determine the construct if internal consistency is lacking (Francis et al., 2004b). Therefore, the correlations of DPBC items with intentions were investigated.

6.8.3 Direct perceived behaviour control and intentions

To determine DPBC items useable in the TPB model a Pearson's product-moment correlation between intentions and direct perceived behaviour control items (DPBC) was performed.

Table 6.19

Pearson's product-moment correlations between intentions and direct perceived behaviour controls (DPBC)

Intentions	Direct perceived behaviour control (DPBC)									
	1	2	3	4	5	6	7	8	Sum 1-8	Sum 1,6
Int 1	.17	.06	-.13	-.24**	-.03	.18	.01	-.09	-.04	.21*
Int 2	.34**	.20*	-.20*	-.20*	-.01	.24**	-.05	-.02	.07	.35**
Int 3	.17	.02	-.14	.12	.19*	.30**	.20*	.03	.25**	.27**
Int 4	.15	-.02	-.31**	-.11	-.12	.25**	.10	.08	-.05	.22*
Int 5	.13	.06	-.07	-.02	.17	.12	.11	-.02	.14	.15
Int 6	.32**	.12	-.17	-.02	.11	. 23*	.14	.01	.21*	.34**
Sum of intentions	.30**	.07	-.22*	-.13	.06	.30**	.09	-.02	.13	.36**

**Significant at the 0.01 level (2-tailed). *Significant at the 0.05 level (2-tailed).

Intentions 2 and 6 were significantly and positively correlated with DPBC 1, and intention 3 with DPBC 6. This suggests that respondents who report riparian forests on their list of priorities of intentions (Int 2) and were planning to maintain the area (Int 6) were also the ones who felt that they can maintain their riparian forest without being compensated for it (DPBC 1) (Table 6.19).

Landowners who intended to do something about the riparian forest if there was a need (Int 3) also agreed that it was easy for them to maintain good riparian forests (DPBC 6).

A significant negative correlation was found between intention 4 and DPBC 3 (Table 6.19): People with intentions of donating their time to work with Land care agencies to maintain the riparian forest if there was a need (Int 4), felt that it was patronizing of other people to tell them what to do with their riparian forest (DPBC 3) (this would be an impediment). But when landowners felt in control because they found

maintenance easy (DPBC 6) they associated positively (weakly but significantly) with donating time.

The negative correlation is difficult to explain. Why do these respondents have intentions to work with Land Care agencies (Int 4) when they find it patronizing of other people to tell them what to do (DPBC 3)? Perhaps these respondents realized that land care agents are not telling them what to do but are working with them. Only when other people lecture them about riparian maintenance do these respondents perceive it as a behaviour impediment, and react by lowering their intentions.

(This conclusion was further obscured by a significant negative correlation of this intention 4 item with the underlying beliefs of DPBC 6, the power (p) of impediments, in this case strict environmental rules and regulations in regards to streamside forests (IPBC 4p) (Table 6.21). It may mean that the respondents do not hold the land care agencies responsible for generating rules and regulations that are too strict.)

Investigation of the underlying beliefs of the control strength and of the perceived power of control may give some insight into the structure of the DPBC items, which may explain the lack of correlation.

6.8.4 The direct perceived behaviour construct to be used in the TPB model

The TPB model requires a DPBC construct that has good internal consistency. Where an acceptable Cronbach alpha cannot be obtained, a decision will be made on the basis of significant correlations with intentions. The two items DPBC 1 and 6 fulfilled the criteria best and the sum of these variables will be used as the DPBC construct.

To obtain an insight into what beliefs underpinned the control measures the relationship between DPBC items and IPBC composites and individual beliefs will be investigated in the following section. Significant correlations with beliefs are also considered an additional selection criterion of convergent validity (Francis 2004b).

6.9 Indirect perceived behaviour control

The direct perceived behaviour controls (DPBC) in the TPB are assumed to be underpinned by beliefs of indirect perceived behaviour controls (IPBC). The association between the beliefs and the direct perceived behaviour controls was investigated to elucidate what underlies the formation of direct control measures.

There were eight items representing beliefs in the presence of control IPBC c, and the corresponding beliefs in the power of the control IPBC p. Four composites (IPBC 1 to IPBC 4) were created by multiplication of corresponding belief pairs according to the TPB principle. The indirect perceived behaviour control construct in the TPB is the sum of belief composites. The wording of the eight control beliefs are in Appendix D.

6.9.1 Correlations between direct and indirect perceived behaviour control

The first Pearson's product-moment correlation analysis was performed between direct and indirect perceived behaviour control items to establish which beliefs composites underpin DPBC items, especially DPBC 1 and 6. These were the items which best represented the TPB construct. The correlations will also provide an indication of convergent validity.

Table 6.20

Pearson's product-moment correlation between direct perceived behaviour control items (DPBC) and indirect perceived behaviour control composites (IPBC)

Direct perceived behaviour control	Indirect perceived behaviour control belief composites				
	IPBC 1	IPBC 2	IPBC 3	IPBC 4	IPBC Sum
DPBC 1	.28**	.52**	.26**	.37**	.58**
DPBC 2	.09	.13	.17	.20*	.26**
DPBC 3	-.08	-.16	-.04	-.18	-.16
DPBC 4	.19*	.23*	-.08	-.04	.10
DPBC 5	.21*	.18	.14	-.02	.19*
DPBC 6	.38**	.52**	.25**	.32**	.55**
DPBC 7	.06	.05	.11	.19*	.19*
DPBC 8	.36**	.27**	-.04	.03	.16

**Significant at the 0.01 level (2-tailed). *Correlation is significant at the .05 level (2-tailed).

DPBC 1, 6 and 8 showed correlation coefficients above .3 with one, two or three individual IPBC composites (Table 6.20). But only DPBC 1 and 6 were related significantly and strongly with the sum of IPBC composites, the indirect measure of perceived behaviour control.

For DPBC 1 this relationship meant that the direct perception of behaviour control of landowners who did not need compensation to maintain their riparian forest (DPBC 1) was underpinned by the beliefs that they could afford to maintain the riparian forest (IPBC 2). The next strongest influential belief composite represented the low perceived controlling impact of restrictive environmental rules and regulations (composite IPBC 4). The weak but significant correlations with the two remaining IPBC items (IPBC 1 and 3) further supported the convergent validity of this DPBC 1 item. Similarly, the landowners who found it easy to maintain good riparian forest (DPBC 6) showed that this correlated with beliefs of being able to afford to maintain the riparian forest (IPBC 2) and plant a new riparian forest (IPBC 1); it correlated also

with the beliefs that they did not find environmental rules and regulations too restrictive (composite IPBC 4), and that they could afford to lose a 10m strip of land along the waterways for a streamside forest (IPBC 3).

These data strengthened the decision to use the sum of DPBC 1 and 6 as representative of the DPBC construct in the TPB.

6.9.2 Indirect perceived behaviour control beliefs underlying direct perceived behaviour controls

To provide further insight into the relationship with the composites the correlation with the individual control beliefs were investigated. Pearson product-moment correlations between direct perceived behaviour control items (DPBC) and the eight individual control beliefs (IPBC 1c to IPBC 4c, and IPBC 1p to IPBC 4p) and the sum of the belief categories IPBC c and IPBC p were performed.

Table 6.21

Pearson's product-moment correlation between direct perceived behaviour control items (DPBC) and indirect perceived control beliefs (IPBC c and IPBC p)

Direct perceived behaviour control	Indirect perceived behaviour control belief									
	IPBC 1		IPBC 2		IPBC 3		IPBC 4		Sum of IPBC c	Sum of IPBC p
	1c	1p	2c	2p	3c	3p	4c	4p		
DPBC 1	.37**	-.11	.53**	.47**	-.02	36**	.41**	26**	.53**	.50**
DPBC 2	.11	.05	.22*	.09	.10	.19*	.15	.14	.25**	.13
DPBC 3	.05	-.19*	-.06	-.14	.21*	-.23*	-.05	-.28**	.05	-.23*
DPBC 4	.13	.21*	.10	.24*	-.01	-.11	.04	-.01	.14	.24*
DPBC 5	.32**	.07	.16	.19*	.09	.13	.03	-.04	.23*	.16
DPBC 6	.45**	.30**	.51**	.49**	.08	.27**	.25**	31**	.54**	55**
DPBC 7	.11	.07	.07	.02	-.06	.18*	.13	.17	.11	.10
DPBC 8	.30**	.41**	.26**	.26**	-.01	-.04	.03	.08	.23*	31**
Sum of DPBC	.47**	.24**	.47**	.40**	.11	.21*	.28**	.16	.54**	43**

**Significant at the 0.01 level (2-tailed). *Significant at the 0.05 level (2-tailed).

When inspecting the IPBC c and IPBC p correlations with DPBC items the following picture emerged:

DPBC 1 (I can maintain the area without compensation) was underpinned equally by the sum of IPBC c- and IPBC p - beliefs. But two individual beliefs did not correlate at all, IPBC 1p and IPBC 3c. For the indirect composite IPBC 1 this meant that the direct perceived behaviour control of being able to maintain streamside forest without getting compensation correlated with the strong belief that they could afford it (IPBC 1c) but not with the belief that they could spend a lot of money on it (IPBC 1p). It sounds a realistic conclusion by someone who likes to get by without financial help but is aware that there are limits to how much they can spend. For the composite IPBC 3 this meant that the respondents believed that they could afford to lose a 10m strip of land on either side of the waterway (IPBC 3p) but not if it meant losing cropland (IPBC 3c) (Table 6.20). These landowners may be cultivating some of their riparian areas, but don't mind a forest in areas they do not use as cropland.

DPBC 6 (it is easy for me to maintain good streamside forest) presented the same picture for IPBC 3c which meant, as it did for DPBC 1 that loosing 10m of riparian area was alright but not if it was cropland (Table 6.21).

Item DPBC 8 also showed by significant correlations with IPBC items that it was underpinned by several beliefs, but did not reach the strength of correlations presented by DPBC 1 and 6. Therefore, the description and discussion does not feature here for further decisions about which DPBC items that best represent the construct in the TPB.

The significant correlation coefficients showed that DPBC 1, and 6, and to a certain extent DPBC 8 were underpinned by at least five of the eight beliefs indicating that convergent validity for the perceived control constructs was apparent (Table 6.28).

6.9.3 Intentions and indirect perceived behaviour control beliefs

Further investigation of indirect control belief composites was undertaken to assess the relationship with intentions. The correlation matrix revealed significant correlations between intentions and IPBC composites (Table 6.22).

Table 6.22

Pearson's product-moment correlations between intentions and indirect perceived behaviour control composites (IPBC)

Intentions	Indirect perceived behaviour control				Sum of IPBC	Sum of IPBC
	IPBC 1	IPBC 2	IPBC 3	IPBC 4	1,2,3,4	2,3
Int 1	.17	.20*	.26**	.22*	.34**	.30**
Int 2	.23*	.27**	.25**	.29**	.40**	.34**
Int 3	.16	.38**	.32**	.20*	.44**	.45**
Int 4	.12	.34**	.13	.20*	.33**	.32**
Int 5	.01	.24*	.25**	.11	.26**	.33**
Int 6	.15	.36**	.29**	.15	.41**	.42**
Sum of intentions	.19*	.42**	.35**	.28**	.50*	.51**

** Significant at the 0.01 level (2-tailed). * Significant at the 0.05 level (2-tailed).

The strongest significant correlations with the sum of intentions were found for IPBC 2 and 3, and a weaker one for IPBC 4. This indicated that respondents who had strong intentions (sum of intentions) were more likely believing that they could afford to do so financially (IPBC 2), and they could afford to give up a 10m strip of cropland to riparian forests (IPBC 3). This positive thinking about riparian forests may be based on the fear of erosion and loss of land that would be uppermost in landowners' minds.

In contrast, the marginal correlation of the sum of intentions with IPBC 1, a composite also containing beliefs about financial capability, indicated that when confronted with the idea of planting a new streamside forest without the threat of erosion or other undesirable events in mind, the respondents' intentions weakened considerably.

The marginally but significantly correlating composite IPBC 4 with the sum of intentions showed that the respondents' intentions increased when they believed that environmental rules and restrictions were no impediment.

6.9.4 Intentions and control beliefs

To provide insight into the relationship between intentions and the individual beliefs of the IPBC composites, Pearson's product-moment correlations was performed with the eight control beliefs (four beliefs in the strength of the control IPBC c, and four beliefs in the power of the control IPBC p) (Table 6.23).

Table 6.23

Pearson's product-moment correlations between intentions and indirect perceived behaviour beliefs (beliefs in the strength, c, and beliefs in the power of the control or impediment, p)

Intention	Indirect perceived control beliefs									
	IPBC 1		IPBC 2		IPBC 3		IPBC 4		Sum of	
	1c	1p	2c	2p	3c	3p	4c	4p	IPBC c	IPBC p
Int 1	.22*	.09	.33**	.19*	-.12	.42**	.17	.19*	.25**	.36**
Int 2	.26**	.14	.38**	.26**	-.13	.40**	.32**	.11	.34**	.38**
Int 3	.13	.17	.28**	.35**	-.03	.41**	.13	.19*	.21*	.43**
Int 4	.10	.11	.30**	.30**	-.12	.24**	.07	.19*	.24*	.33**
Int 5	.21*	-.06	.31**	.17	.06	.31**	.08	.03	.28**	.21*
Int 6	.21*	.08	.43**	.30**	-.04	.43**	.06	.18	.26**	.42**
Intent Sum 6	.27**	.12	.50**	.35**	-.09	.54**	.19*	.21*	.36**	.50**

** Significant at the 0.01 level (2-tailed). * Significant at the 0.05 level (2-tailed).

The composite IPBC 2 which correlated with the sum of intentions showed that the relationship with the belief in the strength of the perceived control IPBC 2c was stronger than in the power IPBC 2p (Table 6.23). Thus, while the respondents believed strongly they could afford to maintain their riparian forests (IPBC 2c); they were not so sure that the cost involved made it easy (IPBC 2p). This is a sentiment easily accepted, since the mention of costs in this context would hold one back somewhat, while it is easier to simply agree that one can afford it.

Composite IPBC 3 which had correlated significantly with the sum of intentions, revealed to have very strong belief in the power of the perceived control IPBC 3p, that they could afford to lose 10m of streamside land. But the idea of losing 10m of cropland IPBC 3c seemed to be detrimental to the formation of intentions (Table 6.23). The marginal negative correlation coefficients in this relationship indicate that farmers did not want to lose 10m of cropland. The strong discrepancy in relationships is very interesting to know and gives an idea of what hinders stronger intentions to be formed. This may be a point where behaviour change could be considered as recommended by Ajzen (1991). Financial compensation for loss of existing cropland on riparian areas could be the solution. Other studies have found this situation (Klapproth, 1999c) Trying to convince farmers that there will be long-term benefits from having functional riparian areas have not worked with cattle farmers when there was no perceptible damage to the land (Fielding et al., 2005).

In the context of the TPB the discrepancy in the belief strengths does not matter since both beliefs are weighted equally in the calculation of the indirect perceived behaviour control item. (IPBC 2 shows acceptable correlation with intentions (Table 6.22) and will be used in the construct of IPBC measure.)

The significant intention relationship between Int 2 and IPBC 4c (Table 6.23) deserves an interpretation. It suggests that landowners who reported that streamside forests were on their list of priorities (Int 2) rarely felt restricted by environmental rules and regulations in regards to their streamside forests (IPBC 4c). This relationship makes sense and points to the fact that landowners for whom the protection of the riparian forest is important accept the existing rules and regulations.

Strong correlations between the sum of intentions and the composites IPBC 2 and IPBC 3 (Table 6.29) were reflected in all individual beliefs, except the composites IPBC 3 which was revealed to have IPBC 3c beliefs that showed a negative relationship (Table 6.23). Since the beliefs are equally weighted in the indirect TPB construct, the insight gained is of interest purely outside the model.

In further analyses with control beliefs the two IPBC composites 2 and 3 will be used on the strength of their correlation with intention. Furthermore, the individual beliefs represented in the sums of IPBC c and p may yield information about the types of beliefs. Since the summed results include several very low and negative correlations with intentions, the beliefs of IPBC 2c and 2p as well as IPBC 3p may be very useful in finding significant relationships with behaviour indicators.

6.9.5 The DPBC construct to be used in the TPB

The TPB model requires a DPBC construct that has internal consistency, significant association with intentions, and convergent validity on the basis of correlation with beliefs (indirect perceived behaviour controls). DPBC 1 and 6 satisfied these criteria best. These measures showed significant inter-correlation (Table 6.25), significant association with the sum of intentions, in particular with Int 1 and 6 (Table 6.26), and

significant correlation with the sum of indirect perceived behaviour composites (Table 6.27) and their control beliefs (Table 6.28). The sum of the two direct perceived control measures DBPC 1 and 6 will be used as the DPBC construct when applying the TPB.

(Both items represent the notion of self-efficacy and confidence in being able to perform the behaviour, i.e. to see no financial impediments, no need for compensation, and to find it easy. A short discussion on self-efficacy as a control factor in this study is in Appendix D).

6.10 The predictors of intentions in the TPB model

So far the reliability, relevance and strength of association of the TPB constructs that were predictors of intentions were investigated, which informed the decision as to which items should be employed in testing the TPB model in a meaningful way. The items for the constructs were selected on the basis of internal consistency (representing convergent validity) using Cronbach Alpha where possible, of association with intentions and with indirect (belief-based) perceived behaviour control (supplying information about convergent validity). The individual beliefs were also examined as variables to provide an insight into their contribution in the IPBC composites as well as their strength of correlation with intentions. Table 6.24 is a list of the selected variables and their Cronbach alpha values and correlations with the sum of intentions.

Table 6.24

Summary table of Cronbach alpha reliability indicators, and Pearson's product-moment coefficients of correlations between TPB constructs and intentions

Constructs	Cronbach Alpha	Correlation with intentions
Intentions	.81	-
Direct Attitudes (DAsum10)	.82	.71**
F1 DA Affection	.81	.65**
F2 DA Stewardship	.59	.45**
Indirect attitudes (IA sum of 8)	n.a.[a]	.63**
Attitudinal beliefs		
Evaluation outcome (IA e sum of 8)	n.a.	.63**
Likelihood of outcome (IA b sum of 8)	n.a.	.59**
Direct subjective norm (DSNsum of 2)	n.s.[b]	.39**
Indirect subjective norms (ISNsum of 2)	n.a.	.44**
Normative beliefs		
Belief in expectations (ISN 1n)	n.a.	.55**
Motivation to comply (ISN 2m)	n.a.	.33**
Direct perceived behaviour control (DPBCsum2)	n.s.	.36**
Indirect perceived control (IPBC sum of 4)	n.a.	.50**
Control beliefs		
Beliefs in strength (IPBC c sum of 4)	n.a.	.36**
Beliefs in power (IPBC p sum of 4)	n.a.	.50**
Individual beliefs		
Belief in strength (IPBC 2c)	n.a.	.50**
Belief in power (IPBC 2p)	n.a.	.35**
Belief in power (IPBC 3p)	n.a.	.54**

** Significant at the 0.01 level (2-tailed). [a] Not applicable. [b] Not significant.

6.11 The behaviour indicators

The items used in the behaviour construct in the present study were described in chapter 5 (descriptive statistics) (see section 5.2 for more details). These items were based on self-reported descriptions of respondent's riparian forest collected as dichotomous measures. They are in actual fact self-reported measures of past behaviour of the way the riparian forests were managed.

Assessment of behaviour at the same time as intentions is not considered unrepresentative of the behaviour. Ajzen (2010) notes, "the correlation between these two measures only provides an indication of the extent to which current intentions are consistent with previous behaviour. The correlation can be taken as an indication of the intention's predictive validity only if there is independent evidence to suggest that the behaviour in question has a high degree of temporal validity". There is no reason to assume that the landowners would not continue with management practices that they have followed over some time. This particular kind of land care could reasonably be assumed to be carried on in the future. This contention of "the clear influence of past behaviour on future intentions" (p. 20) was also held by Fielding et al. (2005), who found that past behaviour was a significant predictor of future behaviour. Indeed, Curtis and Robertson (2003a) in a study on river frontage land in the Gouldburn Broken catchment in Victoria used the planting of trees and shrubs as an indicator of the adoption of "current recommended practices".

Desirable and undesirable management practices represented categories of behaviour indicators composed of four items each. While each of these items was treated as a criterion against which the TPB construct are assessed, the categories as sums of the desirable or undesirable items were also tested. The behaviour data were based on questions that required a tick of a box when expressing agreement.

The behaviour indicators

Desirable practices (indicators of good practices/ behaviour) (n_{yes} = ticked responses):

1. Crop or cultivate the land more than 10m away from the edge of the waterway. (n_{yes} = 76)
2. Streamsides have more trees and shrubs on them now than ever before. (n_{yes} = 31)
3. Streamsides have newly planted trees on them. (n_{yes} = 30)
4. Streamsides have tree seedlings on them that are left to grow. (n_{yes} = 46)

Undesirable practices (indicators of bad practices/ behaviour):

5. Agricultural crops grow on the land alongside the stream. (n_{yes} = 32)
6. Crop or cultivate the land from the edge of the waterway close enough to turn a tractor around. (n_{yes} = 35)
7. Streamsides had more trees on them some time ago. (n_{yes} = 41)
8. Streamsides are kept clean. (n_{yes} = 50)

6.11.1 Correlations between behaviour indicators and TPB variables

According to the SPSS manual (Pallant, 2007) when a dichotomous variable is correlated with an interval variable, the appropriate measure of association is point-biserial correlations. However, a Pearson's product correlation can be used in its place (Pallant, 2005, page 145), and is the statistical analysis used here to examine the relationships between behaviour indicators and the belief-based TPB variables and direct TPB constructs listed in Table 6.24. The exceptions are DA-Factor 1 affection and DA-Factor 2 stewardship which will be regarded as external variables and analysed in Chapter 9.

Tables 6.25 and 6.26 list all correlations found. The significant interactions are described and interpreted in the sections following the tables.

Table 6.25

Pearson's product-moment coefficients of correlations between TPB constructs (from summary Table 6.24) and desirable riparian management indicators

TPB constructs	Desirable riparian management indicators				
	1	2	3	4	Sum 1-4
Intentions	.11	-.12	.31**	.17	.13
Direct attitudes (DA)	.04	-.09	.28**	.19*	.15
Indirect attitudes (IA)	.01	-.06	.23*	.17	.10
Attitudinal beliefs:					
Evaluation of outcome (IA e)	.12	-.09	.30**	.22*	.19
Belief in likelihood of outcome(IA b)	-.03	-.11	.16	.16	.06
Direct subjective norm (DSN)	.08	-.01	.02	.19*	.04
Indirect subjective norm (ISN)	-.04	-.17	.02	.12	-.11
Normative beliefs:					
Belief in expectations (ISN 1n)	-.07	-.22*	.13	.14	-.01
Motivation to comply (ISN 2m)	.05	-.03	.04	.07	-.07
Direct behaviour control (DPBC)	.02	-.06	.08	.11	.07
Indirect behaviour control (IPBC)	.11	-.04	.07	.18	.23*
Control beliefs:					
Control belief in strength (IPBC c)	.04	-.03	.17	.23	.24*
Control belief in power (IPBC p)	.08	-.12	.06	.10	.11
Individual beliefs:					
Belief in strength (IPBC 2c)	.05	-.03	.17	.24**	.24*
Belief in power (IPBC 2p)	.08	-.12	.06	.10	.11
Belief in power (IPBC 3p)	.12	-.25**	.10	.10	-.03

** Significant at the 0.01 level (2-tailed). * Significant at the 0.05 level.

Table 6.26

Pearson's product-moment coefficients of correlations between TPB constructs (from summary Table 6.24) and undesirable riparian management indicators

TPB constructs	Undesirable riparian management indicators				
	1	2	3	4	Sum 1-4
Intentions	-.08	-.19*	.21*	.10	.01
Direct attitudes (DA)	-.26**	-.17	.11	.02	-.02
Indirect attitudes (IA)	-.13	-.15	.15	.09	.01
Attitudinal beliefs:					
Evaluation of outcome (IA e)	-.14	-.21*	.09	.08	-.03
Belief in likelihood of outcome (IA b)	-.11	-.09	.15	.06	.02
Direct subjective norm (DSN)	-.04	-.14	.07	-.06	-.11
Indirect subjective norm (ISN)	-.13	-.14	.14	-.04	-.14
Individual beliefs:					
Belief in expectations (ISN 1n)	-.14	-.13	.21*	-.02	-.06
Motivation to comply (ISN 2m)	.02	-.06	.18	.08	.13
Direct behaviour control (DPBC)	.08	-.04	-.11	-.02	-.10
Indirect behaviour control (IPBC)	-.13	-.03	-.09	-.07	-.19
Control beliefs:					
Control belief in strength (IPBC c)	-.18	-.07	-.07	.10	-.16
Control belief in power (IPBC p)	-.09	-.06	-.05	-.15	.20
Individual beliefs:					
Belief in strength (IPBC 2c)	-.17	-.08	-.06	.11	-.15
Belief in power (IPBC 2p)	-.09	-.06	-.05	-.15	-.20
Belief in power (IPBC 3p)	-.13	-.27**	.25**	-.02	-.06

** Significant at the 0.01 level (2-tailed). * Significant at the 0.05 level.

6.11.1.1 Intentions and behaviours

Intentions were found to be positively and significantly correlated with the desirable riparian management indicator (3) of newly planted trees on the streamsides (Table 6.25). Individuals with strong intentions were already managing the area by planting trees since they saw the need for it. This makes sense when considering that the indicator of undesirable behaviour (3) of having had more trees some time ago also

correlated significantly (Table 6.26). Trees can be lost through no fault of the landowners and does not necessarily indicate bad management practices - as long as the intentions are there to remedy the situation. Using the streamsides to turn the tractor (undesirable 2) correlated negatively (Table 6.26), indicated that this undesirable behaviour was not practiced when strong intentions were present.

6.11.1.2 Attitudes and behaviours

The direct attitude construct, DA correlated significantly and positively with the desirable management indicator of having newly planted trees on the streamsides (3), and leaving tree seedlings to grow (4) (Table 6.25).

Correlations with undesirable riparian management indicators (Table 6.26) showed that DA correlated negatively with having crops growing alongside the stream (undesirable 1). These results support the assumption that individuals who have positive attitudes towards riparian forests will eschew undesirable riparian management practices.

Indirect attitudes, IA, were significantly correlated with the desirable behaviour indicator (3) of having newly planted trees on the streamsides (Table 6.25). The evaluation outcomes, IA e in these composites were the contributors in this relationship not the behavioural beliefs which showed no correlation in this relationship. Evaluation outcome also correlated with the desirable riparian management indicator (4) of leaving tree seedlings to grow on the streamsides while the IA composites did not (Table 6.25). The same was revealed for undesirable behaviour indicator (2) of turning the tractor around on the streamside which was negatively correlated with IA e but not with IA or

IA b (Table 6.26). This may be explained as an indication that individuals believed in the negative outcome that can result from compacting the soil on the streamsides.

6.11.1.3 Subjective norming and behaviour

Direct subjective norms DSN showed a weak significant correlation with the desirable riparian management practice of leaving tree seedlings to grow (4) (Table 6.25), possibly indicating that landowners believe that respected others would approve of that practice.

The normative beliefs, ISN n (people whose opinions are respected would approve of maintaining the streamside forest), correlated negatively with the report that more trees and shrubs are growing there now than ever before (Table 6.25). This result was confirmed by the significant correlation of the same item with the undesirable indicator of having had more trees on the streamsides some time ago (3) (Table 6.26). There was possibly a significant proportion of landowners who believed that too many trees and shrubs were not desirable in their riparian forest. Equally, it may indicate that the loss of trees and shrubs was a statement of fact and was not due to any activity under their control.

6.11.1.4 Perceived behaviour control and behaviour

The TPB construct of direct perceived control did not correlate with any desirable or undesirable behaviour indicators. Only the indirect perceived behaviour controls of IPBC showed a correlation with the sum of all four desirable behaviour indicators (Table 6.32), as did the belief in the control, IPBC 1c. Respondents who believed they were in control of the financial side of riparian management (IPBC) had riparian forests with good management indicators. This relationship was based on the belief in the

strength of the control, IPBC 2c, not on the perceived power of the control IPBC 2p (Table 6.25).

IPBC 1c also correlated with the positive behaviour indicator (4) (tree seedlings were left to grow on the streamsides) (Table 6.25). This suggests that respondents who think they can afford to maintain their riparian forest (IPBC 2c) allow tree seedlings to grow. The other belief power of the control IPBC 3p (one could afford to lose a 10m strip of land along the waterways for a streamside forest) correlated negatively with the positive behaviour indicator (2) of having more trees on the streamside now (Table 6.25). This was confirmed by the correlation of the same control belief with the undesirable behaviour indicator (3) of having fewer trees on the streamside now (Table 6.26). The relationships here are an ambivalent result as it was for the norming belief ISN n and for intentions, and it is difficult to find an explanation. It may have nothing to do with a landowner's riparian management practices, such as removing trees but that the loss of trees was due to natural causes (such as floods, cyclonic winds). The same control belief (IPBC 3p) showed a negative correlation with the undesirable behaviour indicator (2), that is the practice of turning the tractor around was not followed (Table 6.26).

6.11.2 Summary of correlations between riparian management indicators (behaviour) and TPB constructs

Of all TPB constructs, intentions are considered the most proximal predictor of behaviour and under certain conditions involving non-volitional control perceived behaviour control can become actual control and therewith become a direct predictor of behaviour, by-passing intentions. In the context of the TPB model the most important

results from the correlations with behaviours concern the constructs of intentions and direct perceived control.

It was found that intentions were significantly correlated with newly planted trees on the streamsides and with not turning the tractor around on the streamsides. These behaviours were both desirable and people with high intentions to manage their riparian forest were expected to exhibit these. But there was also a significant correlation with the undesirable behaviour indicator of having fewer trees now than before. The result is difficult to explain but may simply mean that the loss of trees was out of the landowners' control.

The direct measure of perceived behaviour control (DPBC 1, 6) used in the TPB model did not show any correlation with behaviour indicators. However, the two items forming this construct of DPBC were selected on the basis of their relatively high and significant correlation with intentions. In the context of testing if there was any direct perceived behaviour controls representing insurmountable impediment that bypassed intentions to performing the behaviour, each DPBC item needed to be checked regardless of its relationship with intentions. The results showed that no significant impediments were related to the behaviour indicators. Nevertheless, of the beliefs that underpinned direct perceived behaviour controls, the control belief that one could not afford to lose 10m of land to a riparian forest (IPBC 3p) was significantly correlated to the undesirable behaviour indicators of turning the tractor around on the streamside (negative correlation) and of having had more trees in the riparian forest some time ago. Both behaviour indicators were also related to intentions.

The correlations reported in this chapter between the TPB constructs and the behaviour indicators give a glimpse of the general relationships between these variables. Further investigations using logistic regression analysis were undertaken to

assess the predictive strength of these relationships to establish between the variables and intentions (Chapter 7) and with the behaviour indicators (Chapter 8).

CHAPTER 7.

PREDICTORS OF INTENTIONS

7.1 Introduction

The aim of this chapter is to examine the variables that precede the construct of intentions in the TPB model as predictors of intentions. Figure 7.1 is a diagram of the TPB model showing all components and the pathways postulated by the theory. The closest constructs to intentions are direct measures of attitudes, subjective norms and perceived behaviour controls, and they are considered the only predictors of intentions in the TPB model.

The beliefs validate the direct constructs; they are not direct predictors of the direct measures or of the intentions and behaviour. Nevertheless, assessing their predictive influence on intentions will yield information that can explain the reason for specific intentions. This unconventional approach will allow insight into significant contributions of individual belief measures that can elucidate the formation of intentions. A study by the research team of Fielding et al. (2005) applying the TPB model assessed beliefs as predictors of intentions and behaviour with rural landholders' (predominantly cattle farmers) intentions and management of their riparian zones. The results from that research allow parallels to be drawn with results from the present research study.

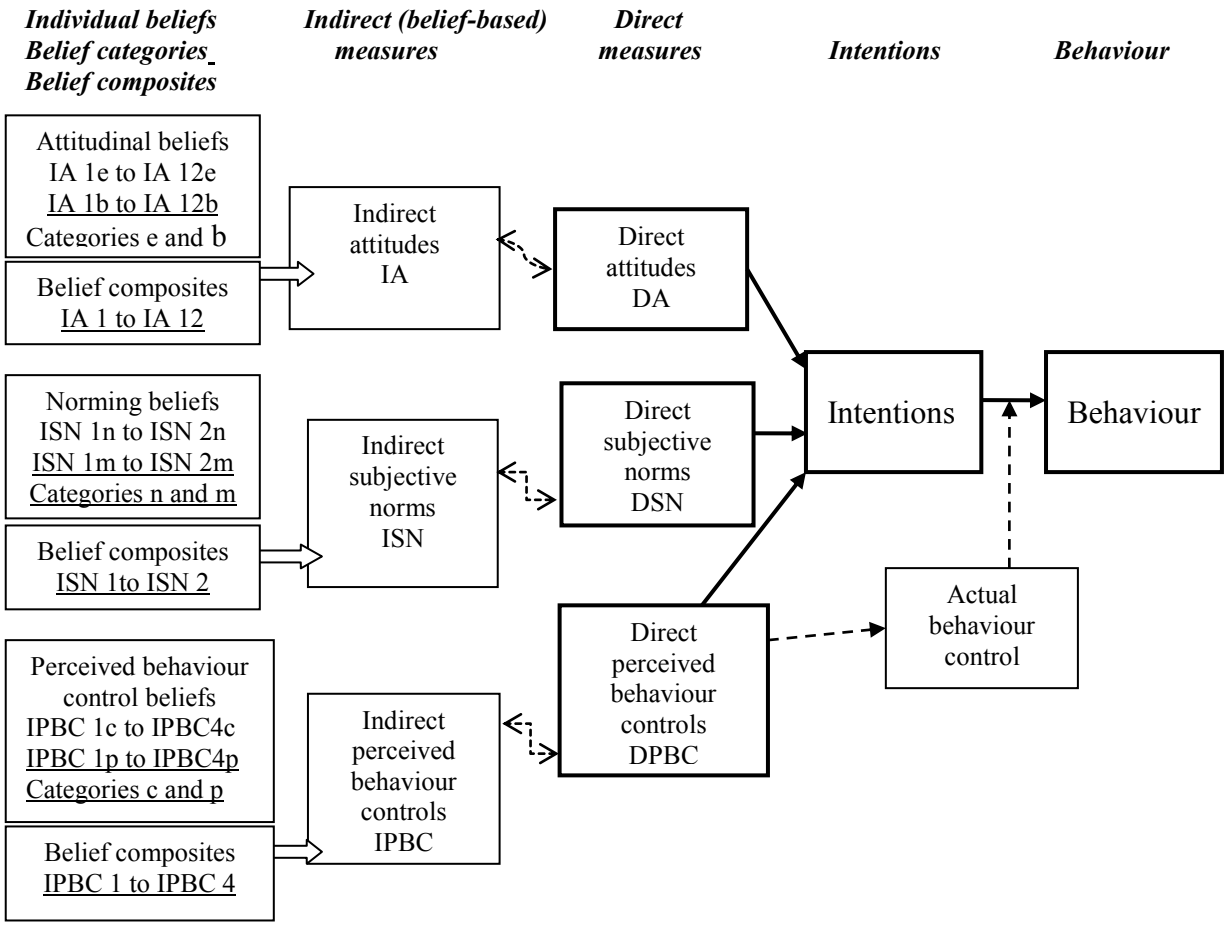


Figure 7.1 Diagram of the model of the Theory of Planned Behaviour (TPB).

To aid the interpretation of the results in the tables a list of intentions is provided here. The intention measure was collected on a 7-point Likert scale, with 7 representing strong intentions and 1 weak intentions.The sum of intentions constituted the sum of the scores of all six individual intention items.

The intentions in the TPB model

Int 1. If Government agencies contacted me, I would work with them on planting or maintaining my streamside forests. (n = 119)

Int 2. Streamside forests are on my list of priorities. (n = 121)

Int 3. If my creek sides needed improvement, I would do something about the streamside forest. (n = 121)

Int 4. Streamside landowners like me would donate their time to work with Land Care agencies to maintain my streamside forest if there was a need. (n = 121)

Int 5. I will plant streamside forests on my waterways this year if there is a need. (n = 117)

Int 6. I am planning to maintain my streamside forest. (n = 116)

7.2 Attitudinal beliefs

The correlations between intentions and the 12 attitude belief composites were reported in the previous chapter (see Table 6.9). The results showed that four composites (IA 4, 8, 9, 11) did not relate sufficiently and their exclusion from the indirect attitude construct (sum of composites) was justified. However, the 24 individual attitudinal beliefs were not assessed as predictors of intentions which would give answers to one of the research questions. To investigate the contribution of the 24 beliefs to the explanation of variance in intentions it was necessary to minimise the number of variables. Therefore factor analysis was performed which resulted in two clear variables that were then assessed as intention predictors. The suitability of the data for factor analysis was confirmed from the correlation matrix which revealed the presence of many coefficients .3 and above (Table 7.1).

The Principal component analysis revealed acceptable Kaiser-Meyer-Olkin value of .82 and significance for the Bartlett test of sphericity confirming the factorability of the data. Six components were listed with Eigenvalues above 1 explaining a total of 59.6% of variance. Comparison of Eigenvalues of these factors with criterion values from parallel analysis (Monte Carlo PCA) indicated acceptance of three factors. Therefore a Varimax rotation method was undertaken with three components which explained cumulative variance of 43.8%.

Table 7.1
Correlation matrix of individual attitudinal beliefs

Variables	IA1e	IA2e	IA3e	IA4e	IA5e	IA6e	IA7e	IA8e	IA9e	IA10e	IA11e	IA12e	IA1b	IA2b	IA3b	IA4b	IA5b	IA6b	IA7b	IA8b	IA9b	IA10b	IA11b	IA12b
IA 1e	1																							
IA 2e	.23	1																						
IA 3e	.20	.54	1																					
IA 4e	.10	.15	.25	1																				
IA 5e	.25	.38	.21	.08	1																			
IA 6e	.26	.17	.11	.22	.07	1																		
IA 7e	.28	.37	.33	.12	.30	.11	1																	
IA 8e	-.11	-.01	.09	.09	.06	-.06	.02	1																
IA 9e	.42	.170	.19	.18	.18	.20	.28	-.11	1															
IA 10e	.20	.44	.42	.27	.28	.36	.36	.07	.33	1														
IA 11e	-.01	.09	.17	.03	.16	.00	.06	.26	.01	.15	1													
IA 12e	.32	.60	.52	.14	.57	.13	.47	.02	.21	.49	.20	1												
IA 1b	.21	.39	.37	.16	.30	.07	.39	.19	.24	.37	.25	.47	1											
IA 2b	.12	.65	.50	.29	.30	.12	.21	.08	.13	.43	.14	.57	.35	1										
IA 3b	-.06	.35	.31	.05	.12	.04	.11	.22	-.08	.22	.28	.21	.10	.23	1									
IA 4b	.17	-.02	.06	-.07	.20	-.01	.10	.09	.12	.11	.14	.17	.16	-.02	-.07	1								
IA 5b	.24	.46	.49	.28	.47	.22	.45	.16	.21	.58	.20	.77	.43	.45	.20	.22	1							
IA 6b	.27	.33	.38	.10	.36	.09	.33	-.06	.13	.25	.19	.54	.27	.34	.10	.20	.40	1						
IA 7b	.09	.35	.18	.25	.15	.10	.30	-.06	.23	.38	.17	.41	.21	.28	.15	-.06	.36	.15	1					
IA 8b	.02	.19	.23	.17	.37	.11	.19	.40	.16	.22	.24	.30	.30	.13	.23	.03	.35	.16	.15	1				
IA 9b	.02	.03	-.03	-.09	-.02	.04	.04	.04	-.10	.01	-.00	-.01	-.04	-.05	-.07	.26	-.01	.11	-.17	-.06	1			
IA 10b	.30	.43	.37	.20	.40	.14	.41	.08	.24	.56	.18	.57	.25	.41	.29	-.00	.66	.33	.42	.28	.05	1		
IA 11b	.07	.05	.12	-.02	.16	.07	.08	-.05	.21	.20	.35	.24	.14	.13	.20	.25	.23	.22	.14	.10	-.07	.21	1	
IA 12b	.36	.57	.47	.23	.40	.21	.65	.06	.30	.47	.09	.67	.49	.47	.23	.07	.54	.44	.37	.22	-.04	.52	.06	1

The rotated component matrix showed no clear loading on the components and the Varimax rotation was repeated for 2 components. The results showed now a better separation of factors but indicated the removal of 3 items that did not load at all and 4 items with a low loading (cutoff level .45). The Varimax rotation was repeated with the reduced set of items. The results now allowed the assumption of two factors (Table 7.2). IA-factor 1 (IA-F1) explained 35.01% of variance and included 13 items. It had an overarching theme of "understanding environmental importance of riparian forests and willingness to manage riparian forests for the sake of the environment". IA-factor 2 (IA-F2) explained 12.57% of variance and included 4 items with overarching theme of "understanding good riparian management practices".

Table 7.2

Principal component analysis with Varimax rotated factor structure of attitudinal beliefs

Item	Loadings		
	IA-F1[a]	IA-F2[b]	h^2
1. Streamside forests are good for environment at large	.86	.11	.76
2. Streamside forests are beneficial to environment 12b	.81	.10	.67
3. More streamside forest means more native animal habitat	.76	. 28	.66
4. To stabilise banks bushes and trees work well 2e	.75	.20	.60
5. Streamside forest provides habitat for creatures in creek	.69	.22	.53
6. Bushes and trees stabilise banks	.67	.11	.46
7. Shade in streamside forest benefit creatures in creek	.66	.17	.46
8. To benefit environment every landowner has to care 7e	.64	.01	.41
9. Having grass on the streamside is not sufficient	.62	.21	.43
10. Streamsides slow down silt and sediment 6e	.58	.10	.35
11. It is good to have native animals in the streamside forest	.53	.23	.34
12. Intact streamside forests will assure water quality	.52	.32	.38
13. Taking care of streamside forest will benefit environment 7b	.51	.10	.27
14. Streamside forest does not make good crop land	-.11	.79	.63
15. Crops do not make good long-term use of streamsides	.21	.70	.53
16. Debris in the creek is beneficial	.10	.61	.39
17. Having only grass on the stream banks is not efficient	.22	.50	.30
Percentage of Variance:	35.01%	12.57%	

[a] "understanding environmental importance of riparian forests".
[b] "understanding good riparian management practices".

7.2.1 Attitudinal belief factors as predictors of intentions

Standard multiple regression analysis with the attitudinal belief factors IA-F1 and IA-F2 as the independent variables and intentions as the dependent variables revealed the following predictive relationships (Table 7.3).

Table 7.3

Significant results of standard multiple regression analyses with intentions as the dependent variable and the attitudinal belief factors 1 and 2 as independent variables

Dependent variable	*Independent variables*	*Variance in DV explained by the model*		*Unique contribution to explanation of variance in DV by the model* [a]		
		%	*P*	*Variable*	β	*P*
Sum of Intentions	IA-F1[b], IA-F2[c] *df*2(105)	38.2	< .0005	IA-F1	.63	<.0005
Int 1	IA-F1, IA-F2 *df*2(107)	22.0	< .0005	IA-F1	.51	<.0005
Int 2	IA-F1, IA-F2 *df*2(107)	30.8	< .0005	IA-F1	.52	<.0005
Int 3	IA-F1, IA-F2 *df*2(107)	18.1	< .0005	IA-F1	.46	< .0005
Int 4	IA-F1, IA-F2 *df*2(107)	17.1	< .0005	IA-F1	.42	<.0005
Int 5	IA-F1, IA-F2 *df*2(107)	8.4	.003	IA-F1	.34	.001
Int 6	IA-F1, IA-F2 *df*2(107)	18.9	<.0005	IA-F1	.46	<.0005

[a] These beliefs contributed to the explanation of variance of intentions when the variance explained by all other variables in the model was controlled for.
[b] "understanding of environmental importance of riparian forests"; [c] "understanding good riparian management practices".

Attitudinal belief factor 1 (IA-F1), representing landowners' understanding of the environmental role and importance of riparian forests significantly explains the variance in all intentions and is the only unique contributor in the models. This finding reflects the results of other studies with landowners where positive attitudes toward riparian forests were found to represent beliefs in an obligation to preserve the environment for its own sake or for future generations indicating intentions to manage the area (Bjornsson et al., 2002; Curtis & Robertson, 2003; Dutcher, 2000; Dutcher et al., 2004, Klapproth & Johnson, 2001). However, in every case these beliefs were not realized in actual practice. Dutcher (2000) also observed that the landowners' understanding of the importance of stream quality was one reason to maintain and create riparian forests.

No intention item was predicted by the attitudinal belief factor 2 (IA-F2). Landowners' good understanding of riparian forest management did not influence their intentions to manage their riparian areas. Knowing about the proper management does not mean having intentions to put the knowledge into practice; not even willingness to work with government (Int 1) and landcare agencies (Int 4) was influenced by this factor.

7.2.2 Attitudinal belief categories

Beliefs that represent understanding of the environmental importance of riparian forests were found to significantly explain intentions. Two other belief types were part of the study. They had the overarching themes of belief in the "evaluation of the desired outcome" (sum of 12 IA e beliefs), and the "belief that the outcome can actually be achieved" (sum of IA b beliefs).

Standard regression analysis with IAe and 12 IAb as independent variables and intentions as the dependent variables revealed that both variables significantly predicted different intentions (Table 7.4).

Table 7.4

Significant results of standard multiple regression analyses with intentions as the dependent variable and the attitudinal belief categories IAe and IAb as independent variables

Dependent variable	*Independent variables*	*Variance in DV explained by the model*		*Unique contribution to explanation of variance in DV by the model* [a]		
		%	*P*	*Variable*	β	*P*
Sum of Intentions	IA e[b], b [c] *df*2(100)	35.7	< .0005	IA e	.39	.006
Int 1	IA e, b *df*2(102)	16.3	< .0005	IA b	.34	.031
Int 2	IA e, b *df*2(102)	30.6	< .0005	IA b	.33	.023
Int 3	IA e, b *df*2(102)	15.1	< .0005	-	-	n.s.
Int 4	IA e, b *df*2(102)	17.7	< .0005	IA e	.38	.015
Int 5	IA e, b *df*2(102)	8.1	.005	IA e	.34	.043
Int 6	IA e, b *df*2(102)	15.8	<.0005	IA e	.36	.025

[a] These beliefs contributed to the explanation of variance of intentions when the variance explained by all other variables in the model was controlled for.
[b] "belief in the evaluation of outcome"; [c] "belief that the outcome can actually be achieved".

First of all, intention to improve creek sides if there was a need (Int 3) was predicted by the statistical model but neither belief category contributed uniquely (Table 7.4). This would be due to variables' overlap or shared variance.

The evaluative beliefs (IAe) were the only unique contributors to the explanation of variance of the sum of all six intentions (Table 7.4). The beliefs that the outcome can be achieved (IA b) were not decisive. Intentions were based on beliefs in positive attributes of riparian forest but on beliefs that these attributes can be achieved. However, this was the case for three of the six individual intentions only, the intentions to work with landcare agencies (Int 4), to plant a streamside forest this year (Int 5), and to maintain the forest (Int 6).). It is unclear why the variance in these intentions were not explained by the outcome beliefs (IA b) which emphasise beliefs in the benefits of riparian management and the actions of agents that can bring it about (i.e. the roots of trees). If one intends to plant and maintain a riparian forest one would presumably also believe in its efficacy to bring about the desirable outcome. Instead, these outcome beliefs were the only significant contributors to the explanation of intentions to work with government agencies to maintain riparian forests (Int 1) and to have riparian forests on the list of priorities (Int 2). These findings partly confirm Fielding et al.'s (2005) reports that strong intenders "judged the benefits as more likely outcomes of riparian zone management than weak intenders" (p. 18).

Belief in the benefits of riparian forest was important for landowners' intentions to maintain the area and to work with government agencies in this study. Disbelief has been reported to be a strong hindrance to adoption of good management practices in several studies (Barr & Carey, 2000; Corbett, 2002; Dutcher, 2000; Klapproth & Johnson, 1999c; Wilson et al., 2003).

7.2.3 Attitudinal belief composites

The next set of belief variables in the TPB model supersedes the individual behavioural beliefs and the belief categories. These are the attitudinal belief composites (IA 1 to IA

12) which represent the product of belief pairs from the two categories e and b (evaluations of the outcome and the beliefs in the outcome). The construct of the composite does not reflect the contribution of the individual belief categories since the product gives equal weight to the categories (for example, IA 1 is the product of IA 1e x IA 1b). The importance of individual belief categories in the explanation of variance in intentions reported in the previous sections will not be deducible from results with the composites. Nevertheless, this is the way in real life, when evaluative beliefs and beliefs in the outcome will most likely be present at the same time and will be assessed to form intentions. Thus the belief composite is the cognitive outcome of the pros and cons of the individuals' beliefs. And in that form they are the antecedents of attitudes as postulated by Ajzen and Fishbein in the theory of reasoned action (1980), the original model of the theory of planned behaviour. The TPB proposes this pathway from individual beliefs and belief categories, to belief composites for indirect measures of attitudes, subjective norms and perceived behaviour controls (see Figure 7.1).

Assessment of the set of 12 attitude composites was undertaken using standard multiple regression analysis with intentions as the dependent variables. The results showed that all models were significant, except Int 5 after Bonferroni adjustment (Table 7.5).

Planning to plant a riparian forest (Int 5) was not predicted well by indirect attitudinal belief composites (see Table 6.9). There were no individual belief composites that contributed to the explanation of variance of intentions when the variance explained by all other variables in the model was controlled for. The results do not add further insight into the intention-belief relationship but that the products of the beliefs that make up the composites were based on values of the same valence.

Table 7.5

Standard multiple regression analysis with intentions as dependent variable and the attitudinal belief composites as independent variables

Dependent variable Intentions	*Independent variable Belief composites df12(94)*	*Variance in DV explained by the model*	
		%	*P*
Sum of Intentions	IA 1 to IA 12 *df*12(94)	40.4	< .0005
Int 1	IA 1 to IA 12 *df*12(98)	18.6	.001
Int 2	IA 1 to IA 12 *df*12(98)	37.4	< .0005
Int 3	IA 1 to IA 12 *df*12(98)	18.7	.001
Int 4	IA 1 to IA 12 *df*12(98)	22.2	< .0005
Int 5	IA 1 to IA 12 *df*12(98)	11.1	.02[a]
Int 6	IA 1 to IA 12 *df*12(97)	22.6	< .0005

[a] Significance not retained with Bonferroni adjustment.

The last belief-based attitude measure in the TPB model is the sum of the composites. This construct will be assessed as a predictor of intentions together with the indirect measures of subjective norms and perceived behaviour control and the results described later in this chapter.

7.3 Norming beliefs as predictors of intentions

The TPB questionnaire included four individual norming beliefs (for the correlations with intentions see Table 6.16). In this section these beliefs and the norming categories

(category n, the strength of the belief in expectations of others, and category m, the motivation to comply), and norming composites underwent multiple regression analysis to assess them as predictors of intentions. The belief items were entered into a standard multiple regression analyses as independent variables and the intentions as the dependent variable.

The statistical model with the set of all four normative beliefs explained 33.1% of variance in the sum of intentions (Table 7.6). ISN1n and ISN 2m were confirmed as significant unique contributors. This meant that the sum of intentions can be explained when landowners believe that friends and other people whose opinion they respect would approve of them maintaining streamside forest (ISN 1n), and if they in general follow recommendations from government agencies (ISN 2m) (Table 7.6).

All individual intentions except Int 3 were explained by unique significant contribution of the norming belief ISN 1, and Int 1 also by the motivational belief ISN 2m (Table 7.6). These results mean that the intention of working with government agencies (Int 1), having streamside forest on their list of priorities (Int 2), donating time to work with land care agencies (Int 4), planting a streamside forest this year if needed (Int 5), and maintaining the streamside forest (Int 6) were explained by the landowners' belief that friends and other people whose opinions they respected would approve of maintaining streamside forest (ISN 1n). However, the intentions to do something about the streamside forest if the creek banks need improvement (Int 3) was not influenced by this norming belief.

Table 7.6

Standard multiple regression analyses with intentions as the dependent variable and the normative beliefs as the independent variables

Dependent variable	*Independent variable (predictor)*	*Variance in DV explained by the model*		*Unique contribution to explanation of variance in DV by the model* [a]		
		%	*P*	*Variable*	*β*	*P*
Sum of Intentions	ISN beliefs *df*4(103)	33.1	< .0005	ISN 1n ISN 2m	.48 .21	< .0005 .013
Int 1	ISN beliefs *df*4(109)	23.9	< .0005	ISN 1n ISN 2m	.42 .25	< .0005 .004
Int 2	ISN beliefs *df*4(109)	23.1	< .0005	ISN 1n	.44	< .0005
Int 3	ISN beliefs *df*4(109)	6.1	.03[b]	-	-	n.s.
Int 4	ISN beliefs *df*4(109)	21.6	< .0005	ISN 1n (ISN 2m	.36 .21	< .0005 .017[b])
Int 5	ISN beliefs *df*4(109)	8.2	.01	ISN 1n	.26	.01
Int 6	ISN beliefs *df*4(108)	14.7	< .0005	ISN 1n	.26	.01

[a] These beliefs contributed to the explanation of variance of intentions when the variance explained by all other variables in the model was controlled for.
[b] Significance not retained with Bonferroni adjustment.

Since the belief that respected others would approve of one's riparian maintenance (ISN 1n) positively influenced the formation of intentions it should indicate that the respondents in general also care that these respected people think they are doing the right thing (ISN 1m). But only the motivational belief ISN 2m contributed to the explanation of variance of one intention, Int 1. This relationship can be logically explained if one considers that when landowners believe they are in general following recommendations from government agencies (ISN 2m) they would be willing to work

with government agencies on planting and maintaining streamside forests if contacted by them (Int 1).

7.3.1 Normative belief categories

The norming belief categories ISN n (beliefs in approval by respected people) and ISN m (motivations to comply with expectations) were assessed as predictors of intentions in a standard multiple regression analysis as independent variables. The results are listed in Table 7.7.

The two norming categories explained 21.4% if variance in the sum of intentions, and the unique contributions from category n (beliefs in approval and expectations of respected others) and category m (motivation to comply with expectations) was of equal importance. Furthermore, both belief categories contributed significantly to the explanation of variance in intentions Int 1, 2, 4, and 6. However, Int 3 the intention to improve creek sides was not predicted by subjective norming beliefs. Furthermore, the intention to plant a streamside forest this year if there was a need (Int 5) was predicted by normative beliefs only, not by motivational beliefs.

A study by Fielding and colleagues (2005) found motivational beliefs (willingness to comply) to be highly predictive of strong intentions, which was not so clearly observed in this study. One of the reasons for the discrepant results may be the diversity of backgrounds of the landowners in this study which would not foster a group belonging such as for the association of graziers in Fielding's study, or other groups of

Table 7.7

Standard multiple regression analyses with intentions as dependent variable and the indirect subjective norm categories as independent variables

Dependent variable	*Independent variables*	*Variance in DV explained by the model*		*Unique contribution to explanation of variance in DV by the model* [a]		
		%	*P*	*Variable*	β	*P*
Sum of Intentions	ISN n[b], m [c] *df*2(104)	21.4	< .0005	ISN n ISN m	.29 .30	.002 .001
Int 1	ISN n, m *df*2(110)	13.7	< .0005	ISN n ISN m	.25 .24	.008 .012
Int 2	ISN n, m *df*2(111)	14.3	< .0005	ISN n ISN m	.28 .21	.002 .024
Int 3	ISN n, m *df*2(111)	n.s.	n.s.	n.s.	n.s.	n.s.
Int 4	ISN n, m *df*2(111)	14.5	< .0005	ISN n ISN m	.20 .30	.034 .002
Int 5	ISN n, m *df*2(108)	7.4	.006	ISN n ISN m	.24 n.s.	.015 n.s.
Int 6	ISN n, m *df*2(108)	13.0	<.0005	ISN n ISN m	.20 .27	.035 .004

[a] These beliefs contributed to the explanation of variance of intentions when the variance explained by all other variables in the model was controlled for.
[b] "normative belief in approval and expectations by others"; [c] "motivational belief to comply with expectations".

farmers in similar studies (Curtis & DeLacy, 1998; Michel-Guillou & Moser, 2006; Atari et al., 2009). Nevertheless, their findings of normative and motivational beliefs as strong influences on the intentions of their respondents to manage their riparian areas are reflected in the results of this study. While the beliefs items in Fielding's study included the approval by other graziers, government and landcare agencies, not dissimilar to the items in the present study, the intention items in this study have more diverse themes.

7.3.2 Subjective norm composites

The norming belief composites (products beliefs from category n and category m, as described above for attitudinal belief composites) do not reflect the individual contribution of beliefs any longer. The two norming belief composites in this study underwent standard multiple regression analysis as independent variables with intentions as dependent variables (Table 7.8).

Table 7.8

Standard multiple regression analyses with intentions as dependent variable and the indirect subjective norm composites as independent variables

Dependent variable	*Independent variables*	*Variance in DV explained by the model*		*Unique contribution to explanation of variance in DV by the model* [a]		
		%	*P*	*Variable*	β	*P*
Sum of Intentions	ISN 1, 2 *df*2(105)	24.0	< .0005	ISN 1 ISN 2	.48 -	<.0005 n.s.
Int 1	ISN 1, 2 *df*2(111)	13.9	< .0005	ISN 1 ISN 2	.35 -	<.0005 n.s.
Int 2	ISN 1, 2 *df*2(111)	15.4	< .0005	ISN 1 ISN 2	.39 -	<.0005 n.s.
Int 3	ISN 1, 2 *df*2(111)	7.5	.005	ISN 1 ISN 2	.31 -	.001 n.s.
Int 4	ISN 1, 2 *df*2(111)	18.2	< .0005	ISN 1 ISN 2	.43 -	<.0005 n.s.
Int 5	ISN 1, 2 *df*2(110)	3.8	.043	ISN 1 ISN 2	.19 -	.051 n.s.
Int 6	ISN 1, 2 *df*2(110)	13.5	<.0005	ISN 1 ISN 2	.36 -	<.0005 n.s.

[a] These beliefs contributed to the explanation of variance of intentions when the variance explained by all other variables in the model was controlled for.

The results revealed that the variance of all intention items was significantly explained by the models. However, in every case only the composite ISN 1 contributed to the explanation significantly. This was the norming belief composite about approval and expectations by respected others and the motivation to comply. (The individual motivational belief ISN 2m which showed some contribution to the explanation of variance in the sum of intentions and in Int 1 (see Table 7.6) did not retain enough influence as part of the composite ISN 2.)

Study 1 did not find this result with the retired farmers who did not admit to being influenced by their neighbours' and friends' opinions. Their responses seemed to preserve their autonomy. However, their remarks about farmers always doing the best for their land, did indicate that they must know something about what everybody is doing in regard to land management practices. The sum of ISN composites which constitutes the construct of indirect subjective norms will be assessed as predictor of intentions later in this chapter.

7.4 Perceived behaviour control beliefs as predictors of intentions

The TPB questionnaire included eight perceived behaviour control beliefs. In this section these beliefs, the control belief categories (IPBC c, beliefs in the power of the controls, and IPBC p, beliefs in the power of these controls), and the control belief composites underwent standard multiple regression analysis to assess them as predictors of intentions. The results of the analysis with the eight individual control beliefs are listed in Table 7.9.

Table 7.9

Significant results of standard multiple regression analyses with intentions as the dependent variable and the eight control beliefs as the independent variables

Dependent variable	*Independent variable*	*Variance in DV explained by the model*		*Unique contribution to explanation of variance in DV by the model* [a]		
		%	*P*	*Variable*	*β*	*P*
Sum of Intentions	IPBC beliefs *df*8(100)	38.5	< .0005	IPBC 2c IPBC 3p	.37 .47	.003 < .0005
Int 1	IPBC beliefs *df*8(106)	20.0	< .0005	IPBC 3p	.40	< .0005
Int 2	IPBC beliefs *df*8(106)	22.4	< .0005	IPBC 3p	.30	.003
Int 3	IPBC beliefs *df*8(106)	17.4	< .0005	IPBC 3p	.35	.001
Int 4	IPBC beliefs *df*8(106)	11.3	.007[b]	-	-	n.s.
Int 5	IPBC beliefs *df*8(105)	12.7	.004	IPBC 3p	.31	.004
Int 6	IPBC beliefs *df*8(104)	27.5	< .0005	IPBC 2c IPBC 3p	.37 .39	.004 < .0005

[a] These beliefs contributed to the explanation of variance of intentions when the variance explained by all other variables in the model was controlled for.
[b] Significance not retained with Bonferroni adjustment.

The statistical model with the set of eight control belief variables significantly explained 38.5% of variance in the sum of intentions. IPBC 2c and IPBC 3p were found to be unique contributors (Table 7.9). It meant that stronger intentions can be predicted when landowners believe they could afford to maintain a riparian forest (IPBC 2c), and also, more importantly (according to the β values) to lose 10m of land for a streamside forest (IPBC 3p).

Except for Int 4, the variance in all individual intentions was explained by the statistical model with the control beliefs as independent variables. The control belief

ICPC 3p contributed significantly to this explanation in all cases, and IPBC 2c added to the explanation of Int 6.

Landowners believed losing a 10m strip of creek side land to riparian forest (IPBC 3p) would have the least impact as an impediment to their intentions to maintain riparian forest. This belief significantly explained the intention to work with government agencies (Int 1), having streamside forests on their list of priorities (Int 2), do something about the creek sides if they need improvement (Int 3), plant a streamside forest this year if there was a need (Int 5), and of planning to maintain their streamside forest (Int 6). Curiously, the explanation of variance in the intention to donate time to work with land care agencies to maintain their riparian forest (Int 4) by the control beliefs was not confirmed after Bonferroni adjustment was applied. However, Int 6 was significantly explained by IPBC 2c, the belief that one could afford the maintenance of their streamside forest. It is a logical step from this belief to actually have the intention to maintain the area.

The results confirm reports in the literature (with graziers) of finding affordability of costs and time as salient control factors that negatively influence the formation of intentions to maintain riparian areas (Fielding et al., 2005), and from adoption of recommended riparian maintenance practices (Curtis & Robertson, 2003).

The control beliefs that specifically address landowners' ability to afford to pay for the planting (not maintaining) of riparian forest (IPBC 1c and 1p), and beliefs that environmental rules and regulations are not too restrictive (IPBC 4c and 4p) did not influence the formation of intentions in this study. This result is not supporting the finding from Study 1 where these themes were being voiced as strong impediments.

7.4.1 Perceived control belief categories

There are two control belief categories. IPBC c represents the strength of the control or impediment (sum of IPBC 1c to 4c) and IPBC p represents the power of the control or impediment (sum of IPBC 1p to 4p). The categories were entered together into a standard multiple regression analysis and the statistical model significantly explained the variance in all intentions (Table 7.10). However, beliefs in the power of the impediment (IPBC p) was revealed as the only unique contributor to the explanation of variance in the sum of intentions, with the exception of Int 5 which was explained only by beliefs in the strength of the impediment (IPBC c).

The intention of planting a streamside forest this year (Int 5) is explained significantly by not believing in the strength of controls (IPBC c). There are no impediments strong enough to prevent this intention. The only individual belief in control strength to contribute significantly to the explanation of variance in the sum of intentions and Int 6 was the belief that one could afford to maintain streamside forest (IPBC 2c). This would be the most important belief in the c category. Thus believing that one can afford to plant a streamside forest would be a decisive item in explaining the influence on Int 5.

Intentions of working with government and landcare agencies (Int1 and 4), of improving creek sides (Int 3), planning to maintain riparian forest (Int 6) and having them on a list of priorities (Int 2) were explained by not believing that there are impediments (such as cost, affordability, loosing streamside land or environmental rules) powerful enough to interfere with these intentions. Landowners with strong intentions

Table 7.10

Significant results of standard multiple regression analyses with intentions as the dependent variable and the perceived control belief categories as the independent variables

Dependent variable	*Independent variables*	*Variance in DV explained by the model*		*Unique contribution to explanation of variance in DV by the model* [a]		
		%	*P*	*Variable*	β	*P*
Sum of Intentions	IPBC c[b], p [c] *df*2(104)	24.4	< .0005	IPBC c IPBC p	- .43	n.s. <.0005
Int 1	IPBC c, p *df*2(107)	11.7	< .0005	IPBC c IPBC p	- .33	n.s .003
Int 2	IPBC c, p *df*2(107)	15.3	< .0005	IPBC c IPBC p	- .28	n.s. .01
Int 3	IPBC c, p *df*2(107)	17.4	<.0005	IPBC c IPBC p	- .46	n.s. <.0005
Int 4	IPBC c, p *df*2(107)	9.2	.002	IPBC c IPBC p	- .31	n.s. .006
Int 5	IPBC c, p *df*2(107)	6.6	.009	IPBC c IPBC p	.24 -	.037 n.s.
Int 6	IPBC c, p *df*2(107)	16.3	<.0005	IPBC c IPBC p	- .40	n.s. <.0005

[a] These beliefs contributed to the explanation of variance of intentions when the variance explained by all other variables in the model was controlled for.
[b] "Beliefs in the strength of controls"; [c] "beliefs in the power of these controls".

to maintain their riparian forest may believe in the presence of these impediments but not that they cannot be overcome. The only significant individual belief in the power of a control found to contribute significantly to the explanation of variance in intentions was the belief that one could afford to let go of a 10m strip of land for the streamside forest (IPBC 3p). This would be the most important belief in the p category.

Landowners who believed they can lose the land can be predicted to have strong intentions of the kind found to be significantly explained in these models.

7.4.2 Perceived control belief composites

The perceived control belief composites (products beliefs from category c and category p, as described above for attitudinal belief composites) do not reflect the individual contribution of beliefs or belief categories any longer. The four perceived behaviour control belief composites underwent multiple regression analysis as independent variables with intentions as the dependent variable.

Table 7.11

Significant results of standard multiple regression analyses with intentions as the dependent variables and the perceived control belief composites as the independent variables

Dependent variable	*Independent variables*	*Variance in DV explained by the model*		*Unique contribution to explanation of variance in DV by the model* [a]		
		%	*P*	*Variable*	β	*P*
Sum of Intentions	IPBC 1,2,3,4 *df*4(103)	23.2	< .0005	IPBC 2 IPBC 3	.33 .24	.002 .008
Int 1	IPBC 1,2,3,4 *df*4(108)	8.3	.009	IPBC 3	.20	.034[b]
Int 2	IPBC 1,2,3,4 *df*4(108)	12.8	.001	IPBC 4	.22	.021[b]
Int 3	IPBC 1,2,3,4 *df*4(108)	17.7	.005	IPBC 2 IPBC 3	.33 .23	.002 .013
Int 4	IPBC 1,2,3,4 *df*4(108)	10.3	.003	IPBC 2	.34	.002
Int 5	IPBC 1,2,3,4 *df*4(108)	8.1	.011	IPBC 2 IPBC 3	.26 .20	.021[b] .039[b]
Int 6	IPBC 1,2,3,4 *df*4(107)	13.9	<.0005	IPBC 2 IPBC 3	.31 .21	.005 .028[b]

[a] These beliefs contributed to the explanation of variance of intentions when the variance explained by all other variables in the model was controlled for. [b] Significance lost after Bonferroni adjustment.

The models with the four control belief composites explained 23.2% of variance in the sum of intentions (Table 7.11). Only two composites showed significant predictive strength (IPBC 2 and 3) which reflects the results of IPBC 2c and IPBC 3p as significant predictors (Table 7.5). It meant that strong intentions could be expected for landowners who believed they can afford to maintain riparian forest and to lose 10m of streamside. These IPBC variables had been selected as the most representative of indirect controls in Chapter 6 on the basis of their correlation with intentions (see Table 6.31).

While the statistical models explained the variance of all six individual intentions, unique contributions were only found for Int 3, Int 4 and Int 6. These contributions were from control composites IPBC 2 and IPBC 3. It meant that landowners who believed that they could afford to maintain their streamside forest (IPBC 2), and who believed that they could lose 10m of land to a streamside forest (IPBC 3), had streamside forests on their list of priorities (Int 3), intended to donate time to work with landcare agencies (Int 4), and were planning to maintain their streamside forest (Int 6).

This concludes the investigation of individual beliefs, belief categories and individual belief composites as predictors of intentions. The pathway of these direct predictive relationships of these belief-based measures and intentions is illustrated in Figure 7.4.

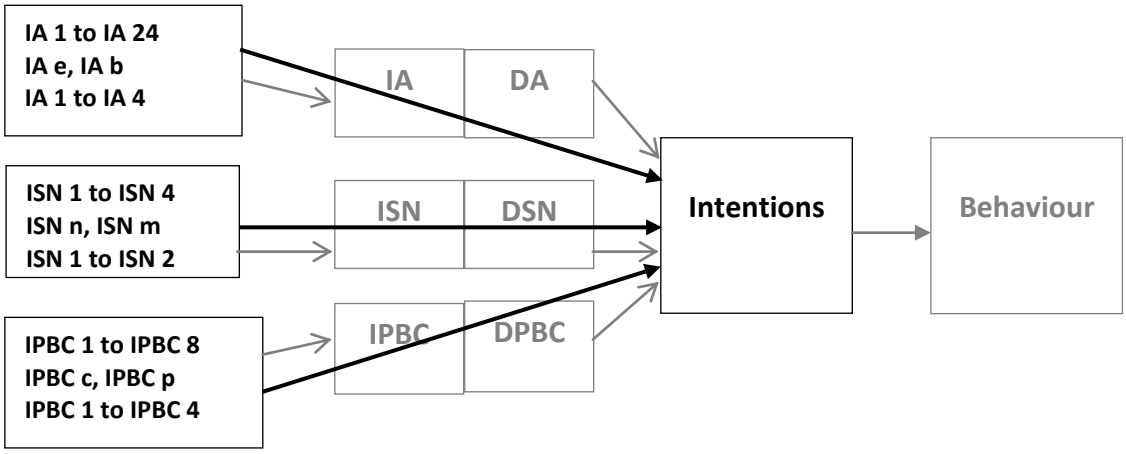


Figure 7.2 Diagram of the TPB model showing the belief composites and the pathway of the predictive relationship with intentions investigated in this section.
(The other constructs of the TPB model are shown in grey.

7.5 Indirect TPB measures as predictors of intentions

The indirect measures of attitudes, subjective norms and perceived behavior controls constitute the sum of composites. Thus, the information about their contribution to the explanation of variance in intentions has already been described. Nevertheless, insight would be gained into the importance of each measure when assessed together as predictors of intentions. Therefore standard multiple regression analysis was performed with the indirect measures (IA, ISN, IPBC) as independent variables. The results are listed in Table 7.12.

As expected the indirect measures did not add new information to the explanation of variance in intentions. Nevertheless, the combined set of indirect measures in the model explained a higher percentage of variance in the sum of intentions (45.9%) than the individual composites (Table 7.12). The least well predicted

was the intention of planning to plant a streamside forest (Int 5). The results reflect those obtained with the belief composites.

Table 7.12

Significant results of standard multiple regression analyses to assess the indirect measures as predictors of intentions to engage in riparian forest management

Dependent variable	*Independent variable*	*Variance in DV explained by the model*		*Unique contribution to explanation of variance in DV by the model* [a]		
		%	*P*	*Variable*	β	*P*
Sum of Intentions	IA, ISN, IPBC *df*3(99)	45.9	< .0005	IA ISN IPBC	.42 .20 .26	<.005 .014 .002
Int 1	IA, ISN, IPBC *df*3(99)	21.5	< .0005	IA ISN IPBC	.24 .22 .18	.025 .025 n.s.
Int 2	IA, ISN, IPBC *df*3(99)	35.0	< .0005	IA ISN IPBC	.44 .14 .16	<.0005 n.s. n.s.
Int 3	IA, ISN, IPBC *df*3(99)	26.3	< .0005	IA ISN IPBC	.36 -.09 .30	.001 n.s. .003
Int 4	IA, ISN, IPBC *df*3(99)	24.1	<.0005	IA ISN IPBC	.25 .27 .15	.017 .006 n.s.
Int 5	IA, ISN, IPBC *df*3(99)	9.0	.006	IA ISN IPBC	- - -	n.s. n.s. n.s.
Int 6	IA, ISN, IPBC *df*3(99)	23.7	< .0005	IA ISN IPBC	.20 .20 .26	.051 .036 .009

[a] These beliefs contributed to the explanation of variance of intentions when the variance explained by all other variables in the model was controlled for.

Attitudinal beliefs (IA) were the most important contributors in all models except with Int 6 where the perceived controls (IPBC) were the most important ones.

This indicated that when landowners plan to maintain their streamside forests (Int 6) their attitudinal and norming beliefs are not as decisive as their beliefs that there are no impediments that cannot be overcome. This influence was shown to be largely based on not believing in the power of the impediments (IPBC p) (see Table 7.10). In contrast, indirect perceived behaviour controls (IPBC) were not important for landowners' intentions to work with government agencies or landcare agencies (Int 1, Int 4), having streamside forest on their list of priorities (Int 2) and planning to plant a streamside forest (Int 5).

Landowners were practicing norming behaviour (ISN) when it came to the intention of donating time to work with landcare agencies (Int 4) and to planning to maintain streamside forest (Int 6). The contribution of ISN was unique and significant in both cases.

The loss of predictive strength of some indirect measures for some intention items compared with individual intention items is most likely due to shared variance that was statistically removed when the three variables were included in one model.

This section investigated the predictive relationships between the indirect belief-based measures (sum of composites) of attitudes, subjective norms and perceived behaviour controls and the intentions. The items and the pathways explored are illustrated in Figure 7.3.

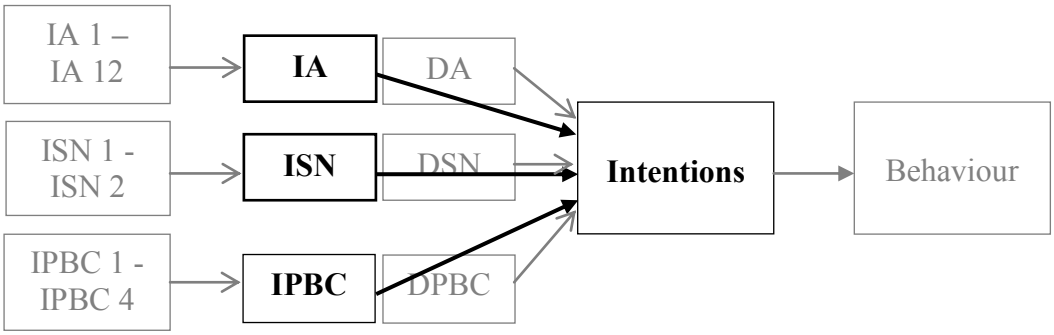


Figure 7.3 Diagram of the TPB model showing the indirect measures and the pathway of their direct predictive relationship with intentions investigated in this section. (The other constructs of the TPB model are shown in grey.)

This concludes the section on beliefs, belief categories and belief composites, and the indirect measures of attitudes, subjective norms and perceived behaviour controls as direct predictors of intentions. The investigations constituted analyses of relationships that are outside the TPB, since only direct measures are considered predictors of intentions in the strict application of the TPB model (see Figure 7.1). The following sections investigate the TPB predictors of direct attitudes, direct subjective norms and direct perceived behaviour controls.

7.6 Direct measures of attitudes, subjective norms and perceived behaviour controls as predictors of intentions in the TPB model

In the model of the TPB the direct measures represent the predictors of intentions (see Figure 7.1). These TPB variables were constructed using the dataset as described in Chapter 6. The direct attitudes (DA) consisted of all available 10 items (DA 1 – DA 10), direct subjective norms (DSN) of two items (DSN 1 and 2), and direct perceived behaviour control (DPBC) of two items (DPBC 1 and 6).

To estimate the proportion of variance in intentions explained by direct measures of attitudes, subjective norms, and perceived behavior controls, standard

multiple regression analyses were performed. The intentions were entered as the dependent variable and the predictors (DA, DSN, and DPBC) as the independent variables.

The normal probability plot of standardized residuals as well as the scatter plot of standardized residuals against standardized predicted values indicated that the assumptions of normality, linearity and homoscedasticity of residuals were met. The Mahalanobis distance did not exceed the critical χ^2 for $df = 3$ (at $p = .001$) of 12.76 for any cases in the data file, indicating that multivariate outliers were not of concern. The high tolerance values for all predictors in the regression model indicated that multicollinearity would not interfere with the interpretation. The results are listed in Table 7.13.

The model summary showed that the three predictor variables (DA, DSN, and DPBC) were able to explain 52% of the variance in intentions (Table 7.13). This is low, compared to the average value of multi-correlations reported in meta-analyses by Ajzen (1991) of 71% but above that reported by Sutton (1998) of 40% - 50% and by Armitage and Conner (2001) of 39%. No research with a land management theme was included in those meta-analyses.

Direct attitudes (DA) made the strongest contribution in explaining the variance in the sum intentions (Table 7.13). The unique contribution of direct perceived behavior control (DPBC) was small but significant while the contribution of direct subjective norms (DSN) did not reach significance. Subjective norms have been reported by other researchers as not being useful predictors of intentions. Ajzen (1991) described results from subjective norms as not following "clearly discernible pattern" (p. 189), and Armitage and Connor (2002) reported that the "subjective norm construct is generally

found to be a weak predictor of intentions…. attributable to poor management and the need for expansion of the normative component" (p. 471.). It has been investigated by other researchers because of its complex nature. Thus, group norms and subjective norms were found to be distinctly different in terms of social identity (Terry & Hogg, 2001; Terry, Hogg, & McKimmie, 2000; Terry et al., 1999), and moral norms found to be valid additional social influences (Beck & Ajzen, 1991; Conner & Armitage, 1998).

Table 7.13

Standard multiple regressions for the six intentions as dependent variables and the direct measures of attitudes, subjective norms and perceived behaviour controls as independent variables

Dependent variable	*Independent variable (predictor)*	*Variance in DV explained by the model*		*Unique contribution to explanation of variance in DV by the model* [a]		
		%	*p*	*Variable*	β	*p*
Sum of intentions	DA, DSN, DPBC df3(102)	.52	<.0005	DA	.61	<.0005
				DSN	.12	n.s.
				DPBC	.15	.035
Int 1	DA, DSN, DPBC df3(104)	.28	<.0005	DA	.47	<.0005
				DSN	.13	n.s.
				DPBC	.05	n.s.
Int 2	DA, DSN, DPBC df3(104)	.30	<.0005	DA	.42	<.0005
				DSN	.10	.n.s
				DPBC	.20	.02
Int 3	DA, DSN, DPBC df3(104)	.25	<.0005	DA	.49	<.0005
				DSN	-.08	n.s.
				DPBC	.12	n.s.
Int 4	DA, DSN, DPBC df3(104)	.27	<.0005	DA	.48	<.0005
				DSN	.09	n.s.
				DPBC	.07	n.s.
Int 5	DA, DSN, DPBC df3(104)	.13	.001	DA	.36	.001
				DSN	.04	n.s.
				DPBC	.03	n.s.
Int 6	DA, DSN, DPBC df3(104)	.35	<.0005	DA	.40	<.0005
				DSN	.21	.015
				DPBC	.19	.024

[a] These beliefs contributed to the explanation of variance of intentions when the variance explained by all other variables in the model was controlled for.

In this study the direct subjective norm measure (DSN) only contributed to the explanation in variance of Int 6 (Table 7.13). The landowners' intention to maintain their streamside forest (Int 6) was influenced by their norming behaviour. The same was found for norming beliefs (ISN) in this study, which validates the direct measure. The norming items obviously did not address norming behaviour that was measureable.

Direct perceived behaviour controls (DPBC) contributed uniquely to the explanation of variance of Int 2 and Int 6 (Table 7.13). Thus, landowners with low perception of impediments were predicted to have streamside forests on their list of priorities (Int 2) and were planning to maintain their streamsides (Int 6). This last intention was also explained by control beliefs (IPBC) in this study.

In summary, the TPB intention predictors were able to explain a substantial proportion of the variance in the sum of intentions to practice good riparian management with direct attitudes. All statistical models were significant. People with positive attitude were very likely to have high intentions to keep a well-managed riparian forest. Planning to maintain their riparian forest was also positively influenced by landowners' norming behaviour and by their low perception of behaviour controls which also predicted having riparian forest on the priority list.

This concludes the assessment of direct TPB constructs as predictors of intentions. The pathways of the predictive relationships that were investigated in this section are visualized in Figure 7.4.

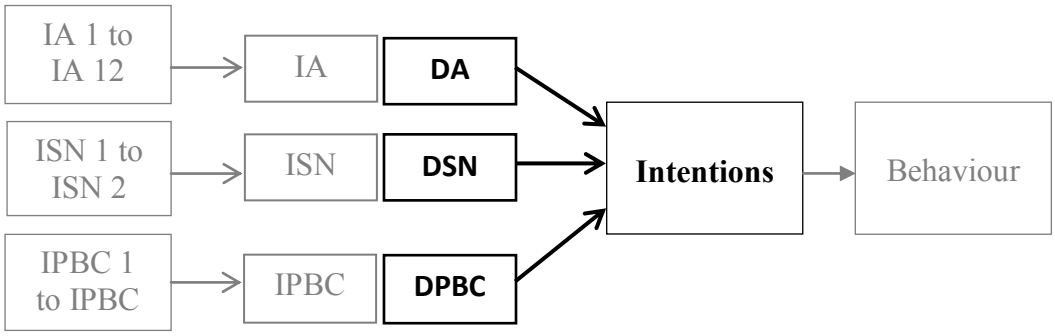


Figure 7.4 Diagram of the TPB model showing the direct measures and the pathway of their predictive relationship with intentions investigated in this section.
(The other constructs of the TPB model are shown in grey.)

7.7 Belief measures as additional predictors of intentions

The indirect measures (belief composites) of attitudes (IA), subjective norms (ISN), and perceived behaviour control (IPBC) were shown to be significant predictors of intentions (Table 7.12). This predictive relationship was assessed directly between the indirect (belief-based) measures and the intentions, bypassing the direct measures which in the TPB model are assumed to incorporate the corresponding belief-based measures. Nevertheless, the examination of beliefs as predictors is not complete without the assessment of their possible contribution to the prediction of intentions to that of direct measures.

Thus the indirect belief-based measures underwent hierarchical multiple regression analysis where the direct constructs of attitudes (DA), subjective norms (DSN), and perceived behaviour control (DPBC) were controlled for in step 1. The corresponding indirect belief-based constructs (IA, ISN, and IPBC) were entered in step 2 (Table 7.14).

Table 7.14

Hierarchical multiple regression analyses to assess the indirect measures of attitudes (IA), subjective norms (ISN), and perceived behaviour controls (IPBC) as predictors of the sum of intentions, when controlling the direct measures (DA, DSN, DPBC)

Step	Predictor	R^2	Adj. R^2	R^2 Change	F	df	Unstand. B	Unstand. S.E.	Stand. β	p	Part^{2a}
1.	DA	.53	.52	.53	37.59	3(99)	.52	.07	.61	.00	.28
	DSN						.36	.22	.12	.10	.01
	DPBC						.36	.17	.15	.04	.02
2.	DA	.56	.53	.03	20.52	6(96)	.41	.10	.48	.00	.07
	DSN						.12	.24	.04	.61	.00
	DPBC						.14	.22	.06	.54	.00
	IA						.01	.01	.07	.52	.00
	ISN						.05	.03	.13	.13	.02
	IPBC						.04	.02	.16	.11	.03

[a] Squared part correlation coefficient x 100 represents the proportion of unique contribution of each variable with any overlap or shared variance partialled out.
Model 1 was significant [$F(3,99) = 37.59$, $p < .0005$]. Model 2 was significant [$F(6,96) = 20.52$, $p < .0005$].

The direct measures in step 1 explained 52% of variance in intentions (Table 7.14). When adding the indirect measures in step 2 direct attitudes remain the largest contributor and the only significant one. However, the β values in step 2 indicate that all direct constructs lost impact as predictors. This is especially evident for direct perceived behaviour control (DPBC) which was a weak but significant contributor in step 1. It means that the contribution of the indirect measures overlapped with that of the direct measures.

The indirect measures (sum of belief composites) explained an additional 3% of variance but none of the indirect measures were significant (Table 7.14). The low values of squared part correlation coefficients indicate a large amount of overlap and shared variance. The independent (belief-based) measures had been found to be significant direct predictors of intentions (see Figure 7.4) and the loss of predictive strength in the variables of independent (belief-based) measures when entered in the

second step shows that they were to a very large extent en encapsulated in the direct measures.

The MRA analysis results showed that the indirect belief-based constructs and the direct measures of attitudes, subjective norms and perceived behaviour controls showed considerable overlap in contributions to explain intentions when the direct measures were controlled for. Only the direct attitudes and one of the subjective norm belief categories of motivations to comply remained as significant predictors.

This concludes the statistical investigation of all TPB constructs of beliefs, belief-based measures and direct measures as predictors of intentions. In the following chapter the same variables will be investigated as predictors of behaviour indicators

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CHAPTER 8.

PREDICTORS OF BEHAVIOUR INDICATORS

8.1 Introduction

The predictors of behaviour in the strict application of the theory of planned behaviour (TPB) are the intentions to perform the behaviour and under certain circumstances the construct of direct perceived behaviour control. Therefore, according to this theoretical model the belief composites or individual beliefs are not considered valid measures for the prediction of behaviour. However, they underpin the direct TPB measures which are the predictors of intentions and through them the behaviour, and thereby provide an insight into the complex relationships between the constructs. Thus, the predictive strength of beliefs on behaviour is affected through the direct constructs. Direct relationships between behaviour indicators and the belief variables should be present, and would give insights about beliefs as predictors that are lost or overshadowed by other components when they become part of the complete TPB model (Ajzen, 1991; Ajzen & Driver 1991; Bamberg, 2003; Hardeman, et al., 2002).

Analyzing the separate beliefs could reveal how much each of the beliefs that constitute the belief composite contributed to this predictive relationship. It is a way to identify the individual beliefs for interventions if one wanted to improve the behavioural outcome (Ajzen, 2001).

This chapter will examine if behaviour indicators are influenced by individual belief variables, the belief categories, the belief composites (products of belief pairs), and the indirect belief-based measures (sums of belief composites) of attitudes,

subjective norms and perceived behaviour controls. Furthermore, the direct measures of these variables as predictors of behaviour indicators will be assessed as predictors of behaviour indicators and their contribution to the explanation of behaviour indicators established.

The behaviour indicators used here are represented by four desirable and four undesirable management practices of riparian forests. As described in Chapter 6, the behaviour indicators, in effect, represented self-report of past behaviour elicited in the survey by several questions about the state of the riparian forest and the use of that area.

Because the behaviour variables were dichotomous (yes/no answers), logistic regression analyses (using SPSS procedure of Binary Logistic according to Pallant, 2005) were employed in the statistical calculations to assess predictive strength of these indicators as the dependent variable. To aid the interpretation the behaviour indicators are listed here.

Behaviour Indicators

Desirable practices (indicators of good practices/ behaviour) (n_{yes} = ticked responses):

1. Crop or cultivate the land more than 10m away from the edge of the waterway. (n_{yes} = 76)
2. Streamsides have more trees and shrubs on them now than ever before. (n_{yes} = 31)
3. Streamsides have newly planted trees on them. (n_{yes} = 30)
4. Streamsides have tree seedlings on them that are left to grow. (n_{yes} = 46)

Undesirable practices (indicators of bad practices/ behaviour):

1. Agricultural crops grow on the land alongside the stream. (n_{yes} = 32)
2. Crop or cultivate the land from the edge of the waterway close enough to turn a tractor around. (n_{yes} = 35)
3. Streamsides had more trees on them some time ago. (n_{yes} = 41)
4. Streamsides are kept clean. (n_{yes} = 50)

8.2 Attitudinal belief-based variables as predictors of behaviour indicators

To assess the attitudinal belief-based measures as predictors of behaviour indicators they underwent logistic regression analyses with each of the eight behaviour indicators separately as the dependent variables. The belief-based measures were two attitudinal belief factors (IA-F1 and IAF2), two attitudinal categories (IA e and IA b), and 12 attitude composites (IA 1 to IA 12). For the measure of indirect attitudes (IA) (the sum of the composites) a one-item variable, the Pearson's product moment correlation coefficient with the behaviour indicator was obtained. Because of the small number of behaviour indicators that were predicted by these belief constructs all significant results are listed in Table 8.1.

The variation in three behaviour indicators was explained by the attitudinal belief constructs (Table 8.1). The only desirable behaviour indicator explained was having newly planted trees on the streamsides. The presence of newly planted trees in riparian forest has been found to be a good indicator of farmers' willingness of adopting recommended management practices (Curtis & Robertson, 2003) and not necessarily based on their understanding of the biophysical functions of trees which makes them so important in good riparian management.

In this study newly planted trees were predicted by attitudinal belief factor IA-F1 and by the evaluative beliefs (Table 8.1). Thus, "understanding environmental importance of riparian forests and willingness to manage riparian forests for the sake of the environment" (IA-F1) and evaluating the attributes of riparian forest as desirable (IA e) significantly influenced the planting of trees. The beliefs that planting trees will lead to the desired outcomes (IA b) such as erosion control, retention of chemicals, etc. did not influence the behaviour indicator. It seems to indicate that when landowners

planted trees they believed that trees are good to have on the streamsides but not that trees actually perform important functions that benefit the environment.

Table 8.1

Significant results of logistic regression analyses with all attitudinal belief–based measures as the independent variables and the behaviour indicators as the dependent variable

Dependent variable (Behaviour indicator)	*Indep. Variables*	*B*	*S.E.*	*Wald*	*df (n)*	*Sig.*	*Exp(B) OR*	*95% C.I.*
				Desirable behaviour indicators				
Newly planted trees 8e	IA-F1[c]	.06	.02	6.37	2(110)	.012	1.06	1.01-1.11
	[χ^2 = 8.07, *df* = 2, *p* = .018[a], 7.1 – 10.5% explained[b]] IA-F1 was a significant predictor, and the model of sufficient adequacy.							
	IA e[d]	.14	.05	7.19	2(105)	.007	1.15	1.04-1.26
	[χ^2 = 10.03, *df* = 2, *p* = .007, 9.1 – 13.5% explained] IA e was a significant predictor, and the model of sufficient adequacy.							
				Undesirable behaviour indicator				
Clean streamsides 8h	IA-F2[e]	-.10	.043	5.45	2(110)	.020	.91	8.32-.98
	[χ^2 = 6.65, *df* = 2, *p* = .036, 5.9 – 7.9% explained] IA-F2 was a significant predictor, and the model of sufficient adequacy.							
	IA 11[f]	-.08	.03	8.64	12(106)	.003	.93	.88-.98
	[χ^2 = 28.27, *df* = 12, *p* = .005, 23.4 – 31.4% explained] IA 11 was a significant predictor, and the model of sufficient adequacy. Bonferroni adjusted.							
Fewer trees now 8b	IA 3[g]	.06	.02	8.20	12(106)	.004	1.06	1.02-1.10
	[χ^2 = 21.21, *df* = 12, *p* = .05, 18.1 – 25.7% explained] IA 3 was a significant predictor, and the model of sufficient adequacy. Bonferroni adjusted.							

[a] Omnibus Test of Model Coefficients. [b]The percentage values refer to the respective Cox & Snell R^2 and Nagelkerke R^2 values in the Model Summary multiplied by 100 which indicate the amount of variation in the dependent variable explained by the model.

[c] "understanding environmental importance of riparian forests and willingness to manage riparian forests for the sake of the environment". [d]Beliefs in the desirability of the outcome. [e] "understanding good riparian management practices". [f] Natural debris in riparian forests is beneficial. [e] Grass alone is not efficient to stabilise streambanks.

This skepticism in the efficacy of one's practices has been clearly demonstrated in a TPB study about recycling behaviour by Castro, Garrido, Reis and Menezes (2009). The participants who did practice recycling questioned the efficacy of their own behaviour mainly because they did not believe that other people practiced it. Therefore, they considered their effort quite futile and did not believe that they could achieve the desired outcome of recycling trash altogether.

The landowners' "understanding of good riparian management practices" (the overarching theme of factor IA-F2) was mainly explained by landowners who did not report to follow the undesirable behaviour indicator of keeping their streamsides clean (negative *B* coefficient) (Table 8.1). The percentage explained was not large (7.1 to 10.5%). However, the finding was confirmed by the much larger percentage of variation explained (23.4 to 32.4%) by the belief composite IA 11 (Table 8.1), which is about beliefs in the beneficial nature of and the need for debris in riparian areas. These predictive relationships are logical extensions of the premises they are based on.

Study 1 found that retired farmers were concerned about natural debris such as fallen trees, undergrowth and stones that in their opinion impede the flow of a healthy creek and cause erosion, and needed to be "cleaned" (Flick et al., 2010). For this reason a question about this practice was included in the present main survey study. It seems that the landowners in the main study did not misunderstand this behaviour indicator. In fact, the idea of keeping the streamsides clean could mean different actions, some of benefit (e.g., removal of trash, weed control) and most others detrimental to riparian forest (e.g., removal of natural debris such as branches and fallen trees, or rocks). The present finding indicates that a majority of landowners who had planted trees recognized the cleaning of streamsides as an undesirable practice.

The only other behaviour indicator of having had more trees on the streamsides some time ago was predicted by the belief composite that grass is not sufficient to stabilize stream banks (IA 3) (Table 8.1). The percentage explained (7.1 to 10.5%) was small but significant. The relationship between the belief and the behaviour indicator is not clear. However, when considering the fact that the landowners who do not believe in grass as sufficient ground cover on the streamsides and who report trees loss over time were very likely aware of the situation and possibly were doing something about it. The loss of trees in the riparian forest also does not have to be due to the landowners' undesirable management practices. It may have resulted from natural tree fall (i.e. cyclone damage by "Larry" six months earlier) or erosion problems not due to the landowner's inaction. Grass on the streamsides is also not totally undesirable. It has been found to actually slow down flash floods to a certain degree but not to prevent erosion in the long run (McKerkow, Prosser, Grayson & Heiner 2004a; McKerkow et al., 2004b). Landowners may have observed the water/ soil retentive action of grass in heavy rain and therefore did not want to dismiss grass as insufficient altogether.

The sum of the attitude composites (IA) represents the TPB measure of the indirect attitudes. As it consisted of one item only, it did not undergo logistic regression analysis but Pearson product-moment correlation coefficients was established instead. There was a small positive correlation between IA and newly planted trees on the streamsides [$r = .21$, $n = 106$, $p = .03$] indicating that positive belief-based attitudes are associated with planting trees. None of the four individual attitude composites (the constituents of IA) was revealed as a significant predictor of this behaviour indicator. However, the finding that understanding of environmental importance of riparian forests and willingness to manage riparian forests for the sake of the environment (factor 1 of attitudinal beliefs) and the beliefs in the desirability of the outcome (IA e)

significantly predicted newly planted trees (see Table 8.1) indicated that these are the most influential factors in the relationship.

8.3 Norming belief-based variables as predictors of behaviour indicators

The four individual norming beliefs, the two norming categories (ISN n, normative beliefs in the approval and expectation by others, and ISN m, the motivation to comply), and the two norming composites underwent logistic regression analyses as the independent variables. For the sum of the composites (ISN) a one-item variable representing the measure of indirect subjective norms, a Pearson's product moment coefficient was obtained with the behaviour indicators. Each behaviour indicator was entered as the dependent variable in a separate analysis. The analyses yielded no significant results.

These belief-based variables of subjective norms did not predict any behaviour indicators in logistic regression analyses. However, the sum of the measure of subjective norms (ISN) revealed a small positive correlation with the behaviour indicator of fewer trees on the streamside [$r = .19$, $n = 114$, $p = .04$]. There seems to be no explanation for this association, but as discussed before the loss of trees does not necessarily mean negligence or bad riparian management by the landowner. Instead natural tree fall is quite common and may not be detrimental to the vegetation cover. It may also indicate that the landowner is aware of the situation which means they pay attention to the area. No individual subjective norm composite was revealed as a significant predictor of this behaviour indicator.

8.4 Perceived behaviour control belief-based variables as predictors of behaviour indicators

Eight perceived behaviour controls were included in the TPB questionnaire. Thus, there were two control belief categories (IPBC c, belief in the strength of the impediment, and IPBC p, belief in the power of the impediment) and four control belief composites (products of respective IPBC c and IPBC p items yielding IPBC 1 to IPBC 4). These measures underwent logistic regression analysis to assess them as predictors of

behaviour indicators. The significant results are listed in Table 8.2. To obtain an indication of the relationship between ISN (the sum of the composites), a one-item variable representing the measure of indirect subjective norms and each of the behaviour indicators the Pearson product-moment correlation coefficient was obtained.

Table 8.2

Significant results of logistic regression analyses with perceived behaviour control belief–based measures as the independent variables and the behaviour indicators as the dependent variable

Dependent variable (Behaviour indicator)	*Indep. Variables*	*B*	*S.E.*	*Wald*	*df (n)*	*Sig.*	*Exp(B) OR*	*95% C.I.*
				Undesirable behaviour indicator				
Fewer trees now 8b	IPBC 3p[c]	.40	.13	9.65	8(111)	.002	1.49	1.16-1.92
	[χ^2 = 22.46, *df* = 8, *p* = .004[a], 18.3 – 26.0% explained[b]] IPBC 3p was a significant predictor. The model was of sufficient adequacy. Bonferroni adjusted.							
	IPBC c[d]	-.17	.06	7.03	2(110)	.008	.85	.75-.96
	IPBC p[e]	-.18	.06	9.63		.002	1.19	1.07-1.34
	[χ^2 = 12.54, *df* = 2, *p* = .002, 10.8 – 15.3% explained] IPBC c and p were significant predictors. The model was of sufficient adequacy.							

[a] Omnibus Test of Model Coefficients. [b] The percentage values refer to the respective Cox & Snell R^2 and Nagelkerke R^2 values in the Model Summary multiplied by 100 which indicate the amount of variation in the dependent variable explained by the model.
[c] Could afford to lose 10m of land to a streamsides forest. [d] Belief in the strength of the impediments.
[e] Belief in the power of the impediments.

The only behaviour indicator predicted by control belief variables was that streamsides had more trees on them some time ago (i.e. fewer trees now) (Table 8.2). The belief that losing a 10m strip of land for the streamside forest (IPBC 3p) was not an impediment explained a substantial amount (18.3 – 26.0%) of the variation in having fewer trees now. The logical connection between these variables may be that the streamside land is available but a streamside forest has not been established. It is also possible that these landowners always have a well-established streamside forest and a

few trees less was no bad thing, or they had recently suffered a loss of trees due to natural causes. Six months before the survey was undertaken a cyclone ("Larry" in March 2006) had actually devastated some forest in the study area.

The result of the analysis with both belief categories IPBC c and p indicated no fewer trees on the creek sides (negative B coefficient). Why landowners who did not believe in impediments report no tree loss on their streamsides is not clear. But it does reveal that the control beliefs in the strength of the impediment (IPBC c) contributed to this result as well as the control beliefs in the power of the impediment (IPBC p). The presence of control beliefs seems to have some influence on behaviour indicators that include trees on the streamside. Perhaps landowners do not remember the density of trees on their streamsides with equal clarity and the individual reports are not comparable.

The individual control belief composites (IPBC 1 to 4) were not predictors of behaviour indicators. The sum of perceived control composites (IPBC) and the behaviour indicators were investigated using Pearson product-moment correlation coefficients. No association was found between the variables.

This concludes the investigation of individual belief-based measures of attitudes, subjective norms and perceived behaviour controls as predictors of behaviour. Table 8.3 is a list of the belief-based variables found to have significant associations with behaviour indicators.

Table 8.3

Behaviour indicators predicted by or significantly correlated with belief-based measures in the TPB study

Behaviour indicator	*Belief-based variable*
Streamsides have newly planted trees on them	IA - Factor 1 (Understanding environmental importance of riparian forests and willingness to manage riparian forests for the sake of the environment.) IA e (Beliefs in the desirability of the outcome.) IA (Positive attitudinal beliefs.)
Streamsides had more trees on them some time ago	IA 3 (Grass alone is not efficient in holding banks together.) ISN (Strong norming behaviour.) IPBC 3p (Can afford to lose 10m strip of land for a streamside forest.) IPBC c and IPBC p (Believing in the strength and the power of impediments.)
Streamsides are kept clean	IA – Factor 2 (Understanding good riparian management practices.) IA 11 (Natural debris benefits the riparian forest.)

8.5 Direct measures as predictors of behaviour indicators

The questions to be explored in this section concern the prediction of behaviour indicators by the direct measures of DA, DSN and DPBC and their individual components when bypassing the TPB construct of intentions: Are direct attitudes, subjective norms and perceived behaviour controls directly predictive of behaviour indicators? Are individual DPBC items significant predictors of behaviour indicators on their own?

Chapter 6 described the selection of the TPB constructs DA, DSN and DPBC. The TPB construct of DA was composed of all available direct attitude items (10), and DSN of two items. However, the DPBC construct for the TPB model included only two items (DPBC 1, 6) of the available eight items. In this section all eight DPBC will be analysed.

The TPB model makes provisions for the construct of DPBC to bypass intentions and become the sole decisive predictor of behaviour. The circumstances of this occurring are fulfilled when impediments preventing the behaviour are out of the control of the person and become an actual behaviour control not a perceived behaviour control. An example in this research study would be the actual lack of money or technical expertise to manage riparian forests. The eight DPBC items included in this study will be investigated to establish if any fulfill the requirement as an actual behaviour control.

8.5.1 Relationships between the direct measures of DA, DSN, DPBC and behaviour indicators

The set of three direct measures of attitudes (DA), subjective norms (DSN) and perceived behaviour controls (DPBC) underwent logistic regression analysis (forced entry method) as the independent variables and the behaviour indicators entered one at a time as the dependent variable (Table 8.4). The analyses revealed that only one behaviour indicator was explained by the three constructs (Table 8.4). The statistical model was significant and explained 8.2 to 12.3% of the behaviour indicator of having newly planted trees on the streamsides. However, DA was the only significant predictor (Table 8.4). Landowners had newly planted trees when they had positive attitudes (DA)

toward riparian forests regardless of their subjective norms (DSN) and their perception of impediments (DPBC).

Table 8.4

Logistic regression analyses with direct measures in a set as the independent variable and the behaviour indicator entered as the dependent variable

Direct measures	*B*	*SE*	*Wald*	*df (n)*	*Sig.*	*Exp(B) OR*	*95% CI*
Streamsides have newly planted trees on them							
DA	.09	.03	7.93	3(108)	.01[b]	1.10	1.03-1.17
DSN	-.07	.09	.50		.48	.94	.78-1.12
DPBC1,6	-.03	.08	.19		.67	.97	.84-1.12
[χ^2 = 9.24, *df* = 3, *p* = .03[a], 8.2 to 12.3% explained[b]]							
Analysis with DPBCsum8 did not change the result.							

[a]Omnibus Test of Model Coefficients. [b]The percentage values refer to the respective Cox & Snell R^2 and Nagelkerke R^2 values in the Model Summary multiplied by 100 which indicate the amount of variation in the dependent variable explained by the model. [b] Bonferroni adjusted.

8.5.2 Relationships between the individual direct measures and behaviour indicators

The Pearson product-moment correlation coefficients for the individual direct measure (DA, DSN, and DPBC) and the behaviour indicators have already been reported and described in Chapter 6. Here, the main findings are shown (Table 8.5) and briefly described again to complete the picture of intention - direct measure associations.

DA was significantly correlated with three behaviour indicators (Table 8.5): Landowners who have very positive attitudes were more likely to have newly planted trees on the streamsides, leave seedlings on the banks to grow, and not grow crops on the streamsides (negative coefficient). It indicates that positive attitudes predispose the landowner to actively manage the riparian forests on their property.

Table 8.5

Significant results of Pearson product-moment correlation coefficients with direct measures as the independent variables and the behaviour indicators as the dependent variable

Behaviour indicator	*Belief-based variables*	*r*	*n*	*p*
Streamsides have newly planted trees on them.	DA	.28	111	.003
Streamsides have seedlings left to grow.	DA	.19	111	.04
	DSN	.19	118	.04
Agricultural crops grown alongside the stream.	DA	-.26	111	.005
Streamsides had more trees on them some time ago.	DPBC 3	-.18	123	.05
	DPBC 4	-.24	120	.01
Streamsides have more trees and shrubs on them now than ever before.	DPBC 4	.22	120	.02

The construct of DSN was an important influence in logistic regression with DA and DPBC. However, Pearson product-moment coefficient revealed that landowners with strong norming behaviour were more likely to leave seedlings to grow on the streamsides (Table 8.5). While there could be a logical connection, that is, landowners see others leaving tree seedlings and then do the same, it is more likely that no norming behaviour is involved and the finding is due to other factors.

The influence of the construct of DPBC was also not important in the prediction of behaviour indicators when entered together with DA and DSN in logistic regression analyses. However, this construct included only DPBC 1 and 6 (selected on the basis of their correlation with intentions, see Chapter 6). When Pearson product-moment correlation coefficients were determined for all eight direct control items and behaviour indicators, two significant associations were found with DPBC items not included in the

TPB construct: When landowners found it patronising to be told by other people what to do with their riparian forest (DPBC 3), and when they did not need technical help to bring their riparian forest up to scratch (DPBC 4), they were less likely to have fewer trees now on the streamsides than some time ago. For DPBC 4 this relationship was confirmed by the significant positive correlation with the behaviour indictor of having more trees now than ever before.

It indicated that control items that predicted the behaviour indicator did not focus on impediments to do with the cost of riparian management but more on confidence and pride as managers of riparian forests (DPBC 3,) and having the technical means for the job (DPBC 4). Thus, the landowners who were more likely to report no change in number of trees on the streamsides over time actually seemed to be confident about what to do with their streamside forests (at least they found it patronising of other people telling them what to do), and they claimed not to need technical assistance.

8.6 Intentions as predictors of behaviour indicators

This section will report on the statistical analyses that investigated the TPB construct most proximal to the behaviour construct, the intentions. The other potentially proximal construct is that of direct perceived behaviour controls which can become actual controls when the control factor is actually insurmountable. In that situation the perceived behaviour control becomes a direct predictor of behaviour in the TPB.

The questions to be explored are: Are relationships of intentions with any behaviour indicator predictive? What are the relationships between the individual

intentions and behaviour indicators? Is there an actual behaviour control that is insurmountable?

8.6.1 Relationships between intentions and behaviour indicators

To aid the interpretation of the results the six intention items are listed here again. The frequency of responses in the survey sample of 123 landowners is added to each item.

The intentions in the TPB model

Int 1. If Government agencies contacted me, I would work with them on planting or maintaining my streamside forests. (n = 119)

Int 2. Streamside forests are on my list of priorities. (n = 121)

Int 3. If my creek sides needed improvement, I would do something about the streamside forest. (n = 121)

Int 4. Streamside landowners like me would donate their time to work with Land Care agencies to maintain my streamside forest if there was a need. (n = 121)

Int 5. I will plant streamside forests on my waterways this year if there is a need. (n = 117)

Int 6. I am planning to maintain my streamside forest. (n = 116)

To obtain an indication of the relationship between the sum of intentions and each of the behaviour indicators the Pearson product-moment correlation coefficients were obtained. The sum of intentions was found to be significantly correlated with the behaviour indicator of newly planted trees on the streamsides (Table 8.6). Nevertheless, the correlations between this behaviour indicator and the individual intention items found that Int 1, 2, 5, and 6 showed significant Pearson's product-moment correlation coefficients (Table 8.6). It indicated that when landowners had strong intentions to manage their riparian forests they were significantly more likely to

report newly planted trees in there. This was the case for the specific intention of working with government agencies on planting and maintaining their streamside forests (Int1), of having streamside forests on their list of priorities (Int 2), of planting a forest on their waterways this year if there was a need (Int 5) and of maintaining their streamside forest (Int 6). The landowners had probably planted these trees as part of their riparian forest management. Past behaviour has been found to be a good indicator of future behaviour (Ajzen, 2002b) thus the landowner is likely to plant trees again. Planting trees and shrubs has been used as an indicator of adoption of recommended management practice by Curtis and Robertson (2003) in the Gouldburn Broken catchment in Victoria.

The sum of intentions was also significantly correlated with the behaviour indicator of not turning the tractor around too close to the waterway (Table 8.6). This was based on the significant correlation with Int 5 (Table 8.6). The intention to plant a streamside forest (Int 5) was also confirmed as a predictor of the behaviour indicator in a logistic regression analysis [B = -.53, SE = .16, df = 6 (111), p = .001]. The statistical model explained 16.9 to 24.5% of variation. No other intention item was significant in this regression model. Landowners were most likely aware of the detrimental impact of compaction of the soil on the stream banks.

Table 8.6

Significant Pearson product moment correlation coefficients between intention variables and behaviour indicators

Behaviour indicator	*Intention variable*	*r*	*n*	*p*
Streamsides have newly planted trees on them.	Sum of Intentions	.31	111	.001
	Int 1	.22	119	.02
	Int 2	.31	121	.001
	Int 5	.33	117	<.001
	Int 6	.25	116	.006
Crop or cultivate the land from the edge of the waterway close enough to turn a tractor around.	Sum of Intentions	-.19	111	.04
	Int 1	.21	119	.02
	Int 2	.18	121	.05
	Int 5	-.32	117	.001
Streamsides had more trees on them some time ago.	Sum of Intention	.21	111	.03
	Int 1	.21	119	.02
	Int 2	18	121	.05
Streamsides have more trees and shrubs on them now than ever before.	Int 1	-.20	119	.03
Crop or cultivate the land more than 10m away from the edge of the waterway.	Int 5	.19	117	.04

The sum of intentions was also associated with the undesirable behaviour indicator of fewer trees on the streamside (Table 8.6). This was based on the significant association of Int 1 and 2 with the behaviour indicator (Table 8.6) representing the intention to work with government agencies and having trees on the priority list. It indicates the logical assumption that landowners who are aware of tree loss in their riparian forest have good intentions to remedy the situation. This explanation is confirmed by the negative correlation between Int 1 and reporting more trees and shrubs on the streamsides now than ever before (Table 8.6).

Significant Pearson's product-moment correlation coefficient was also found for the desirable behaviour indicator of cultivating 10m from the edge of the waterway and Int 5 (Table 8.6). Landowners who intend to plant a streamside forest this year if there was a need are already not using the area for growing crops. It indicates that their intention to plant a forest there is most likely genuine and also that they are probably aware of the detrimental impact of agricultural use of riparian areas.

This concludes the results of relationships between intentions and behaviour indicators in the study.

8.7 Direct perceived behaviour controls as moderators of behaviour indicators

As already mentioned, in the model of the theory of planned behaviour the direct perceived behaviour controls can in some circumstances by-pass the intentions and become predictors of behaviour (see Figure 8.1). When the impediments are actually present and are insurmountable, the perceived controls become actual behaviour controls. In Ajzen's words:

> "In the TPB, actual behavioural control (ABC) moderates the effect of intentions on behaviour. An essential prerequisite for assessing a person's ABC is a good understanding of the various internal factors (skills, knowledge, physical stamina, intelligence, etc.) and external factors (legal barriers, money, equipment, cooperation by others, etc.) that are needed to perform the behaviour or that can interfere with its performance; as well as a way to assess the extent to which the person has or can obtain the requisite resources and overcome potential barriers. Because it is usually much more

> difficult to measure actual behavioural control than perceived behavioural control (PBC), most studies rely on PBC as a proxy for ABC." (Ajzen, 2002a).

In this section the relative importance of direct perceived behaviour control variables and intention variables in predictions of behaviour indicators will be examined using logistic regression analyses.

To gain an insight into the relative importance of intentions and direct perceived behaviour control that were revealed as predictors of the same behaviour indicators in the previous section, the questions to be explored are: What is the relative importance of intentions and direct perceived behaviour controls in the prediction of these behaviour indicators? Are there any specific items of direct perceived behaviour control and intentions that are stronger predictors than others? Is there evidence of an actual perceived behaviour control?

To aid the interpretation of the results the eight direct perceived behaviour control items (DPBC) are listed here. The frequency of responses in the survey sample of 123 landowners is added to each item.

Direct perceived behaviour control item in the TPB questionnaire

DPBC 1. I can maintain a streamside forest on my land even if I am not compensated for it. (*n* = 120)

DPBC 2. I know how to take care of my streamside forest. (*n* = 120)

DPBC 3. It is patronising of other people telling landowners what to do with their streamside forests. (*n* = 123)

DPBC 4. If my streamside forests needed to be brought up to scratch I would not need technical help. (*n* = 120)

DPBC 5. All landowners can take care of their streamside forests. (*n* = 121)

DPBC 6. It is extremely easy for me to maintain good streamside forest. (*n* = 121)

DPBC 7. It is in the hands of the landowners like me to control the water quality in the waterways. (*n* = 121)

DPBC 8. Financial help would not be necessary to improve everybody's streamside forest. (*n* = 121)

The two direct control items constituting the DPBC construct in the TPB model (DPBC1 and 6), correlated with intentions (see Chapter 6). The association with intentions meant that landowners who found the cost of maintenance no impediment (DPBC 1) and who found it easy to maintain a good streamside forest (DPBC 6) were the ones with the strongest intentions. However, in logistic regression analysis with behaviour indicators as dependent variables these intentions were not found to be predictors.

In this section all eight direct perceived behaviour control items were investigated. Logistic regression analysis revealed that two (DPBC 3 and 4) of the eight individual direct perceived behaviour controls predicted that there had been no more trees on the streamside some time ago (negative *B* coefficients) (see Table 8.5). DPBC

4 confirmed this by predicting more trees now than ever before (see Table 8.5). These were the only behaviour indicators predicted by direct perceived behaviour controls.

It meant that the control items that predicted the behaviour indicator did not concentrate on impediments to do with the cost of riparian management but more on confidence and pride as managers of riparian forests (DPBC 3,) and having the technical means for the job (DPBC 4). Thus, the landowners who were more likely to report no change in number of trees on the streamsides over time actually seemed to be confident with what to do with their streamside forests (at least they found it patronising of other people telling them what to do), and they claimed not to need technical assistance.

To establish the relative importance of these direct control variables and intentions the first logistic regression analysis was performed with the sum of intentions entered in step 1 and the two direct perceived behaviour control variables (DPBC 3 and 4) in step 2 with the behaviour indicator of having had more trees on the streamsides some time ago as the dependent variable (Table 8.7).

The model was of sufficient adequacy and revealed DPBC 4 as the only significant predictor of the behaviour indicator (negative *B* coefficient) (Table 8.7). DPBC 4 was also the most important variable according to the *Wald test* coefficient (according to Pallant 2005, p.168) and the sum of intentions was the least important. It indicated that the major factor that predicted whether there had been more trees on the streamsides some time ago was when landowners did need technical help to bring their riparian forest up to scratch (DPBC 4) (negative *B* coefficient).

Table 8.7

Logistic regression analyses with the intentions and the direct perceived behaviour control variables as the independent variables and the behaviour indicator entered as the dependent variable

Predictor variables	*B*	*S.E.*	*Wald*	*df*	*Sig.*	*Exp (B) - OR*	*95% CI*
Streamsides had more trees on streamsides some time ago							
IntentionsSum6	.04	.03	2.04	3(111)	.15	1.05	.98-1.11
DPBC 3[c]	-.22	.11	3.67		.06	.81	.65-1.01
DPBC 4[d]	-.27	.12	5.46		.02	.76	.61-.96
[χ^2 = 14.81, *df* = 3, *p* = .002[a], 12.5 to 17.3% explained[b]]							

[a] Omnibus Test of Model Coefficients. [b]The percentage values refer to the respective Cox & Snell R^2 and Nagelkerke R^2 values in the Model Summary multiplied by 100 which indicate the amount of variation in the dependent variable explained by the model.
[c] It is patronizing of other people telling landowners what to do with their streamside forests. [d] If my streamside forests needed to be brought up to scratch I would not need technical help.

It would mean that landowners who were strongly in need of technical help (DPBC 4) found it an insurmountable impediment which was reflected in a loss of trees on their streamsides. DPBC 4 could represent an actual behaviour control that bypasses intentions, and can be logically explained. Technical help could mean machinery to fix erosion problems or technical know-how about stabilising banks or choosing the right type of vegetation. If landowners feel they are lacking these technical backups they may not attempt to bring their riparian forest up to scratch, and thus would not have intentions to do so.

To confirm the significant importance of DPBC 4 over the sum of intentions a forced entry method logistic regression analysis was performed with the two independent variables and the behaviour indicator as the dependent variable. The result confirms the behaviour indicator of having fewer trees on the streamsides is determined by the need of technical help and the intentions are not important (Table 8.8).

Table 8.8

Logistic regression analyses of intentions and direct perceived behaviour controls as independent variables with one of the behaviour indicators as the dependent variable

Predictor variables	*B*	*S.E.*	*Wald*	*df*	*Sig.*	*Exp (B) - OR*	*95% CI*
Streamsides had more trees on streamsides some time ago							
Int sum	.06	.03	3.54	2(117)	.06	1.06	1.00-1.12
DPBC 4[c]	-.27	.12	5.49		.02	.76	.61-.96
[χ^2 = 7.56, *df* = 2, *p* = .02[a], 6.3 – 9.2% explained[b]]							

[a]Omnibus Test of Model Coefficients. [b]The percentage values refer to the respective Cox & Snell R^2 and Nagelkerke R^2 values in the Model Summary multiplied by 100 which indicate the amount of variation in the dependent variable explained by the model. [c] If my streamside forests needed to be brought up to scratch I would not need technical help.

The diagram in Figure 8.1 illustrates the significant finding from this section. It indicates that landowners with insufficient technical backup cannot take care of their riparian forest regardless of their intentions. DPBC 4 is therefore most likely an actual control factor: Landowners who need technical help may find it an insurmountable impediment to riparian forest management.

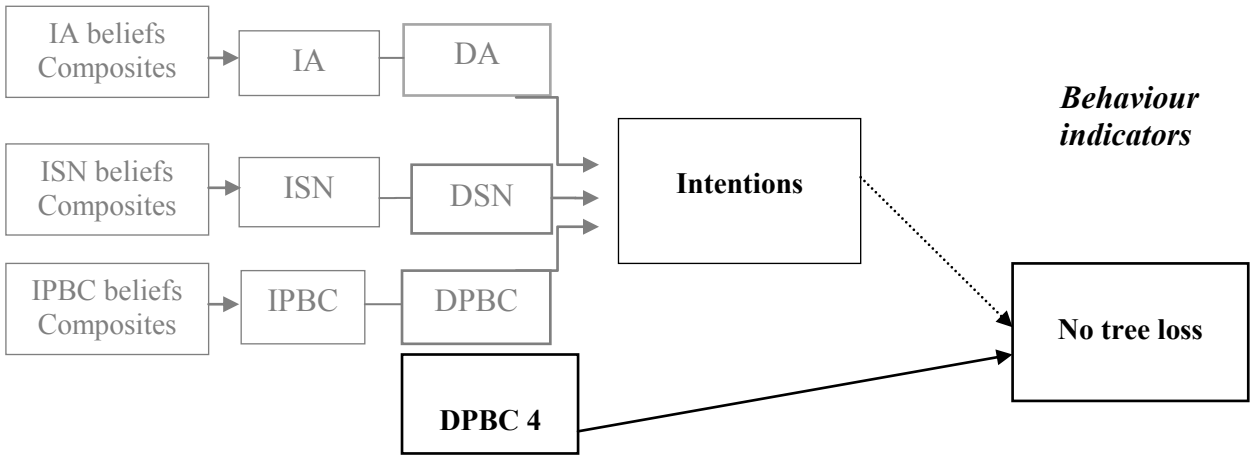

Figure 8.1 Diagram of the influence of DPBC 4 on the predictive relationship between Intentions and the behaviour indicator of tree loss on the streamside

This concludes the chapter on the statistical analyses and the interpretation of all measures in the TPB model of Survey 1 as predictors of behaviour indictors. The following chapter deals with the statistical analysis of the influence of external variables on intentions and behaviour indicators.

CHAPTER 9.

EXTERNAL VARIABLES

9.1 Introduction

The statistical analysis so far involved variables that were formal components of the theory of planned behaviour (see Figure 7.1). The subject of this chapter is the investigation of variables external to the TPB model and their possible influence on the relationships of TPB intention predictors and intentions, and the intentions - behaviour relationships. In the TPB the external variables (background factors) are assumed to be incorporated during the formation of the beliefs that underlie attitudes, subjective norms and perceived behaviour control (Ajzen, 2002a). Nevertheless, the saliency of some factors may not have been sufficient to be integrated into the belief components in the present study. They could therefore represent additional factors that interfere with or augment the predictive relationship between the intention predictors (the direct measures of attitudes, subjective norms and perceived behaviour control) and intentions.

In the words of Ajzen (webpage 2010) external variables are

> "…considered 'background factors' in the TPB… [that are] assumed to influence intentions and behaviour directly by affecting behavioral, normative, and/or control beliefs. That is, the components of the TPB are assumed to mediate the effects of background factors on intentions and actions … with the aid of the TPB it becomes possible to examine why a

> given background factor influences behavior by tracing its effects via the more proximal antecedents of the behavior."

When an external or background factor affects a belief it becomes involved in the formation of the belief. Beliefs incorporate all salient influences present at the time the belief is created in the mind. In the TPB the beliefs underpin the direct measures of attitudes, subjective norms and perceived behaviour controls, which predict intentions, the most proximal antecedents of the behaviour. Thus, the background factors should already have imparted their influence through the beliefs to the direct measures and have become part of the predictive relationships. They should not provide additional explanation to the variance of intentions or variation in behaviour. Nevertheless, in every study there will be external variables that have not been taken into account in the belief-based and direct TPB measures of the model. These external influences would have been absent in the items in the TPB questionnaire that provided the TPB measures. It would be important to check any variables from other sections of the survey questionnaire and test if they influence intention and behaviour predictors.

The external variables examined in this chapter were the result of questions included in the main survey, and represent landowner's reactions to meetings and workshops about land management and riparian forest, and their sources of knowledge about the same subjects (described in Chapter 5). The way landowners learn about land management or riparian forests may influence the formation of attitudes, subjective norms and perception of behaviour controls, and have a bearing on how they plan to manage their riparian areas. Thus, the knowledge from one's own experience through trial and error, for instance, could lead to strong intentions and to either desirable or undesirable practices, or could predict these practices (measured as behaviour or

management indicators). For instance, Kraack (2000) found that sugarcane farmers used a network of information gathering that influenced their adoption of recommended land management practices.

An additional external variable examined was a measure of general environmental attitudes, the new ecological paradigm (NEP, Dunlap et al., 2000) (see Chapter 3 for details). The NEP is a measure of general environmental awareness and has been used in a study with cattle farmers by Curtis and Robertson (2003). While it has not shown to be a predictor of adoption of good land management practices it will be investigated as an external influence on the prediction of intentions and behaviour indicators.

Also of interest are two components resulting from factor analysis of the attitudinal beliefs and the direct attitudes (see Chapter 6 for details) which are not strictly external variables. The belief factors are IA-F1 and IA-F2 ("understanding the environmental role and importance of riparian forests" and "understanding good riparian management practice", respectively), and the direct attitude factors are DA-F1 ‘affection’, and DA-F2 ‘stewardship’. Investigations with these variables will concentrate on their impact on behaviour indicators, and will assess if removing (controlling for) the concepts that the factors represent, will impact on the predictive relationships between intentions and behaviour.

The first section of the chapter examines external variables as influences on the significant predictive relationships between direct measures of attitudes, subjective norms, perceived behaviour controls and intentions found in Chapter 7. The second section will examine the influence of external variables on the significant predictive relationships found in Chapter 8 between intention variables and behaviour indicators.

A list of external variables is included here to aid interpretation of the tables. Dichotomous variables are marked with 'yes/no' or '1/2'. All other variables are data from a 7-point Likert scale with 1 representing 'nothing" and 7 "most of it" (see Appendix B).

External variables

Demographic information

- Age
- Gender (Male = 1, Female = 2)
- Number of children
- Land use of sugarcane (yes/no)
- Level of education
- Social desirability

Attendance and knowledge variables

- Claiming more correct knowledge about riparian forests than what scientists have found
- Having been ask about riparian forest before (yes/no)
- Having been offered information or help with riparian forest by anybody or any agency (yes/no)
- New ecological paradigm (NEP)
- Attendance of meetings or workshop about land management (yes/no)
- Having learned a lot in the meetings or workshops about land management
- Having found the meetings or workshops on land management useful
- Attendance of meetings or workshop about riparian forest (yes/no)
- Having learned a lot in the meetings or workshops about riparian forest
- Having found the meetings or workshops on riparian forests useful
- Attendance of meetings or workshops about land management or riparian forests (none, one, both)
- Knowledge from agricultural journals about land management or riparian forests
- Knowledge from newspapers about land management or riparian forests
- Knowledge from television about land management or riparian forests
- Knowledge from radio (wireless) about land management or riparian forests
- Knowledge from own experience through trial and error about land management or

riparian forests

- Knowledge from observation of other people's practices about land management or riparian forests
- Knowledge from traditional practices handed down about land management or riparian forests
- Knowledge from scientific journals about land management or riparian forests
- Knowledge from meetings and workshops about land management or riparian forests
- Knowledge from government agencies about land management or riparian forests

Attitude factors (assessed for intention-behaviour relationships)

- IA-F1 "understanding the environmental role and importance of riparian forests"
- IA-F1 "understanding good riparian management practice"
- DA-F1 "affection for riparian forests"
- DA-F2 "stewardship for riparian forests"

9.2 Correlations between external variables and intentions

Pearson product-moment coefficients were obtained to establish the strength and direction of the relationships between the external variables and the intention variables. Tables 9.1 to 9.4 list the results of significant relationships.

It was found that age was associated with several intention variables (Table 9.1). Younger landowners were more likely to have strong intentions to manage their riparian forests, especially intentions to work with Government agencies if contacted to plant and maintain their riparian forests (Int 1), to have streamsides on their list of priorities, and to donate time to work with Land care agencies (Int 4). Female landowners were more inclined to have streamside forests on their list of priorities (Int 2). The number of children was negatively associated with the likelihood have strong

Table 9.1

Significant Pearson product moment coefficients between demographic variables and intentions

External variables and intention variables	*r*	*n*	*p*
Age and			
Sum of intentions	-.27	110	.004
Int 1	-.26	118	.004
Int 2	-.23	120	.01
Int 4	-.20	120	.03
Gender and Int 2	.18	121	.05
Number of children and			
Sum of intentions	-.22	111	.02
Int 1	-.18	119	.05
Int 5	-.30	117	.001
Level of education and			
Int 1	.19	119	.04
Int 2	.24	121	.01

intentions, especially intentions to work with Government agencies (Int 1) and to plant a streamside forest (Int 5). A higher level of education was found to be related to stronger intention to work with government agencies (Int 1) and to have streamside forest on the list of priorities (Int 2).

When landowners claimed to have more correct knowledge than scientists, it was associated with weaker intentions to work with government agencies (Int 1) (Table 9.2). However, when landowners had been asked by anybody anything about riparian forest before (a question in the survey) they were more likely to have stronger intentions to work with government agencies (Int 1), to have streamside forests on their

Table 9.2

Significant Pearson product moment coefficients between knowledge belief, previous contact, agency help, NEP score and intentions

External variables and intention variables	*r*	*n*	*p*
Claiming more correct knowledge than scientists and			
Int 1	-.18	117	.05
Having been asked about riparian forest and			
Sum of intentions	.30	111	.001
Int 1	.25	117	.001
Int 2	.38	110	<.000
Int 4	.24	120	.01
Int 5	.21	117	.02
Int 6	.24	115	.01
Having been offered help by agency and			
Sum of intentions	-.20	111	.04
Int 1	-.19	117	.04
Int 2	-.29	110	.002
Int 4	-.22	120	.02
New ecological paradigm (NEP) score and			
Int 2	.22	102	.03

list of priorities (Int 2), to donate their time to work with Land care agencies (Int 4), to plant a streamside forest this year (Int 5), and to maintain their streamside forest (Int 6) (Table 9.2). It suggests that when landowners were cognitively engaged in the subject of riparian forests by being asked about their streamside forests they formed stronger intentions to take care of it.

In contrast, when landowners were contacted and offered information or help with streamside forests, it was associated with weaker intentions to work with Government agencies (Int 1), with having streamside forest on their list of priorities (Int 2), and with donating time to work with Land care agencies (Int 4) (Table 9.2). There is

no easy explanation for these relationships. They may indicate an unacceptable encounter with government personnel.

The NEP score association with having streamside forests on the list of priorities (Int 2) is most likely a reflection of the landowners' awareness of the importance of riparian forests (Table 9.2).

Attendance of workshops about land management was associated with stronger intentions in particular the intentions to work with government agencies (Int 1), having streamside forests on the list of priorities (Int 2), donate time to work with landcare agencies (Int 4), and planning to maintain streamside forests (Int 6) (Table 9.3). When the landowner had attended more workshops they were likely to have stronger intentions, in particular having streamside forests on the list of priorities (Int 2) and donate time to work with landcare agencies (Int 4) (Table 9.3). When landowners found meetings or workshops about riparian forests useful it correlated with the intention of working with government agencies to plant and maintain them (Int 1) (Table 9.3). These results indicate that attendance of meetings and workshops related positively to landowners' intentions to manage riparian forests.

Table 9.3

Significant Pearson product moment coefficients between attendance of and satisfaction with meetings and intentions

External variables and intention variables	*r*	*n*	*p*
Attendance of workshops about land management			
Sum of intentions	.23	111	.01
Int 1	.19	116	.05
Int 2	.20	118	.03
Int 4	.22	118	.02
Int 6	.20	116	.03
Attendance of workshops about land management or riparian forest			
Sum of intentions	.25	110	.008
Int 2	.27	117	.003
Int 4	.24	117	.009
Meetings about riparian forests were useful and			
Int 1	.37	32	.04

Knowledge obtained from listening to radio broadcasts about land management and about riparian forests was a significant predictor of intentions (Table 9.4). Landowners who reported radio as a source of knowledge about land management had stronger intentions in general (sum of intentions) and in particular to work with government agencies (Int 1), to donate time to work with landcare agencies (Int 4) (this intention was also associated with knowledge from radio about riparian forest), and planning to maintain their streamside forest (Int 6). This difference in information about land management and riparian management is most likely due to the fact that radio programs include both areas but land management is more salient to the landowners.

Table 9.4

Significant Pearson product moment coefficients between knowledge sources and intentions

External variables and intention variables	*r*	*n*	*p*
Knowledge from radio about land management and			
Sum of intentions	.26	93	.012
Int 1	.25	99	.014
Int 4	.29	101	.004
Int 6	.25	96	.014
Knowledge from radio about riparian forests and			
Sum of intentions	.28	95	.007
Int 4	.28	104	.004
Knowledge about riparian forests from own experience through trial and error and			
Int 6	.22	105	.022
Knowledge from observation of other people's practices about land management and			
Sum of intentions	.25	100	.011
Int 6	.22	104	.024
Knowledge from observation of other people's practices about riparian forest and			
Int 3	.19	109	.047
Int 6	.20	104	.044
Knowledge from traditional practices handed down about land management and			
Int 1	-.23	105	.016
Knowledge from traditional practices handed down and about riparian forests and			
Int 1	-.22	104	.026
Knowledge from government agencies about land management and			
Sum of intentions	.23	100	.023
Int 1	.22	105	.022
Int 4	.22	107	.024
Knowledge from government agencies about riparian forests and			
Int 1	.20	118	.028
Int 2	.20	120	.026
Knowledge from meetings and workshops about land management and			
Int 3	.24	103	.017
Int 4	.21	103	.038

Knowledge about riparian forest from own experience but not land management was correlated with landowners' intentions of planning to maintain their streamside forest (Int 6). Knowledge from observation of other people's practices about land management was associated with stronger intentions in general and in particular with the intention to maintain streamside forests (Int 6). This intention was also associated with this source of knowledge for riparian forests which also related to the intention of landowners' to improve the creek sides if there was a need (Int 3).

Knowledge from traditional practices handed down about land management or riparian forests not unexpectedly predicted that landowners were less inclined to work with Government agencies to plant and maintain their riparian forests if contacted by them (Int 1). It is likely that they did not agree with any new or scientifically based ideas of land or riparian management which they would have to follow. However, when the source of knowledge was reported as coming from Government agencies about land management or riparian forests it correlated with the landowners' intentions to work with these agencies (Int 1). In addition, land management knowledge from government agencies also related to landowners' intention to work with landcare agencies (Int 4), while riparian forest knowledge from Government agencies related to the intention that streamsides are on their list of priorities (Int 2). Knowledge from meetings and workshops about land management only, was associated with the intention to improve creek sides (Int 3) and to donate time to work with Land care agencies (Int 4).

External variables as significant predictors of one or more of the six intentions

- Age
- Gender
- Number of children
- Level of education
- Claiming more correct knowledge about riparian forests than what scientists have found
- Having been ask about riparian forest before (yes/no)
- Having been offered information or help with riparian forest by anybody or any agency (yes/no)
- New ecological paradigm
- Attendance of meetings or workshop about land management (yes/no)
- Having found the meetings or workshops on riparian forests useful
- Attendance of meetings or workshops about land management or riparian forests (none, one both)
- Knowledge from radio (wireless) about land management
- Knowledge from radio (wireless) about riparian forests
- Knowledge from own experience through trial and error about riparian forests
- Knowledge from observation of other people's practices about land management
- Knowledge from observation of other people's practices about riparian forests
- Knowledge from traditional practices handed down about land management
- Knowledge from traditional practices handed down about riparian forests
- Knowledge from meetings and workshops about land management
- Knowledge from government agencies about land management
- Knowledge from government agencies about riparian forests

The correlations found between the external factors and intentions were all small but nevertheless significant. The influence of these external variables in the relationship of intentions with the TPB predictors of intentions (DA, DSN, and DPBC) will be tested in hierarchical multiple regression analyses in the following sections.

9.3 Impact of external variables on predictors of intentions

The intention construct in the TPB consisted of the sum of individual intention items. This study included six items (Int 1 to Int 6) which represented an acceptable measure of intentions (see Chapter 6 for details). The predictors of intentions in the TPB model are the direct measures of attitudes, subjective norms and perceived behaviour control (DA, DSN, and DPBC). The influence of external variables on the predictive relationship between intentions and the set of direct measures was examined in this section. All external variables found to have significant correlations with any intention were assessed in hierarchical multiple regression analyses. The external variable was controlled for by entering it in the first step of the analysis, and the set of direct measures was entered in the second step. The sum of intentions constituted the dependent variable in all analyses.

There were five external variables that significantly impacted on the direct measure - intention relationship. These are reported in the following section. The other external variables on the list had no significant influence.

9.3.1 Controlling for age in predicting intentions in the TPB mode

The hierarchical multiple regression analysis controlling for age in the TPB model in the prediction of intentions revealed that the model in the first block (age variable entered) explained 6.0% (Adjusted R^2) of the variance (Table 9.5). When the second block of variables (DA, DSN and DPBC) was entered the overall model explained 54.0% (Adjusted R^2). The model as a whole (including all variables) was significant [$F(4,101) = 31.78$, $p < .001$]. This meant that 49.0% (R^2 change) of the overall variance in

intentions was explained when the effect of age was statistically controlled for (Table 9.5).

Table 9.5

Hierarchical multiple regression analysis for intentions to engage in riparian forest management and direct TPB measures, controlled for age

Step	*Predictor*	R^2	*Adj.* R^2	R^2 *change*	*F*	*df*	*Unstandard*		*Stand.* β	*p*	*Part*[2a]
							B	*S.E.*			
1.	Age	.07	.06	.07	8.13	1(104)	-.10	.04	-.16	.02	.03
2.	DA	.56	.54	.49	31.78	4(101)	.48	.07	.56	.000	.22
	DSN						.43	.21	.15	.05	.02
	DPBC						.40	.17	.17	.02	.03

[a] Squared part correlation coefficient x 100 represents the proportion of unique contribution of each variable with any overlap or shared variance partialled out.

Each variable in this model made significant unique contributions, "when overlapping effects of the other variables were statistically removed" (p. 158, Pallant, 2005). The age of landowners was a weak but significant negative predictor of intentions on its own [β = -.16, p = .02]. DA remained the strongest contributor and DSN actually showed an increase in contribution (compare with Table 7.13) and reached significance when age was controlled for (the intentions of younger landowners were influenced by subjective norming behavior). The diagram in Figure 9.1 visualises the effects of age and the TPB predictors on intentions indicated by the β weights. Younger age groups have been found to show more environmental concern (Fenton, 1998), and the age factor affected farmers' decision-making processes in another study (Farmar-Bowers & Lane, 2009).

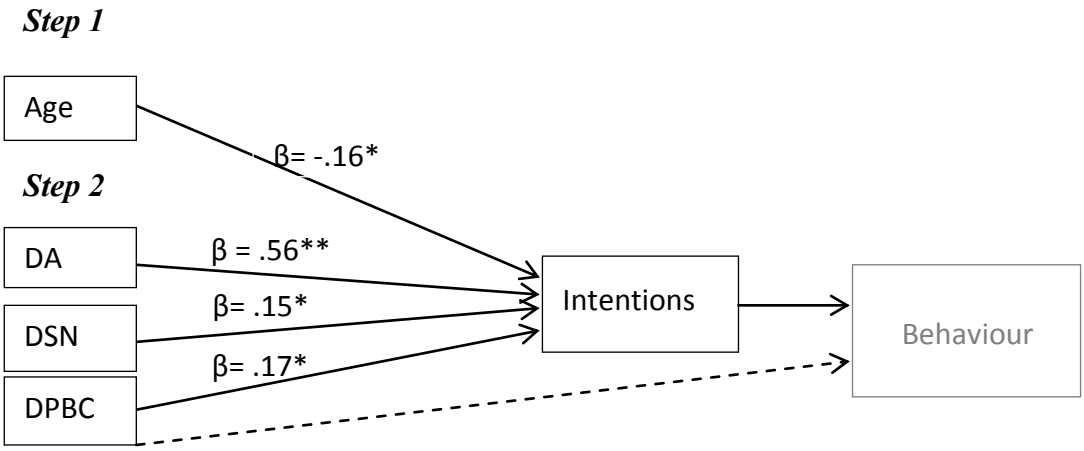

Figure 9.1 The TPB model with the β coefficients in a hierarchical multiple regression.

9.3.2 Controlling for cases who had been previously asked about riparian forest in predicting intentions in the TPB model

Study 1 found that none of the participants had ever been asked about riparian forests. This was considered an important fact which meant that answers were comparable within the study and not influenced by long deliberations on the subject which may lead to a negative assessment when considering the time, cost and other impediments in regards to maintenance of a riparian forest. This would constitute a priming effect. The main survey included this question in order to assess the influence of this possible priming effect on intentions from having previously been asked about riparian forest (coded 1 = no, 2 = yes). The dichotomous variable was controlled for in the first step in a hierarchical MRA with the TPB measures of DA, DSN and DPBC in the second step.

Statistical evidence showed a weak but significant influence by this external factor on the TPB predictors of intentions. It contributed to the explanation of variance in intentions (Table 9.6). The model summary revealed that the first block (having

previously been asked about riparian forest) explained 8.3% of the variance. When the second block of variables (DA, DSN and DPBC) was added 54.5% was explained. The model as a whole (including all variables) was significant [F (4,101) = 32.46, p < .001]. This meant that 47.1% of the overall variance in intentions was explained when the effect of having been asked about riparian forest was statistically controlled for (Table 9.6).

Table 9.6

Hierarchical multiple regression analysis for intentions to engage in riparian forest management and direct TPB measures, controlled for having been asked about riparian forest before.

Step	*Predictor*	R^2	*Adj.* R^2	R^2 *change*	*F*	*df*	*Unstandard.* *B*	*SE*	*Stand.* *β*	*p*	*Part*[2a]
1. Been asked about riparian forest before		.09	.08	.09	10.46	1(104)	3.04	1.16	.18	.01	.03
2.	DA	.56	.55	.47	32.46	4(101)	.50	.07	.59	.000	.26
	DSN						.33	.21	.11	.12	.01
	DPBC						.32	.16	.14	.05	.02

[a] Squared part correlation coefficient x 100 represents the proportion of unique contribution of each variable with any overlap or shared variance partialled out.

Having been asked about riparian forests resulted in a significant contribution by attitudes and by perceived behaviour controls to the explanation of variance of intentions. A priming effect may have led to lowered perception of impediments to riparian management (the contribution of DPBC to the explanation of intentions is significant). The cognitive engagement with the subject of riparian forest did not influence subjective norming (no significant contribution).

The diagram in Figure 9.2 visualises the effects of having been asked about riparian forests and the TPB predictors on intentions as indicated by the β coefficients.

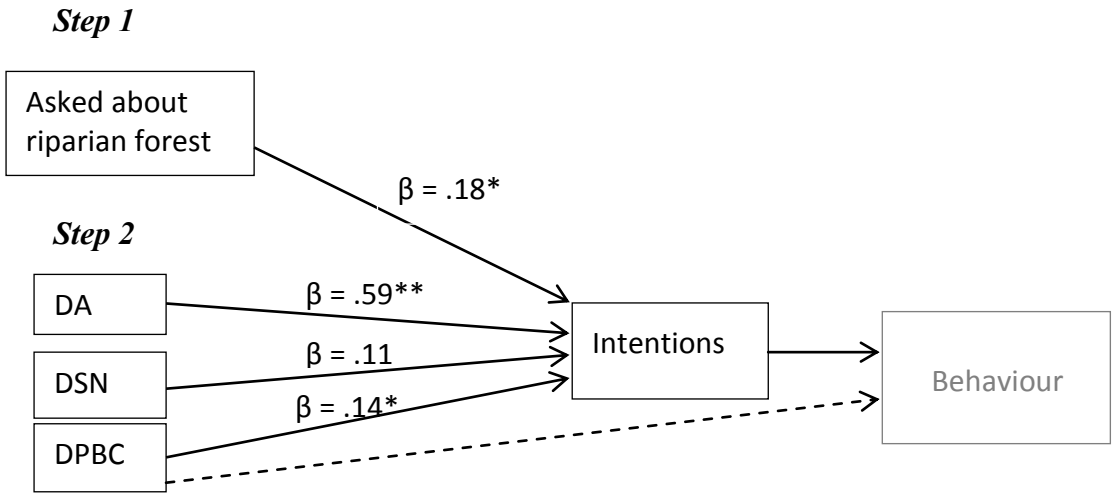

Figure 9.2 The TPB model with the β coefficients from the hierarchical multiple regression analysis.

9.3.3 Controlling for knowledge about land management and riparian forests from radio

The hierarchical multiple regression analysis controlling for radio as a source of knowledge revealed that the model in the first block (variable of knowledge from radio entered) explained 5.6% of the variance. When the second block of variables (DA, DSN and DPBC) was entered the overall model explained 53.7%. The model as a whole (including all variables) was significant [F (4,87) = 27.34, $p < .001$]. This meant that 49.0 % of the overall variance in intentions was explained when the effect of knowledge about land management from radio was statistically controlled for (Table 9.7). (The differences in the results for knowledge about riparian forests from the radio were minor.)

Table 9.7

Hierarchical multiple regression analysis for intentions to engage in riparian forest management and direct TPB measures, controlled for knowledge from the radio (about land management and about riparian forests)

Step	Predictor	R^2	Adj. R^2	R^2 change	F	df	Unstandard. B	Unstandard. S.E.	Stand. β	p	Part^{2a}
1. Land - Radio		.07	.06	.07	6.45	1(90)	.64	.29	.17	.03	.02
2.	DA	.56	.54	.49	27.34	4(87)	.52	.07	.61	.000	.28
	DSN						.21	.24	.07	.39	.00
	DPBC						.38	.18	.16	.03	.02
1. Riparian - Radio		.08	.07	.08	7.63	1(93)	.58	.28	.15	.04	.02
2.	DA	.55	.53	.48	27.87	4(90)	.50	.07	.59	.000	.26
	DSN						.27	.23	.09	.24	.01
	DPBC						.38	.17	.16	.03	.02

[a] Squared part correlation coefficient x 100 represents the proportion of unique contribution of each variable with any overlap or shared variance partialled out.

Knowledge from the radio about land management or riparian forests predicted stronger intentions of landowners [β = .17 and β = .15, respectively]. Kraack (2000) found that information transfer by radio is indeed a preferred way to receive information for some sugarcane growers. (The diagram illustrates the influence of knowledge from radio about land management; knowledge about riparian forests would display a β of .15 in step 1.)

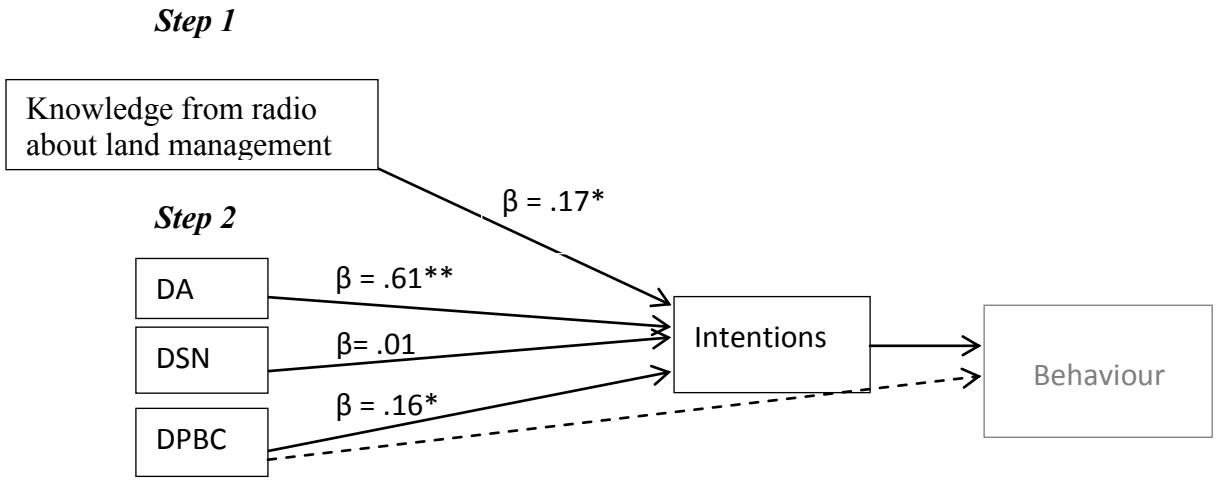

Figure 9.3 The TPB model with the β coefficients from the hierarchical multiple regression analysis.

9.3.4 Controlling for knowledge about land management from observation of other people's practices

The hierarchical multiple regression analysis controlling for knowledge from other people's management practices revealed that the model in the first block (knowledge variable entered) explained 5.5% of the variance. When the second block of variables (DA, DSN and DPBC) was entered the overall model explained 53.4%. The model as a whole (including all variables) was significant [F (4,95) = 29.31, p < .001]. This meant that 48.8% of the overall variance in intentions was explained when the effect of having been asked about riparian forest was statistically controlled for (Table 9.8).

Table 9.8

Hierarchical multiple regression analysis for intentions to engage in riparian forest management and direct TPB measures, controlled for knowledge about land management from observation of others people's practices

Step	*Predictor*	R^2	*Adj.* R^2	R^2 *change*	*F*	*df*	*Unstandard.* *B*	*S.E.*	*Stand.* *β*	*p*	*Part*^{2a}
1. Land-Observation											
		.06	.06	.06	6.73	1(98)	.72	.35	.15	.04	.02
2.	DA	.55	.53	.49	29.31	4(95)	.50	.07	.59	.000	.26
	DSN						.26	.23	.09	.25	.01
	DPBC						.42	.17	.18	.02	.01

[a] Squared part correlation coefficient x 100 represents the proportion of unique contribution of each variable with any overlap or shared variance partialled out.

When landowners got more of their knowledge about land management through observation of other people's practices they had stronger intentions. This fact is not reflected in a higher contribution of DSN in the model, but it does not exclude the landowners informally observing what others do and wanting to try it out themselves. Kraack (2000) mentions a variety of information sources as part of the information network of sugarcane farmers. It would indicate that the subjective norm construct was influenced by this variable of knowledge from observation of others. (The exploration of the norming beliefs (see Chapter 8) revealed that both belief types, belief in the expectation of respected others and the motivation to comply with these expectations, contributed significantly and equally to the explanation of variance in intentions).

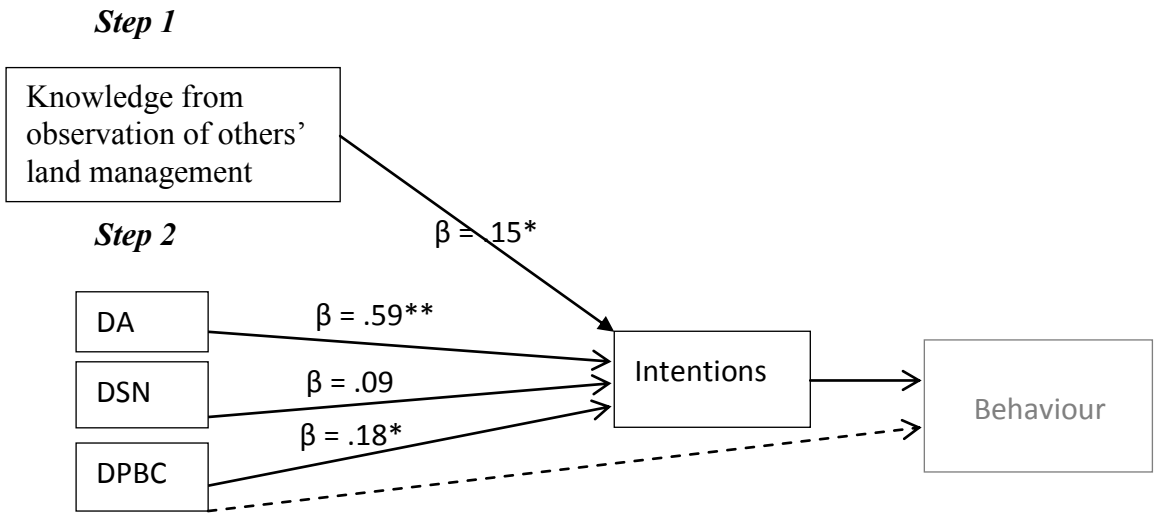

Figure 9.4 The TPB model with the β coefficients from the hierarchical multiple regression analysis.

9.3.5 Controlling for knowledge about land management from traditional practices handed down

The external variable of traditional practices as a source of knowledge predicted Int 1 only, not the sum of intentions. Nevertheless, analysis revealed that in a hierarchical statistical model it explained a significant proportion of the variance of intentions.

The hierarchical multiple regression analysis controlling for traditional practice as a source of knowledge revealed that the model in the first block (knowledge variable entered) explained 1.5% of the variance. When the second block of variables (DA, DSN and DPBC) was entered the overall model explained 53.9%. The model as a whole (including all variables) was significant [F (4,94) = 29.65, p < .001]. This meant that 53.3% of the overall variance in intentions was explained when the effect knowledge about land management from traditional practices handed down was statistically controlled for (Table 9.9).

Table 9.9

Hierarchical multiple regression analysis for intentions to engage in riparian forest management and direct TPB measures, controlled for knowledge about land management from traditional practices handed down

Step	Predictor	R^2	Adj. R^2	R^2 change	F	df	Unstandard. B	Unstandard. S.E.	Stand. β	p	Part^{2a}
1. Land - Tradition											
		.03	.02	.03	2.45	1(97)	-.61	.26	-.16	.02	.03
2.	DA	.56	.54	.53	29.65	4(94)	.51	.07	.60	.000	.27
	DSN						.43	.22	.15	.05	.02
	DPBC						.34	.17	.15	.05	.02

[a] Squared part correlation coefficient x 100 represents the proportion of unique contribution of each variable with any overlap or shared variance partialled out.

When landowners who got more of their knowledge about land management practices according to traditional practices handed down, they had weaker intentions (negative *B* coefficient). This may suggest that they saw no need to have intentions because they were sure that whatever they already did was sufficient, and always had been to their knowledge. This result reflects the findings from Study 1 (Flick et al., 2010) but has also been reported by Kraack (2000) as part of the information network available. It may also be an indication that the landowners did not recognize erosion or pollution on their streamsides which has been reported by other researchers **(**review by Corbett, 2002; Klapproth et al., 2001; Wilson et al., 2003; Dutcher, 2000; Barr & Cary, 2000; Wilson, Jansen, Curtis & Robertson, 2003). The source of knowledge here increased subjective norming to reach significance and to equal the amount of unique contribution of perceived behavior control. It indicates that landowners who get most of their knowledge from traditional practices handed down are more inclined to pay attention to what respected others think of their riparian management. But the negative *β* coefficient meant that they had weaker intentions because of it.

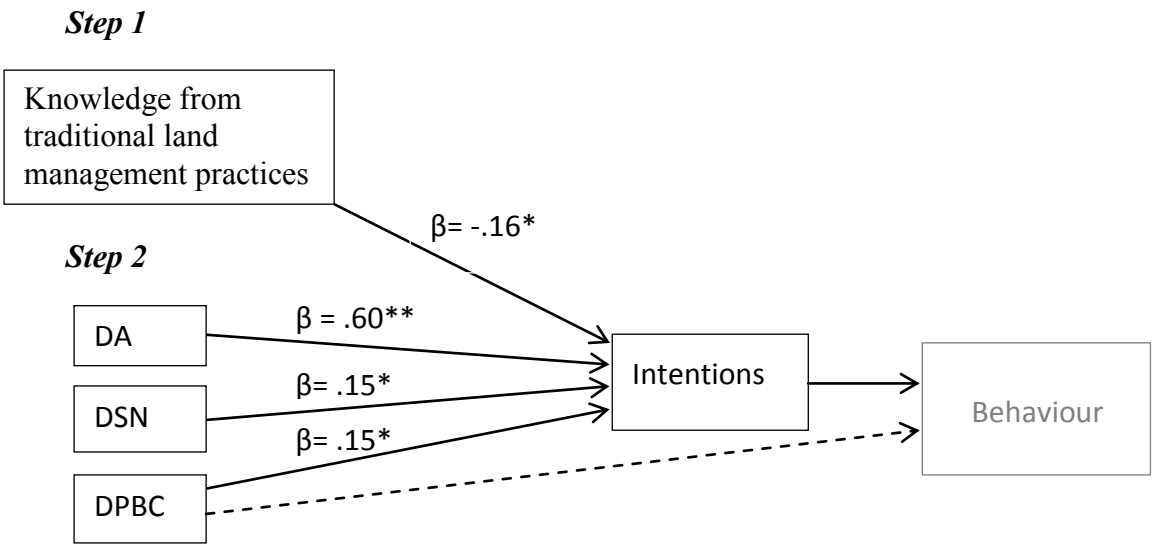

Figure 9.5 The TPB model with the β coefficients from the hierarchical multiple regression analysis.

This concludes the statistical results of external variables as predictors of intentions and influences on the prediction of intentions by direct measures in the TPB model. In summary, the external variables that predicted the sum of intentions (or Int 1 in one case) were found to impact significantly on the predictive relationship of direct TPB measures and the sum of intentions. The next section will examine the influence of external variables on the relationship between intentions and behaviour indicators.

9.4 A note about the number of statistical analyses performed with external variables

A comment needs to be made here in regards to the large number of analyses that were performed and whether a Bonferroni adjustment needed to have been invoked. Firstly, the individual analyses never involved more than four independent variables altogether. Secondly, inspecting the alpha levels of the variables of importance, it reveals that direct attitudes consistently show highly significant levels of greater than .001. External

variables of age (Table 9.5), having been asked about riparian forest (Table 9.6), and knowledge from traditional practice (Table 9.9) show alpha levels of .01 and .02. These alpha levels would still reach significance with more stringent levels. Only the influence of knowledge from radio (Table 9.7) or observation of others (Table 9.8) would possibly loose significance. Direct subjective norms and direct perceived behavior controls were not strong contributors to the explanation of variance of intentions in any analyses. It was decided that when only one variable at a time was controlled for (in step 1 of a hierarchical regression analysis) the Bonferroni adjustment need not be applied.

9.5 Impact of knowledge variables on intention - behaviour relationships

A large number of variables of sources of knowledge about land management or riparian forests were found to be associated with intentions variables (see Table 9.4). However, hierarchical multiple regression analysis found that only five knowledge variables were significant contributors in the explanation of variance of intention variables (see Tables 9.7 to 9.9). The external variables were:

1. Knowledge from radio about land management.
2. Knowledge from radio about riparian forests.
3. Knowledge from own experience through trial and error about riparian forests.
4. Knowledge from observation of other people's practices about land management.
5. Knowledge from traditional practices handed down about land management.

While some of these knowledge variables significantly explained variance in individual intentions (Int 1 to Int 6), the analyses in this section will only assess the TPB construct of intentions that is composed of the sum of all six intentions. This construct was found to be reliable measure of intentions according to the TPB requirements (see Chapter 6). Thus, the independent variable of intentions in this section is the TPB construct of intentions, denoted 'Intentions'.

The four variables resulting from factor analyses of attitudinal beliefs (IA-F1 and IA-F2), and of direct attitudes (DA-F1 and DA-F2) were also assessed in this section, as was the NEP score. Statistically removing their contribution would reveal their influence on intention-behaviour relationships.

The behaviour indicators included in the analyses had significant associations with intentions variables (see Table 8.6). These were:

1. Crop or cultivate the land more than 10m away from the edge of the waterway.
2. Streamsides have more trees and shrubs on them now than ever before.
3. Streamsides have newly planted trees on them.
4. Crop or cultivate the land from the edge of the waterway close enough to turn a tractor around.
5. Streamsides had more trees on them some time ago.

Hierarchical logistic regression analysis will be the statistical method to accommodate the dichotomous data of behaviour indicators. The behaviour indicators represent the dependent variables. The external variables (knowledge sources, attitude factors, NEP) as independent variables are controlled for in step 1, and the intentions as

independent variable in step 2, the dependent variable is the construct of intentions in all cases.

9.5.1 Knowledge sources as significant external influences in the prediction of behaviour indicators

In this study knowledge about riparian forests from own experience through trial and error was found to correlate with intentions (see Table 9.4). This knowledge variable was also found to be a predictor of the desirable behaviour indicator of having more trees on the streamsides than ever before (Table 9.10). The hierarchical logistic regression analysis revealed it as the only independent variable that explained the variation in having more trees on the streamsides now than ever before. The intentions were not a contributing factor in this relationship (Table 9.10). The results suggest that the landowners had learned good management of the riparian forest by trial and error and that their intentions played no role in their management of the area.

Table 9.10

Logistic (step-wise) regression analysis intentions as predictors of more trees on the streamsides now than ever before when knowledge about riparian forests from own experience is controlled for

External Variable controlled Step 1	*Predictor variable Step 2*	*B*	*SE*	*Wald*	*df (n)*	*Sig.*	*Exp(B) OR*	*95% CI*
Streamsides have more trees on them now than ever before								
Knowledge about riparian forests from experience by trial and error		.50	.18	7.67	2(101)	.006	1.65	1.16-2.35
	Intentions	-.04	.03	1.67		.21	.91	.91-1.02
[χ^2 = 11.36, *df* = 2, *p* = .003[a], 10.6 – 15.5% explained[b]]								

[a] Omnibus Test of Model Coefficients. [b] The percentage values refer to the respective Cox & Snell R^2 and Nagelkerke R^2 values in the Model Summary multiplied by 100 which indicate the amount of variation in the dependent variable explained by the model.

Similarly, a considerable proportion of the behaviour indicator of newly planted trees on the streamside was explained by the same source of knowledge. However, intentions also contributed significantly (Table 9.11). The knowledge variable was marginally more important according to the higher Wald value. The amount of variation explained by both variables amounted to 20.5 to 30.4%.

Table 9.11

Logistic (step-wise) regression analysis with intentions as predictors of newly planted trees when knowledge about riparian forests from own experience is controlled for

External Variable controlled Step 1	*Predictor variable Step 2*	*B*	*SE*	*Wald*	*df (n)*	*Sig.*	*Exp(B) OR*	*95% CI*
		Newly planted trees on the streamside						
Knowledge about riparian forests from experience by trial and error		.68	.22	9.41	2(101)	.002	1.98	1.28-3.06
	Sum of Intentions	.12	.04	8.07		.04	1.12	1.04-1.21
[χ^2 = 23.11, *df* = 2, *p* = .000[a], 20.5 – 30.4% explained[b]]								

[a] Omnibus Test of Model Coefficients. [b] The percentage values refer to the respective Cox & Snell R^2 and Nagelkerke R^2 values in the Model Summary multiplied by 100 which indicate the amount of variation in the dependent variable explained by the model.

The results indicating that landowners relied on their own experience by trial and error represents important information. Kraack (2000) was one researcher using qualitative interview data who also found that this factor was strongly endorsed among sugarcane farmers. Her recommendation to acknowledge these landowners' contributions and include them in further development of desirable riparian management practices is supported by the results of the quantitative analyses in the present study.

No other knowledge variable was found to significantly influence the predictive relationship of intentions - behaviour indicators.

9.5.2 Attitudinal components and NEP as significant influences in the prediction of behaviour indictors

The aim of this section was also to investigate if attitudinal factors identified in Chapter 6 and the general environmental awareness can have an impact on the predictive relationship between intentions and the five behaviour indicators identified (see Table 8.6). If these variables are controlled for (removed from the equation), will intentions still explain the variation in the behaviour indicators? Hierarchical logistic analysis with the factors of ‘affection‘ (DA-F1) and ‘stewardship’ (DA-F2) as independent variables did not find these variables to influence the intentions – behaviour prediction, indicating that they are not important factors in that relationship. The NEP score of general environmental awareness also did not influence the relationships.

However, controlling for attitudinal belief factors representing the notions of “understanding environmental importance of riparian forests” (IA-F1) and “understanding good riparian management practices” (IA-F2) revealed one significant result (Table 9.12).

Attitudinal beliefs of understanding good riparian management practice (IA-F2) were the only contributor to the explanation of variation in reporting more trees on the streamsides now. A stronger belief factor indicated that the creek sides had fewer trees (negative *B* coefficient) while the intentions did not contribute to the explanation in the variation of the behaviour. The result seems to indicate that the landowners do know there are fewer trees and they also believe they understand good riparian management practices. To reconcile these contradictory findings one has to consider that tree loss itself is not necessarily a sign of bad management. It does not mean there are not

Table 9.12

Logistic (step-wise) regression analysis with intentions as predictors of more trees on the streamside now than ever before and the belief factor of understanding good riparian management practice (IA-F2) controlled for in step 1

External Variable controlled Step 1	*Predictor variable Step 2*	*B*	*SE*	*Wald*	*df (n)*	*Sig.*	*Exp(B) OR*	*95% CI*
Streamsides have more trees on them now than ever before								
Understanding good riparian management practice (IA-F2)		-.46	.18	6.45	2(110)	.01		
	Sum of Intentions	-.03	.03	.87		.35		
[χ^2 = 9.14, *df* = 2, *p* = .01[a], 8.0 – 11.9% explained[b]]								

[a] Omnibus Test of Model Coefficients. [b] The percentage values refer to the respective Cox & Snell R^2 and Nagelkerke R^2 values in the Model Summary multiplied by 100 which indicate the amount of variation in the dependent variable explained by the model.

enough trees or seedlings on the streamsides. Equally, loss of trees can be due to natural causes and not to bad riparian management. Less than 8 months before, cyclone "Larry" may have devastated the forest of some landowners in the study area. However, the lack of involvement of intentions may mean that these landowners are not planning to take care of their riparian area.

The two external variables found as additional contributors to the explanation of variation in the behaviour variable represent factors that were not included in the TPB construct of intentions in this model. They reveal the importance of landowners' riparian practices based on trial and error and their understanding of good riparian practices. This concludes the investigations of external variables and their role in the prediction of behaviour indicators by intentions.

CHAPTER 10. ANALYSIS OF SURVEY 2

10.1 Introduction

The second survey (Survey 2) of the research study consisted of a booklet with two parts (Appendix C). Part 1 contained five colour plates of riparian forest images, and part 2 presented a questionnaire of 11 items selected from the TPB questionnaire of Survey1 (Appendix B). The booklet was introduced with the following paragraph: "What do streamside forests do? They have many roles to play in a well-functioning streamside system. The five main ones are described on the following pages."

Each of the photos contained a paragraph of information about a biophysical or environmental role of a riparian forest. Each facing page of the photos contained the questions: "Do you agree with these statements? What is your experience with this … (the particular role)? and Do you have any suggestions about how to deal with it? or Do you have any ideas on this subject? or How do you use them?" This section represented an intervention which could prime the respondents' answers to the questions in the second part of Survey 2.

The second section of Survey 2 consisted of items identical to those in Survey 1. If a significant change should be found it could indicate a "sleeper effect" (a delayed impact of an initially discounted message which is accepted now) (Eagley & Chaiken, 1993) due to the time elapsed since the respondents thought about these questions when answering them in Survey 1. It may equally well be attributed to the priming effect due to cognitive engagement with the subject when looking at the photos and responding to questions in the first part of Survey 2. A detailed description of the method used for Survey 2 including selection of participants, materials and procedure is in Chapter 4.

Survey 2 yielded 75 responses of which 24 (32%) could be identified by the codes and compared with Survey 1. The descriptive answers to the first section were analysed as qualitative data, and the responses to the second section analysed and assessed.

This chapter will first report and compare the demographic background of the samples of Survey 1 and 2, as well as the answers to some knowledge and information source items. These descriptive data of frequencies and percentages will be assessed and discussed.

The following section will present qualitative analyses of the descriptive responses to the biophysical roles of riparian forests from part 1 of Survey 2. It will involve the establishment of themes and key roles and of reporting the proportion of answers containing these.

The data of the questionnaire of part 2 of Survey 2 will be explored for differences with the results from Survey 1. Independent-sample t-tests will be employed to investigate the entire samples of Survey 1 and 2, and repeated-measure t-tests will be used for the code-matched sample.

10.2 Comparison of demographic background of respondents between surveys

Only the demographics of the 24 respondents from Survey 2 that could be identified by their matching codes with Survey 1 could be used to assess differences. The data on age, gender, landuse, and educational level of the sample of 24 respondents of Survey 2 were compared with the sample of 123 respondents of Survey 1. The results are reported in Tables 10.1 to 10.4.

Table 10.1

Age distribution of Survey 1 (n = 123) and Survey 2 (n = 24[a])

	Mean		*SD*		*Minimum*		*Maximum*	
Survey	1	2[b]	1	2	1	2[b]	1	2[b]
Age	55.8	55.0	53	41	32	32	85	73

[a] This sample represents only the matched respondents of Survey 2. [b] The respondents were found to have given these answers in Survey 1.

The average age of respondents of Survey 1 and Survey 2 was found to be almost the same. But the age range was much wider for the sample of Survey 1 due to the much higher maximum age. The oldest Survey 1 respondents did not respond to the second survey.

Table 10.2

Gender distribution of Survey 1 (n = 121) and Survey 2 (n = 24[a])

		Survey 1		*Survey 2*	
		f	*%*	*f*	*%*
Gender	Male	89	73.6	16	66.7
	Female	32	26.4	8	33.3

Gender distribution showed a slightly larger number of females (6.9%) responding to the second survey.

Table 10.3

Frequency and percentage of landuse in Survey 1 (n = 123) and Survey 2 (n = 24[a])

Landuse	*Survey 1*		*Survey 2[b]*	
	f	*%*	*f*	*%*
Sugarcane	68	55.3	13	54.1
Tropical crops	17	13.8	4	16.7
Cattle	13	10.6	3	12.5
Non-farming[b]	25	20.3	4	16.7
Total	123	100	24	100

[a] This sample represents only the matched respondents of Survey 2. [b] The respondents were found to have given these answers in Survey 1.

The sample of Survey 2 respondents showed a distribution of landuse not substantially different from the Survey 1 sample.

Table 10.4

Frequency and percentage of level of education in Survey 1 (n = 123) and Survey 2 (n = 24[a])

Education level	*Survey 1*		*Survey 2[b]*	
	f	*%*	*f*	*%*
1. primary school	13	10.5	1	4.2
2. secondary school 2.	59	48.0	8	33.3
3. tertiary-University	24	19.5	8	33.3
4. tertiary-TAFE	6	4.9	2	8.3
5. tertiary-Apprenticeship	21	17.1	5	20.9
Total	123	100	24	100

[a] This sample represents only the matched respondents of Survey 2. [b] The respondents were found to have given these answers in Survey 1.

Survey 1 respondents showed a larger proportion of respondents with primary and secondary education levels. However, the small number of Survey 2 respondents does not allow any conclusions to be drawn on differences in education level.

10.3 Comparison level of knowledge and social desirability items of respondents between surveys

The questionnaire of Survey 1 contained several items which were considered of interest in assessing if the sample of matched respondents of Survey 2 differed substantially. The items selected were those measuring social desirability (3 items), the question about the respondent thinking that their knowledge about riparian forests was more correct than what scientists have found, attendance of workshops about land management and riparian forests, and two items on having been asked about riparian forests before or having been offered information about riparian forests by any agency. These last two items were included to test a possible sleeper effect of having had time to think about riparian forests. The results are reported in Tables 10.5 to 10.7.

Table 10.5

Social desirability levels and claiming more knowledge about riparian forests than scientists' in Survey 1 (n = 119) and Survey 2 (n = 24[a])

	Survey 1		*Survey 2[b]*	
	Mean	*SD*	*Mean*	*SD*
Social desirability (7 = strong desirability)	5.40	.97	5.40	1.01
Claiming more correct knowledge than scientists' (7 = definitely more knowledge)	4.00	1.62	4.21	1.25

[a] This sample represents only the matched respondents of Survey 2. [b] The respondents were found to have given these answers in Survey 1.

Social desirability showed no difference between the survey samples. Both samples showed above median levels of social desirability (Table 10.5).

There was no substantial difference between the survey samples claiming more correct knowledge than scientist'. Both samples showed that the landowners did think that their knowledge about riparian forest was neither more nor less than that of scientists (Table 10.5).

Table 10.6

Exposure to questions and offer of information or help by agencies in Survey 1 (n = 121) and Survey 2 (n = 24[a])

		Survey 1			*Survey 2*[b]	
		f	*%*		*f*	*%*
Having been ask about riparian forest before	Yes	32	26.4	Yes	8	33.3
	No	89	73.6	No	16	66.7
Having been offered information or help with riparian forest by anybody or any agency	Yes	32	26.4	Yes	6	25.0
	No	89	73.6	No	18	75.0

[a] This sample represents only the matched respondents of Survey 2. [b] The respondents were found to have given these answers in Survey 1.

A slightly larger percentage of Survey 2 respondents had been asked about riparian forests before. But, the majority of landowners in the surveys had never been asked about riparian forests.

A slightly smaller percentage of Survey 2 respondents had not been offered information about or help with their riparian forests. The majority had never been contacted by anybody or any agency offering information or help with riparian forests. A sleeper effect can therefore not be expected for the majority of respondents.

Table 10.7

Attendance of meetings and workshops in Survey 1 (n = 119) and Survey 2 (n = 24[a])

Attendance of meetings and workshops	Survey 1		Survey 2[b]	
	f	%	f	%
About land management	75	63.0	18	79.2
About riparian forests	34	28.8	5	20.8
Attended none	88	73.9	19	79.2
Attended both	31	26.1	5	20.8

[a] This sample represents only the matched respondents of Survey 2. [b] The respondents were found to have given these answers in Survey 1.

Compared with Survey 1 a larger proportion of Survey 2 respondents had attended meetings or workshops about land management, but a smaller proportion about riparian forests. The differences between the surveys are not substantial and the small number of respondents in Survey 2 does not allow conclusions to be drawn.

10.4 Qualitative analysis of Survey 2 part 1

The first part of Survey 2 consisted of five colour plates illustrating an ecological role of riparian forests and the facing page asked for three separate comments pertaining to the statement of the riparian function shown: their agreement with this statement, their personal experience with it, and their suggestions of remedies or ideas on the subject. A qualitative analysis was performed by searching for themes and keywords in answers to each statement in the booklet (Silverman, 2000). This was undertaken by two readers, one of them the author. Cross-checks were made and the key terms established.

Some respondents' comments were short and not always informative. Other landowners described their experiences and their opinions at great length. The following description of the qualitative data cannot relate the details of all personal

experiences and opinions. Some respondents had written general comments not specifically in answer to each statement; others had not addressed every one but only agreed about the function described. Nevertheless, recurring themes were found.

The following is a description of key themes or words for each role in the booklet. The first paragraph of each analysis gives the information about the role of a riparian forest that was presented together with the colour plate.

Role 1. Stabilisation of banks.

Streamside erosion is a natural process, but:

- Roots of native trees and shrubs will hold the soil.
- Natural debris and rocks provide environment for new seedlings.
- Snags and rocks in the creek will lessen the force of fast water and help prevent scouring and undercutting of banks.

Only 13% (n = 10) landowners disagreed with these statements, 86% (n = 65) agreed. 32% (n = 24) stressed that trees are important and 16% (n = 12) that rocks were needed for stabilising banks. Even car bodies were mentioned together with rocks to help reinforce banks. 16% (n = 12) also wanted to remove debris which indicated that they did not accept fully the benefits of natural debris. Grass was also mentioned by five landowners (7%) as the best stabiliser of banks.

Role 2. Slow-down of heavy runoff.

- The mass of plants in the streamside forest (native grasses, shrubs, trees) represents a barrier which reduces the force of the water during floods.
- The vegetation and the natural debris trap silt and soil in surface run-off.

88% (*n* = 67) of respondents agreed with these statements. Trees were mentioned as necessary by 17% (*n* = 13) and grass as the best option by 15% (*n* = 11). Revegetation was recommended by 12% (*n* = 9) and leaving it to nature by 20% (*n* = 15). Floods were considered too much of a force of nature to be fought. Removal of debris was again considered beneficial by 8% (*n* = 6), and providing drainage ditches and flood paths was mentioned by 11% (*n* = 8) landowners.

Role 3. Clean Water.

- Streamside forest can hold or take up excess nutrients (especially nitrogen and phosphorous from fertilisers and soil)
- Streamside forests can filter, remove, and transform agricultural chemicals.
- The survival of the Great Barrier Reef depends on clean water from the creeks and rivers of the catchment.

These statements were agreed to by 75% (*n* = 58) of respondents and 11% (*n* = 8) disagreed with them. This was reflected in only 13% (*n* = 10) of respondents mentioning the benefits of having trees. 8% (*n* = 6) made the point that there are other polluters rather than farmers, and the same proportion wrote that the Great Barrier Reef is not affected because there is no terrestrial pollution.

Role 4. Habitat for wildlife.

- Land animals can move safely in the vegetation to find food.
- Owls and other raptors find places to perch during their hunt for prey, others can roost and nest in the trees.
- Fish and other aquatic animals will thrive in clean shaded waterways.

92% (*n* = 70) agreed with these statements. 13% (*n* = 10) recommended more trees, and the same proportion mentioned feral pigs. 20% (*n* = 15) stated that the area should be left alone to allow wildlife to thrive. Rare native animals such as cassowary

and platypus were recorded but also crocodiles in unacceptable numbers and the arrival of the pest fish tilapia.

Role 5. A place for recreation and relaxation.

- Fishing and swimming are activities highly valued by people.
- People feel good in the vicinity of water and seek the serenity of natural environments for mental restoration.

These statements were accepted by 88% (n = 67) of the respondents, two did not agree, and five did not answer. The comments with the greatest frequency stressed the importance of riparian areas for recreation and relaxation, by 24%, (n = 18), and expressions of enjoyment by 25% (n = 19). Respondents were aware that these places needed to be looked after, especially in regards to rubbish disposal and toilet facilities, by 20% (n = 15). And despite comments that people destroy these places, 15% (n = 11), other respondents wanted to make sure that people have access to them, 11% (n = 8). The danger of crocodiles was also talked about.

The reporting of the main themes and expressions do not give a picture of the sometimes colourful comments. When reading the respondents' writings, a genuine concern for riparian forests was evident in most responses, as was their appreciation of the natural environment they provide. A concern mentioned by several landowners was the increase of crocodiles and feral pigs, and the disregard of the general public to keep accessible locations clean and undisturbed.

The qualitative analysis did not reveal new opinions of landowners when comparing it with information from Survey 1. Nevertheless, it engaged the respondents cognitively with the subject of riparian forests and possibly primed them for the

questions in the second part of the booklet. At least, it was an opportunity to allow the respondents' relationship to riparian forest to be focused to a certain extent in preparation for the questions on the last pages of the booklet.

10.5 Quantitative analysis of Survey 2 part 2 and comparison with Survey 1

The second part of Survey 2 consisted of a questionnaire with 11 items. These were identical to items in Survey1 and were thought at the time of assembly of the Survey 2 to be representative and relevant to the five objectives of riparian forests covered in section one. The questionnaire consisted of two direct attitudes (DA 7, DA 8), eight attitudinal beliefs which yielded four indirect attitude composites (IA 1, IA 4, IA 11, IA 12), and one direct perceived behaviour control (DPBC 2).

To aid the interpretation of the results the items are listed in Table 10.8 together with the item names and the role they refer to in part 1 of Survey 2.

There is a preponderance of role 3 (clean water) which was considered at the time as a good indicator of landowners' understanding of riparian forests. This understanding was expected to be reflected in good riparian management expressed as behaviour indicators in Survey 1.

The *means* of the items in Survey 2 and the corresponding data from Survey 1 were calculated and independent-samples t-tests performed to determine if significant differences existed between the mean scores of items from Survey 1 and 2. The data set of Survey 1 (n = 123) included the respondents of Survey 2 (n = 75). But these could not be separated because only 24 respondents could be identified (by code matching). This small sample of 24 will undergo a repeated-measures t-test (see next section).

Table 10.8

Variables, item names and the representative role in the Survey 2 questionnaire

Variable	Item name	Role
Good water quality in the catchment waterways is desirable.	IA 1e	Role 3.
It is very likely that streamside forests can remove excess nutrients (nitrogen and phosphorous) from the soil.	IA 4b	Role 3.
I know how to take care of my streamside forest.	DPBC 2	
Keeping the waterways on my land free of debris such as tree branches is extremely good.	IA 11e	Role 1.and 2.
Streamside forests are very good to have for the environment at large.	IA 12e	Role 4.and 5.
Since the water from my creek will end up in the Great Barrier Reef Lagoon (that is the sea between the shore and the Great Barrier Reef) I am responsible for the water quality in my creek.	DA 8	Role 3.
Intact streamside forests will assure good water quality in my creek.	IA 1b	Role 1.and 3.
Excess nutrients (nitrogen and phosphorous) from the water catchment are extremely bad for the marine environment.	IA 4e	Role 3.
Streamside forests benefit from natural debris in the creeks.	IA 11b	Role 2.
I take my role as a keeper of clean waterways very seriously.	DA 7	
That streamside forests are very beneficial for the environment at large is extremely likely.	IA 12b	Role 4.5.

The assumptions for the independent sample t-test were upheld for all but two variables (DPBC 2 and IA 11e, Table 10.9) according to the significance value of more than .05 of Levene's test. Equal variances were assumed for these variables. However, the two variables with smaller Levene's test significance values can be used because the SPSS program "provides [you with] an alternative t-value which compensates for the

fact that variances are not the same" (p.207, Pallant, 2005). Thus, it was possible to use t-test results of all variables.

The t-test revealed a significant difference for direct perceived behaviour control DPBC 2 between the two survey groups [$t(181) = -3.12$, $p = .002$] (Table 10.9) which confirmed the increase in the mean score of survey 2. The respondents of Survey 2 perceived significantly fewer impediments by agreeing that they knew how to take care of their streamside forests (DPBC 2). The effect size of Eta squared .05 is just below the recommended moderate value of .06 (according to Cohen, 1988 cited in Pallant, 2005).

Direct perceived behaviour control according to the theory of planned behaviour assesses a persons' perception of their ability to perform the behaviour and of impediments that prevent them from taking control. A meaningful agreement also means that the person has confidence in being able to care for the riparian forest. Thus, a high rating would express confidence. Was Survey 2 composed of respondents that were self-selected for greater confidence, or were they people that felt they just knew a lot about riparian forest management?

The attitudinal belief composite about riparian forest's capability to remove excess nutrients from the soil before it reaches the waterways, which would be bad for the marine environment (IA 4), showed a significant difference between the scores of the two surveys [$t(188) = -2.91$, $p = .004$, small effect size of Eta squared = .04]. This was mainly due to the significant result for IA 4b, the belief in the likely outcome of the riparian function by respondents of Survey 2 [$t(191) = -2.83$, $p = .01$, small effect size Eta squared = .04]. The corresponding evaluative belief category IA 4e, that

Table 10.9

Independent samples t-test results with the means of variables in the Survey 1 and Survey 2

Variables	Levene's Test		t-test for equality of means					
	F	Sig.	t	df (n=survey1, survey2)	Sig [b]	M Diff.[c]	SE	C.I.[d]
DA 8,7	.15	.70	-.49	186(120,74)	.63	-.09	.19	-.47-.28
DPBC 2	9.02	.003	-3.12[e]	181(120,74	.002	-.77	.25	-1.26--.28
IA1,4,11,12	.25	.62	-1.85	176(112,67)	.07	-2.45	1.32	-5.07-.16
Attitudinal belief composites								
IA 1	.40	.53	.46	192(121,74)	.65	.95	2.06	-3.12-5.02
IA 4	1.79	.18	-2.91	188(118,73)	.004	-5.51	1.89	-9.24--1.78
IA 11	2.75	.10	-.91	188(117,74)	.36	-1.65	1.81	-5.21-1.92
IA 12	.01	.92	-.84	192(120,73)	.40	-1.58	1.89	-5.32-2.15
Attitudinal beliefs								
IA 1e	.36	.55	-.29	194(122,74)	.78	-.04	.13	-.29-.21
IA 1b	.01	.94	.72	191(121,74)	.47	.20	.27	-.34-.74
IA 4e	.002	.97	-.67	189(118,74)	.51	-.14	.21	-.57-.28
IA 4b	.95	.33	-2.83	191(121,73)	.01	-.71	.25	-1.20--.21
IA 11e	5.51	.02	-.14[e]	135(118,74)	.89	-.04	.26	-.55-.47
IA 11 b	.16	.69	-2.40	193(122,74)	.16	-.41	.30	-.99-.17
IA 12e	.001	.98	-1.05	194(122,73)	.30	-.21	.20	-.60-.18
IA 12b	.01	.93	-.67	192(120,74)	.50	-1.28	.19	-.50-.25
Attitudinal belief categories								
Sum IA e	.37	.54	-.96	184(113,73)	.38	-.23	.24	-.70-.24
Sum IA b	.13	.72	-3.43	189(117,73)	.001	-1.21	.35	-1.91--.52

[a] Levene's Test for Equality of Variances. [b](2-tailed). [c]Mean difference. [d]95% Confidence Interval of the Difference, upper and lower limits. [e] Equal variances not assumed.

excess nutrient is bad for the marine environment showed no significant difference on its own [$t(188) = -.67$, $p = .51$].

IA 4b also contributed to the significant finding of the sum of the outcome belief category IA b (Sum IA b) [$t(189] = -3.43$, $p = .001$, medium effect size of Eta

squared = .06]. The sum of the evaluative beliefs IA e, showed no significant difference between the surveys [$t(184) = -.96$, $p = .38$].

The finding suggests that the group of landowners of Survey 2 were more convinced of riparian forest capacity to remove excess nutrients from the soil by the time they responded to this survey questionnaire. Perhaps their belief in this biophysical function of riparian forests had become stronger due to a priming effect, or a sleeper effect. It is also possible that the Survey 2 respondents were self-selected and had always believed more strongly in this riparian role. The repeated-measures t-test of the code-matched sample in the next section was expected to elucidate this question.

10.6 Analysis of the code-matched sample of Survey 2 and comparison with Survey 1

Paired sample t-tests of the means score of responses to the code-matched sample of 24 landowners were undertaken to assess differences between Survey 1 and 2. First, the means for each variable were calculated, followed by repeated measures (paired samples) t-tests to test if there are statistically significant differences in the mean scores of the items of attitudes or direct perceived control for Survey 1 and 2. No differences were found.

The significant results obtained from the independent-sample t-test (comparing the means of corresponding variables with the entire sample of Survey 1 ($n = 123$) and Survey 2 ($n = 75$), Table 10.9) were not evident in the repeated measures t-test of the code-matched sample ($n = 24$) (no table). According to results for this matched sample, the respondents of Survey 2 did not show a priming effect. The perception of

impediments, DPBC 2, and the attitudinal belief, IA 4b, and the sum of the outcome belief category IA b, also did not differ significantly between the surveys.

No further investigations such as comparisons between behaviour indicators of Survey 1 and Survey 2 were deemed appropriate. The small sample size did not allow conclusions to be drawn.

In conclusion, Survey 2 did not reveal any information that could lead to recommendations, unless one considers the possible priming effect for the belief in the capacity of riparian forests to remove excess nutrients from the soil (IA 4b) found to be significant in the independent samples t-test (Table 10.9). Perhaps this biophysical function of riparian forests became more evident to the respondents after it was presented as an important function for clean water in the creeks (Role 3 in the survey booklet). Nevertheless, other beliefs related to the clean water role were not influenced, and the result was not confirmed in the repeated measures t-test with the 24 matching respondents. Therefore, no conclusions can be drawn from this result.

This is the last chapter on statistical analysis and interpretation. The next chapter will draw together the results and conclude with an overall interpretation of findings.

CHAPTER 11. CONCLUSIONS

11.1 Introduction

This chapter will bring together the notable findings from the research study and report on the outcomes according to the research objectives and questions outlined in the introductory chapter. The primary objective of this research project was to investigate the social psychological aspects of landowners' management practices of riparian forests in the catchment of the Great Barrier Reef in far North Queensland, Australia. This objective was based on the very evident concerns for the conservation status of the iconic World Heritage listed Great Barrier Reef, a conservation status closely interconnected with land management practices undertaken in the adjacent terrestrial landscape including the water catchment regions. A major concern is the clearing of riparian vegetation which has resulted in dangerous chemical stress loads in the marine environment (Fabricius, 2005). Since the evidence from scientific studies suggests that riparian forests continue to be degraded or destroyed (Australian Productivity Commission, 2003; Brodie, 2002; Brodie et al., 2012; Brodie & Mitchell, 2005; Devlin & Brodie, 2005; Gilbert & Brodie, 2001; Queensland Department of Local Government and Planning, 2008; Rasiah et al., 2003; Werren & Arthington, 2002), the need for a social psychological analysis of the problem was evident. The combination of riparian landholders and the detrimental effect their land management practices can have on the health of the GBR was considered worthy of research. Insight into what guides the management practices of landowners could assist in the formulation of recommendations for government and land care agencies on how to work with landowners to preserve these important ecological landscapes.

11.2 The theoretical background

The attitude-behaviour model of the theory of planned behaviour (TPB) (Ajzen, 1991) provided the theoretical and conceptual framework for the study and guided the research design and the construction of the survey questionnaires. The TPB has been found to be a useful model in assessing the impact of attitudes, subjective norms and perceived behaviour control variables on intentions and actual practice of riparian and land management (Beedell & Rehman, 2000; Fielding, Terry, Masser, Bordia, & Hogg, 2005). Furthermore, the model posits that these intention predictor variables are underpinned by a person's beliefs which are constantly updated and modified by the influences of salient memories and external factors (Ajzen & Fishbein, 2005). Changes in the beliefs result in changes of attitudes, subjective norms and perceived behaviour controls (Ajzen & Fischbein, 2005). The TPB thus provides an additional layer of information in the form of beliefs that underpin the measures of attitudes, subjective norms and perceived behaviour controls. Exploring the direct links of these belief variables with intentions and behaviour indicators allows insight into the underlying reasons for the intentions and behaviour (Ajzen & Driver, 1991). The present study assesses the efficacy of the TPB model to predict landowners' intentions and actual practices (behaviour) in regard to riparian forest management in the catchment of the Great Barrier Reef of far north Queensland.

The model's efficacy is contingent on the usefulness of the TPB constructs of direct measures of attitudes, subjective norms and perceived behaviour controls as predictors of intentions. Thus, the aim included the investigation of the contributions of these variables and determination of the strongest predictors. Likewise, the role of beliefs and of external factors such as demographics, sources of knowledge

and general environmental attitudes were explored in the formation of intention predictors, and their impact assessed on intentions and behaviour indicators.

11.3 The structure of the research study

The research commenced with Study 1, an interview study with retired farmers, that set out to elicit relevant and salient information needed for the generation of the TPB survey questionnaire. The main postal survey (Survey 1), a self-administered questionnaire, followed. This survey accessed the landowners' responses to TPB items, as well as demographic items, knowledge status, and a short general environmental assessment using the New Ecological Paradigm. The second postal survey (Survey 2) was sent out with the objective of finding differences in responses to questions from Survey 1 as a function of cognitive involvement from answering the questionnaire in Survey 1, and of having been given a booklet about the roles of riparian forest before the questionnaire as part of Survey 2.

The survey methodology used an anonymous format and was therefore limited in the implementation of before and after treatment beyond sending a second survey that was hoped to show differences in responses. Unfortunately, the response rate was 75 out of 123 respondents of which only 24 could be matched by self-assigned codes. The other respondents had forgotten their code. Despite this drawback, the methodology of the postal surveys was successful in that suitable and sufficient data were collected for the application of the social psychological model of the TPB. Likewise, the data allowed the testing of a priming effect with two interventions, and of the investigation of the influence of a large number of external variables on TPB outcomes.

11.4 Conclusions from Study 1

In general, information from the semi-structured interviews with eleven retired farmers added to the body of literature about landowners' positive evaluation and liking of riparian forests and their strong feeling of stewardship for the land (Barr & Carey, 2000; Bjornsson et al., 2002; Corbett, 2002; Curtis & Robertson, 2003; Dutcher, 2000; Institute for Rural Futures, 2009; Klapproth & Johnson, 1999c; Mallawaarachchi et al., 1999; Wilson et al., 2003). In particular the notions of stewardship or guardianship for the land was found in statements of subjective norming concepts expressed as a strong sense of belonging to a farming community which always tried to do its best. The theme "landowners' feelings of responsibility, appreciation of the land including riparian forests, as individuals and as a member of the farming community" was a finding in this research that was comparable with other studies in Australia and overseas (Atari et al., 2009; Beedell & Rehman, 1999; Dutcher, 2000; Fenton, 2004; Grasby et al., 2000; Klapproth & Johnson, 1999c; Kraack, 2000; Mallawaarachchi et al., 1999; Michel-Guillou & Moser, 2006; Reeve & Black, 1993; Terrill, 1999; Vanclay, 1992b). These repeated findings should indicate and confirm the notion that riparian landowners sincerely believe that their management practices were undertaken to the best of their knowledge and ability. Therefore, their efforts need to be acknowledged and built upon, when introducing new information and recommendations on how to improve, preserve or establish riparian forests.

The interviews also disclosed a surprising lack of understanding and acceptance of scientific information about the biophysical functions of riparian forests according to scientific research, and the importance of efficient riparian zones for the health of the Great Barrier Reef. For the retired farmers' personal knowledge was considered most

applicable which they were convinced was the same as the scientific information given in an intervention brochure. All but one interviewee insisted that they already knew the information from the brochure despite their comments to the contrary during the entire interview. From these findings one can conclude that most farmers lack the basis for sound riparian forest management practices according to scientific knowledge which has been found to increase adoption of riparian protection measures (Curtis & Robertson, 2003; Wilson et al., 2003). Further findings in this study indicated that scientific information was not believed because it was thought to be inconsistent. In particular the role of agricultural practices and chemicals in the marine pollution that threaten the Great Barrier Reef which they believed had not been endorsed by all scientists and had actually been downplayed by some marine experts. It also revealed that the interviewees were not convinced about the outcome of management strategies. This need for certainty of outcomes of recommended practices was also reported by Allan and Curtis (2005) in their southeastern Australian study investigating watershed management.

Control factors as impediments to riparian management were perceived by most interviewees in the form of environmental regulations. The interviewees agreed that no further regulations in regard to riparian forest management were necessary since the younger landowners were doing a good job. However, technical and financial assistance from government sources for the management of riparian forests was uniformly endorsed. Perceived or actual government interventions have been found to influence uptake of riparian management programs in Australia and overseas (Brown & Harris, 2005; Corbett, 2002; Fenton, 2004, 2007; Kraack, 2000; McNaughton & Ziegler, 1999; Reeve & Black, 1993; Thompson & Pepperdine, 2003). It can be concluded that the

retired farmers were not so much conversant with environmental regulations for riparian areas but rather considered the younger farmers' efforts in this regard as far greater than theirs had been and therefore they must be sufficient. It is not certain that younger farmers thought the same about the government's role in the regulation of riparian management but it can be assumed that technical and financial help would be welcomed. A report based on interviews with farmers in North Queensland (Fenton, 2004) found that participants list economic consideration as stronger than preservation of riparian land. While financial incentives such as tax rebates in exchange for long-term conservation efforts are one way to increase adoption of appropriated land management practices, they have been found to be difficult to implement and assess (Gunningham, 2007).

Practical recommendations for the presentation of scientifically based information need to acknowledge current practices and to expand or amend them with scientific findings that can be demonstrated to a certain degree. It means that cherished beliefs should not be dismissed but integrated in some form into the new riparian management. Dismissing the landholders' practices out of hand will prevent engagement with new ideas and make it difficult for them to consider new practices. It may threaten their self-esteem and they may feel out of their "comfort zone" (Goleman, 1996). To tackle the whole issue, the wholehearted participation of the landholders in the process of presenting and explaining the new ideas is necessary (Fenton, 2004).

The insights into what retired farmers with riparian forests believe were very informative and provided relevant themes for the formulation of the questionnaire of the main survey. The findings of this study were published in 2010 (Flick, Caltabiano, & Bentrupperbäumer, 2010).

11.5 Conclusions from Survey 1

11.5.1 TPB as an efficient model in predicting intentions and behaviour

On the basis of providing an analytical, conceptual and theoretical framework, and when compared with findings from other rural studies (Beedell & Rehman, 1999, 2000; Fielding, McDonald, & Louis, 2008), and empirical reviews (Hagger, Chatzisarantis, & Biddle, 2002; Sheeran, 2002), the social psychological model of the theory of planned behaviour was found to be an effective model for this study.

The statistical methods employed in the analysis of the data were restricted by the number of responses (n = 123) to the questions used in multiple regression analyses. Only results with significance values of less than .05 were reported and considered in the discussions. The use of path analysis or SEM was unfortunately not possible due to the small sample size. These analyses require a minimum of five responses for each independent variable. The TPB variables already numbered 61. Advanced statistical tools would have been desirable because they would have allowed for more information about the linkages between the TPB components, and the influences that determined the intentions and the behaviour indicators, as well as any external variables considered. For this study the proportion of variance in the intentions construct explained by the TPB constructs of attitudes, subjective norms and perceived behaviour controls was established with multiple regression analyses. For the behaviour indicators (dependent variables), logistic regression became the statistical technique of choice.

Prediction of intentions. The variance explained in the sum of intentions construct amounted to 52%. This result compares well with that of a meta-analysis of 185 non-rural studies which reported attitudes alone explained on average 39% of variance in

intentions (Armitage & Conner, 2001). The 10-item direct attitude construct was the most reliable measure with 28% unique contribution to the explanation of variance, perceived behavior controls' contribution was small but significant, while subjective norms did not contribute significantly.

Prediction of behaviour. The model was less efficient in predicting the behaviour construct in the TPB. The study analysed eight single behaviour indicators representative of the landowners' past riparian management practices. Such behaviour indicators are accepted as current behaviours and are assumed to be maintained in the future (Ajzen, 2002b; Conner & Armitage, 1998; Fielding et al., 2005). Since there was no acceptable reason for combining the list of behaviours into a single construct; it was necessary to analyze this data with a technique that was able to handle categorical dependent variables. In short logistic regression analysis was employed to determine the amount of variation explained in each of the behaviour indicators.

In the present study the construct of the sum of intentions was not an efficient predictor but the individual intention to plant trees on the streamside predicted the behaviour indicator of newly planted trees on the streamside forest and explained 16.9 to 24.5% of variation. Armitage and Conner (2002) reported an average of 11% explained variance in their meta-analysis of TPB studies. Since the newly planted trees were an activity performed in the past it can be assumed that this behaviour indicator of good riparian maintenance will be performed in the future (Ajzen, 2002b). Newly planted trees as an indicator of cattle farmers' willingness to adopt recommended good riparian management was found by Curtis and Robertson (2003).

The significant correlations found between the intention construct and several behaviour indicators were due to individual intentions expressing willingness to work with government agencies, having streamside forests on the list of priorities, and proposing to plant a streamside forest this year if there was a need. Such intentions meant that cropping or cultivating the land from the edge of the waterway close enough to turn a tractor around was significantly likely not to be practiced by landowners. One can assume that these landowners were aware of the detrimental impact of compaction of the soil on the stream banks. The study also established that mostly sugarcane growers were following this undesirable practice, while landowners who attended workshops on land or riparian management were significantly less likely to follow it.

One other TPB construct that can moderate the prediction of behaviour by the intentions was an actual not a perceived behaviour control. The behaviour control variable of needing technical help to bring their riparian forest up to scratch became the major factor in the prediction of the behaviour indictor of having fewer trees on the streamside explaining up to 9.2% of the variation on its own. The conclusion is that landowners who are strongly in need of technical help find this an insurmountable impediment which was reflected in a loss of trees on their streamsides, regardless of their intentions. The obvious recommendation would be assisting riparian landowners with technical help. The retired farmers in the interview study for this research (Study 1) also mentioned the need for technical and financial help. Fenton (2004) recommended this assistance for farmers in North Queensland in his report on capacity building requirements in relation to natural resources management in the wet tropics, based on extensive interviews of farmers in the region.

The application of the TPB in the present study can be considered efficacious on the strength of the predictor constructs of intentions, the direct measures of attitudes, subjective norms and perceived behaviour control. The proportion of variance explained in the intention construct was comparable to results in the literature. The intention construct predicted one behaviour indicator, and four significant correlations with the behaviour indicators. These behaviour indicators were 'newly planted trees', 'turning the tractor around on the streamside', 'streamsides had more trees some time ago', 'more trees and shrubs now than ever before', and 'crop or cultivate land more than 10m from edge of waterway'.

11.5.2 Attitudes and intentions

While the attitude construct was found to be the strongest direct measure in predicting intentions in the TPB model, the attitudinal beliefs (indirect attitudes) that underpin these direct attitudes were found to explain an even greater proportion of variance. In the TPB the beliefs validate the direct constructs (the Pearson's product-moment correlation between these attitudes was .79, p <.01) but are not employed to directly predict intentions or behaviour in the TPB (Ajzen, 1991). Nevertheless, analyzing beliefs as predictors of intentions gives insight of their impact on the formation of intentions and their role in the behaviour indicators.

In this study the 24 attitudinal beliefs of the survey underwent factor analysis to minimise the number of variables. Two factors were found which encompassed 17 belief-based attitudes. Factor 1 representing good understanding of the environmental importance of riparian forests and willingness to manage riparian forests for the sake of the environment, explained a significant proportion of variance in intentions (38%).

This finding reflects Curtis and Robertson's (2003) position of ascertaining the extent that an understanding of riparian function in the environment promotes adoption of recommended riparian management practices. Likewise, in Dutcher's (2000) observation of his sample of riparian landowners, one reason to maintain and create riparian forests was the understanding of the importance of stream quality.

Factor 2 represented an understanding of good riparian management practices. It did not explain any intention. This may be a reflection of the landowners not believing in the efficacy of riparian management (also found by Dutcher, 2000; Wilson et al., 2003 and others) or more likely that they thought their riparian areas did not need any improvement. The inability to recognize land degradation on their own land when they can point it out easily on other farmers' land has been reported before (Barr & Carey; Corbett, 2002; Dutcher, 2000; Earles, Rose & Brownlea, 1979; Klapproth & Johnson, 1999c; Wilson et al., 2003).

Furthermore, regression analysis found the attitudinal beliefs based on evaluation of the desirability of riparian forests were the only significant contributor and predicted 35.7% of the variance in intentions. The predominance of evaluative beliefs in the prediction of intention items is in line with results from a rural study employing the TPB (Fielding et al., 2005), and a study on recycling (Castro, Garrido, Reis, & Menezes, 2009). In contrast, the disbelief in the outcome of riparian maintenance has been reported as a major problem preventing the adoption of good management practices (Barr & Carey, 2000; Corbett, 2002; Dutcher, 2000; Klapproth & Johnson, 1999c; Wilson et al., 2003). However, from the findings in this study one can conclude that understanding the efficacy of good riparian management practices does not necessarily imply strong intentions, but beliefs in the desirability of the

outcome, such as the benefits of good water quality, erosion control, and vegetation cover on the streamsides do.

Nevertheless, beliefs in the efficacy of riparian care (beliefs that the outcome can be achieved) were found to be exclusive predictors of the individual intention items that express willingness to work with government agencies on planting and maintaining streamside forests if contacted, and of having streamsides on the list of priorities. This implies that landowners who understand and accept the biophysical capacity of riparian forest also understand the benefits of working with government agencies, and have plans to practice riparian management. The impact of understanding scientific information is again found to be facilitating intentions.

The interplay of the attitudinal beliefs became evident when the 12 belief composites (products of evaluative beliefs and beliefs in the outcome) were regressed on intentions. Together they explained 40.4% of the variance in the sum of intentions. They also significantly predicted all five of the six individual intentions. This strong result allows the conclusion that ascertaining landowners' attitudinal beliefs in regard to riparian forests can be used as a valid measure of intentions to maintain it.

11.5.3 Attitudes and behaviour

The explanation of variation in the behaviour indicators of newly planted trees and reporting more trees on the streamsides now than ever before was confirmed by several predictors. Logistic regression analysis showed direct attitudes to be the significant predictor of the variation (the model explained up to 12.3%) in the behaviour indicator of newly planted trees on the streamside (direct measures of subjective norms and perceived behaviour controls were not predictors of behaviour indicators). The

combined evaluative beliefs were also decisive contributors explaining up to 13.5% of variation of newly planted trees (beliefs that the outcome can be achieved did not feature at all).

Belief Factor 1, understanding the environmental importance of riparian forests and willingness to manage riparian forests for the sake of the environment also explained newly planted trees. Understanding of good riparian management (belief Factor 2), emerged as a stronger predictor than intentions only in a step-wise logistic regression analysis of another behaviour indicator: having more trees on the streamsides now than ever before. This does not indicate newly planted trees but rather that the landowner has not interfered with regrowth.

The recommendations following from these findings are to concentrate on establishing and fostering beliefs in the outcome of recommended riparian management practices. While education about biophysical functions of riparian forests seems to be the obvious approach, it would nevertheless, have to rely on practical demonstrations to overcome the landowners' skepticism, rather than presentation of scientific data about riparian function alone. Scientific facts have to be fitted into the already present beliefs in the desirable attributes of streamsides.

11.5.4 Subjective norms and intentions and behaviour

The failure of the subjective norming measure as a contributor in the explanation of variance in intentions has been reported in meta-analyses (Ajzen, 1991; Armitage & Conner, 2001; Sutton, 1998) and has been the subject of research into the separate concepts which are most representative of subjective norming in the particular setting. Several research groups have tackled this difficult concept of social influence

manifested in subjective norming (Beck & Ajzen, 1991; Conner & Armitage, 1998; Terry & Hogg, 2001; Terry, Hogg, & McKimmie, 2000; Terry, Hogg, & White, 1999).

Prediction of intentions. In this study the direct measure of subjective norms was limited to opinions and expectations of respected others and neighbours in regard to riparian forests preservation. Nevertheless, this narrowly defined direct subjective norming construct correlated with the intentions construct, and it significantly contributed to the explanation of variance in the individual intention item of landowners planning to maintain their streamside forest. This planning intention was predicted to a small extent by the approval and expectations of others.

Furthermore, subjective norming became a significant factor in the prediction of intentions by the direct measures when landowners were younger. Age has been found to be a factor in farmers' decision making processes (Farmar-Bowers & Lane, 2009). The reason that younger farmers are more inclined to comply with social expectations has been attributed to different family and social obligations that demand closer involvement with the community.

Another external variable that changed the contribution of direct subjective norms to become significant was found. When landowners considered their major knowledge source to come from traditional land management practices handed down, they showed stronger subjective norming. Its additional significant contribution to the explanation of intentions in the TPB model was negative, meaning that intentions to practice riparian management declined, but at the same time it increased the influence of subjective norming on intentions. The greater influence of the opinion of others may mean that landowners assumed others think the same and would approve of keeping the

traditional practices. Therefore they had no need to report they had any intentions since whatever riparian management they already practiced was sufficient and always had been to their knowledge. Study 1 found that retired farmers were proud of their good custodianship of their land including riparian forests, and considered all farmers to have used practices to the best of their ability (Flick et al., 2010). Nevertheless, studies that include inspection of the farming land consistently report that landowners do not recognize erosion or pollution of riparian areas (Barr & Carey, 2000; Corbett, 2002; Dutcher, 2000; Earles, Rose & Brownlea, 1979; Klapproth & Johnson, 1999c; Wilson et al., 2003).

The four norming belief measures in this study were found to be stronger predictors of intentions to practice riparian forest maintenance than the direct measures of subjective norming behaviour. The beliefs explained 33.1% of variance in intentions. The beliefs in the approval and expectations of respected others rather than the motivation to comply with these expectations, were the more important and more significant variables in the multiple regression analysis. The explanation of variance was the strongest and most significant for the individual intention to work with government agencies on planting or maintaining riparian forests by the beliefs of motivations to comply. This finding reflects Fielding and colleagues (2005) who reported that graziers with strong intentions had significantly stronger beliefs of motivations to comply with government and quasi-government agencies. This is an intriguing finding that could be explored further to investigate if the offer of financial and technical help may be the motivation to comply with government expectations.

The recommendations flowing from the information about the willingness to work with government and land care agencies include regular contacts with landowners

and offers of help with riparian maintenance. This kind of continuity allows government personnel to introduce new information while evaluating what has been done to date together with the landowner. Allan and Curtis (2005) considered this communication that allows for reflection on both side an important part of adaptive management. Since the intentions of working with government agencies was also strongly influenced by the belief that respected others would approve, showing evidence that other landowners found cooperation with agencies extremely useful would be another recommendation that could be successful.

Prediction of behaviour indicators. Subjective norms were not predictors of any behaviour indicators. Nevertheless, a significant correlation was found with having fewer trees on the streamsides. While the connection with subjective norming behaviour is unclear it has to be mentioned that this undesirable behaviour indicator does not necessarily mean neglect or bad riparian management. Other reasons such as natural tree fall can be the case, especially since a cyclone devastated part of the study area seven months before. The association does indicate that these landowners who are in tune with other people's expectations noticed the loss of trees. They pay attention to changes in their riparian forests.

Recommendations based on these results of the impact of subjective norming in the TPB part would be to target those landowners who report a loss of trees on their streamsides and enlist them in programs of regeneration and maintenance of riparian forests. These landowners are most likely willing participants who would require the least persuasion.

11.5.5 Perceived behaviour controls and intentions

Prediction of intentions. The direct perceived behaviour control construct contributed significantly to the explanation of the sum of intentions. However, this was based entirely on predicting two individual intentions: the landowners' intentions of planning to maintain their streamside forest, and of having streamside forests on their list of priorities. These intentions were predicted when the perception of impediments was low.

Multiple regression analysis with the set of eight perceived control beliefs showed that these explained a large proportion of variance in the sum of intentions (38.5%). Further analyses revealed that only two of the eight perceived control beliefs were significant predictors. Thus, landowners with strong intentions did not feel impeded by financial constraints, and believed they could afford to lose a 10m strip of streamside land to a riparian forest.

While these findings makes sense, Fielding and colleagues (2005), however, found no difference between graziers with weak and strong intentions and their perception of behaviour controls. The cattle farmers in their study considered the cost of managing riparian forests equally strongly as impediments, regardless of intentions. Nevertheless, one can conclude that for many landowners the cost and the loss of crop land present major impediments to their intentions of riparian maintenance. This was also reported for graziers in Victoria (Curtis & Robertson, 2003) and in other research studies (Cable et al., 1999; Curtis & Robertson, 2003; Klapproth & Johnson, 1999c; Wilson et al., 2003).

When landowners believed they can afford the economic costs of maintaining their riparian forest, they also had the intention of maintaining them. No other intentions were predicted by this belief. However, those landowners who believed they could afford to lose a 10m strip of streamside land to a riparian forest also had strong intentions to plant, maintain and improve their riparian forest and would work with government agencies, but curiously, intentions to donate time to work with land care agencies failed to be predicted. Engagement with government personnel may be perceived differently from land care groups. Landholders may appreciate that government personnel can be more permanent than land care groups, thus they are able to keep in contact once they have established a working relationship. This viewpoint was also important in recommendations made by Allan and Curtis (2005) in connection with adaptive management. Investigation into landowners' expectations of acceptable help from agencies specifically in the context of riparian forest could shed light on the impediments that need to be addressed.

Prediction of behaviour. The control belief of being able to afford to lose 10m of cropland to riparian forest was also found to be a predictor of reporting a loss of trees on the streamsides (the model explained up to 26% of variation). While this appears to contradict the strong intentions to manage the riparian forest well, it actually lends support. Landowners who noticed that the streamsides on their land have fewer trees on them most likely have watched the deterioration and intend to remedy it. Tree loss is not always a sign of neglect or mismanagement but may be due to natural tree fall and can happen suddenly, for instance during a cyclone (cyclone "Larry" went through this area of country half a year before the survey was conducted).

Recommendations have to clearly address the insurmountable impediments that keep some landowners with good intentions from planting trees on their streamsides. Those landowners who feel they cannot afford the costs could be persuaded by offers of compensation in return for riparian forest maintenance. The loss of land may also be a point which could be negotiated. There are benefits of riparian maintenance (erosion control, environmental concern) which, when clearly outlined may sway those landowners who do not think they can afford to lose the land, and help them to establish a streamside forest. Riparian maintenance programs that offer technical and financial help may well be taken up by already motivated landowners.

This brings up the dilemma of who should be responsible for riparian maintenance. After all riparian forest is also a public resource that is essential for good water quality, and in far north Queensland for a healthy marine environment safeguarding the Great Barrier Reef. In the interview study (Study 1) retired farmers were well aware of this and mentioned their indirect contribution to the tourist industry by maintaining the riparian zone. Furthermore, Fenton (2004) reported that many community members considered compensation for landowners in order, since it was also for the public good.

Willingness-to-pay for and willingness-to-participate in environmental programs such as planting trees or preserving natural areas has been reported repeatedly as linked to personal satisfaction, appreciation of nature, and benefitting the common good (Bohnet & Kinjun, 2009; De Young, 2000; Herbohn, 1999; Spash et al., 2009). Thus, public awareness and understanding of the environment should to be fostered by continuing the funding of land care programs and environmental groups in order to

maintain support, and understanding the need for environmentally responsible behaviour.

11.6 External variables as influences on predictors of intentions and behaviour

In the TPB the external variables (background factors) are assumed to be incorporated during the formation of the beliefs that underlie attitudes, subjective norms and perceived behaviour control (Ajzen, 2002). Nevertheless, the saliency of some factors may not have been sufficient to be integrated into the belief components in the present study. They could therefore represent additional factors that interfere with or augment predictions of intentions and behaviour. This was found for the variables of age and considering traditional practices handed down as a major source of knowledge in the prediction of intentions by subjective norms.

Hierarchical multiple regression found that age was a weak but significant negative predictor of intentions on its own, but also that it influenced subjective norming to become a significant contributor. It meant that younger landowners were more likely to have strong intentions. Age was found to influence farmers' decision making processes (Farmar-Bowers & Lane, 2009), but the change in subjective norming may be due to a stronger environmental concern which was reported by Fenton (1998).

Further external factors were found to add to the explanation of variance in intentions. Thus, when landowners had been asked by anybody, anything about riparian forest, it was also found to strengthen their intentions. One may conclude that cognitive processes were triggered that led to intentions. This finding confirms the recommendation made above that engaging landowners in riparian matters by

contacting them or suggesting they attend meetings and workshops will increase the intentions to manage their riparian forest. The study also found attendance of meetings or workshops especially when it was found useful, to correlate significantly with the intention of working with government agencies to plant and maintain them.

The other external variables were concerned with the landowners' important sources of knowledge about riparian forests: *Listening to the radio* and *observation of other people's land management practices*. The implications are that the radio was a good way to communicate information about riparian management that leads to intentions. Landowners did not recall specific programs that they had listened to, as ascertained by another question, but some message must have added to the strength of their intentions. The significant contribution of the external variable of observation of other people's practices to the explanation of intentions signifies that a considerable number of landowners are willing to adopt practices that worked well for others. While following other farmers' practices is reminiscent of the "diffusion theory" (Rogers, 1983), other research (Barr & Carey, 2000) found farmers gave greater consideration to their social role in the community when giving preference to local knowledge about riparian forests over that from outside sources (e.g. workshops and land care agent). The interviewees in Study 1 also very strongly eschewed the idea that they observed their neighbours.

The external variable representing knowledge about riparian forests from own experience by trial and error was a most important contributor to the explanation of variation of the behaviour indicator of having newly planted trees on the streamsides. The model explained up to 30.4% of variation. This result was confirmed for the behaviour indicator of reporting to have more trees on the streamside now than ever

before. Kraack (2000) also found sugarcane growers' own experience to be an important factor affecting their land management in a qualitative research study. Her recommendation to acknowledge these landowners' contributions and include them in further development of desirable riparian management practices is supported by the results of the quantitative analysis in the present study.

The results point to recommendations for finding effective ways of imparting knowledge that will support strong intentions, and for keeping the subject of riparian forests fresh in the landowners' mind. Radio programs would be acceptable and efficient ways to impart knowledge, as would practical workshops that allow observation and comparison of their own and other people's land management practices especially when new scientifically-based approaches are incorporated.

11.7 Conclusions from Survey 2

Survey 2 had a dataset of only 75 cases (response of 16.1%) compared to the 123 in Survey 1 (response rate of 22.8%). Nevertheless, independent samples t-test revealed a significant result for difference in the belief in the capacity of riparian forests to remove excess nutrients from the soil. This gave an indication of a priming effect. Also, Survey 2 respondents perceived significantly fewer impediments that would interfere with their riparian management implying that the sample was self-selected to some extent. The 24 code-matched responses of this survey underwent repeated measures t-test but could not confirm the priming effect or the significantly lower perception of impediments found for the entire sample.

The responses to the illustrated roles of riparian forests as biophysical agents were strongly in agreement with all five proposed items. Thus, the majority (86%) of

the respondents agreed that tree roots and shrubs as well as natural debris will help in preventing erosion, and 88% agreed that riparian forest will slow-down floods. A slightly smaller percentage (75%) agreed that streamside forests can remove or transform agricultural chemicals thus providing cleaner water for the catchment of the Great Barrier Reef. However, 8% of respondents did not believe that there was terrestrial pollution and if there was, it would not affect the Great Barrier Reef.

Also, the undesirable practice of removing debris was believed to be beneficial by very few respondents as was the belief in grass as sufficient riparian vegetation cover. There was also a feeling of giving up the unequal struggle with floods and leaving it to nature (20%). The riparian forest as a wildlife habitat was supported by 92% of respondents and 20% wanted it left for the sake of wildlife. Nevertheless, crocodiles and feral pigs were cited to live there in unacceptable numbers, and together with the pest fish tilapia was mentioned as threats to native wildlife. A large proportion (88%) of respondents found riparian areas great places for recreation and relaxation, while being aware of problems arising from public access to swimming holes.

Judging by the comments of the 75 respondents of Survey 2, one can conclude that a large proportion of the landowners in both surveys had a genuine liking for riparian forests and at the same time had concern for their preservation.

Overview of key findings, recommendations and further research

Key findings from the elicitation Study 1.

Retired farmers exhibited:

- strong positive feelings of stewardship for the land and the riparian forest

- strong sense of belonging to a farming community which always tried to do their best
- a surprising lack of understanding and acceptance of scientific information
- no acceptance of importance of the riparian zone to the health of the GBR
- no scientific basis for sound riparian forest management practices
- little trust in efficacy of recommended riparian forest management practices
- a negative view to further regulations in regard to riparian forest management
- endorsement for technical and financial assistance
- strong support for younger farmers

Key findings from Surveys 1 and 2.

- landowners in general have a genuine liking for riparian areas
- beliefs in biophysical functions of riparian forest generally did not lead to intentions or behaviour indicators

Prediction of intentions

By the model

- the TPB model explained 52% of variance in intentions
- direct attitudes contributed 28% of the variance in intentions (unique contribution)

The theory of planned behaviour (TPB) was an efficient model for the prediction of intentions and behaviour indicators, and for significant correlations between TPB variables and external factors.

By attitudinal beliefs

- attitudinal beliefs predicted intentions better than direct attitudes (40.4% explained)
- beliefs representing *understanding environmental importance of riparian forests and willingness to manage riparian forests for the sake of the environment* were significant predictors of intentions (38% explained)
- beliefs in the desirable values of riparian forest (evaluative beliefs) were significant predictors of intentions (35.7% explained)
- beliefs representing an *understanding and acceptance of the principles of good riparian management* did not explain intentions
- beliefs in the biophysical capacity of riparian forest predicted
    - willingness to work with government agencies, and
    - having streamsides on the list of priorities

By norming beliefs

- norming beliefs were stronger predictors of intentions to practice riparian forest maintenance than the direct measures of norming behaviour (33.1% explained)
- strong need for approval and expectations of others (subjective norming) predicted intention to maintain their streamside forest
- beliefs of motivation to comply with expectations of respected others were best predictors of the individual intention to work with government agencies

By control beliefs

- control beliefs were significant predictors of intentions (38% explained)

- low perception of impediments (perceived behaviour controls) predicted intentions of
    - planning to maintain their streamside forest, and
    - having streamside forests on their list of priorities
- believing one can afford to lose a 10m strip of streamside land to a riparian forest predicted strong intentions, specifically
    - willingness to work with government agencies
    - have streamside forest on the list of priorities
    - improve the streamsides if needed
    - plant a streamside forest this year, and
    - planning to maintain the streamside forest
- believing one can afford the cost of maintaining riparian forest predicted the intention of planning to maintain them

Intentions were strengthened by

- listening to radio programs about riparian forest
- engaging landowners by contacting them
- meetings and workshops about land and riparian management
- knowledge from observing other people's practices
- age: younger landholders have stronger norming behaviour that predicted intentions
- major knowledge source of traditional land management practices handed down predicted weaker intentions

Prediction of behaviour indicators

- Newly planted tree on the streamside were predicted by
    - direct attitudes, and
    - the intention to plant trees
    - evaluation of riparian forest as desirable (evaluative beliefs)
- Not using a tractor on the streamsides was significantly correlated with intentions of
    - willingness to work with government
    - listing streamsides as a priority
    - intending to plant a streamside forest this year, and
    - attendance of workshops about land or riparian management
- mostly sugarcane growers drive tractors on the streamsides

By control beliefs

- need of technical help was a significant predictor of having few trees on the streamside
- need of technical help was an insurmountable impediment for some landowners
- understanding the principles of good riparian management explained more trees on the streamsides now than ever before
- belief of not being able to afford to lose 10m of cropland to riparian forest was a predictor of loss of trees on the streamsides (26% explained)

By external variables

- 90% of workshop attendees reported trees on their streamsides

- knowledge from experience by trial and error significantly explained new trees

Recommendations about landowners' needs and the approaches to information programs

Technical and financial help

- essential to assist landowners to bring riparian forest up to scratch
- compensation for costs incurred while implementing recommended riparian management by the landowner
- financial assistance for long-term conservation efforts

Use of information material that considers

- establishing and fostering beliefs in the outcome of recommended riparian management practices
- building on already present beliefs in the desirable attributes of streamsides and advocate practices based on scientific findings that will bring about these attributes
- including practical demonstrations to overcome the landowners' skepticism, rather than presentation of scientific data about riparian function alone
- showing evidence that respected other landowners have found cooperation with agencies extremely useful, increases motivation and reduces scepticism about new management practices
- finding out the major source of knowledge about riparian management and building on that
    - observation of other people's practices strengthen intentions, and

    - regular radio programs about riparian forest to convey information
- landowners with strong norming behaviour who are more likely to be willing participants in riparian management programs

Approaches that may assist in long-term riparian management

- establish frequent contacts with landowners and offer help and information while reflecting on past riparian issues
- negotiate solutions, such as financial and technical help and use persuasion by showing benefits from loss of land for the establishment of a streamside forest
- offer workshops and meetings about latest information about riparian management

Objectives for further analysis of the data

The data from this study can provide material for more in-depth analysis which was out of the scope for this thesis. Thus, some questions may be answered to some extent by addressing the following points:

- What is the extent of awareness about the need to preserve riparian forest in the community of riparian landowners?
- Why do the motivations to comply with expectations of respected others predict intention to work with government agencies? Are financial and technical help the most likely incentives?
- Do landowners appreciate long-term engagement with agencies when addressing their riparian forest management practices?
- Why do beliefs representing an understanding and acceptance of the principles of good riparian management not predict intentions or behaviour indicators?

- Why do beliefs representing understanding environmental importance of riparian forests and willingness to manage riparian forests for the sake of the environment predict intention but the general measure of environmental awareness scale (NEP) did not?

Furthermore, if a postal survey of this kind could be repeated the most obvious shortcomings to be addressed would be the behaviour indicators to allow more extensive statistical analysis:

- devise behaviour indicators that can provide interval data, and
- employ visual evidence of riparian condition as the behaviour variable.

11.8 Further research

This thesis did not explore several themes that would be of interest but were considered outside the scope of this research. Thus, the direct attitude factors of "affection" and "stewardship" are worthy of further investigation, and so are scientific knowledge as an aspect of attitudes toward riparian forest, as well as landowners' perception of their competence as managers of riparian forest. Furthermore, the interplay and the impact of external variables on beliefs and the benefits of meetings and workshops on riparian forest management practice also present further opportunity for important research.

Furthermore, the general environmental awareness score (NEP) has not been explored in this thesis any further than its influence on behaviour indicators. However, comparisons of the population sample of riparian landowners in far north Queensland with diverse populations worldwide may reveal salient and informative differences.

11.9 Concluding remarks

The research of this thesis was undertaken within the framework of the theory planned behaviour (Ajzen, 1991) which allowed for the assessment of the impact of behavioural, social, and control variables as well as external factors on the formation of intentions to practice riparian forest management. The prediction of behaviour indicators from intentions and exploration of beliefs as underlying causes was also undertaken.

By attempting to strictly follow the instructions and requirements for the TPB questionnaire, great care and attention was given to comply with assumption of the TPB model, and to retain meaningful statements that contained the ideas intended. Nevertheless, to some readers the wording of selected items seemed convoluted and some questions redundant. However, the 123 respondents of Survey 1 patiently waded through questions, sometimes leaving comments about them, thus showing their cognitive engagement. There is room to improve the questionnaire of the present study, especially of subjective norming and behaviour control items.

Other researchers have formulated their TPB questionnaire differently. For instance Fielding et al. (2005) assessed behavioural beliefs by listing benefits and costs of proposed management changes, and similarly normative beliefs by presenting a list of referents who expected compliance, and control beliefs by a list of possible barriers.

The research methodology did not allow visual inspection of riparian forests to verify the behaviour indicators, therefore leaving open the possibility that these variables were not totally reliable. Future research may want to include visual inspection of the riparian forest and some way of quantifying this.

The limitations of this study were mainly the low response rate to the two surveys (Survey 1, 22.8%; Survey 2, 16.1%). This was the reason that statistical analysis could not be undertaken beyond regression analysis and also jeopardized the assessment of the intervention. Structural equation modeling would have been ideal for this kind of study but it requires a larger sample size. Furthermore, the categorical behavioural measures would also limit the application of this technique to some extent.

The generalization of the results to the population of landowners in the study area is also dependent on how many of the possible population participants responded to the survey. As the participants were volunteers, it is not possible to argue that this is a probability sample and thus generalization to riparian landowners is jeopardized.

The behaviour construct in this study was not a satisfactory measure, and there was a chance that some items may have been misunderstood. For example, the notion of keeping streamsides clean was grouped as an undesirable behaviour indicator. It nevertheless could also include the desirable practice of removing rubbish such oil cans and plastic containers. Nonetheless, the notion of riparian practice was manifestly present in each behaviour indicator.

Consideration had been given to the way this information was elicited. During Study 1 with retired farmers, the researcher found that they did not take kindly to the suggestion that they may not have managed their land including riparian zones properly. It became clear that the variable of behaviour had to be obtained by indirect questions. Thus, asking about the present and former state of their riparian forest was resorted to in order to get candid answers.

In Fielding et al.'s (2005) study subjects were landholders with riparian forests and therefore comparable with the current research. They used the landholders' affirmation of having been actively engaged in riparian management in the past as their behaviour indicator. It is arguable whether that variable was more representative of landholders' behaviour since the statement also could not be verified. It is not clear if the landowners actually undertook recommended riparian management or if some undesirable management activity was thought a good thing. In the present survey only 24.2% of landowners were involved in a river rejuvenation project and their behaviour indicators were found to have no relationship to the activity.

Most of the landowners reported to have trees (93.5%) or shrubs (53.7%) growing alongside the stream rather than agricultural crops (26%) or noxious weeds (26%) seemingly indicating that most of the riparian zone was covered in natural vegetation. This contrasts with findings (Armour et al., 2004, Australian Productivity Commission, 2003; Gilbert & Brodie, 2001) that riparian vegetation cover is lacking in many areas and diminishing every year. It may imply that landholders have a different idea regarding what constitutes a desirable plant cover. Future researchers would have to use methods that disclose the state of riparian forests such as Google Earth (Lawson, 2007 used aerial and satellite images) to establish a reliable indicator to use as the behaviour variable in the TPB. In this research study the survey had another drawback in that it was anonymous to the extent that the location of the land and the corresponding responses could not be matched.

Despite these drawbacks statistical analysis was possible which resulted in significant findings, providing insight into landowners' thoughts on aspects of the subject of riparian forests. The study has shown that the TPB can be used in identifying

social psychological aspects of landowners' intentions in regard to riparian forest management that explain behaviour indicators. Furthermore, underlying beliefs as mainsprings of behaviour can be explored with the TPB model. Likewise the impact of additional external influences not incorporated in the questions of the TPB can be detected with this social psychological attitude-behaviour model.

In short, the identification of factors that make landowners practice desirable and recommended riparian management practices or at least have intentions to do so adds to the literature on this subject as well as allows recommendations to be made. These are focused on changes of beliefs which in the context of the TPB are considered the theoretical bases for changes of attitudes, norming behaviours and perceptions of impediments.

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APPENDICES

APPENDIX A
STUDY 1

STUDY 1 LETTER OF INVITATION AND RESPONSE NOTE

ADMINISTRATIVE DOCUMENTATION HAS BEEN REMOVED

STUDY 1 INFORMATION SHEET

ADMINISTRATIVE DOCUMENTATION HAS BEEN REMOVED

STUDY 1 CONSENT FORM

ADMINISTRATIVE DOCUMENTATION HAS BEEN REMOVED

STUDY 1 INTERVIEW PROTOCOL AND QUESTIONNAIRE

Interview Protocol

To begin the interview the participant is read the following:

This interview is part of a study performed by researchers at James Cook University. The interview is entirely voluntary, and your identity will be kept confidential.
The interview is not a test, and you should not think that any of the questions have a correct answer.

The purpose of the interview is to gather information, not to promote any idea or practice. Your participation in this interview is important to the researchers who are engaged in this study. Your responses will guide the construction of a survey questionnaire and the results of the study may assist researchers and others who are interested in the thoughts and perspective of people who own land along streams.
The interview will take about one hour.

I would like to ask your permission to tape-record this interview; it makes it much faster than writing your responses down. Is that all right with you?

IF THE INTERVIEWEE DOES NOT WANT ANY RECORD TO BE TAKEN,

TAPED OR WRITTEN, THE INTERVIEW HAS TO BE TERMINATED.

Do you have any questions?

RECORD DATE AND TIME……..

Interview Questionnaire

Interview Number:

Part I - Interview questions before presenting the leaflet:

1. How long have you lived here?)

Did you always farm the land?

What farming activity did you engage in?

2. What was the land like when you came here?

3. Do you feel responsible for this land?

4. What do you think of the river/creek on your land?

How do you use your river/creek? PROMPT: **For fishing, swimming, boating, irrigation?**

Did you always think that way?

PROMPT: **Is the commercial value more or less important as you get older?**

5. Has the river/creek changed over the years?

IF YES: **Please describe**

6. What is it about your river/creek that you like?

7. Do your neighbours and friends think the same?

8. Have you enjoyed having the river/creek?

PROMPTS: **Beautiful? Peaceful? Recreation?**

9. What do you think of the water quality of your stream?

Has the water quality changed? IF IF IT HAS

DETERIORATED: **What do you think caused it?**

10. What do you think of the water quality of other streams around here?

Elsewhere in the country? Where?

IF IT IS WORSE: **Who does the polluting and how?**

11. Do you believe that the quality of the water flowing in your creek affects the Great Barrier Reef?

IF NO: **Have you heard about this connection?**

12. Is the streamside land important to you and in what way?

Do you see it as a problem in any way?

13. Have you thought about what will happen to your land and the streamside areas?

PROMPTS: **Go on farming – housing development - reforesting**

What about the environment in general?

14. Have you seen any wildlife in the river/creek and on the banks?

Has there been a change in wildlife?

Do you like having those animals there?

15. Has anyone contacted you in the past with information about land-management practices?

IF YES: **What kind of information?**

Did the agency follow up on it?

16. Landcare agencies place a great importance on streamside forests. Why do you think they consider them important?

Part II – Presenting the leaflet:

I am showing you now a leaflet with some pictures and explanations. The information summarizes what scientists are saying about the connection between streamside forests and water quality and other benefits of these areas.

Then I would like to ask you some more questions.

LET THE PARTICIPANT LOOK AT THE LEAFLET AND EXPLAIN ITEMS.

Part III - Interview after showing the leaflet:

17. Is there anything in this leaflet that is new to you?

PROMPT: **Can you explain exactly what?**

PROMPT: **How about the connection of streamside forests with:**

a) Water quality
b) Fish habitat
c) Wildlife habitat
c) Flood control
d) Livestock
e) The Great Barrier Reef

18. Do you think the information in the leaflet is generally known?

19. Do you think it could change some people's ideas about streamside forests?

20. Do you think one should encourage establishing and keeping streamside forests?

21. Can you suggest ways to do this?

PROMPT: **Can you think of ways of how NOT to do this?**

22. If the government owned the land along the streams, would you expect them to establish and maintain the streamside forests?

23. Have you any suggestions that would encourage the establishment and protection of streamside forests?

IF NO ANSWER, SUGGEST THE FOLLOWING:

These are some suggestions that have been made. What do you think of these:

a. Technical Assistance only: Government or environmental organisations would provide the technical information to the landowner on how to manage the streamside forests.

b. Technical Assistance plus Cost: landowner would receive compensation for all or part of the expenses for planting and maintaining streamside forests

c. Have a Covenant on the Land: the landowner would agree to preserve the streamside land for ten years or so.

d. Government Purchase of the streamside land of 15meter.

e. Voluntary donation of the streamside land to a government or environmental group, as a complete donation or a permanent promise not to use the land.

f. Strict Zoning Laws that forbid the use of streamside land by any landowner for other than non-destructive recreational use, i. e. fishing, and swimming.

g. Tax Incentives to landowners that keep and maintain streamside land, such as rate rebate and tax reductions.

24. Do you believe that the scientific findings presented in the leaflet in regard to streamside forests and water quality are correct?

a) Do scientific findings influence your opinion?

b) Do you know what your neighbours and friends think?

25. Do you believe that we should keep the streamside forests just for the pleasant surroundings they provide?

26. What is your overall reaction to the things we have discussed today?

There are just a few questions

I like to ask you about the Leaflet:

27. What do you think about this leaflet?

PROMPTS:

a) Is the information interesting, relevant and easy to understand?

b) Do you like the layout of the leaflet?

c) Is there enough/ too much information on the leaflet?

d) Is it easy to read?

e) Do you like it?

f) Are the pictures good for what I want to show?

We are nearly at the end of the interview!

28. I would like to jot down a few personal data before we finish:

a) How old are you?

b) Did you go to school here? Or where? For how long? Have you been to Agricultural College or Uni?

c) Where do you get information from?

PROMPTS:

- Newspapers **- TV /radio**

- Neighbours/friends **- Books**

- Professional newsletters

29. How long have you been retired from farming?

30. Have you sold your land, or is it managed by relatives or by others?

31. Would you like to add any other comment about anything we have discussed her?

That concludes this interview. THANK YOU!!

RECORD DATE AND TIME……..

GENDER OF PARTICIPANT……..

NAME OF STREAM if applicable……

MY IMPRESSIONS:
(write these down later out of sight of the participant)

Did the person understand the questions?

Did some make him angry?

Did some cause him concern?

What was the general mood state of the person?

What impression did the home and the surroundings give?

STUDY 1 FIRST LETTER OF THANKS

ADMINISTRATIVE DOCUMENTATION HAS BEEN REMOVED

STUDY 1 SECOND LETTER OF THANKS

ADMINISTRATIVE DOCUMENTATION HAS BEEN REMOVED

APPENDIX B
SURVEY 1

SURVEY 1 LETTER OF INVITATION

ADMINISTRATIVE DOCUMENTATION HAS BEEN REMOVED

SURVEY 1 CONSENT FORM

SURVEY 1 QUESTIONNAIRE

Your Responses to the Survey

Landowners' Views on Streamside Forests.

Before you start:
Please read the following so you know what is meant by the terms "waterway " , "streamside", "streamside zone", or "streamside forest":

In this questionnaire the term "waterway" means any kind of natural or man-made stream such as a creek, a river or a drain, and also refers to wetlands. Any waterways count even if they are dry for part of the year or for longer if the wet season does not deliver enough rain.

The words "streamside " and "streamside zone" used here describe the area of the waterway itself together with the land alongside it. These areas are also called "streamside forests" if there are trees on it or not.
Another word for streamside is "riparian zone" or "riparian forest".

SECTION A.

The questions in this section are asked to establish first of all that you have a creek, and then what your creek and its banks look like, how you use the area, and what changes you have observed over time.

Please circle Yes or No

Do you have any waterway (creek, river, stream, drain or wetland) on your property or alongside it?

Yes **NO**

If your answer is "NO" please return this questionnaire unanswered in the enclosed envelope.

Only the responses of landowners with waterways are needed in this survey.

Thank you!

To assure total anonymity when matching the two surveys I need you to write a **secret code** in the box that is easy for you to remember for the second survey; perhaps the year of birth of a family member and your mother's maiden name initials. For example: 1973EB

How many waterways (creeks, drains etc.) or wetlands do you have?
Please write a number: .....

How often is there water in the waterways on your land?
(Please tick as many boxes as are necessary for each waterway.)

	Waterway 1	Waterway 2	Waterway 3
All year round			
Only in the wet			
Other:			

What is your land used for?
(Please circle as many numbers as are necessary.)

1. Sugar Cane
2. Bananas
3. Other Tropical Fruit
4. Vegetables
5. Flowers
6. Cattle
7. Other: .....

What do the banks of the waterway look like?
(Please tick as many boxes as are necessary for each waterway.)

	Waterway 1	Waterway 2	Waterway 3
Very steep and more than 3 metres (15 feet) high			
Less than 1 metre (3 feet) high			
No banks. Becomes a lake during the rain.			
Other:			

What kind of plants grow on the land alongside the stream?
(Please tick as many boxes as are necessary for each waterway.)

	Waterway 1	Waterway 2	Waterway 3
Trees			
Shrubs			
Grass			
Agricultural Crop			
Declared noxious weeds			
Very little or nothing			
Other:			

Have you seen animals in the water or on the stream banks? What kind?
(Please write in the kind of animals seen in as many boxes as are necessary for each waterway.)

	Waterway 1	Waterway 2	Waterway 3
Native animals? What kind?			
Feral animals? What kind?			
Other:			

How close to the edge of the waterway do you crop or cultivate the land?
(Please tick as many boxes as are necessary for each waterway.)

	Waterway 1	Waterway 2	Waterway 3
More than 10 metres away			
Close enough to turn a tractor around			
Up to the top of the bank			
Other:			

Have your streamsides _____?
(Please tick as many boxes as are necessary for each waterway.)

	Waterway 1	Waterway 2	Waterway 3
always looked the way they look today			
had more trees on them some time ago			
more trees and shrubs on them now than ever before			
grass on them now and had the trees removed			
newly planted trees on them			
tree seedlings on them that are left to grow			
had all the weeds removed			
been kept clean by you			
Any other comments?			

About how much streamside frontage do you have on your land? …….Metres or in……..Feet

Does the waterway represent a boundary on your land? Yes – No

How long have you been on this property? …….years

How long has your family been on this land? …….years

Section B.

In this section are a few questions about yourself and about your plans in the next 12 months.

(Please circle the appropriate answer or fill in the number.)

How old are you? ..... Years

Are you male or female? Male - Female

If you have children: How many do you have? .....
If you have grandchildren: How many do you have? .....

What school education level do you have?
(Please circle one representing the highest level in which you had some education or which you completed)

1. Primary School
2. Secondary School
3. Tertiary - University
4. Tertiary - TAFE
5. Tertiary - Apprenticeship
6. Other? Please explain:

If you are planning to leave your property in the next 12 months, is it because you want to _____.

1. sell to a private party?
2. sell to a company or business consortium?
3. hand it to the younger generation who will manage the property?
4. Other? Please explain:

Section C.

The items in this section are focussing on your views, observations, feelings and ideas on the subject of streamside forests. There is no particular order to the statements.

Under each statement is a scale from 1 to 7 on which you grade your agreement or disagreement with the statement by circling the number that best represents your opinion.
The 7 places should be interpreted as follows:

Strongly agree : 1 : 2 : 3 : 4 : 5 : (6) : 7 : Strongly disagree
extremely : quite : slightly : neither : slightly : quite : extremely

For example, if the statement is :
"Last year's rainy season was very wet."
and you don't agree with it totally you would circle the 6 for "quite disagree".

In another example, the statement is :
"To walk on the Cairn's Esplanade is_____."

Pleasant : 1 : 2 : (3) : 4 : 5 : 6 : 7 : Unpleasant
extremely quite slightly neither slightly quite extremely

If you find it "slightly pleasant" you would circle the 3.

Please read each statement carefully and then circle the number that best represents your opinion

I think that most people whose opinion I value would recommend the preservation of streamside forests. **Strongly agree : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Strongly disagree**
I can maintain a streamside forest on my land only if I am compensated for it. **Strongly agree : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Strongly disagree**
I know how to take care of my streamside forest. **Strongly disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Strongly agree**
I feel very restricted by the environmental rules and regulations in regard to my streamside forests. **Very often : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Very rarely**
If I was to plant a new streamside forest I could afford to pay for it. **Definitely true : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Definitely false**
I find streamside forests _____. **Extremely pleasant : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Extremely unpleasant**
Good water quality in the catchment waterways is _____. **Desirable : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Undesirable**
I could afford to maintain of my streamside forest. **Strongly agree : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Strongly disagree**

I never hesitate to go out of my way to help somebody in trouble. **Strongly agree : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Strongly disagree**
Grass alone is extremely efficient in holding the creek banks together. **Strongly disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Strongly agree**
The roots of plants in streamside forests are capable of converting agricultural chemicals into non-toxic substances. **Strongly agree : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Strongly disagree**
Taking care of my streamside forests will be of no benefit to the environment. **Strongly disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Strongly agree**
Reforesting the stream sides on my land would be_____. **Extremely desirable: 1 : 2 : 3 : 4 : 5 : 6 : 7 :Extremely undesirable**
Agricultural crop make good long term use of streamside forest land. **Strongly disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Strongly agree**
Stabilising the streamsides with bushes and trees works _____. **Extremely well : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Extremely badly**
If Government agencies contacted me I would work with them on planting and maintaining my streamside forests. **I definitely would : 1 : 2 : 3 : 4 : 5 : 6 : 7 :I definitely would not**
Having only grass on the streamsides to stabilise them is _____. **Sufficient : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Not sufficient**

If I had to keep a streamside forest it would mean that I could not grow crops or use the land otherwise on the 10 meters (30 feet) on either side of the waterway. **Extremely likely : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Extremely unlikely**
The cost involved in maintaining a streamside forest makes it difficult for me to do so. **Strongly disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Strongly agree**
Excess nutrients (nitrogen and phosphorous) from the water catchment are _____ to the marine environment. **Extremely beneficial : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Extremely bad**
Slowing down the flow of silt and sediments during heavy rain is _____. **Extremely desirable : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Extremely undesirable**
That streamside forests are very beneficial for the environment at large is _____. **Extremely unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Extremely likely**
Friends and other people whose opinion I respect would approve of me maintaining streamside forests. **Extremely unlikely: 1 : 2 : 3 : 4 : 5 : 6 : 7 :Extremely likely**
Streamside forests are not on my list of priorities. **Strongly agree : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Strongly disagree**
I find the native animals I see in the streamside forest _____. **Very enjoyable : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Not enjoyable**
I could <u>not</u> afford to loose a 10 metre (30 foot) strip of land along the waterways for a streamside forest. **Strongly agree : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Strongly disagree**

Intact streamside forests will assure good water quality in my creek. **Extremely unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Extremely likely**
To have native animals live in streamside forests is _____. **Extremely good : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Extremely bad**
It is patronising of other people telling landowners what to do with their streamside forests. **Strongly agree : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Strongly disagree**
The preservation of my streamside forests is _____. **Valuable : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Worthless.**
If my streamside forests needed to be brought up to scratch I would need technical help. **Strongly disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Strongly agree**
In general I follow recommendations from Government agencies. **Not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Very much**
In order to stabilise the stream banks, growing bushes and trees works extremely well. **Strongly disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Strongly agree**
All landowners can take care of their streamside forests. **Strongly agree : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Strongly disagree**
I am sometimes irritated when people ask favours of me. **Strongly disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Strongly agree**

In order to benefit the environment it is a good idea for every landowner to care for his/ her streamside forests Strongly agree : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Strongly disagree
Walking on the banks of creeks is _____. Pleasant : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Unpleasant
If my creek sides needed improvement I would do something about the streamside forest. Strongly agree : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Strongly disagree
Streamside forests benefit from natural debris in the creeks. Strongly disagree: 1 : 2 : 3 : 4 : 5 : 6 : 7 :Strongly agree
It is very likely that a streamside forest provides a good habitat for the creatures living in the creek. Strongly agree : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Strongly disagree
It is _____ for me to maintain a good streamside forest. Extremely easy: 1 : 2 : 3 : 4 : 5 : 6 : 7 :Extremely difficult
It is _____ that streamside forests can remove excess nutrients (nitrogen and phosphorous) from the soil. Very unlikely: 1 : 2 : 3 : 4 : 5 : 6 : 7 :Very likely
In general I care that my neighbours think I am doing the right thing. Strongly disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Strongly agree
A streamside forest land makes good agricultural land in the long term. Strongly agree : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Strongly disagree

It is in the hands of landowners like myself to control the water quality in the waterways. Definitely true : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Definitely false
To detoxify agricultural chemicals in the soil before they reach the waterways is _____. Extremely desirable: 1 : 2 : 3 : 4 : 5 : 6 : 7 :Extremely undesirable
Streamside landowners like me would donate their time to work with Land Care agencies to maintain my streamside forest if there was a need. Definitely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Definitely not
Maintaining of streamside forests is a waste of money and time. Strongly agree : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Strongly disagree
I will plant streamside forests on my waterways this year if there is a need. I definitely will not: 1 : 2 : 3 : 4 : 5 : 6 : 7 :I definitely will
With less strict environmental regulations in regard to streamside forests things would be easier. Strongly disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Strongly agree
When I don't know something I don't at all mind admitting it. Strongly agree : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Strongly disagree
In general I care that people whose opinion I respect think I am doing the right thing. Not at all : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Very much
I take my role as a keeper of clean waterways very seriously. Strongly agree : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Strongly disagree

The shade in streamside forests benefits the creatures living in the creek. **Extremely likely: 1 : 2 : 3 : 4 : 5 : 6 : 7 :Extremely unlikely**
I would maintain streamside forests only if other landowners did the same. **Strongly agree : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Strongly disagree**
Keeping the waterways on my land free of debris such as tree branches is **Extremely good : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Extremely bad**
Government agencies think I should follow their recommendations about streamside forests. **Extremely likely: 1 : 2 : 3 : 4 : 5 : 6 : 7 :Extremely unlikely**
Streamside forests are very good to have for the environment at large. **Strongly agree : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Strongly disagree**
If planting a streamside forest means spending a lot of money it would make it more difficult for me to do so. **Strongly agree: 1 : 2 : 3 : 4 : 5 : 6 : 7 :Strongly disagree**
Since the water from my creek will end up in the Great Barrier Reef Lagoon (that is the sea between the shore and the Great Barrier Reef) I am responsible for the water quality in my creek. **Strongly agree : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Strongly disagree**
That streamside forests will slow down the flow of silt and sediments during heavy rain is _____. **Extremely likely: 1 : 2 : 3 : 4 : 5 : 6 : 7 :Extremely unlikely**
I always believed that I did the right thing about my streamside forests. **Strongly agree : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Strongly disagree**

It is _____ that more streamside forests means more habitat for native animals. **Extremely likely: 1 : 2 : 3 : 4 : 5 : 6 : 7 :Extremely unlikely**
I am planning to maintain my streamside forest. **Not at all: 1 : 2 : 3 : 4 : 5 : 6 : 7 :Definitely**
To have trees on the riverbanks on my land is **Extremely good : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Extremely bad**
Financial help would be necessary to improve everybody's streamside forest. **Strongly agree : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Strongly disagree**

SECTION D.

These last questions are about your experience with information about streamside management that is available to landowners.

As before, please circle the number that best represents your opinion.

Have you ever participated in meetings or workshops about Land Management?

Yes No
(Please circle one)

IF YES:
How much did you learn?
A lot : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Nothing

How useful was it?
Very useful : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Not at all useful

Have you ever participated in meetings or workshops specifically about Streamside Forests?

Yes No
(Please circle one)

IF YES:
How much did you learn?
A lot : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Nothing

How useful was it?
Very useful : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Not at all useful

From where do you get your knowledge about Land Management Practices?
(Please circle the number that best represents your opinion)

Agricultural journals
Most of it : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Nothing

Newspapers
Most of it: 1 : 2 : 3 : 4 : 5 : 6 : 7 :Nothing

Television
Most of it: 1 : 2 : 3 : 4 : 5 : 6 : 7 :Nothing

Radio (Wireless)
Most of it: 1 : 2 : 3 : 4 : 5 : 6 : 7 :Nothing

Own experience through trial and error
Most of it: 1 : 2 : 3 : 4 : 5 : 6 : 7 :Nothing

Through observation of other people's practices
Most of it: 1 : 2 : 3 : 4 : 5 : 6 : 7 :Nothing

Traditional practices handed down
Most of it: 1 : 2 : 3 : 4 : 5 : 6 : 7 :Nothing

Scientific journals
Most of it: 1 : 2 : 3 : 4 : 5 : 6 : 7 :Nothing

Meetings and workshops
Most of it: 1 : 2 : 3 : 4 : 5 : 6 : 7 :Nothing

Government Agencies
Most of it: 1 : 2 : 3 : 4 : 5 : 6 : 7 :Nothing

From where do you get your knowledge about Streamside Forests?
(Please circle the number that best represents your opinion)

Agricultural journals
Most of it : 1 : 2 : 3 : 4 : 5 : 6 : 7 :Nothing

Newspapers
Most of it: 1 : 2 : 3 : 4 : 5 : 6 : 7 :Nothing

Television
Most of it: 1 : 2 : 3 : 4 : 5 : 6 : 7 :Nothing

Radio (Wireless)
Most of it: 1 : 2 : 3 : 4 : 5 : 6 : 7 :Nothing

Own experience through trial and error
Most of it: 1 : 2 : 3 : 4 : 5 : 6 : 7 :Nothing

Through observation of other people's practices
Most of it: 1 : 2 : 3 : 4 : 5 : 6 : 7 :Nothing

Traditional practices handed down
Most of it: 1 : 2 : 3 : 4 : 5 : 6 : 7 :Nothing

Scientific journals
Most of it: 1 : 2 : 3 : 4 : 5 : 6 : 7 :Nothing

Meetings and workshops
Most of it: 1 : 2 : 3 : 4 : 5 : 6 : 7 :Nothing

Government Agencies
Most of it: 1 : 2 : 3 : 4 : 5 : 6 : 7 :Nothing

Agricultural College
Most of it: 1 : 2 : 3 : 4 : 5 : 6 : 7 :Nothing

On a scale from 1 to 7: Do you think your knowledge about Streamside Forests is more or less correct than what scientists have found?

(Please circle the number that best represents your opinion)

Definitely more: 1 : 2 : 3 : 4 : 5 : 6 : 7 :Definitely less

Has anybody asked you anything about your Streamside Forests before?

Yes No

(Please circle one)

Has anybody or any agency ever contacted you and offered information or help with Streamside Forest?

Yes No

(Please circle one)

This year have you seen

1. any programs on TV about Streamside Forest or **Yes No**

2. heard a talk on the radio or **Yes No**

3. read an article in any newspaper **Yes No**

(Please circle one)

What can you remember about the media reports?

Please write down what stuck in your mind:

Are you involved in any River Rejuvenation Project?

Yes No

(Please circle one)

SURVEY 1 THE NEW ECOLOGICAL PARADIGM (NEP)

Following is a set of questions which is used internationally since the 1970's to measure environmental beliefs people have and changes that have occurred over the years in different countries. It is called the New Ecological Paradigm Scale.
Your participation is very much appreciated.
Please answer the following question by placing a cross where your opinion fits
Thank you.

	Strongly agree	Mildly agree	Unsure	Mildly disagree	Strongly disagree
	SA	MA	U	MD	SD
1. We are approaching the limit of the number of people the earth can support.					
2. Humans have the right to modify the natural environment to suit their needs.					
3. When humans interfere with nature it often produces disastrous consequences.					
4. Human ingenuity will insure that we do NOT make the earth unliveable					
5. Humans are severely abusing the environment.					
6. The earth has plenty of natural resources if we just learn how to develop them					
7. Plants and animals have as much right as humans to exist.					
8. The balance of nature is strong enough to cope with the impacts of modern industrial nations					
9. Despite our special abilities humans are still subject to the laws of nature.					
10. The so-called "ecological crisis" facing humankind has been greatly exaggerated.					
11. The earth is like a spaceship with very limited room and resources.					
12. Humans were meant to rule over the rest of nature.					
13. The balance of nature is very delicate and easily upset.					
14. Humans will eventually learn enough about how nature works to be able to control it.					
15. If things continue on their present course, we will soon experience a major ecological catastrophe.					

SURVEY 1 FIRST REMINDER LETTER

SURVEY 1 SECOND REMINDER LETTER

APPENDIX C
SURVEY 2

SURVEY 2 LETTER OF INVITATION

ADMINISTRATIVE DOCUMENTATION HAS BEEN REMOVED

SURVEY 2 SECRET CODE

Your Responses to Survey 2

Landowners' Views on Streamside Forests.

To assure total anonymity when matching the two surveys I asked you in the first survey to write a **secret code** in the box. Please write that same code again in the box on the right that you used in the first survey. You forgot it? Perhaps is was the year of birth of a family member and your mother's maiden name initials? For example: 1973EB

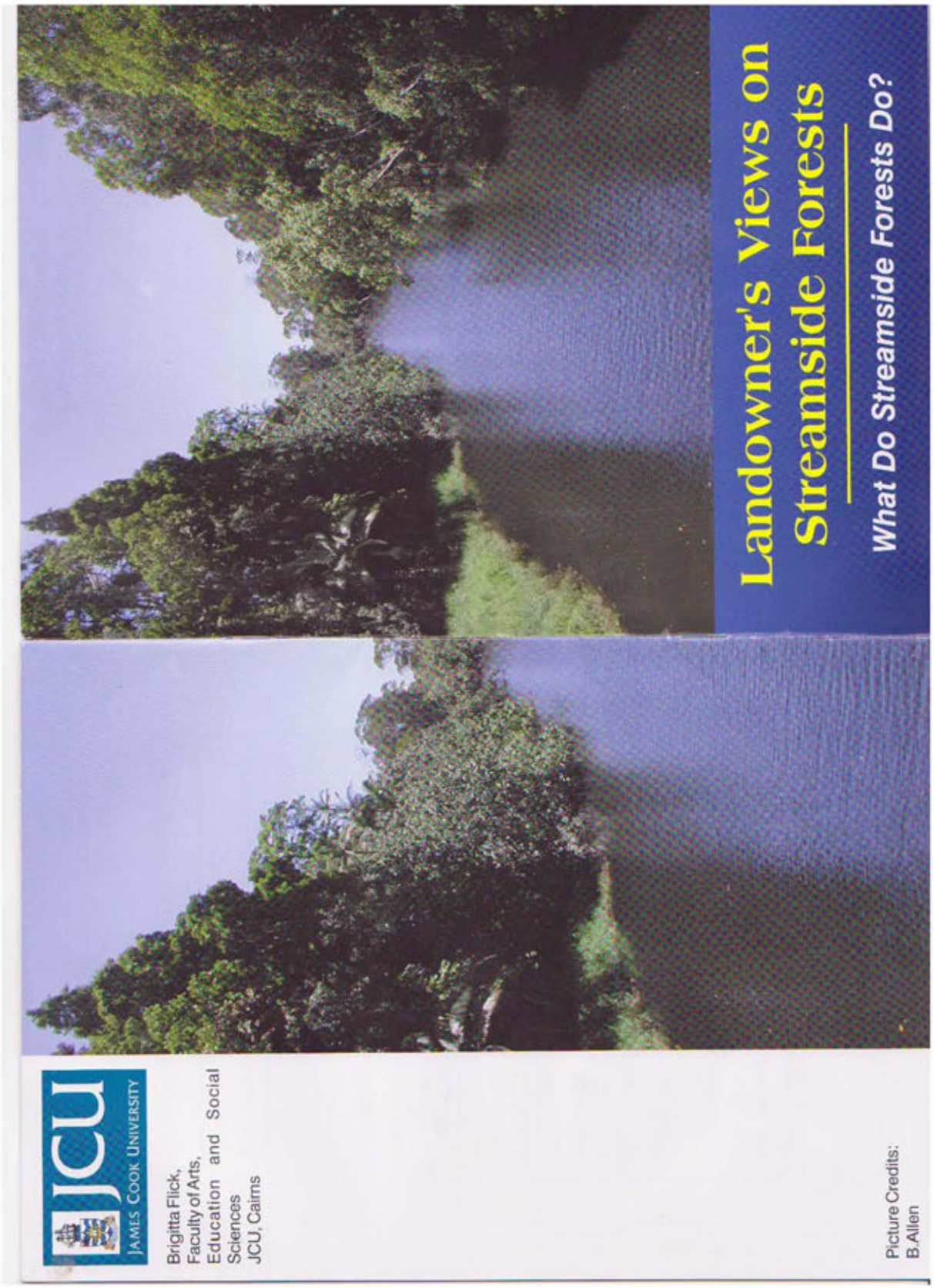
If you have forgotten your secret code or did not participate in the first survey go ahead and just leave the box empty.

Thank you!

SURVEY 2 CONSENT FORM

ADMINISTRATIVE DOCUMENTATION HAS BEEN REMOVED

SURVEY 2 QUESTIONNAIRE BOOKLET



What do streamside forests do?

They have many roles to play in a well-functioning stream side system.

The 5 main ones are described on the following pages.

On the following pages are free spaces for you to write down your thoughts and opinions. You can be as candid as you like. The survey is totally anonymous.
At the very end is a very short questionnaire (11 questions).

Thank you for taking the time to share your thoughts.

Role 1. Stabilisation of banks

Streamside erosion is a natural process but:

Roots of native trees and shrubs will hold the soil.

Natural debris and rocks provide environment for new seedlings

Snags and rocks in the creek will lessen the force of fast water and help prevent scouring and undercutting of banks.

2

Do you agree with these statements?

YES
NO **Please explain:**

What is your experience with stream bank erosion?

How do you deal with it?

3

Role 2. Slow-down of Heavy runoff

The mass of plant in the streamside forest (native grasses, shrubs, trees) represents a barrier which reduces the force of the water during floods.

The vegetation and the natural debris trap silt and soil in surface run-off.

4

Do you agree with these statements?

YES
NO **Please explain:**

What is your experience with run-off during floods?

Do you have any suggestion on how to deal with it?

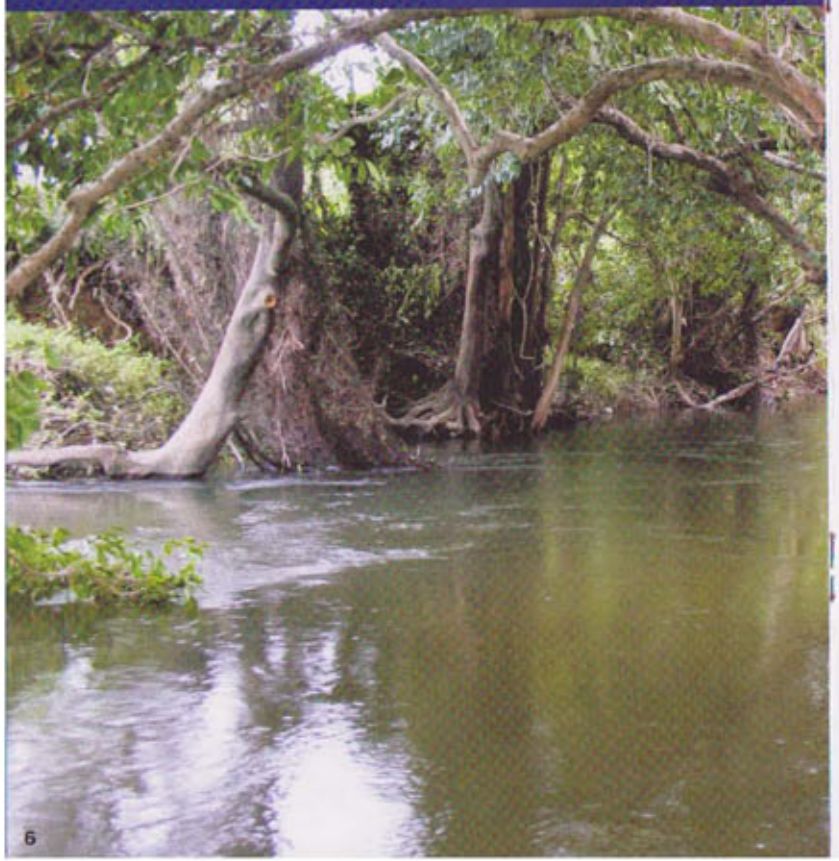
5

Role 3. Clean Water

Streamside forest can hold or take up excess nutrients (especially nitrogen and phosphorous from fertilisers and soil)

Streamside forests can filter, remove, and transform agricultural chemicals.

The survival of the Great Barrier Reef depends on clean water from the creeks and rivers of the catchment.



6

Do you agree with these statements?

YES
NO **Please explain:**

What is your experience with water quality?

Do you have any ideas on the subject?

7

Role 4. Habitat for Wildlife

Land animals can move safely in the vegetation to find food.

Owls and other raptors find places to perch during their hunt for prey, others can roost and nest in the trees.

Fish and other aquatic animals will thrive in clean shaded waterways.

Do you agree with these statements?

YES
NO **Please explain:**

What is your experience with wildlife on the creeks?

How do you deal with it?

Role 5. A Place for Recreation and Relaxation

Fishing and swimming are activities highly valued by people.

People feel good in the vicinity of water and seek the serenity of natural environments for mental restoration.

10

Do you agree with these statements?

YES
NO **Please explain:**

What are your thoughts on stream banks as places of recreation and relaxation?

How do you use them?

11

Landowner's Views on Streamside Forests

The following is a very short questionnaire very much like in the first survey.

Please answer the way you feel and whatever seems right at the time.

There is no particular order to the statements.

Under each statement is a scale from 1 to 7 on which you grade your agreement or disagreement with the statement by circling the number that best represents your opinion.

Good water quality in the catchment waterways is _____.

Desirable — Undesirable
1 : 2 : 3 : 4 : 5 : 6 : 7

It is _____ that streamside forests can remove excess nutrients (nitrogen and phosphorous) from the soil.

Very unlikely — Very likely
1 : 2 : 3 : 4 : 5 : 6 : 7

I know how to take care of my streamside forest.

Strongly disagree — Strongly agree
1 : 2 : 3 : 4 : 5 : 6 : 7

Keeping the waterways on my land free of debris such as tree branches is

Extremely good — Extremely bad
1 : 2 : 3 : 4 : 5 : 6 : 7

Streamside forests are very good to have for the environment at large.

Strongly agree — Strongly disagree
1 : 2 : 3 : 4 : 5 : 6 : 7

Since the water from my creek will end up in the Great Barrier Reef Lagoon (that is the sea between the shore and the Great Barrier Reef) I am responsible for the water quality in my creek.

Strongly agree — Strongly disagree
1 : 2 : 3 : 4 : 5 : 6 : 7

Intact streamside forests will assure good water quality in my creek.

Extremely unlikely — Extremely likely
1 : 2 : 3 : 4 : 5 : 6 : 7

Excess nutrients (nitrogen and phosphorous) from the water catchment are _____ to the marine environment.

Extremely beneficial — Extremely bad
1 : 2 : 3 : 4 : 5 : 6 : 7

Streamside forests benefit from natural debris in the creeks.

Strongly disagree — Strongly agree
1 : 2 : 3 : 4 : 5 : 6 : 7

I take my role as a keeper of clean waterways very seriously.

Strongly agree — Strongly disagree
1 : 2 : 3 : 4 : 5 : 6 : 7

That streamside forests are very beneficial for the environment at large is _____.

Extremely unlikely — Extremely likely
1 : 2 : 3 : 4 : 5 : 6 : 7

SURVEY 2 FIRST REMINDER LETTER

ADMINISTRATIVE DOCUMENTATION HAS BEEN REMOVED

SURVEY 2 SECOND REMINDER LETTER

ADMINISTRATIVE DOCUMENTATION HAS BEEN REMOVED

APPENDIX D
LIST OF VARIABLES AND NOTES

VARIABLES IN THE TPB QUESTIONNAIRE

Behaviour Indicators

Desirable practices (indicators of good practices/ behaviour):

1. Crop or cultivate the land more than 10m away from the edge of the waterway. (n_{yes} = 76)
2. Streamsides have more trees and shrubs on them now than ever before. (n_{yes} = 31)
3. Streamsides have newly planted trees on them. (n_{yes} = 30)
4. Streamsides have tree seedlings on them that are left to grow. (n_{yes} = 46)

Undesirable practices (indicators of bad practices/ behavior):

1. Agricultural crops grow on the land alongside the stream. (n_{yes} = 32)
2. Crop or cultivate the land from the edge of the waterway close enough to turn a tractor around. (n_{yes} = 35)
3. Streamsides had more trees on them some time ago. (n_{yes} = 41)
4. Streamsides are kept clean. n_{yes} = 50)

Intentions

Int 1. If Government agencies contacted me, I would work with them on planting or maintaining my streamside forests.

Int 2. Streamside forests are on my list of priorities.

Int 3. If my creek sides needed improvement, I would do something about the streamside forest.

Int 4. Streamside landowners like me would donate their time to work with Land Care agencies to maintain my streamside forest if there was a need.

Int 5. I will plant streamside forests on my waterways this year if there is a need.

Int 6. I am planning to maintain my streamside forest.

Direct Attitudes

DA 1. I find streamside forests extremely pleasant.

DA 2. Reforesting the stream sides on my land would be extremely desirable.

DA 3. I find the native animals I see in the streamside forest very enjoyable.

DA 4. The preservation of my streamside forest is valuable.

DA 5. Walking on the banks of creeks is pleasant.

DA 6. Maintaining of streamside forests is not a waste of money and time.

DA 7. I take my role as a keeper of clean waterways very seriously.

DA 8. Since the water from my creek will end up in the Great Barrier Reef Lagoon (that is the sea between the shore and the Great Barrier Reef) I am responsible for the water quality in my creek.

DA 9. I always believed that I did the right thing about my streamside forests.

DA 10. To have trees on the riverbanks on my land is extremely good.

Indirect (belief-based) Attitudes – (Attitudinal Beliefs)

IA 1e. Good water quality in the catchment waterways is desirable.

IA1 b. Intact streamside forests will assure the water quality in my creek extremely likely.

IA 2e. Stabilising the streamsides with bushes and trees works extremely well.

IA 2b. In order to stabilise the stream banks, growing bushes and trees works extremely well.

IA 3e. Having only grass on the streamsides to stabilise them is sufficient.

IA 3b. Grass alone is extremely efficient in holding the creek banks together.

IA 4e. Excess nutrients (nitrogen and phosphorous) from the water catchment are extremely bad for the marine environment.

IA 4b. It is very likely that streamside forests remove excess nutrients (nitrogen and phosphorous) from the soil.

IA 5e. To have native animals in streamside forests is extremely good.

IA 5b. It is extremely likely that more streamside forest means more habitat for native animals.

IA 6e Slowing down the flow of silt and sediments during heavy rain is extremely likely.

IA 6b That streamside forest slows down the flow of silt and sediments during heavy rain is extremely likely.

IA 7e. In order to benefit the environment it is a good idea for every landowner to care for his/her streamside forest.

IA 7b. Taking care of my streamside forests will be of benefit to the environment.

IA 8e. A streamside forest land makes good agricultural land in the long term.

IA 8b. Agricultural crops make good long term use of streamside forest land.

IA 9e. To detoxify agricultural chemicals in the soil before they reach the waterways is extremely desirable.

IA 9b. The roots of plants in streamside forests are capable of converting agricultural chemicals into non-toxic substances.

IA 10e. The shade in streamside forests benefits the creatures living in the creek.

IA 10b. It is very likely that shade of the streamside forest provides a good habitat for the creatures in the creek.

IA 11e. Keeping the waterways on my land free of debris such as tree branches is extremely bad.

IA 11b. Streamside forests benefit from natural debris in the creeks.

IA 12e. Streamside forests are very good to have for the environment at large.

IA 12b. That streamside forests are beneficial to the environment at large is extremely likely.

Direct Subjective Norms

DSN 1. I think that most people whose opinion I value would recommend the preservation of streamside forests.

DSN 2. In general I care that my neighbours think I am doing the right thing.

DSN 3. I would maintain streamside forests only if other landowners did the same.

Indirect (belief-based) Subjective Norms - (Normative Beliefs)

ISN 1n. Friends and other people whose opinion I respect would approve of me maintaining streamside forests.

ISN 1m. In general I care that people whose opinion I respect think I am doing the right thing.

ISN 2n. Government agencies think I should follow their recommendations about streamside forests.

ISN 2m. In general I follow recommendations from Government agencies.

Direct Perceived Behaviour Control

DPBC 1. I can maintain a streamside forest on my land even if I am not compensated for it.

DPBC 2. I know how to take care of my streamside forest.

DPBC 3. It is patronising of other people telling landowners what to do with their streamside forests.

DPBC 4. If my streamside forests needed to be brought up to scratch I would not need technical help.

DPBC 5. All landowners can take care of their streamside forests.

DPBC 6. It is extremely easy for me to maintain good streamside forest.

DPBC 7. It is in the hands of the landowners like me to control the water quality in the waterways.

DPBC 8. Financial help would not be necessary to improve everybody's streamside forest.

Indirect (belief-based) Perceived Behaviour Control - (Control Beliefs)

IPBC 1c. If I was to plant a new streamside forest I could afford it pay for it.

IPBC 1p. If planting a streamside forest means spending a lot of money it would not make it more difficult for me to do so.

IPBC 2c. I could afford to maintain my streamside forest.

IPBC 2p. The cost involved in maintaining a streamside forest does not make it difficult for me to do so.

IPBC 3c. If I had to keep a streamside forest it would not matter that I could not grow crops or use the land otherwise on the 10 m (30 feet) on either side of the waterway.

IPBC 3p. I could afford to lose a 10 m (30 feet) strip of land along the waterways for a streamside forest.

IPBC 4c. I rarely feel very restricted by the environmental rules and regulations in regards to my streamside forests.

IPBC 4p. With less strict environmental rules and regulations in regards to streamside forest things would not be easier.

SHORT SOCIAL DESIRABILITY SCALE

1. I never hesitate to go out of my way to help somebody in trouble.
2. I am sometimes irritated when people ask favours of me.
3. When I don't know something I don't at all mind admitting it.

Ajzen, I. (2002). Perceived behavioral control, self-efficacy, locus of control, and theory of planned behaviour. *Journal of Applied Social Psychology, 32*, 1-20.

Bandura, A. (1997). *Self-efficacy : the exercise of control*. New York: W.H. Freeman.

Cheung, S. F., Chan, D. K.-S., & Wong, Z. S.-Y. (1999). Reexamining the theory of planned behaviour in understanding wastepaper recycling. *Environment and Behavior, 31 (5), 587-589.*

Crowne, D. P., & Marlowe, D. (1960). A new scale of social desirability independent of psychopathology *Journal of Consulting Psychology, 24*, 349-354.

Pallant, J. (2007). *SPSS Survival Manual. A step-by-step guide to data analysis using SPSS for Windows (Version 15)* (Third ed.). Crows Nest, NSW Australia: Allen and Unwin.

FACTOR ANALYSIS OF DIRECT ATTITUDES

Principal component analysis

The principal component analysis (PCA) using PASW Statistics 18 resulted in Kaiser-Meyer-Olkin value of .82, exceeding the recommended value of .6 (Kaiser, 1974, cited in Pallant, 2007). The Bartlett's Test of Sphericity was statistically significant, and the correlation matrix showed the majority of correlations to be above .30. Factor analysis was therefore considered appropriate for this set of items.

The PCA showed only two components, the cross-loading of the items did not allow a clean separation. Therefore, factor rotation analyses on two factors were performed to aid the interpretation.

Rotation methods and analyses

Varimax rotation will result in orthogonal, uncorrelated factor solutions. Even though the underlying constructs of the PCA components were not assumed to be independent, Varimax rotation will allow interpretation and comparison with the results of an oblique rotation, Oblimin rotation which allows the factors to be correlated.

To obtain information on the relationship before deciding which results to use, both rotation methods were performed. The information from Oblimin rotation of the strength of the relationship presented in the Component Correlation Matrix showed that the correlation was above .3. The reasonably high correlation indicated that the components are not independent but related. This information means that the Oblimin rotation results are the more appropriate ones for interpretation and labeling of the components.

Table D.1

Pattern and Structure Matrix for PCA, and communalities with Oblimin Rotation of the two factor solution of the 10 TPB direct attitude items

10 item direct attitude construct	Pattern coefficients		Structure coefficients		Comm-unalities
	Component		Component		
	1	2	1	2	
DA 6. Maintaining of streamside forests is a waste of money and time.	.85	-.08	.82	.22	.68
DA 2. Reforesting the stream sides on my land would be extremely desirable.	.81	-.08	.78	.21	.61
Da 4. The preservation of my streamside forest is valuable.	.78	.18	.85	.46	.75
DA 1. I find streamside forests extremely pleasant.	.77	.03	.78	.30	.61
DA 3. I find the native animals I see in the streamside forest very enjoyable.	.66	-.04	.65	.20	.42
DA 10. To have trees on the riverbanks on my land is extremely good.	.49	.40	.63	.58	.54
DA 9. I always believed that I did the right thing about my streamside forests.	-.12	.83	.17	.79	.64
DA 7. I take my role as a keeper of clean waterways very seriously.	-.08	.78	.20	.75	.57
DA 5. Walking on the banks of creeks is pleasant.	.21	.59	.41	.66	.48
DA 8. Since the water from my creek will end up in the Great Barrier Reef Lagoon (that is the sea between the shore and the Great Barrier Reef) I am responsible for the water quality in my creek.	.05	.52	.23	.54	.30

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

The Oblimin rotation results of the Pattern Matrix (Table D.1) show two components. Five items (DA 6, 2, 4, 1, 3) loaded strongly on Component 1 with no cross-loading on

Component 2. One item (DA 10) loaded strongly on both components, and four items (DA 9, 7, 5, 8) loaded on Component 2.

The Structure Matrix table (Table D.1) showed that DA 4 and DA 5 were also correlated to both factors in addition to DA 10 in the set of items.

The Communalities table (Table D.2) showed that the variance of DA10 is explained well with an extraction value of .54. But from the Pattern Matrix we know that the explanation of the variance is split by both factors almost equally. It was therefore decided to exclude DA10 from the set of items and repeat the PCA and Oblimin rotation with the remaining nine items.

The results of that analysis with nine items showed a Kaiser-Meyer-Olkin value of .79 (down from .82 for 10 items) which still exceeded the recommended value of .6 (Kaiser, 1974, cited in Pallant, 2007) and the cumulative variance of 55.0% (down 1% from the 10 item set). Component 1 contributed 39.1% (compared with 40.9%) and Component 2 contributing 15.9% (compared with 15.1.0%). The strength of the relationship between the factors was unchanged (correlation in Component Correlation Matrix were above .3).

The distribution of loadings between the 9-items was otherwise not different from the 10- item set. The Communalities table showed minor change between the 9- and 10-item sets except for DA 8 which increased from .30 to .33 indicating that this item fits even better into Component 2 now (Table D.2).

Table D.2

Pattern and Structure Matrix for PCA, and communalities with Oblimin Rotation of the two factor solution of nine TPB direct attitude items (DA10 excluded)

Direct attitude construct (9 items)	Pattern coefficients		Structure coefficients		Communalities
	Component		Component		
	1	2	1	2	
DA 6. Maintaining of streamside forests is a waste of money and time.	.84	-.07	.82	.21	.68
DA 2. Reforesting the stream sides on my land would be extremely desirable.	.79	-.06	.77	.20	.59
DA 4. The preservation of my streamside forest is valuable.	.78	.18	.84	.43	.73
DA 1. I find streamside forests extremely pleasant.	.77	.05	.79	.30	.62
DA 3. I find the native animals I see in the streamside forest very enjoyable.	.64	-.02	.63	.18	.40
DA 9. I always believed that I did the right thing about my streamside forests.	-.12	.81	.14	.77	.61
DA 7. I take my role as a keeper of clean waterways very seriously.	-.06	.77	.18	.74	.56
DA 8. Since the water from my creek will end up in the Great Barrier Reef Lagoon (that is the sea between the shore and the Great Barrier Reef) I am responsible for the water quality in my creek.	.09	.54	.26	.57	.33
DA 5. Walking on the banks of creeks is pleasant.	.26	.53	.42	.61	.44

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

The overall result of the PCA showed two components that could be described by their contents as follows:

Factor 1 (containing five items, see below) expresses "affection" for the area, its flora and fauna, and willingness to preserve it, because it is considered "valuable" by the person.

DA 1. I find streamside forests extremely pleasant.

DA 2. Reforesting the stream sides on my land would be extremely desirable.

DA 3. I find the native animals I see in the streamside forest very enjoyable.

DA 4. The preservation of my streamside forest is valuable.

DA 6. Maintaining of streamside forests is not a waste of money and time.)

Factor 2 (containing four items, see below) expresses the individuals' acceptance of their "stewardship" of the riparian forest and also the Great Barrier Reef, and their conviction that the riparian forest has been cared for properly by them.

DA 9. I always believed that I did the right thing about my streamside forests.

DA 7. I take my role as a keeper of clean waterways very seriously.

DA 5. Walking on the banks of creeks is pleasant.

DA 8. Since the water from my creek will end up in the Great Barrier Reef Lagoon (that is the sea between the shore and the Great Barrier Reef) I am responsible for the water quality in my creek.)

Reliability of the Factors as an attitude scale

The Cronbach alpha for the entire set of 10-item direct attitude scale had been found to be .82. Cronbach's alpha for Factor 1 had a value of .81 and Factor 2 of .59. The lowest value is .7 (Pallant, 2007) which render Factor 2 not reliable. The small number of items in the component is not expected to give a reliable alpha value according to Pallant.

EXCLUSION OF THE DIRECT SUBJECTIVE NORM VARIABLE DSN 3

Exclusion of the direct subjective norm variable DSN 3

The subjective norming item DSN 3 ("I would maintain streamside forests only if other landowners did the same") does not seem to fit into the construct of subjective norming. This item correlated negatively with DSN 1 and DSN 2 and therefore it must be representing an opposite notion of subjective norming. One reason may be that the item does not include the object of the behaviour, which makes the item more relevant to general subjective norming than specific to streamside forest maintenance. DSN 3 was excluded to preserve internal consistency of the DSN construct.

DSN 3 also showed a negative correlation with intentions construct which is difficult to explain. Does it mean that landowners will act on their own advice and assessment of the need to maintain their streamside forest regardless of what other landowners are doing? That would indicate low subjective norming behaviour. Observations during the pilot study seem to support this possibility. The interviewees (retired farmers) were very certain that every farmer knows what is best and never practices something because the neighbour does it. Farmers did not want to look like they copy anybody. Nobody knew or admitted to knowing what the neighbour did in terms of land management.

DIRECT PERCEIVED BEHAVIOUR CONTROL AND SELF-EFFICACY

Direct perceived behaviour control (DPBC) and the notion of self-efficacy is explored here. The concept of self-efficacy or "people's beliefs about their capabilities to exercise control over their own level of functioning and over events that affect their lives" p. 257 (Bandura, 1997), expresses control over the behaviour not the outcome of the behaviour. Studies using the model of the TPB using this notion as 'perceived self-efficacy' found that it explained a significant portion of variance, more than attitudes and subjective norms (Cheung, Chan, & Wong, 1999).

In the present study several items express this notion of capability to exercise control in the management and preservation of their riparian forests a having the knowledge and seeing no impediments. The direct PBC measure incorporates two items (DPBC 2 and 6): 'I know how to take care of my streamside forest', and 'it is easy for me to maintain a good streamside forest'. All eight indirect (belief-based) perceived behaviour items (beliefs in strength of controls and beliefs in the power of the control) are questions about self-efficacy to some extent. The theme of financial capability is expressed in IPBC1c and p, IPBC2c and p, of willingness to give up cropland in IPBC3c and p, and of agreement with rules and regulations in IPBC4c and p.

When examining these items as predictors of intentions, the correlations coefficients indicate that the relationships are non-existent or marginal. The notion of self-efficacy cannot be shown to be separate control factor in this study. In regard to the concept of perceived behavior control in the TPB, Ajzen (2002) explains: "Whether these resources and obstacles [of perceived control] are internal or external to the person is immaterial. The theory is concerned only with the extent to which they are believed to be present and are perceived to facilitate or impede performance of the behaviour under consideration" p.12-13, (Ajzen, 2002).

In this study the PBC items are not efficient predictors of intentions and to separate a concept would not give more insight. Therefore, the factor of self-efficacy will not be explored any further.

RELIABILITY OF THE DPBC SCALE

The reliability analysis showed a *Cronbach's alpha* value is .51. Since the scale consists of only the small number of eight items which "it is sometimes difficult to get a decent *Cronbach alpha* value" p.98 (Pallant, 2007). Therefore, factor analyses were undertaken to find out if there are distinctly different notions of perception of controls within the set of six variables.

Factor analyses

The eight direct perceived control items were subjected to principal component analysis (PCA) using SPSS PASW Statistics version 18. In the exploratory analysis the eight items showed a *Kaiser-Meyer-Olkin* value of .620 which is just above the above the critical value of .6 that allows a factor analysis. The Bartlett's test of sphericity was significant. The correlation matrix contained very few correlations above .3 which does not make a factor analysis very meaningful. Nevertheless, the principal components analysis revealed 3 components with eigenvalues above 1: 24.78%, 16.54% and 13.50%, which explained a total of 54.82% of accumulated variance. The screeplot showed two elbows which separated three components that can be retained as factors. But when checking the validity of the factors using the Monte Carlo PCA for parallel analysis and comparing the eigenvalues of the components only two factors pass the criterion and should be accepted.

To assist in the interpretation of the two factors the analysis was repeated with *Varimax* and *Oblimin* rotation and specifying two factors. The total variance with the *Varimax* rotation explained by two the components was 41.32%. The highest loading in component 1 was on DPBC 6 an item which contained a clear statement of confidence and the absence of impediments in regard to maintenance of good a streamside forests; the highest loading in component 2 was DOBC 2 which is a statement that asserts the respondent's confidence in having the knowledge of how to take care of riparian forests.

The *Oblimin* rotation gives information on the inter-component correlations. The correlation matrix showed that the correlation was very low at .013 and it has to be assumed that the two components are related. There were no clear factors and items representative of perceived behaviour control will have to be selected by their meaning.

Pallant, J. (2007). SPSS Survival Manual. A step-by-step guide to data analysis using SPSS for Windows (Version 15) (Third ed.). Crows Nest, NSW Australia: Allen and Unwin.