Integrating trees in rural landscapes: Landowner Assessment

FINAL REPORT

Report 4, Next Generation Forest Plantation Investment Research Project

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Scope

The *Integrating Trees in Rural Landscapes: Landowner Assessment Final Report* outlines key findings and recommendations from the social research component of the *Next Generation Plantation Investment* research project. The overall objective of the multidisciplinary project was to design and test new models supporting landscape approaches to forest plantation investment that will meet the requirements of industry, landowners, capital investors and other stakeholders. The aim of the social research component of the project was to improve understanding of the social and psychological factors underlying landowner attitudes to establishing forestry for commercial harvest. Findings from the landowner assessment will be used to develop new models for establishing commercial forestry to align with the goals and objectives of private landowners.

Funding for the project was provided by the Commonwealth Government's Voluntary Matching Program, co-funded by Hancock Victorian Plantations Ltd, Midway Ltd, Australian Paper, AKD Softwoods and OneFortyOne Plantations Ltd. Research was conducted through the University of Melbourne, with additional support from Swinburne University of Technology. The project was administered by Forest and Wood Products Australia on behalf of the Department of Agriculture and Water Resources.

Executive summary

There is a growing demand for wood and wood-based products both globally and in Australia, driven principally by increased population growth (O'Grady & Mitchell, 2017). Planted forests are a major source of commercial wood products in Australia. However, although the integration of commercial forest plantations within the rural landscape can provide multiple social, environmental and economic benefits as well as providing timber and fibre resources, there has been an overall decline in Australia's commercial plantation area over the past 5 years, with almost no investment in new plantations during this period. To increase the area of forest plantations on privately owned land it is necessary to develop new models for establishing plantings that align with the goals and objectives of private landowners.

While there has been significant research investigating trees on farms in Australia and overseas over the past two decades, the focus of much of this research has been on the environmental, social and economic benefits of farm trees, opportunities for agroforestry products, markets, and investment and socio-economic and public policy issues including identifying training and extension needs (Powell, 2009). There has been relatively little qualitative or quantitative research seeking to understand the social and psychological factors underlying landowner attitudes and motivations to participate in commercial forestry in Australia.

Research objectives

The objectives of this research were to: identify the perceived benefits and barriers private landholders associate with integrating plantation forestry with existing land uses; examine how these beliefs relate to intentions to participate in forestry; and identify how perceived benefits and barriers relate to the acceptability of different investment models. The outputs from this research will contribute to developing new types of partnership models for investment in commercial forestry on privately owned land in ways that more closely align with the goals and objectives of landowners.

Research approach

The research approach draws on the social psychology theory of reasoned action (Fishbein & Ajzen, 2010) as a conceptual framework. The research was undertaken in two-stages. In the first stage, qualitative data was collected during 34 semi-structured interviews conducted with land owners in the study region in October – December 2017. In the second stage quantitative data was collected in a postal survey of 183 landowners and land managers in the study region in September – October 2018. The objective of the postal survey was to quantify and expand on key themes identified in the interviews.

Key findings and implications

Key findings and implications relating to the social psychological factors underlying landholder beliefs and motivations to integrate plantations for commercial harvest are:

- **Key finding 1:** Three broad categories or types of beliefs about planting trees for commercial harvest are related to intentions to engage in forestry: beliefs that commercial forestry can provide multiple environmental, social and economic benefits; beliefs about the importance of maximising income and returns from the land; and beliefs about the

compatibility of commercial forestry with current land uses. Actively considering planting trees for commercial harvest is more likely to be associated with beliefs that commercial forestry can provide multiple benefits, while beliefs that commercial forestry is incompatible with current land uses is more likely to be associated with having no intention or interest in participating in commercial forestry.

Implications: To encourage participation establishment and management models should clearly demonstrate the 'relative advantage' of forestry to landowners from a social, environmental and economic perspective. This can be done by designing tree plantings to enhance the on-farm and environmental benefits of commercial plantings, and by structuring financial returns in terms of both cash flow and overall returns to align with the requirements of the landholder and that are commensurate with current land uses.

- **Key finding 2:** Landholders vary in the degree to which they agree with or subscribe to different beliefs about commercial forestry. Five 'types' or groupings of landowners sharing similar beliefs are identified and labelled to reflect the dominant beliefs in each group: Incompatible; Beneficial; Financial; Ambivalent and Lifestyle. Intentions to engage in plantation forestry vary between landowner 'types', essentially reflecting the relative importance of each belief category within the group.

  Implications: Identifying the dominant beliefs and motivations of landholders can be used to tailor establishment and management models that align with the underlying objectives and motivations of the landholder.

- **Key finding 3:** Landowner 'types' as defined by shared beliefs about commercial forestry are not readily distinguished by sociodemographic or land use characteristics alone.

  Implications: It is necessary to find ways to identify the dominant beliefs and motivations of individual landholders that are independent of, or in addition to, sociodemographic or land use characteristics.

- **Key finding 4:** Landowner beliefs about their ability to control or achieve the desired social, environmental and economic outcomes from commercial forestry can be a barrier to participation. Beliefs contributing to a perceived ability to control outcomes included beliefs about the uncertainty arising from knowledge deficits, evident in the clear distinctions made between being a farmer or a forester, and the associated lack of skills or interest to successfully engage in forestry. Beliefs about the uncertainty and risk inherent in natural systems, such as from fire, insect attack, drought, or changing climate, or the commercial and sovereign risks associated with the relative long-time frames involved in commercial forestry, were also a barrier to participation.

  Implications: Partnership models should align with the individual landholder's beliefs about their skills, interest, time available, and preparedness to undertake some of the work themselves. Beliefs about the capacity to achieve the desired outcomes can be built with experience.

- **Key finding 5:** Being actively involved in the initial planning and decision making is important for all landholder types, while financial outcomes and the provision of additional environmental and on-farm benefits are important for most landholders.

Implications: These findings highlight the importance of having landowner or land manager involvement in decision making relating to the establishment of commercial plantings, including where trees are established, planting configuration, species planted and having access to the land once the trees are established. Having active landholder input will require more flexible establishment and management models to allow alignment with the different goals and objectives of individual landholders.

- **Key finding 6:** The area landowners are willing to consider for commercial forestry as a proportion of property size is relatively small, with just over half (55%) of landholders surveyed willing to plant trees for commercial harvest on up to 10% of their land. Only 17% of surveyed landowners were willing to consider planting on more than 20% of their land.

  Implications: Depending on the size of the property and the proximity to existing forest plantations, achieving economies of scale in timber production may require management of smaller areas of trees on multiple properties.

- **Key finding 7**: There is support for three broad investment models: Independent – where the landholder is responsible for establishing and managing the trees, pays all associated costs and receives all of or a share of the net proceeds at the time of sale; Third party – where a commercial partner is responsible for, and pays all associated costs with establishing and managing trees, with the landholder receiving an annual payment or a share of the net sales proceeds at the time of sale; and Shares – where responsibility for establishment and management is shared between the landowner and a third party. Payment arrangements vary depending on the arrangements and agreement with the third party. The three models essentially differ in the degree of risk borne by landholder.

  Implications: All three models are acceptable to a greater or lesser degree, highlighting the need to match business models to the tolerance for risk as well as to the goals and objectives of individual landholders.

- **Key finding 8:** Receiving additional financial benefits such as tax concessions or carbon credits can increase landholder willingness to consider planting trees for commercial harvest.

  Implications: The perceived 'relative advantage' of plantation forestry in economic terms can be enhanced by incorporating additional payments for ecosystem services, such as a carbon price, and quantifying the on-farm benefits associated with increasing trees in the rural landscape.

Recommendations

Drawing on the key findings from the research, six recommendations are made for developing business models that align with landholder goals and objectives:

- **Recommendation 1:** Beliefs are an important determinant of intention to engage in a behaviour. Consider how beliefs are shaped and formed to actively promote beliefs that are more amenable to integrating commercial plantings on privately owned land (Key finding 1 and 2).

- **Recommendation 2:** Develop a means to identify the goals and objectives of individual landholders that are not dependent on sociodemographic or land use characteristics alone (Key finding 3). This could be done by developing decision tools such as questionnaires incorporating decision trees to systematically identify landholder values, including key objectives, goals and preferences for establishment models (Key finding 7).

- **Recommendation 3:** Develop flexible tree planting designs that complement existing land uses. This is necessary to account for the different beliefs underlying willingness to engage in commercial forestry (Key finding 2) as well as differences in the perceived acceptability of different establishment and management models (Key finding 7). Key to developing more flexible models is recognition of the importance of landholder input and preference for autonomy in the design of tree plantings (Key finding 5).

- **Recommendation 4:** Develop some simple rules and approaches to aggregate smaller areas to achieve required economies of scale (Key finding 6) (see Section 4: Limitations and future research needs).

- **Recommendation 5:** Reduce uncertainty and enhance beliefs about abilities to achieve or control outcomes (Key finding 4) by aligning establishment models with landowner skills, interest, and preparedness to participate in the management of commercial plantings. Develop forestry advisory systems or integrate with existing agricultural advisory services to meet the information and support needs of landowners: enlist advisors, create open and transparent markets, foster landowner autonomy in decision making (Key finding 5), while also incorporating contingency planning and provisions structured to reduce commercial risk and uncertainty for the landowner.

- **Recommendation 6:** Facilitate and broker payments to landowners for the ecosystem services that forestry plantations may provide or generate rules for sharing this income (Key finding 8).

"WE'RE NOT TREE FARMERS, WE'RE DAIRY FARMERS. WE'RE INTO PRODUCING MILK. IF WE CAN GET A BENEFIT FROM TREES WE WILL TAKE IT BUT IT'S NOT OUR FIRST PRIORITY. BUT THAT DOESN'T MEAN IF SOMEBODY'S GOT A GOOD IDEA WE CAN'T WORK WITH THEM."

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Section 1: Introduction

LAND USE DECISION MAKING IS INFLUENCED BY PSYCHOLOGICAL, SOCIAL AND STRUCTURAL FACTORS

Much of the land suitable for new commercial tree plantations in Victoria is privately owned. However, despite multiple policy initiatives since the late 1980s seeking to promote forestry on private land, the area of privately owned land established to forestry remains relatively low (Stewart, 2009). Forestry plantings when integrated with existing agricultural enterprises can potentially provide multiple social, environmental and economic benefits including increasing biodiversity in agricultural landscapes, carbon sequestration, improved water quality, income diversification and increased farm productivity (e.g.O'Grady & Mitchell, 2017; Silva, Freer-Smith, & Madsen, 2018; Stephens & Grist, 2014). While current analyses suggest there is limited scope for commercial forestry to compete economically for high value agricultural land, developing investment models designed to provide a broad range of on-farm benefits to landholders offers scope for integrating plantations within existing agricultural enterprises (Matysek & Fisher, 2016).

Approaches to support forestry investment on privately owned land frequently utilise financial incentives such as direct or indirect subsidies to landowners to encourage participation (Enters & Durst, 2004). Such incentives can lead to market distortions and result in generally unsatisfactory outcomes for growers, investors and the community (Bull et al., 2006). As well, although financial returns are an important consideration for most landowners, the generally low level of uptake of

> Landowner assessment objectives:
> What do landholders perceive to be the benefits and barriers of integrating plantation forestry on their land?
> How do these beliefs relate to intentions to participate in forestry and to the acceptability of different forestry establishment models?

agricultural innovations in response to financial incentives indicates land use decisions are not driven purely by economic or financial considerations alone (Neumann, Krahn, Krogman, & Thomas, 2007) but are influenced by non-monetary social and psychological factors such as the intrinsic, expressive and social values associated with farming (Duesberg, O'Connor, & Dhubháin, 2013; Rhodes, Aguilar, Jose, & Gold, 2018; Sneddon, Soutar, & Mazzarol, 2011). Forestry and farming are frequently viewed as competing or incompatible land uses (Anderson, Ford, & Williams, 2017; Osmond & Upton, 2012), with social factors acting as a significant constraint on plantation establishment (Polglase et al., 2011). Landholder beliefs about the outcomes of establishing plantations on agricultural land, as well as a range of other concerns, have been identified as significant barriers to participation in plantation forestry (Duesberg, Upton, O'Connor, & Dhubháin, 2014; Herbohn, Emtage, Harrison, & Smorfitt, 2005; Schirmer, Kanowski, & Race, 2000). The expansion of commercial forestry on private land requires identifying and removing barriers to planting, including structural and psychosocial

constraints (Enters, Brown, & Durst, 2004). To be acceptable to landholders, new investment models must consider the social, psychological and structural factors influencing landholder participation in commercial forestry (Lawrence, Dandy, & Urquhart, 2010).

Conceptual framework

The conceptual framework for this research (Figure 1) draws on the updated Theory of Reasoned Action (Fishbein & Ajzen, 2010) from social psychology, and research investigating factors influencing landowner adoption of new agriculture practices (Kuehne et al., 2017).

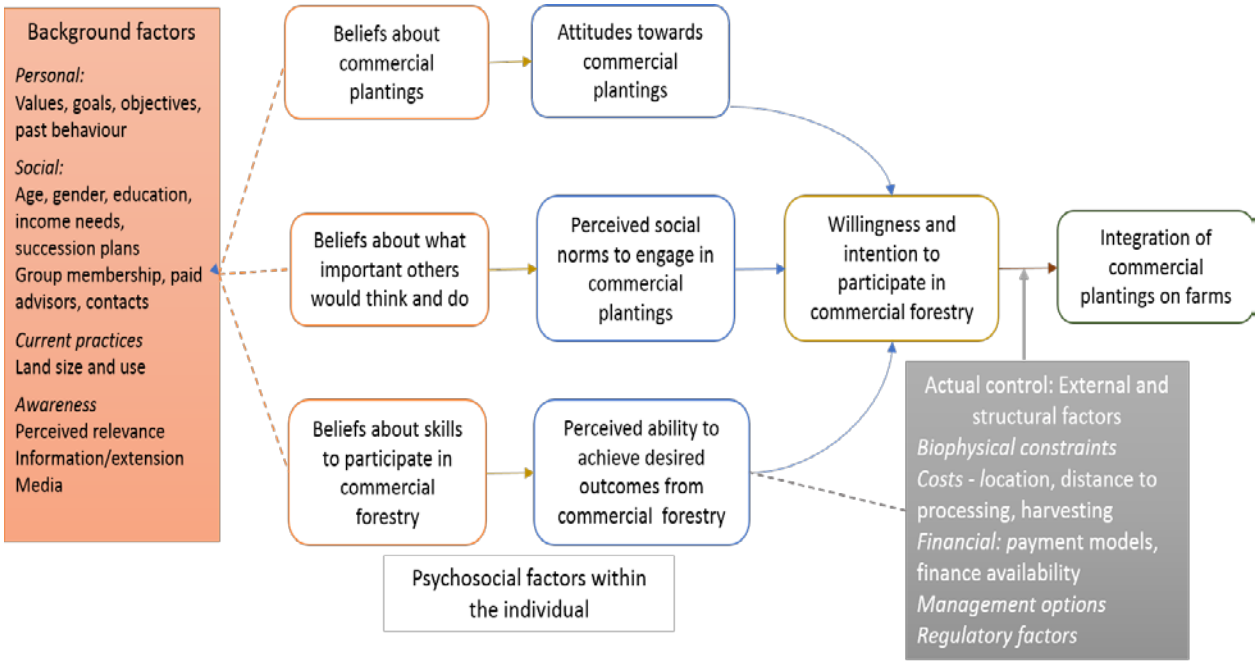

Figure 1: Conceptual framework drawing on the Theory of Reasoned Action (Fishbein & Ajzen, 2010) and (Kuehne et al., 2017) linking landholder beliefs with intentions to integrate commercial forestry in rural landscapes.

The Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 2010), and the associated Theory of Planned Behaviour (TPB) (Ajzen, 1991), provide a useful framework for understanding farmer decision making and intentions. TRA and TPB have been used to examine the adoption of a wide range of on-farm initiatives, including, amongst other things, landowner decisions to update infrastructure to improve water delivery efficiency (Jorgensen & Martin, 2015), decisions about riparian zone management (Fielding, Terry, Masser, Bordia, & Hogg, 2005), and small landholders behavioural intentions to adopt sustainable agricultural practices (Zeweld, Van Huylenbroeck, Tesfay, & Speelman, 2017). Within the conceptual framework it is proposed that landowner intentions to invest in commercial forestry is influenced by psycho-social factors within the individual, as well as a range of background and structural factors external to the individual. Multiple background variables potentially influence beliefs, as outlined on the left side of the framework, while characteristics of the practice itself and other structural factors, including rules, regulations, biophysical constraints, and financial arrangements as indicated on the right side of the framework, can potentially intercede between landowner willingness or intention to participate in forestry, and actual performance of the behaviour. While recognising that background factors relating to the individual, as well as structural

factors outside the individual, can significantly influence land use decision making (Kuehne et al., 2017), the focus of the research in this study is to identify social-psychological factors influencing landowner willingness to participate in commercial forestry: specifically beliefs about the likely consequences of integrating forestry with existing agricultural practices, normative beliefs about what important others think and do, and beliefs about the ability to achieve the desired objectives from engaging in forestry.

How was information collected?

The research was undertaken in two stages. In the first stage, qualitative data was collected during 34 semi-structured interviews conducted with land owners in the study region in October – December 2017 (see Figure 8 for details of study region). The aim of the interviews was to investigate the benefits and barriers landowners and land managers associate with establishing trees on their properties, and to identify ideas about how commercial forest plantations could be integrated with existing agricultural land uses. The second stage involved a postal survey of owners and managers of land >10ha in the study region conducted in September – October 2018. The postal survey was used to collect quantitative data relating to landowner's beliefs and attitudes to forestry. Questions in the survey were developed to reflect key findings from the interviews. Of the 183 participants in the survey, 29 (16%) indicated some previous experience with establishing trees for commercial harvest, 25 (14%) were actively considering planting trees for commercial harvest, 97 (31%) indicated they might consider planting in the future, and 57 (31%) indicated they had no interest or intention to plant trees for commercial harvest in the future. Of those indicating having previous experience, 6 (20%) were actively considering planting again, 18 (62%) indicated they might consider planting again, and 5 (17%) would not consider planting again.

Details of the research methods and data collection are provided in Appendix 1.

Section 2: Key findings and implications

Key finding 1: Three broad categories of beliefs about planting trees for commercial harvest are related to intentions to engage in forestry: beliefs that commercial forestry can provide multiple environmental, social and economic benefits; beliefs about the importance of maximising income and returns from the land; and beliefs about the compatibility of commercial forestry with current land uses.

Implications: To encourage participation establishment and management models should clearly demonstrate the 'relative advantage' of forestry. This can be done by designing tree plantings to enhance the on-farm and environmental benefits provided by commercial plantings, and by structuring financial returns in terms of both cash flow and overall returns to align with the requirements of the landholder and to be commensurate with current land uses.

New or innovative land uses are more likely to be adopted if they are perceived to have higher 'relative advantage' compared with existing or alternative land uses (Pannell et al., 2006). Perceived relative advantage is linked to beliefs about the consequences of performing an action or behaviour which in turn influences the intention or willingness to engage in that behaviour (Fishbein & Ajzen, 2010). Three broad categories of beliefs about the consequences of planting trees for commercial harvest are associated with intentions to plant trees for commercial harvest (Box 1): beliefs that commercial plantings have multiple benefits; beliefs about the importance of maximising income when considering commercial plantings; and beliefs that commercial plantings are not compatible with current use. The degree to which landowners ascribe to each belief group varies, as outlined in Key finding 2.

Box 1: Three categories of beliefs about the consequences of planting trees for commercial harvest identified in the survey.

Belief category 1: Commercial plantings have multiple benefits

Commercial plantings are associated with economic, social and environmental benefits. Positive beliefs include: commercial plantings are a good investment for the future; they are a good way to diversity income; they add to the enjoyment of owning land and would give a lot of satisfaction; they are a good use of land, they would increase the value of the land, and they are a good legacy to leave future generations.

Within this category are beliefs that commercial forestry does not conflict with the main farm business, commercial plantings are not considered to discourage future buyers of the land, and uncertainty about future markets and returns does not discourage growing trees for commercial purposes. Holders of this group of beliefs are less likely to consider all the land is needed for agriculture or express a preference for focusing on current land uses rather than growing trees for commercial purposes.

Belief category 2: The importance of maximising income

The dominant theme underlying beliefs in this category is the importance of maximising financial returns from the land: that farming is a business rather than a way of life. This category includes beliefs that commercial plantings should only be considered if the returns from forestry are better than the returns from current activities; that maximising income from the land is the most important factor in land use decisions; that trees should only be planted on poorer or less productive land; that uncertainty about future markets and returns from forestry discourages growing trees for commercial purposes; and that commercial plantings should only be considered if they provide additional farm benefits such as shade and shelter, i.e. trees are planted to complement current land use.

Belief category 3: Commercial plantings are incompatible with current land uses

In this category commercial plantings are believed to conflict with the current land use: that growing trees for commercial purposes could conflict with the main farming business, and there is a preference for focusing on existing agricultural activities rather than growing trees for commercial purposes.

Belief groupings are related to intention to engage in planting trees for commercial harvest (Figure 2). Beliefs that commercial plantings provide social and economic benefits are more likely to be associated with an intention (either actively considering or might consider) to plant trees for commercial harvest in the future. A lack of interest or intention to engage in commercial forestry is associated with beliefs that forestry conflicts with or is incompatible with current land uses. The association between having no interest or intention to plant trees for commercial harvest and a preference for the current land use, and the relatively low agreement about the benefits forestry can provide, indicates forestry is not perceived to provide sufficient 'relative advantage' when compared to existing land uses.

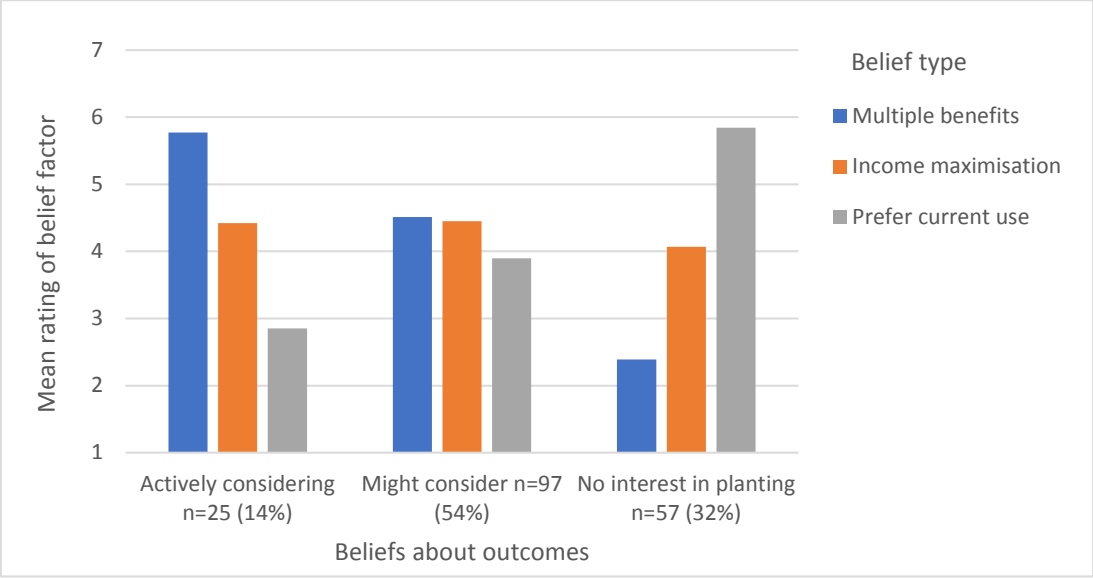

Figure 2: Association between intention to trees for commercial harvest and the mean rating for each of the three categories of beliefs associated with commercial forestry. Level of agreement was indicated on a 7-point scale: 1 = Strongly disagree and 7 = Strongly agree

Key finding 2: Landholders vary in the degree to which they agree with or subscribe to different beliefs about the outcomes of commercial forestry varies. Five 'types' or groupings of landowners sharing similar beliefs are identified and labelled to reflect the dominant beliefs in each group: Incompatible; Beneficial; Financial; Ambivalent and Lifestyle. Intentions to engage in commercial forestry vary between each landowner 'type'.

Implications: Identifying the dominant beliefs and motivations of landholders can be used to tailor establishment and management models that align with the underlying objectives and motivations of the landholder.

Landowners typically hold a combination of beliefs from each of the three belief categories outlined in Key finding 1. Identifying landholder 'typologies' – groups of landholders sharing similar beliefs and motivations (Emtage, Herbohn, & Harrison, 2006) – can assist with more targeted approaches to developing new partnership models for establishing commercial forestry on privately owned land (Bohnet, Roberts, Harding, & Haug, 2011). Five broad 'types' of landholders sharing similar combinations of beliefs were identified in the survey (Box 2). Landholders were grouped or clustered based on the level of agreement with items in the three belief categories (Figure 3). Landowner 'types' are labelled to reflect the dominant beliefs within the grouping: Incompatible; Beneficial; Financial; Ambivalent and Lifestyle. Excerpts from the interviews have been used to further expand on the themes within each landholder 'type'.

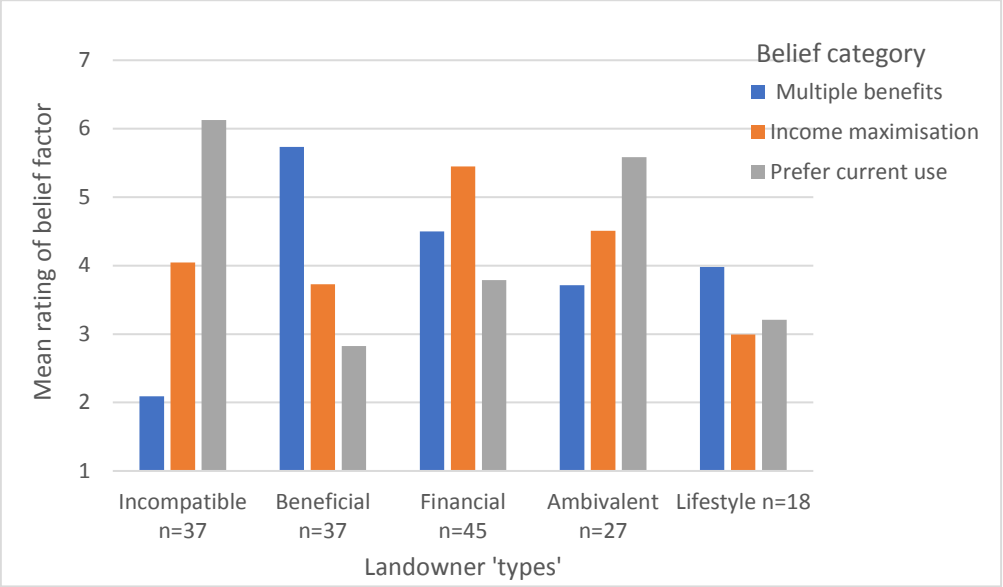

Figure 3: Landholder 'types' distinguished by shared beliefs about commercial forestry. The mean rating for each group of beliefs as indicated on a 7-point scale where 1 = Strongly disagree and 7 = Strongly agree. The number of survey participants within each landholder 'type' is indicated on the x-axis.

Box 2: Five broad landholder 'types' defined by shared beliefs based on the level of agreement with items in the three belief categories.

Box 2.1 'Incompatible': Commercial forestry is incompatible with current agricultural land uses; plantation forestry is 'not core business'.

Landowners in this group prefer to focus on their current land use, feeling that they need to use all their land for existing agricultural enterprises. They tend to disagree that growing trees for commercial harvest can provide other benefits such as being a good legacy to leave future generations, are a good use of the land or would provide a lot of satisfaction. Income maximisation, although relatively important, it is not a major concern.

"[Commercial forestry] is just an exercise that's outside my business." Interview 9

"We're farmers, as in sheep and cattle and that sort of thing. We don't want to be tree farmers." Interview 23

"But in terms of converting large tracts of good grazing land to trees for forestry and harvesting purposes, that's not me." Interview 7

Box 2.2 'Beneficial': Commercial forestry provides multiple benefits

The dominant theme within this group is that commercial plantings provide multiple benefits: that forestry is a good legacy to leave future generations, can provide a lot of satisfaction, would add to the enjoyment of owning the land, are a good investment, would be a good way to diversify the business, that forestry is a good use of the land and would increase the value of the land. Landholders in this group did not agree commercial plantings would discourage future buyers or that trees conflict with current land uses. Income maximisation was not a major concern for this group.

"Aesthetically it's every nice when you head out to do your farm work to actually look at the plantations, especially early mornings and that when you're shifting sheep. It's just pleasant to work there, it's a good work environment which puts you in a better mood" Interview 6

"I think they represent a valuable resource for the future" Interview 2

"So the plantings I've done are for the next generation. So I'm 57 and I might not necessarily see the value of them" Interview 10

Box 2.3 'Financial': Income maximisation is the most important factor when considering planting trees for commercial harvest

The dominant consideration for landholders in this group is maximising financial returns from their enterprise: they would consider commercial plantings if the financial returns were as good as or better than returns from current activities, and that commercial plantings are believed to be a good way to diversify the business, particularly if plantings provided additional on-farm benefits.

"If the economics were good enough, you might even contemplate actually buying land for it." Interview 1

"If the figures stacked up and it all went that way, I'd have no problem in putting a percentage [of the property] in" Interview 5

"I know what I can generate off the farm or you know, from the farm I should say, so I would need above and beyond that to even consider." Interview 28

"…most of our plantings are about adding value to our land and it's the shelter belts, the windbreaks, the riparian zones along the riverways and remnant vegetation and that sort of thing" Interview 12

Box 2.4 'Ambivalent': Prefer current use but also believe commercial forestry can provide other benefits

Landowners in this group prefer to focus on their current land use, but unlike landholders in 'Incompatible', also believe commercial plantings have other benefits, providing a good legacy for future generations but only if other on-farm benefits were realised, such as providing shade and shelter or dividing paddocks. While financial returns are important, landholders in this group tend to agree that enjoying the rural lifestyle is an important consideration.

"I think it's a legacy that I'll just leave the children. What they'll do with them, I have no idea" Interview 4

"I suppose the poorer nature of the land, like that to me it's worth more under trees than pasture would ever be" Interview 7

"…personally, I would like it to work in harmony with the livestock. So corridors, rather than huge areas. I can see the benefits of the corridors or the corners" Interview 10

Box 2.5 'Lifestyle': The importance of enjoying a rural lifestyle

Landholders in this group believed strongly that enjoying a rural lifestyle was more important than the financial returns from the land, and that it would be satisfying to grow high quality trees for commercial harvest. While preferring current land uses, landholders in this group do not agree that maximising the financial returns from the land trees was important, that planting trees for commercial harvest would conflict with current land uses, or that growing trees for commercial harvest would be a way to reduce the workload of farming the land.

Speaking about planting trees for commercial harvest*: "… you're not killing animals. You're not shipping them off to slaughter yards. You're not, you know, mulesing or doing that stuff."* Interview 24

"I've always been interested or wondered about pursuing [planting trees with the intention to harvest them], and occasionally we've looked into it, but never gone further." Interview 34

ASSOCIATIONS BETWEEN LANDHOLDER TYPES AND INTENTION TO ENGAGE PLANTINGS FOR COMMERCIAL HARVEST

Intentions to engage in plantation forestry vary between landowner 'types', essentially reflecting the relative importance of each belief category within the group (Figure 4). While most landholders in all but the 'Incompatible' group indicated they were actively considering or might consider planting in the future, the pattern of beliefs within the landholder group provides insights into factors underlying and motivating this intention. For example, the relatively high level of agreement with beliefs about the multiple benefits of commercial forestry in 'Beneficial', suggests landholders in this group would be more likely to respond to planting models giving priority to the on-farm benefits of trees, while the relative importance of income maximisation for those within the 'Financial' group indicate landholders in this group may be more receptive to investment models giving priority to financial returns while also providing on-farm benefits.

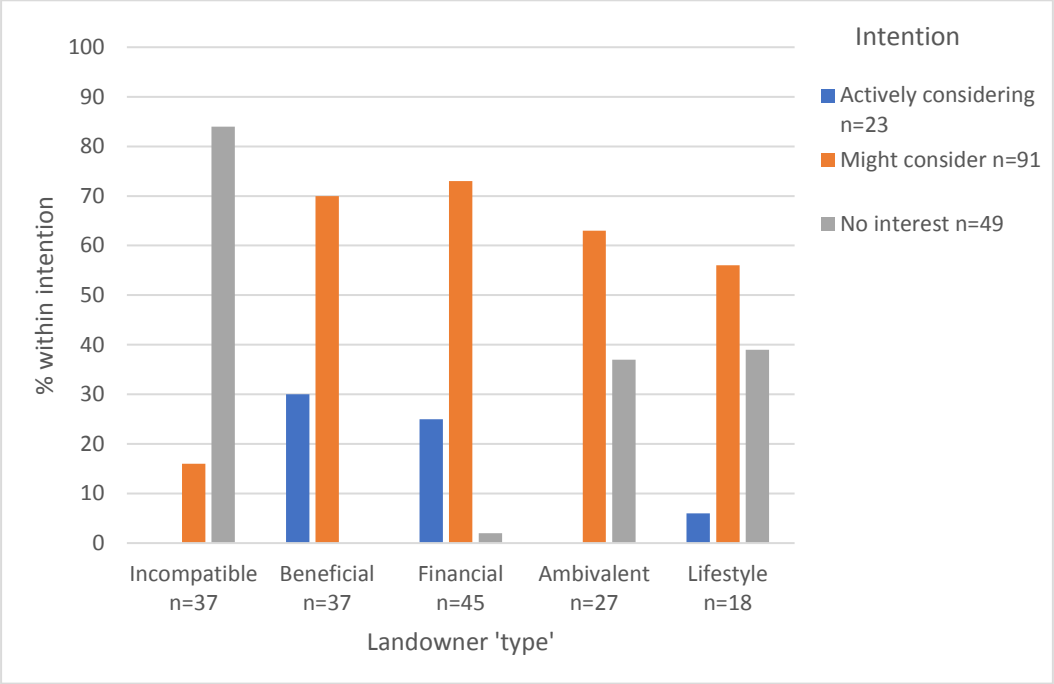

Figure 4: The percentage of respondents in each landowner 'type' indicating they were actively considering, might consider, or had no interest in engaging in plantings for commercial harvest in the future.

Key finding 3: Landowner 'types' defined by shared beliefs about forestry are not readily distinguished based on sociodemographic or land use characteristics alone.

Implications: It is necessary to find ways to identify the dominant beliefs and motivations of individual landholders that are independent of, or in addition to, sociodemographic or land use characteristics.

While identifying landowner 'types' can help to design establishment models that align with the dominant goals and motivations of the group, membership of landholder groups cannot be readily distinguished by sociodemographic factors (age, gender, education, occupation) or land use alone, although some trends can be discerned. Demographic factors more likely to distinguish between landowner 'types' include the time the property had been in the current or family ownership: a preference for the current land use was related to the time the property had been in the current or family ownership, with respondents in the 'Incompatible' and 'Ambivalent' belief groupings being more likely to have owned or had family connections with the property for more than 30 years. Respondents whose main land use was dairy tended to have beliefs consistent with 'Incompatible', while landowners engaged in mixed enterprises tended to have beliefs consistent with 'Financial'. Respondents not engaged in traditional agricultural land uses (n=11) tended to have beliefs consistent with 'Multiple benefits'.

Key finding 4: Landowner beliefs about their skills and ability to control or achieve desired social, environmental and economic outcomes from commercial forestry can be a barrier to participation.

Implications: Partnership models should align with the individual landholder's beliefs about their skills, interest, time available, and preparedness to undertake some of the work themselves. Beliefs about capacity to achieve the desired outcomes can be built with experience.

The degree to which people believe they have the skills to successfully integrate trees for commercial harvest, or have an expectation that investment in commercial forestry will lead to the outcomes they desire, is an important determinant of intention to engage (Fishbein & Ajzen, 2010).

The importance of beliefs about having the necessary skills to invest in commercial forestry is evident in the description of one interviewee who had established 80 acres to commercial plantings: "*I [planted] all the blue gums and that was like 80,000 trees and I planted pretty much all of them…I managed them… spraying, fertilising for the first two years and then they just grew and maintained firebreaks*". This landholder believed they had the necessary skills to establish and manage the trees but drew on outside expertise to achieve the desired financial returns: "*Then we put them into contract … and then they were harvested in 2008. They were a really good crop*." (interview 10)

A perceived lack of skills or ability to control outcomes was a significant barrier to investing in commercial forestry for many participants in the interviews. This was evident, for example, in interviews where participants drew clear distinctions between farming and forestry:

> *"We're not tree farmers, we're dairy farmers. We're into producing milk"* (Interview 12)

> *"We are not business people from that point of view, we're too much farmers."* Interview 8

> *"…if a professional forester came in who knows about thinning, then they can come in and apply their rules and they can do it all, but it's much more difficult for the farmer to take control of that themselves."* Interview 27

A perceived lack of time and capital, and the delay in receiving returns, was described as a barrier to achieving desired outcomes:

> "*Our biggest disincentive I suppose is cost and time. So at the end of the day, and if you're looking at planting trees and you're not going to get an income for 25 to 30 years it's hard to get enthused about something like that, especially if you've got an upfront cost as well*." Interview 20

Knowing how or where to access outside expertise can help address concerns about a perceived lack of skill, as described by one interviewee:

> *"Our skills are in animal husbandry, they're not in horticulture. So we would have to get advice from people and how to manage those trees to get the most out of them and probably get contractors in and whatnot to manage them*." Interview 33

Doubts about achieving the desired outcomes from engaging in commercial forestry are exacerbated by the inherent uncertainty associated with commercial plantings. In the survey for example landholders with no interest or intention to plant trees for commercial harvest were more likely to agree that uncertainty about future markets and returns discouraged them from growing trees for commercial harvest (mean = 4.73 on a 7-point scale where 1= Strongly disagree and 7 = Strongly agree) than those that were actively considering planting (mean = 3.28). In the interviews, uncertainty was associated, amongst other things, with growth rates, future demand for selected species, uncertainty about receiving a fair market price (particularly if there are only a few buyers), and uncertainty about future changes in the regulatory environment affecting such things as the ability to harvest:

> *"We put in…about 600 trees earlier this year and huge frosts knocked them down and it hasn't rained here, we're about 10 inches below our average rainfall for this time of the year"* Interview 22

> "*…concerns of anyone managing a long rotation crop I think is that the regulatory environment changes sort of on a much shorter timeframe"* Interview 25

> "*Well the other problem with trees is because they're so far down the track whether it's 20 years or 25 years or whatever it is you really don't know what's going to happen. I remember years ago everyone was talking about planting trees because we needed them for the future and then you get 25 years down the track and they're worth nothing"* Interview 20

> "*One particular plantation I'd closed the gate, I'd planted 2,000 trees, and thought 'that's a job well done'. Went back 10 days later just to have a look, and 80% of the trees had just been ripped out of the ground [by cockatoos]"* Interview 23

> *"But I suppose it's sitting there for 10, 12, 15 years with no income and it's a bit of a gamble at the end isn't it?"* Interview 11

Key finding 5: Being actively involved in the initial planning and decision making is important for all landholder types, while financial outcomes and the provision of additional environmental and on-farm benefits are important for most landholders.

Implications: These findings highlight the importance of having land owner or land manger involvement in decision making relating to the establishment of commercial plantings, including where trees are established, planting configuration, species planted and having access to the land once the trees are established. Having active landholder input will require more flexible establishment and management models to allow alignment with the different goals and objectives of individual landholders.

Four factors were identified as influential in landholder decision-making about engaging in commercial forestry: landholder input into design and planning; financial returns and relationships; obtaining environmental and on-farm benefits; and the degree of third party involvement in establishing and managing the trees (Box 3).

Box 3: Key factors or motivations when considering establishing trees for commercial harvest

Factor 1: Landholder input into design and planning

This factor reflects the importance of being actively involved in the initial planning and decision making, including having the choice of species planted, choosing the shape of the planting, such as in blocks, belts or some other configuration, having the choice of where the trees are planted on the property, as well as having access to the land once the trees are established.

Factor 2: Financial returns and relationships

Items in this factor reflected the relative importance of financial returns from plantings, including tax concessions or additional payments for environmental benefits such as carbon credits, as well as the importance of having an ongoing relationship with a timber or management company providing regular updates about tree performance, market trends, prices etc.

Factor 3: Obtaining environmental and on-farm benefits

This factor reflected the importance of obtaining additional on-farm benefits such as increasing biodiversity, or shade and shelter, even if it meant lower commercial returns from the trees, as well as the importance of having permanent plantings not intended for harvesting planted alongside trees established for harvest.

Factor 4: Third party involvement

Items in this factor reflected the importance to the landowner of having little or no active involvement in the establishment and on-going management of commercial tree plantings. Important in this factor was having an outside organisation to manage all maintenance and harvesting tasks. Being actively involved in all decision making relating to the trees and having the choice of species to be planted was negatively associated with this factor.

ASSOCIATIONS BETWEEN LANDHOLDER TYPES AND THE IMPORTANCE OF DECISION FACTORS WHEN CONSIDERING COMMERCIAL FORESTRY

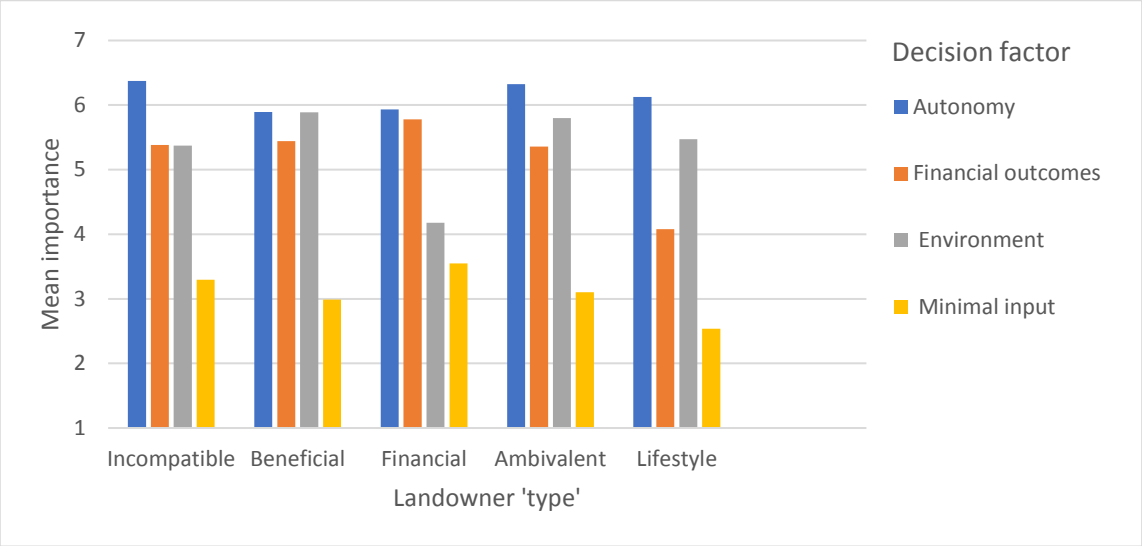

Figure 5: The mean importance of the four decision factors by landholder 'type' indicated on a 7-point scale where 1 = Not important at all and 7 = Very important.

Having input into the initial design of commercial forestry plantings – species, shape, location – was very important for all landholder groups (Figure 5). This contrasts starkly with the very low level of importance assigned to having an outside organisation manage all maintenance and harvesting tasks and having no or minimal landholder input. The desire to be actively involved in decision making is consistent with the need to have independence and control over all on-farm decision making associated with farmer identity and sense of self identified elsewhere (Stock & Forney, 2014; F. Vanclay, 2004). It is imperative new approaches to integrating commercial forestry within agricultural enterprises accommodate sufficient landholder input in a way that aligns with rather than conflicts with farmer identities including the need for autonomy and control over land use decision making.

> *"We don't want to have to sign up paperwork, "yeah, we've got 20,000 trees, we can put them in" like this, and then we're not allowed to touch them"* Interview 29

Consideration of financial returns from forestry were also a very important factor for all landholder types except 'Lifestyle'. While this is consistent with the landholder types being distinguished by the importance of maximising financial returns ('Financial' and 'Ambivalent'), it also reflects the importance of financial returns even when income maximisation is not such a priority ('Beneficial' and 'Incompatible'). The role of financial return was captured in the interviews:

> *"So yeah we need the land for moving as many cows as we can, that's our income. If they turned and said we're going to generate this sort of income from planting timber and starting in timber or something like that, we'd look at it that way"* Interview 29

In contrast, having additional environmental and on-farm benefits was very important for all landholder 'types' except 'Financial', reflecting the priority assigned to maximising income and financial returns from the land for this group.

The relative importance of the different decision factors did not vary significantly between landholders who were either actively considering and who might consider commercial plantings in the future, and those with no interest in or intention to plant in the future.

Key finding 6: The area landowners are willing to consider for commercial forestry as a proportion of property size is relatively small, with just over half (55%) of landholders surveyed willing to plant trees for commercial harvest on up to 10% of their land. Only 17% of surveyed landowners were willing to consider planting on more than 20% of their land.

Implications: Depending on the size of the property and the proximity to existing forest plantations, achieving economies of scale in timber production may require management of smaller areas of trees on multiple properties.

Even though the majority (68%) of landholders in the survey were either actively considering or might consider planting trees for commercial harvest in the future, the area landholders were prepared to plant to trees as a proportion of their property, assuming the management, ownership and financial return arrangements were acceptable, was relatively small, with less than 10% of landholders prepared to plant more than 20% of their land to commercial plantings (Table 1). The property size of survey participants ranged from 13ha to 8500ha, with a mean of 281ha and median 79ha. There was no significant difference in the percentage of land survey respondents were willing to plant and property size, or between intention to plant and property size: those with larger property were not prepared to commit a higher proportion of their land to trees and were no more likely to have an intention to plant in the future than those with smaller properties. Most (70%) of the landowners who were prepared to commit over 20% of their property to commercial forestry had property sizes less than 100ha.

Table 1: Proportion of land survey participants would consider planting to trees for commercial harvest, assuming the management, ownership and financial return arrangements were acceptable

Proportion of land	Frequency	Percent	Cumulative %
None	37	21%	21%
Up to 10%	61	34%	55%
Up to 20%	49	28%	83%
Up to 50%	15	8%	91%
More than 50%	16	9%	100%
Total	178	100%	

The uptake of agricultural innovations such as land use change is influenced by the degree to which the innovation can be trialled or is easy to test and learn about beforehand (Pannell et al., 2006). A reluctance to commit larger areas of land initially at least may reflect the relative lack of 'trialability' of forestry due, for example, to the longer growth times and time commitment compared to other agricultural innovations, particularly when landowners frequently assume rotations of 20 to 30-years. As observed by one interviewee:

"That's another problem with the farm forestry thing, there's a lot of risk. You're looking at a 30-year crop, so in that time you could have a lot of different things go wrong with it, so it's a risky proposition, and a lot of farmers probably aren't that long sighted." Interview 21

Key finding 7: There is support for three broad investment models: Independent – where the landholder is responsible for establishing and managing the trees, pays all associated costs and receives all of or a share of the net proceeds at the time of sale; Third party – where a commercial partner is responsible for, and pays all costs associated with establishing and manage trees, with the landholder receiving an annual payment or a share of the net sales proceeds at the time of sale; and Shares – where responsibility for establishment and management is shared between the landowner and a third party. Payment arrangements vary depending on the arrangements and agreements with the third party. The three models essentially differ in the degree of risk borne by landholder.

Implications: All three models are acceptable to a greater or lesser degree to all landholder 'types', highlighting the need to match business models to the tolerance for risk as well as the goals and objectives of individual landholders.

Investment models for establishing forestry plantations for commercial harvest can vary by who is responsible for establishing and managing the trees, who pays the associated costs, and how the financial returns are received. Three broad investment models reflecting groupings of model components were identified in the survey and labelled to reflect the distinguishing features within each grouping: Independent; Shares; and Third party (Box 4).

Box 4: Descriptions of the three investment models for trees planted for commercial harvest

Model 1: Independent

The landowner is responsible for establishing and managing the trees, including stump removal. The landholder retains ownership of the trees until they are sold. The landholder pays all costs associated with establishment and management of the trees and receives all or a share of the net proceeds at the prevailing market price at the time the trees are sold.

Model 2: Third party

A commercial partner is responsible for, and pays all associated costs, for establishing and managing the trees, including stump removal. The third party retains ownership of the trees. The landowner receives either an annual payment or a share of the net sales proceeds at the time of sale. Being paid an agreed price determined before the trees are planted, or receiving an annual annuity tied to the projected outcomes from sale of the trees, is also acceptable within this model.

Model 3: Shares

A third party is responsible for some aspects of establishing and managing the trees, with the landowner also contributing some work (e.g. fencing or weed control). Ownership of the trees is shared proportionally by prior agreement (e.g. 50/50). The landowner is either paid for the work done and receives an annual payment but does not receive a share of the sales proceeds or pays an agreed share of the costs and receives an annual payment as well as an agreed share of the net sales proceeds.

The three investment models essentially reflect differences in the willingness to assume the responsibility for, and the potential risk, associated with commercial plantings. In Model 1, 'Independent', all the risk and potential reward is borne by the landholder. In contrast, in Model 2 'Third party', the landholder pays no costs and assumes no responsibility for the trees but receives an annual payment irrespective of the financial outcomes when the trees are harvested and sold. Falling between Model 1 and 2, responsibilities and potential risk and rewards in Model 3 'Shares' are shared between the landholder and a third party.

ASSOCIATIONS BETWEEN LANDHOLDER TYPES AND THE ACCEPTABILITY OF DIFFERENT INVESTMENT MODELS

The tolerance of landholders to perceived risk (e.g. future markets, growth rates) varies, as reflected in the relative acceptability of the different models (Figure 6). While differences in the acceptability of the three investment models is evident across all landholder belief groupings, models where risk is shared between the landholder and a third party were generally rated as more acceptable overall compared to models where either the landholder assumes all costs and receives all proceeds, or where all risk, including the potential for high returns at the time of sale, is borne by a third party.

Some differences between landholder belief groupings can be discerned. Model 1 'Independent' was rated as more acceptable by landholders within the 'Lifestyle' grouping, who also rated Model 2 'Third party' as least acceptable. In contrast, landholders within the 'Incompatible' belief grouping rated the Model 1 'Independent' model to be least acceptable. The relatively low rating of 'Independent' within the 'Incompatible' belief grouping is consistent with the overall lack of support or interest this group has for integrating commercial forestry within their enterprise.

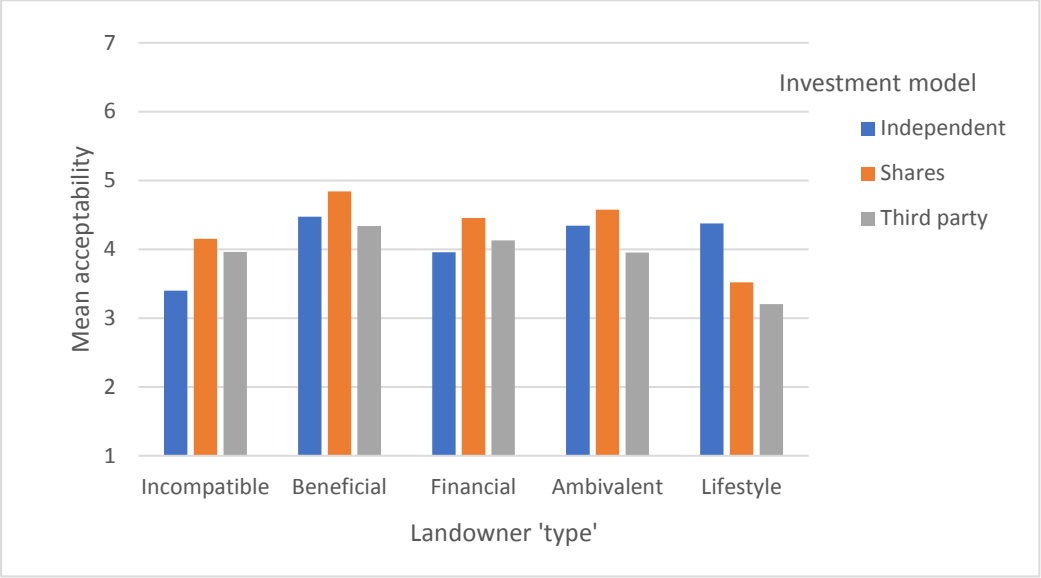

Figure 6 The mean acceptability of the three establishment models by landholder 'type' indicated on a 7-point scale where 1= Not acceptable at all and 7= Very acceptable.

Key finding 8: Receiving additional financial benefits such as tax concessions or carbon credits can increase landholder willingness to consider planting trees for commercial harvest.

Implications: The perceived 'relative advantage' of plantation forestry in economic terms can be enhanced by incorporating additional payments such as ecosystem services, such as a carbon price, and quantifying the on-farm benefits associated with increasing trees in the rural landscape.

In the survey financial outcomes were an important factor in decisions to establish trees for commercial harvest for all landholder types except 'Lifestyle' (see Figure 5). Receiving additional financial benefits such as tax concessions or carbon credits significantly increased the willingness to consider planting trees for commercial harvest for landholders within the 'Beneficial' and 'Financial' belief groupings but were less likely to change willingness to consider for those in 'Conflicting' or 'Lifestyle' (Figure 7). While the prospect of increased financial returns is consistent with the income maximisation ideals characteristic of beliefs in the 'Financial' group, the lower importance assigned to income maximisation in 'Beneficial' (Figure 3) is likely to reflect a more nuanced relationship between willingness to consider forestry and receiving additional payments.

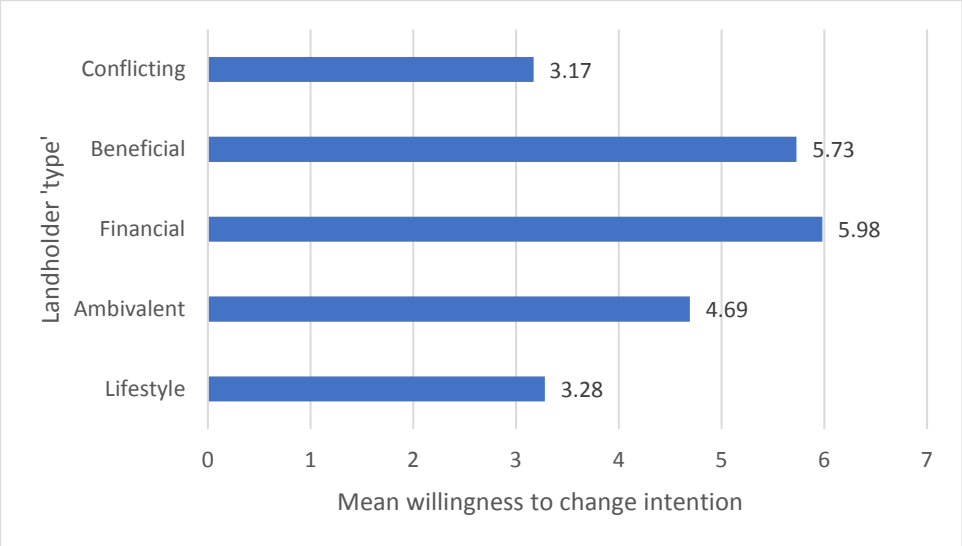

Figure 7: Mean change in willingness to consider planting trees for commercial purposes if other financial benefits such as tax concessions or carbon credits were received by landholder 'type'. Rated on a 7-point scale, where 1= No change in willingness and 7= Much more willing to consider.

Section 3 Recommendations

The key objective of the landowner assessment research was to contribute to the development of new types of partnership models for investment in commercial forestry on privately owned land. This was done by identifying the perceived benefits and barriers private landholders associate with establishing commercial plantings on their land and examining how these beliefs relate to intentions to participate in forestry. Drawing on the key findings from the research, six recommendations are made for developing new partnership models for investment in commercial forestry.

Recommendation 1: Beliefs are an important determinant of intention to engage in a behaviour. Consider how beliefs are shaped and formed to actively promote beliefs that are more amenable to integrating commercial plantings on privately owned land (Key finding 1 and 2).

These findings highlight the central role of beliefs in shaping attitudes and intention to engage in forestry. Beliefs are "subjective probabilities", individual estimations of the likelihood an outcome will occur (Fishbein & Ajzen, 2010). As "subjective probabilities", landholder beliefs about forestry may seem irrational or biased, or may appear to have no relationship to what others may consider to be 'reality'. Regardless of what may be 'the truth', beliefs comprise the information and knowledge used in decision making, and can result in outcomes that do not necessarily maximise the expected utility or efficiencies of agricultural innovations (Sneddon et al., 2011). An understanding of how beliefs are formed can help to shape beliefs that are more amenable to forestry as a land use.

Beliefs about a land use are shaped by, amongst other things, direct observation and experience, by making inferences from the observations of others engaging in the practice, and interactions within the social context in which decisions are made, such as information from outside (trusted) sources, including agricultural consultants, extension agencies, the media, industry groups, or from speaking with other farmers (Fishbein & Ajzen, 2010; Frank, Eakin, & López-Carr, 2011). The importance of previous experiences in shaping land use decision making is highlighted in the survey where 81% of those who had previously planted trees for commercial harvest indicated they were actively considering or might consider planting in the future.

Normative factors, including information from the media, friends and extension workers, contribute to landowner decision making and intentions to adopt new practices (Zeweld et al., 2017). Landowners are more likely to attend to, and feel pressure to comply with, information and practices carried out within the groups they identify with (Abrams & Hogg, 1990). The importance of inferring outcomes from the experiences of others was evident in the interviews, where more negative beliefs about commercial forestry were shaped by stories and observations of other's experiences:

> *"The fact that, well the native legislation that basically what we're hearing is that people who planted trees aren't allowed to cut them down."* Interview 20

"… the small plots that people have put in that aren't worth much when it comes to harvest and what's happened with the likes of Great Southern and Timbercorp, I mean there's been these promises of yields that just haven't materialised in areas like this, certainly with native species." Interview 22

"So that's why I say you've got to be very, very careful I think where you plant the things. Look at the guys who put all those Blue Gums in, most of them have been – you go over near Ballarat and you'll see a few there, they've all been pushed up into windrows and basically burnt but that's pasture ground so it's not too bad, you can sort of rip through it and put a bit of grass in and that's it." Interview 20

Research in Australia investigating farmer learning styles highlights the importance of informal learning sources such as from experts, observation and experience, and from other farmers (Kilpatrick & Johns, 2003). To help shape beliefs that are more amenable to the adoption of commercial forestry it is important to encourage and promote 'positive stories' within the social context in which beliefs are shaped, such as through local farmer organisations, landholder networks and groups (Faure, Desjeux, & Gasselin, 2012). It is also important to recognise that the three belief types – beliefs about outcomes, normative beliefs about what important others do, and beliefs about the ability to control outcomes (Figure 1) - are interrelated; attempting to shape only one set of beliefs such as increasing the perceived ability to engage in commercial forestry is unlikely to change intentions to adopt forestry if the landholder does not believe such participation will achieve a desired outcome (Wauters, Bielders, Poesen, Govers, & Mathijs, 2010).

Recommendation 2: Develop a means to identify the goals and objectives of individual landholders that are not dependent on sociodemographic or land use characteristics alone (Key finding 3). This could be done by developing decision tools such as questionnaires incorporating decision trees to systematically identify landholder values, including key objectives, goals and preferences for establishment models (Key finding 7).

Identifying landholder typologies provides a useful means to understand landholder response to commercial forestry, and for developing more targeting extension programs (Bohnet et al., 2011; Ficko et al., 2017; J. K. Vanclay, 2005). Social research commonly seeks to identify causal links between farmer decision making and sociodemographic characteristics such as age, gender, farming experience, formal education and gender as an indicator to help predict behaviour (see for example Burton, 2014; Edwards-Jones, 2006). However, the relationship between sociodemographic characteristics and farmer behaviour is complex, particularly given the changing demographic profile of rural landowners and farming (Burton, 2014). While the willingness to engage in commercial forestry differed between landholder 'types' defined by beliefs about commercial forestry (Figure 3), a key finding from this research is that socio-demographic and other variables such as land size or land use activities on their own do not reliably predict of identify groups of landholders sharing similar beliefs, goals and objectives relating to commercial forestry (Key finding 3).

Rather than relying on sociodemographic characteristics as indicators of likely willingness to engage or to predict the most acceptable investment models, alternative decision tools, such as a 'hierarchical decision tree' could be developed and incorporated into questionnaires to

systematically identify establishment models that align with landowner's individual goals and objectives (Darnhofer, Schneeberger, & Freyer, 2005; Franzel, Scherr, Coe, Cooper, & Place, 2002). Decision trees would involve a series of yes/no questions relating to discrete decision criteria relevant to decisions to invest in commercial forestry to tailor investment models to the goals, objectives and constraints of individual landholders. The beliefs identified in this study as influencing intentions to participate in commercial forestry provides a good starting point for developing the decision trees, but further development, pre-testing and refinement of the decision tool is essential to ensure optimal performance and outcomes from use of the tool.

Recommendation 3: Develop flexible tree planting designs that complement existing land uses. This is necessary to account for the different beliefs underlying willingness to engage in commercial forestry (Key finding 2) as well as differences in the perceived acceptability of establishment and management models (Key finding 7). Key to developing more flexible models is recognising the importance of landholder input and preference for autonomy in the design of tree plantings (Key finding 5).

A major driver of intentions to participate in commercial forestry plantings is the perceived on-farm and environmental benefits derived from strategically located plantings designed to complement rather conflict with existing land uses (Key finding 1). The potential environmental, economic and social benefits of agroforestry are well documented (see for example Powell, 2009). In general, landowners in both the interviews and the survey were aware of the multiple benefits achieved from integrating trees on their property. Notably however, in the interviews the perceived benefits attributed to non-commercial plantings (e.g. for shade and shelter, for control of land degradation or to increase on-farm biodiversity) were less likely to be extended to plantings for commercial harvest. This may relate to concerns about the loss of benefits such as shelter and shade when trees are harvested, reflected by the relative importance for most landholder types of having permanent plantings not intended for harvest established alongside trees for harvest (see Key finding 5). Developing investment models to enhance on-farm and environmental benefits from commercial plantings is likely to encourage greater participation in commercial forestry. This could be done by providing planting options designed to align with and complement existing land uses, such as smaller scale plantings located to assist on-farm management, or planting trees to maximise shade and shelter. Related to this is the need for alternative harvesting strategies to minimise the loss of benefits once trees are harvested.

This research shows that landholders differ in their goals and objectives. The underlying driver of planting design development should be to tailor the planting design to align with the needs of individual landowners. Landholders for example who assign priority to financial returns from the land may prefer more traditional planting models that maximise returns, such as larger block plantings. More novel and innovative designs, such as plantings along fence lines or on less productive land, may be required to encourage adoption by landholders seeking to realise multiple on-farm benefits in addition to income from commercial forestry.

A major barrier to engaging in commercial plantings was perceived non-economic returns, particularly in relation to the opportunity cost of using the land for other commercial activities. Concerns about financial returns could be ameliorated to a degree by more explicitly linking and quantifying the complementary on-farm benefits commercial plantings can provide.

Recommendation 4: Develop simple rules and approaches to aggregate smaller areas to achieve required economies of scale (Key finding 6)

Related to Recommendation 3, the area landowners are prepared to consider for planting to commercial forestry is, as a proportion of total area, relatively small. To achieve the necessary economies of scale it is important to find ways to effectively aggregate or consolidate relatively small areas of plantings established on properties within similar localities but in different private ownership. One option would be to explore new or innovative organisational structures, such as New Generation Cooperatives proposed to reduce scale and transactions costs within the renewable energy sector (Downing, Volk, & Schmidt, 2005), or to 'revisit' opportunities provided by forest cooperatives (Hull & Ashton, 2008). Further research is required to identify organisational opportunities to align with landowner willingness to allocate only relatively small proportions of their properties to commercial forestry.

Recommendation 5: Reduce uncertainty and enhance beliefs about ability to achieve or control outcomes (Key finding 4) by aligning establishment models with landowner skills, interest, and preparedness to participate in the management of commercial plantings. Develop forestry advisory systems or integrate with existing agricultural advisory services to meet the information and support needs of landowners: enlist advisors, create open and transparent markets, foster landowner autonomy in decision making (Key finding 5)

Uncertainty and concerns about the ability to control outcomes and achieved outcomes is a major barrier to landowner investment commercial forestry, particularly when commercial forestry is perceived to conflict with the main farming business focus and existing skill sets. Uncertainty about outcomes can arise from a lack of knowledge, or from the variability inherent in natural systems (Sword-Daniels et al., 2018).

To enhance perceptions of control, build on the skills farmers already have, and where necessary, reduce the perceived need for 'forestry skills' to achieve desired outcomes. This could be done by establishing support networks including advisory systems and encouraging group involvement, enhancing relevant skills and knowledge through farmer networks, and increasing awareness of the potential for commercial forestry (Kuehne et al., 2017). Develop measures to reduce uncertainty, such as having open and transparent pricing structures and providing regular market reports. As observed in the interviews:

> *"I would like to have information from somebody who knows about trees tell us what species could grow well here… People who understand this climate and trees and rates of growth and pests of trees and spacing of trees, how to grow them; all those sorts of things and anything that I would need information about"* Interview 2

> Speaking about what wold encourage adoption: *"If somebody else came in and said to me, "I've got a proposition for you" or "This is what we'd like you to grow if you could, we know the soil types, we know what will grow here and what's commercially viable" because I don't know that and I don't have the time or energy to be running around checking it."* Interview 12

Farmers are accustomed to using agricultural advisory systems such as agronomists and animal nutritionists to develop the technical, organisational and management skills necessary to support decision making and problem-solving (Birner et al., 2009; Faure et al., 2012). Farmer decision making is further assisted by having ready access to market reports, including trends and forecasts for agricultural commodities such as livestock, wool, milk solids, grain and oilseed. Forestry advisor systems similar to agricultural advisory systems could be established to provide information and skills to reduce uncertainty, while readily accessible open and transparent markets would reduce uncertainty arising from incomplete knowledge.

> *"Well if you sell cattle, you go to the market, you have a yarn to everyone at the market, you're talking about cattle prices, you've got two shops in town… where you've got your access to your information.* [But for forestry] t*here's nothing. There's absolutely nothing. There was with the private forestry officers. There was somebody to go to and they would come out. But to have people come to your place is huge".* Interview 24

> *"I don't go to the Chinese and sell them my wool. I go to my wool broker"* Interview 14

The ability for advisory systems to reduce uncertainty could be further enhanced through developing web-based applications to assist landowners and advisors to evaluate potential sites and suitable tree and shrub species (seeO'Grady & Mitchell, 2017), such as that provided in the Southeastern Agroforestry Decision Support System (SEADSS) in Southeast United States (Ellis, Nair, & Jeswani, 2005).

Other approaches to reducing commercial risk and uncertainty from the perspective of the landowner includes providing clear and comprehensive contingency arrangements within landholder agreements to reduce the uncertainty inherent in natural systems, such as from drought, fire, insect attack, wind and storms. Landowners need to be assured commercial plantings established on their property remain an asset rather than a liability, particularly given the experiences of some landowners with the failure of MIS schemes in the last decade:

> *"[A neighbour] up the road, he leased all his place. He put probably 2,500 acres in. He still owns it. But he was getting paid but then all of a sudden when they [the timber company] went bad he still owned the land, but he didn't really own the trees."* Interview 13

Options to reduce commercial risk and uncertainty include clearly outlining responsibility for rehabilitating or restoring the land once trees are harvested. This could be secured for example by bank guarantees, or by developing a sinking fund with contributions tailored to the growth stage of the trees and associated costs of restoration, to be drawn on by either the landowner or third-party partner in the event of insolvency or payment default. Further research is needed to explore alternative financing structures as a way reduce landowner exposure to commercial risk and uncertainty.

Recommendation 6: Facilitate and broker payments to landowners for the ecosystem services that forestry plantations may provide or generate rules for sharing this income (Key findings 8).

Receiving additional financial benefits such as tax concessions or carbon credits significantly increased the willingness of survey participants to consider planting trees for commercial harvest. Forestry plantations when integrated within agricultural landscapes can provide regulating and provisioning ecosystem services through carbon sequestration, soil enrichment, biodiversity conservation, and contributing to air and water quality (Jose, 2009; O'Grady & Mitchell, 2017). Receiving payment for the environmental services commercial plantations provide would enhance financial returns, acting as a further incentive to encourage adoption (Dwivedi, Bailis, Stainback, & Carter, 2012; Scher, Milder, & Shames, 2009). Scher et al. (2009) identify five types of buyers participating in payment for environmental services markets: public sector agencies seeking to secure 'public goods'; private sector companies acting under regulatory obligations; private businesses or organisations seeking to secure ecosystem services; philanthropic buyers; and consumers of eco-certified products. Although outside the traditional ambit of organisations requiring forestry resources, facilitating and brokering financial payments for the environmental services forestry provide, and ensuring these payments flow to landholders either directly or through share arrangements, would remove a significant barrier to adoption by increasing profitability and the perceived relative advantage of commercial forestry, while reducing financial risks associated with uncertainty arising from the long time lag for profits to be realised (Kuehne et al., 2017).

Section 4: Limitations and future research

Drawing on the social psychology Theory of Reasoned Action as a conceptual framework, this research sought to understand the beliefs of private landowners underlying decision making and willingness to consider commercial forestry. Within the conceptual framework, the research focused on identifying social and psychological factors associated with landowner's intentions to engage in forestry. However, intentions to perform a behaviour do not always result in performance of the behaviour. Practical constraints operating outside the individual frequently intervene between intentions to engage and actual behaviour (Fishbein & Ajzen, 2010; Malawska & Topping, 2016). For example, in the development of a tool to predict farmer uptake of new agricultural practices Kuehne et al. (2017) outlines a range of variables relating to characteristics of the practice itself, such as projected financial returns, the ease with which the practice can be trialled, practice complexity, and the reversibility of the practice. Other practical constraints include biophysical constraints such as climate, slope and soil, costs associated with location, distance to processing, availability of subsidies, and regulatory factors (see Figure 1). While understanding the underlying socio-psychological factors influencing farmers willingness to engage in forestry provides guidance for engaging with landowners and developing investment models tailored to landowner beliefs, goals and objectives, more research is needed to explore the range and role of external factors intervening between an interest or willingness to consider commercial forestry, and actual commitment to commercial forestry. In effect, to identify and remove external impediments to encourage the large percentage of landholders in the survey to move from 'might consider' to 'actively considering', and to move those 'actively considering' to adoption.

The recommendations in this report draw on key findings from the research. Many of the recommendation relate to developing business models and support networks to more closely align with the needs of landholders. Further research is needed to develop and test these recommendations. For example, exploring options for securing and brokering payment for environmental service to complement landowner returns from forestry (Recommendation 6), to investigate alternative organisational systems and structures to aggregate smaller plantings on multiple properties to achieve sufficient scale to be operationally and financially viable (Recommendation 4), or to explore financial and business options to reduce landowner commercial uncertainty and risk (Recommendation 5).

Finally, a note of caution is required for generalising these findings to all land owners and managers in the study region. The relatively small sample in the interviews means these findings are not representative of all landowners within the study area. Similarly, response rates for the postal survey (approximately 10%) were relatively low and skewed towards owners and managers of smaller properties. This is consistent with declining returns for postal surveys observed in both Australia and overseas (Sinclair, O'Toole, Malawaraarachchi, & Leder, 2012), with response rates affected by, amongst other things, the perceived saliency and relevance of the topic, the time of year, and the complexity of the survey questions (Connelly, Brown, & Decker, 2003), as well as issues relating to the quality of the postal address databases (Schirmer & Bull, 2011). However, the consistency of findings between the interviews and survey responses represents a degree of triangulation, providing support for the overall findings.

Section 5 References

Abrams, D., & Hogg, M. A. (1990). Social Identification, Self-Categorization and Social Influence. *European Review of Social Psychology, 1*(1), 195-228. doi:10.1080/14792779108401862

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179-211.

Anderson, N. M., Ford, R. M., & Williams, K. J. H. (2017). Contested beliefs about land-use are associated with divergent representations of a rural landscape as place. *Landscape and Land Use Planning*, 75-89. doi:10.1016/j.landurbplan.2016.05.020

Birner, R., Davis, K., Pender, J., Nkonya, E., Anandajayasekeram, P., Ekboir, J., . . . Cohen, M. (2009). From best practice to best fit: A framework for designing and analyzing pluralistic agricultural advisory services worldwide. *The Journal of Agricultural Education and Extension, 15*(4), 341-355. doi:10.1080/13892240903309595

Bohnet, I. C., Roberts, B., Harding, E., & Haug, K. J. (2011). A typology of graziers to inform a more targeted approach for developing natural resource management policies and agricultural extension programs. *Land Use Policy, 28*(3), 629-637. doi:https://doi.org/10.1016/j.landusepol.2010.12.003

Bull, G. Q., Bazett, M., Schwab, O., Nilsson, S., White, A., & Maginnis, S. (2006). Industrial forest plantation subsidies: Impacts and implications. *Forest Policy and Economics, 9*(1), 13-31. doi:http://dx.doi.org/10.1016/j.forpol.2005.01.004

Burton, R. J. F. (2014). The influence of farmer demographic characteristics on environmental behaviour: A review. *Journal of Environmental Management, 135*, 19-26. doi:https://doi.org/10.1016/j.jenvman.2013.12.005

Connelly, N. A., Brown, T. L., & Decker, D. J. (2003). Factors Affecting Response Rates to Natural Resource - Focused Mail Surveys: Empirical Evidence of Declining Rates Over Time. *Society & Natural Resources, 16*(6), 541-549. doi:10.1080/08941920309152

Darnhofer, I., Schneeberger, W., & Freyer, B. (2005). Converting or not converting to organic farming in Austria:Farmer types and their rationale. *Agriculture and Human Values, 22*(1), 39-52. doi:10.1007/s10460-004-7229-9

Downing, M., Volk, T. A., & Schmidt, D. A. (2005). Development of new generation cooperatives in agriculture for renewable energy research, development, and demonstration projects. *Biomass and Bioenergy, 28*(5), 425-434. doi:https://doi.org/10.1016/j.biombioe.2004.09.004

Duesberg, S., O'Connor, D., & Dhubháin, Á. N. (2013). To plant or not to plant—Irish farmers' goals and values with regard to afforestation. *Land Use Policy, 32*, 155-164. doi:http://dx.doi.org/10.1016/j.landusepol.2012.10.021

Duesberg, S., Upton, V., O'Connor, D., & Dhubháin, Á. N. (2014). Factors influencing Irish farmers' afforestation intention. *Forest Policy and Economics, 39*, 13-20. doi:http://dx.doi.org/10.1016/j.forpol.2013.11.004

Dwivedi, P., Bailis, R., Stainback, A., & Carter, D. R. (2012). Impact of payments for carbon sequestered in wood products and avoided carbon emissions on the profitability of NIPF landowners in the US South. *Ecological Economics, 78*, 63-69. doi:https://doi.org/10.1016/j.ecolecon.2012.03.014

Edwards-Jones, G. (2006). Modelling farmer decision-making: concepts, progress and challenges. *Animal Science, 82*(6), 783-790. doi:10.1017/ASC2006112

Ellis, E. A., Nair, P. K. R., & Jeswani, S. D. (2005). Development of a web-based application for agroforestry planning and tree selection. *Computers and Electronics in Agriculture, 49*(1), 129-141. doi:https://doi.org/10.1016/j.compag.2005.02.008

Emtage, N., Herbohn, J. L., & Harrison, S. R. (2006). Landholder typologies used in the development of natural resource management programs in Australia - A review. *Australasian Journal of Environmental Management, 13*(2), 79-94.

Enters, T., Brown, C. L., & Durst, P. B. (2004). What does it take? Incentives and their impact on plantation development. In T. Enters & P. B. Durst (Eds.), *What does it take? The role of incentives in forest plantation development in Asia and the Pacific* (pp. 262-278). Bangkok: Food and Agriculture Organization of The United Nations Regional Office for Asia and the Pacific.

Enters, T., & Durst, P. B. (Eds.). (2004). *What does it take? The role of incentives in forest plantation development in Asia and the Pacific*

Bangkok: Food and Agriculture Organization of The United Nations Regional Office for Asia and the Pacific.

Faure, G., Desjeux, Y., & Gasselin, P. (2012). New challenges in agricultural advisory services from a research perspective: A literature review, synthesis and research agenda. *The Journal of Agricultural Education and Extension, 18*(5), 461-492. doi:10.1080/1389224X.2012.707063

Ficko, A., Lidestav, G., Ní Dhubháin, Á., Karppinen, H., Zivojinovic, I., & Westin, K. (2017). European private forest owner typologies: A review of methods and use. *Forest Policy and Economics*. doi:https://doi.org/10.1016/j.forpol.2017.09.010

Fielding, K. S., Terry, D. J., Masser, B. M., Bordia, P., & Hogg, M. A. (2005). Explaining landholders' decisions about riparian zone management: The role of behavioural, normative, and control beliefs. *Journal of Environmental Management, 77*(1), 12-21. doi:https://doi.org/10.1016/j.jenvman.2005.03.002

Fishbein, M., & Ajzen, I. (2010). *Predicting and changing behavior : the reasoned action approach*. New York: Psychology Press.

Frank, E., Eakin, H., & López-Carr, D. (2011). Social identity, perception and motivation in adaptation to climate risk in the coffee sector of Chiapas, Mexico. *Global Environmental Change, 21*(1), 66-76. doi:https://doi.org/10.1016/j.gloenvcha.2010.11.001

Franzel, S., Scherr, S. J., Coe, R., Cooper, P., & Place, F. (2002). Methods for assessing agroforestry adoption potential. In S. Franzel & S. J. Scherr (Eds.), *Trees on the Farm: Assessing the Adoption Potential of Agroforestry Practices in Africa* (pp. 11-36): CABI Publishing in association with the International Centre for Research in Agroforestry, Wallingford.

Fusch, P. I., & Ness, L. R. (2015). Are we there yet? Data saturation in qualitative research. *Qualitative Report, 20*(9), 1408-1416.

Herbohn, J. L., Emtage, N. F., Harrison, S. R., & Smorfitt, D. B. (2005). Attitudes of landholders to farm forestry in tropical eastern Australia. *AUSTRALIAN FORESTRY, 68*(1), 50-58.

Hull, R. B., & Ashton, S. (2008). Forest cooperatives revisited. *Journal of Forestry, 106*(2), 100-105. doi:10.1093/jof/106.2.100

Jorgensen, B. S., & Martin, J. F. (2015). Understanding farmer intentions to connect to a modernised delivery system in an Australian irrigation district: a reasoned action approach. *Journal of Environmental Planning and Management, 58*(3), 513-536. doi:10.1080/09640568.2013.864620

Jose, S. (2009). Agroforestry for ecosystem services and environmental benefits: an overview. *Agroforestry Systems, 76*(1), 1-10. doi:10.1007/s10457-009-9229-7

Kilpatrick, S., & Johns, S. (2003). How farmers learn: Different approaches to change. *The Journal of Agricultural Education and Extension, 9*(4), 151-164. doi:10.1080/13892240385300231

Kuehne, G., Llewellyn, R., Pannell, D. J., Wilkinson, R., Dolling, P., Ouzman, J., & Ewing, M. (2017). Predicting farmer uptake of new agricultural practices: A tool for research, extension and policy. *Agricultural Systems, 156*, 115-125. doi:https://doi.org/10.1016/j.agsy.2017.06.007

Lawrence, A., Dandy, N., & Urquhart, J. (2010). *Landowner attitudes to woodland creation and management in the UK*. Alice Holt, Farnham: Forest Research.

Malawska, A., & Topping, C. J. (2016). Evaluating the role of behavioral factors and practical constraints in the performance of an agent-based model of farmer decision making. *Agricultural Systems, 143*, 136-146. doi:https://doi.org/10.1016/j.agsy.2015.12.014

Matysek, A. L., & Fisher, B. S. (2016). *The economic potential for plantation expansion in Australia: Report to the Australian Forest Products Association*. Retrieved from

Neumann, P. D., Krahn, H. J., Krogman, N. T., & Thomas, B. R. (2007). 'My grandfather would roll over in his grave': Family farming and tree plantations on farmland. *Rural Sociology, 72*(1), 111-135.

O'Grady, A. P., & Mitchell, P. J. (2017). *Agroforestry: realising the triple bottom benefits of trees in the landscape.* . Retrieved from

Osmond, J., & Upton, S. (2012). *Growing our woodlands in Wales: the 100,000 hectare challenge*. Cardiff: Institute of Welsh Affairs.

Pannell, D. J., Marshall, G. R., Barr, N., Curtis, A., Vanclay, F., & Wilkinson, R. (2006). Understanding and promoting adoption of conservation practices by rural landholders. *Australian Journal of Experimental Agriculture, 46*(11), 1407-1424. doi:10.1071/EA05037

Polglase, P., Reeson, A., Hawkins, C., Paul, K., Siggins, A., Turner, J., . . . Opie, K. (2011). *Opportunities for carbon forestry in Australia: Economic assessment and constraints to implementation*. Retrieved from

Powell, J. C., Rural Industries Research and Development Corporation. (2009). *Fifteen Years of the Joint Venture Agroforestry Program - Foundation research for Australia tree crop revolution.* Retrieved from

Rhodes, T. K., Aguilar, F. X., Jose, S., & Gold, M. (2018). Factors influencing the adoption of riparian forest buffers in the Tuttle Creek Reservoir watershed of Kansas, USA. *Agroforestry Systems, 92*(3), 739-757. doi:10.1007/s10457-016-0045-6

Scher, S., Milder, J. C., & Shames, S. (2009). Paying for biodiversity conservation in agricultural landscapes. In S. Lockie & S. Carpenter (Eds.), *Agriculture, Biodiversity and Markets: Livelihoods and Agroecology in Comparative Perspective* (pp. 229-252): Routledge.

Schirmer, J., & Bull, L. (2011). *Planting trees for carbon sequestration: what do landholders think? Technical Report 218* (Cooperative Research Centre for Forestry Ed.). Hobart, Tasmania: Cooperative Research Centre for Forestry.

Schirmer, J., Kanowski, P., & Race, D. (2000). Factors affecting adoption of plantation forestry on farms: Implications for farm forestry development in Australia. *AUSTRALIAN FORESTRY, 63*(1), 44-51.

Silva, L. N., Freer-Smith, P., & Madsen, P. (2018). Production, restoration, mitigation: a new generation of plantations. *New Forests*. doi:10.1007/s11056-018-9644-6

Sinclair, M., O'Toole, J., Malawaraarachchi, M., & Leder, K. (2012). Comparison of response rates and cost-effectiveness for a community-based survey: postal, internet and telephone modes with generic or personalised recruitment approaches. *BMC Medical Research Methodology, 12*(1), 132-139. doi:10.1186/1471-2288-12-132

Sneddon, J., Soutar, G., & Mazzarol, T. (2011). Modelling the faddish, fashionable and efficient diffusion of agricultural technologies: A case study of the diffusion of wool testing technology in Australia. *Technological Forecasting and Social Change, 78*(3), 468-480. doi:https://doi.org/10.1016/j.techfore.2010.06.005

Stephens, M. L., & Grist, P. (2014). Market failure for plantations: Past experiences and emerging trends for delivering wood production and ecosystem services in Australia. *International Forestry Review, 16*(2), 205-215. doi:10.1505/146554814811724784

Stewart, H. T. L. (2009). *Victorian farm forestry inventory scoping study*: Farm Forest Growers Victoria Inc., Mansfield, Victoria.

Stock, P. V., & Forney, J. (2014). Farmer autonomy and the farming self. *Journal of Rural Studies, 36*, 160-171. doi:https://doi.org/10.1016/j.jrurstud.2014.07.004

Sword-Daniels, V., Eriksen, C., Hudson-Doyle, E. E., Alaniz, R., Adler, C., Schenk, T., & Vallance, S. (2018). Embodied uncertainty: living with complexity and natural hazards. *Journal of Risk Research, 21*(3), 290-307. doi:10.1080/13669877.2016.1200659

Vanclay, F. (2004). Social principles for agricultural extension to assist in the promotion of natural resource management. *Australian Journal of Experimental Agriculture, 44*(3), 213-222. doi:https://doi.org/10.1071/EA02139

Vanclay, J. K. (2005). *Using a typology of tree-growers to guide forestry extension.* Paper presented at the ACIAR Smallholder Forestry Project-Redevelopment of a Timber Industry Following Extensive Land Clearing: Proceedings from the End-of-Project Workshop.

Wauters, E., Bielders, C., Poesen, J., Govers, G., & Mathijs, E. (2010). Adoption of soil conservation practices in Belgium: An examination of the theory of planned behaviour in the agri-environmental domain. *Land Use Policy, 27*(1), 86-94. doi:https://doi.org/10.1016/j.landusepol.2009.02.009

Zeweld, W., Van Huylenbroeck, G., Tesfay, G., & Speelman, S. (2017). Smallholder farmers' behavioural intentions towards sustainable agricultural practices. *Journal of Environmental Management, 187*, 71-81. doi:https://doi.org/10.1016/j.jenvman.2016.11.014

Appendix 1: Research methods

Stage 1: Interviews with landholders in the study area

Qualitative data was collected during 34 semi-structured interviews conducted with land owners in the study region in October – December 2017. Interview participants were owners and managers of agricultural land in the South West of Victoria (16 participants) and in Gippsland (18 participants) within a 200km radius of Colac, Mt Gambier and Morwell (Figure 8). During the interviews participants were asked details of their current agricultural enterprises, previous tree planting and plantation forestry experience, either direct or anecdotal, attitudes and beliefs about plantation forestry, what factors influence these beliefs, and ideas about plantation configuration (e.g. mixed or single species, percentage of land area, type of land, shape of plantings, ownership models) that would be likely to encourage participation in plantation forestry.

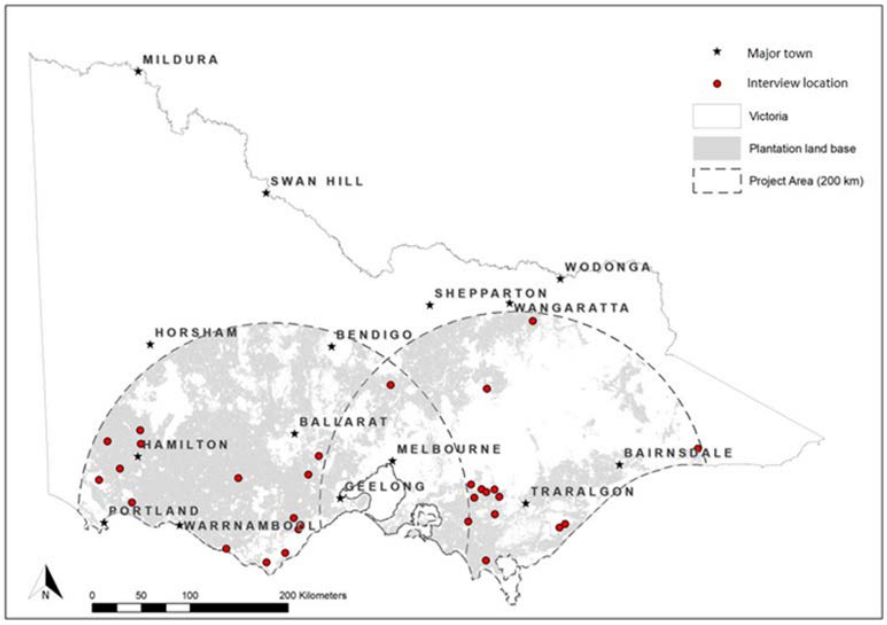

Figure 8: The study region and location of interviews conducted in the first stage of data collection.

The objective of participant selection was to speak to landowners and land manager likely to have a wide range of views and experiences about integrating trees within existing agricultural enterprises. The identification of participants was guided by the goal of achieving sufficient depth and quality of information to ensure 'saturation', that is, where no new themes or information were identified in subsequent interviews and where there was sufficient information to allow the findings to be replicated (Fusch & Ness, 2015). Potential participants included landowners known to the researchers or identified by industry partners as having previously being engaged in plantation forestry. Other invitations to participate were circulated by industry and NGO bodies (e.g. Catchment Management Authorities, Landcare Networks, agricultural consultants). Interview participants were engaged in a range of agricultural enterprises, including dairy, horticulture, forestry, beef, wool and prime lambs (Table 2). All participants had previously planted trees on their properties for some reason, with just over one third (12) having some association either directly or

indirectly (e.g. land purchased with trees already established) with trees planted for commercial purposes.

The size of landholding varied from 11ha to 11,331ha (median 268ha) with an average long-term annual rainfall between 520mm to 1500mm. Most previous plantings were established to provide shade and shelter for stock and pasture, for environmental benefits (e.g. control of soil erosion or manage water), or to improve farm management such as excluding stock from steep or unproductive land.

Table 2: Details of participants in the interviews

		South West Victoria (n=16)		Gippsland[a] (n = 18)		Total (N = 34)	
		No.	%	No.	%	No.	%
Age	18 – 34 years	2	12%	3	17%	5	14%
	35-44 years	0	0	4	22%	4	12%
	45 - 54 years	2	12%	3	17%	5	15%
	55-64 years	8	50%	7	39%	15	44%
	65 years' plus	4	25%	1	5%	5	15%
Gender	Male	12	75%	12	67%	24	71%
	Female	4	25%	6	33%	10	29%
Land size	< 100ha	3	18%	7	39%	10	29%
	101 – 500ha	5	31%	5	28%	10	29%
	>500ha	8	50%	6	33%	14	41%
Long term average rainfall	<600mm	0	0	2	11%	2	6%
	600 – 900mm	15	93%	7	39%	22	65%
	>900mm	1	6%	9	50%	10	29%
Tree plantings	Any purpose	16	100%	18	100%	34	100%
	For harvest	5	31%	7	39%	12	35%
Land uses	Grazing (sheep and cattle)	16	100%	10	55%	26	76%
	Dairy	1	6%	5	28%	6	18%
	Horticulture (potatoes, olives)	0		2	11%	2	6%
	Cropping	1	6%	1	5%	2	6%
	Agroforestry	4	25%	5	28%	9	26%
	Other (tourism, pigs)	1	6%	1	5%	2	6%

Data analysis

The interviews were recorded and transcribed. The data was examined to identify themes in the way participants described their views about the benefits and barriers to integrating trees on their properties, and their ideas about factors influencing participation in commercial forestry.

Stage 2: Postal survey

Quantitative data was collected in a postal survey of 183 landowners and land managers in the study region in September – October 2018. The objective of the postal survey was to build on findings from the interviews to improve understanding of factors underlying landowner attitudes to commercial forestry. Items in the survey included: background information including land use, land area, sociodemographic factors including age, gender, education level, and main occupation; beliefs about planting trees for commercial harvest; previous experience of commercial forestry and intentions to plant in the future; factors considered in decision making; the relative acceptability of different establishment, management and payment options; and the proportion of land willing to establish to trees if the management, ownership and financial return arrangements were right. Respondents were almost equally divided between the west (47%) and east (53%) of Melbourne (Table 3).

Respondent characteristics

Respondents were predominantly older (82% were over 50 years) and male (69%). Education levels were relatively evenly spread, with the most frequent level of education being post-secondary certificate or diploma (28%). Almost one third (37%) of respondents had either a university bachelor or post-graduate qualification. Over half of the respondents were farmers or employed in agriculturally related occupations (58%). Most respondents (56%) had some form of off-farm work, while almost half (44%) reported no off-farm work, although this figure is likely to include retirees (18% of sample).

Property details

Survey respondents mostly owned or managed smaller properties, with 57% of respondent indicating a land size of less than 100ha. The dominance of smaller properties may reflect trends to smaller land areas in the study region given the proximity to Melbourne. Almost all (83%) properties were used for agriculture, with 11% being used for lifestyle purposes and 4% for conservation purposes. The major agricultural enterprises were beef cattle (49%); dairy (15%) and mixed enterprise (15%). Sheep rearing, for lamb or wool, was indicated to be a major land use for only 8% of respondents.

Data analysis

Almost all the items in the survey were closed questions using a 7-point scale to indicate the level of agreement, importance or how acceptable the items were to participants. Responses were coded and aggregated for analysis. Descriptive and univariate statistics were used to describe the data and to identify differences between groups. Factor analysis was used to identify underlying factors and patterns of association within the data, with groupings of participants sharing similar views identified using cluster analysis.

Table 3: Characteristics of respondents in the postal survey

		South West Victoria		Gippsland		Total (including respondents not indicating location) [a]	
		No.	%	No.	%	No.	%
Age	< 30 years	2	1%	2	1%	4	2%
	30 -39 years	6	4%	3	2%	10	6%
	40 - 49 years	7	4%	11	7%	20	11%
	50 -59 years	28	17%	22	14%	54	30%
	> 60 years	42	26%	38	24%	94	52%
Gender	Male	59	37%	51	32%	123	69%
	Female	25	16%	23	15%	55	31%
Land size	10 - 50ha	25	15%	25	15%	59	32%
	51 - 100ha	18	11%	22	14%	46	25%
	101 – 200ha	16	10%	17	10%	35	19%
	201 – 400ha	13	8%	6	4%	20	11%
	>401ha	13	8%	6	4%	21	12%
Major agricultural activity	Sheep	11	7%	2	1%	13	8%
	Cattle	34	21%	46	28%	90	49%
	Dairy	18	11%	5	3%	27	15%
	Mixed	13	8%	11	7%	25	14%
	Other	4	3%	6	4%	13	7%
	None	6	4%	6	4%	15	8%
Time owned property or in family ownership	< 5 years	8	5%	8	5%	19	11%
	5 – 15 years	15	10%	24	15%	43	25%
	16 – 30 years	20	13%	16	10%	40	23%
	> 30 years	39	25%	27	17%	74	42%
Previous experience forestry	No experience	69	44%	64	41%	150	84%
	Previous experience	14	9%	11	7%	29	16%
Education level	Year 9 or below	2	1%	5	3%	8	5%
	Year10 - 11	18	12%	15	10%	39	22%
	Year 12	6	4%	6	4%	12	7%
	Certificate/diploma	24	16%	16	10%	48	28%
	Bachelor	14	9%	13	9%	30	17%
	Post graduate	18	12%	15	10%	35	20%
Occupation	Farmer	42	26%	47	29%	101	56%
	Ag consultant	2	1%	1	1%	3	2%
	Professional	12	8%	7	4%	21	12%
	Trade	3	2%	1	1%	5	3%
	Retired	9	6%	9	6%	22	12%
	Other	16	10%	11	7%	29	16%

[a] Not all respondents indicated the location of their property. Totals refer to all respondents, including those not indicating a location, and may differ to the sum of SW Victoria and Gippsland.

Appendix 2: Terminology

During the interviews participants distinguished between:

(a) Trees established for on-farm benefits, including shade, shelter, environmental benefits such as control of erosion and waterlogging, and improving biodiversity; and

(b) Trees established primarily with the intention of harvesting at some stage, whether for the sale of timber and wood products including fire-wood, or for on-farm use, such as for fencing or fire-wood.

Participants generally considered the two establishment models to be independent. Terms used to describe plantings in the first category included shelter belts and windbreaks, while plantings in the latter category were variously described as agroforestry, wood lots, forestry, commercial plantations.

For clarity, this report uses 'commercial forestry' to refer to trees planted with the intention of harvesting, for whatever purpose. Trees established where there is no intention to harvest (e.g. trees planted for shade or shelter, or for biodiversity benefits) are referred to as 'non-commercial plantings'.