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DETERMINANTS OF FORESTRY INVESTMENT AND EXTENT OF FORESTRY EXPANSION BY SMALLHOLDERS IN NEW ZEALAND

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While there has been a large increase in investment in plantation forestry in New Zealand by smallholders during the past decade, there are still many smallholders who have chosen not to become involved in this land use or who are using only a portion of their potentially planted land for forestry. To understand why this is the case, this paper studies two issues, the differences between those who have and have not established plantation forests, and the factors that explain the proportion of land used in forestry by small landholders who have identified that they have potentially plantable land. Land used for forest plantations is treated as a two-step decision process, where first a landowner must decide whether they would consider planting trees at all, and then secondly how much land would be planted in trees. With this approach, a double hurdle model is used to study planting decisions. Using survey data obtained from 344 landholders in four South Island districts, the results indicate that property-specific factors, such as property size, years of ownership, and ownership being part of a partnership, as well as landowner characteristics such as perceptions of tax policies being favourable for forestry, off farm income level and expectations of increasing log prices were correlated with the decision whether to establish a plantation forest. The factors determining the extent of land identified as being potentially profitable in forestry actually being used for plantation forestry include forestry tax policy, expectations of increasing log prices, regional location of a property, owner's annual income, and area used in sheep and beef production.

JEL Classification: *Q15, Q23.*

Keywords: *forestry investment, land use change, non-industrial forests, double hurdle model.*

INTRODUCTION

In New Zealand, small-scale woodlots are numerous and widely distributed. The use of smallholders' land for plantation forestry increased noticeably when agroforestry practices became popular in the 1950's, and when agricultural products lost their markets in the European Union after 1974. The area of land in plantations again increased after the introduction of the new forestry tax policy in 1991 and a significant increase in log prices in 1993. Despite these increases, there are still many landowners with only small or no plantation forests (Statistics

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New Zealand, 1996; Fairweather, 1993). Since plantation forests have many environmental as well as economic benefits, this raises the question of what drives investment in plantation forests for small landowners and why the area of plantations is not larger than it is.

While the reasons for differences in landowners' involvement in plantation forestry in New Zealand have not previously been examined, there have been a number of studies of small-scale or non-industrial land use in forestry in other countries that have identified particular factors that are important in decisions about forestry, although not plantation forestry. Depending on the objective of the research, there are two broad perspectives that studies have used to look at forestry land use, a micro or landowner perspective, and a macro or external perspective. Studies adopting a micro view of individual landowner decisions over whether or not to use land for forestry look at factors such as land attributes, or owner and ownership characteristics. Alig (1986) and Straka *et al*., (1984) found positive relationships between household income and investment in forestry, whereas Kline *et al*., (2000) found a negative relationship between forestry plantations and household income. Fairweather (1992) also reported a positive relationship between these factors in New Zealand. Relative profitability of agricultural and forestry output has also been found to be important (Kula and McKillop, 1988). Nagubadi *et al*., (1996) and Romm *et al*., (1987) found that landowners living on the property were more likely to participate or invest in a forestry plantation program, while Alig (1986) reported that land use in forestry was high with landowners based in urban areas. Hardy and Park (1996) and Greene and Blatner (1986) showed that owners of large tracts have higher areas of forest plantations. The area of interest can also be investment decisions for multipurpose use (*e.g*., agroforestry) or changes in existing forests uses (Bell *et al*., 1994; Parks and Murray, 1994; Tarp *et al*., 1995; Nagubadi *et al*., 1996; Thacher *et al.,* 1997). A number of studies have also indicated the role of information in the forestry adoption decision (Feder *et al.*, 1985; Nkonya *et al.*, 1997). In studies of the extent of land use for forestry, household income, landholding area and knowledge about cost sharing policies of government have been found to be significant factors (Amacher *et al*., 2003; Hardie and Parks, 1996; Hodges and Cubbage, 1990).

Studies taking a macro view focus on external factors that influence forestry decisions. These factors include government policies towards agriculture, the relative prices of agricultural and forestry output (Kula and McKillop, 1988), and factors that influence the wider market for forest output (Loyland *et al*., 1995; Kuuluvainen *et al*., 1996; Royer, 1987). In studies of the extent of land use decisions, stumpage price, cost sharing, and knowledge of cost sharing are found to be significant factors (Amacher *et al*., 2003; Hardie and Parks, 1996). After a detailed literature review, Amacher *et al*., (2003) found that asymmetric information and influence of neighbours' were missing factors in previous studies.

The purpose of this paper is to investigate small landowner's forestry investment decisions by studying decisions at the landowner level. The first objective is to understand the causes of land use change in plantation forestry by smallholders, and to identify the key factors that appear to influence the decision of smallholders in becoming involved in forestry plantations. The second objective of this study is to determine what factors are important in determining the extent to which landowners will develop areas that they perceive as potentially profitable under plantation forestry. In particular, the study tests the assumption that there are key differences in landowners' economic, personal, physical and institutional attributes and opportunities for land use that are associated with differences in the extent of their plantation forests.

A CONCEPTUAL MODEL OF THE FORESTRY PLANTATION DECISION

A rational landowner's decision problem is the appropriate allocation of land, labour and capital between forestry and non-forestry portfolios in order to attain maximum benefits. In general, landowners are likely to allocate land to forestry if its net benefits are greater than under non-forestry uses. However, the decision of whether or not to allocate resources to a forestry plantation portfolio, and if they are allocated, how much to allocate, is a function of a landowner's personal attributes, as well as their investment opportunities.

Investment decisions are likely to vary with landowner characteristics such as attitudes, expectations, objectives, experience, age, training, education, access to property, access to information, and property-specific constraints. For example, personal characteristics such as higher income levels and the availability of off-farm earnings are directly related to the level of available investment funds and alternative resource use opportunities. Smallholders potentially have limited investment funds and a capital rationing problem. Moreover, the funds available for investment in forestry compete with current cashflow requirements to support families. Smallholders may be inclined to invest in other projects that quickly produce income rather than the deferred income from long-term investments such as forestry. As such, forestry is but one possible investment and for most landowners will not be a primary source of income. Land-related factors can also be important, particularly soil quality, as landowners tend to allocate the 'best land' to agriculture and low productivity lands to forestry. The regulatory environment is also likely to have an effect, particularly land management regulations and taxation, and how an individual perceives their effects on land use.

Subject to resource, technical, personal and policy constraints, smallholders need to select from alternative investments opportunities that fit their circumstances, accounting for both profit and risk. In forestry, investments and returns occur in different time horizons so that net return maximisation is an inter-temporal problem. As in other financial markets, smallholders continuously discount the expected costs and returns. Thus an expected net present value is the sum of continuously discounted net profits over time. Following Parks and Murray (1994) and Shapiro *et al*., (1992) the objective of landowners can be formulated as,

$$\text{Maximise } [(\lambda (NPV_1) + (1 - \lambda)(NPV_2)) \text{ A} - C(\lambda, A), G] \quad (1)$$

where,

- λ is the proportion of land used for other than forestry and $0 \leq l \leq 1$
- NPV_1 is the per area net present value of non-forestry investments (eg. agriculture)
- NPV_2 is the per area net present value of forestry investments
- A is the fixed amount of land available
- C is a cost factor
- G is a vector of landowners' attributes and investment opportunities of specific factors that influence the forestry expansion decision

The research problem is to determine the factors that explain the value of λ. If $(1 - \lambda^*)$ denotes the optimum solution to Equation 1, and is a function of NPV_1, NPV_2, and G, as well as the joint probability distribution of NPV_1 and NPV_2, then NPV_1^e and NPV_2^e can be defined as the expected benefits. Proportion of land area used in forestry is the stochastic variable. Since forestry investment is a long-term consideration, decisions are based on present expectation of profitability in the future. Therefore, the terms NPV_1^e and NPV_2^e measure perceived relative profitability. Denoting $(1 - \lambda)$ as Y, the model in Equation 1 can be formulated as,

$$Y = f(NPV_1^e, NPV_2^e, A, \Sigma, G) \tag{2}$$

where Σ is the second or higher order moment of a normal joint probability distribution function. Equation 2 is the basis of empirical models that include economic, personal, physical and institutional elements of a forestry plantation decision (Parks and Murray, 1994; Shapiro *et al.*, 1992).

The decisions about whether to undertake an activity and the extent to which that activity is undertaken can be considered a two-step decision process or double hurdle (Moffatt, 2005; Reynolds, 1990). In this context, the first hurdle is the decision about whether or not to plant potentially profitable land, and if choice is made to plant, the second hurdle is the decision about the extent of the potentially profitable area that is actually planted. Since some landowners may not have planted any of their potential forestry land, some landowners all of their potential forestry land, and others who have planted only a portion of the potential forestry land, the dependent variable consists of both continuous and zero cases. Tobit analysis is a common method for making consistent estimates in a model that has dependent variables containing zero values, since the estimation method treats zero values as part of continuous values. However, the estimation does not separately explain the dual role of dependent variables with zero values (Kimhi, 1999). In the plant or not plant case, a zero is part of a binary dependent variable (0 or 1). In the extent of planting case, a zero is part of a set of continuous positive values.

The Double Hurdle model initially proposed by Cragg (1971) is found to be appropriate for disaggregate analysis of selection and outcome decision problems such as in this study (Moffatt, 2005; Baek and Hong, 2004). The double hurdle model consists of two equations. In the context of this study, the equations include, (i) a regression model to estimate whether a landowner decides to plant or not (Y_P), and, (ii) a regression model to estimate how much area to plant (Y_A).

$$Y_P = \beta X_i + e_i \tag{3}$$

$$Y_A = \alpha Z_i + u_i \tag{4}$$

$$\begin{pmatrix} e_i \\ u_i \end{pmatrix} \sim N\left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 & 0 \\ 0 & \sigma^2 \end{pmatrix}\right]$$

where,

- X is a vector of explanatory variables for the plant/not plant decision
- β is a vector of coefficients of the plant/not plant variables
- Z is a vector of explanatory variables for the extent of planting
- α is a vector of coefficients for the extent of planting variables
- u_i, e_i independently distributed, normal random error terms with mean 0 and variance σ^2

The assumption that the error terms are normally distributed and independent is common in double hurdle models (Moffatt 2005; Reynolds 1990). Since Y_P is a binary decision (0 or 1) it is appropriate to use a probit model for Y_p. Since Y_A has both continuous values and zero values it is appropriate to use a truncated model for Y_A.

Equation 3 is a probit model that examines the probability that the i^{th} landowner would make a decision to invest in plantation forestry. The model can be written as,

$$Y_P = 1 = Y_P^* = \beta X_i + e_i \qquad \text{if} \quad Y_P^* > \tau_P$$
$$Y_P = 0 \qquad \text{Otherwise} \qquad (5)$$

where,

- Y_P a latent variable (1 if planted, 0 otherwise)
- Y_P^* $\alpha + \beta_{j1} x_{ij1} + \beta_{j2} x_{ij2} + ... + \beta_{jk} x_{ijk} + e_i$
- x_{ijk} individual *i*'s evaluation of alternative *j* with respect to attribute *k*
- β_{jk} parameters
- τ_P is the cut off point for having forestry planting
- e_i is an independent and normally distributed random error term mean 0 and variance 1

Since τ_P is a threshold point, if $Y_P^* \leq \tau_P$, then $Y_P = 0$. If Y_P^* crosses the threshold τ_P, then $Y_P = 1$. In this case no planting means $Y_P = 0$.

Equation 4 is a truncated regression model to examine the extent of plantation forestry. The model can be written as,

$$Y_A = Y_A^* = \alpha Z_i + u_i \qquad \text{if} \quad Y_A^* > \tau_A$$
$$Y_A = 0 \qquad \text{Otherwise} \qquad (6)$$

where,

- Y_A a latent variable (continuous values for observed cases, 0 otherwise)
- Y_A^* observed cases or outcome of decision (the extent of forestry plantation)
- τ_A cutoff point for land area in forestry
- u_i independent and normally distributed random error term with mean 0 and variance σ^2

DATA

Equations 5 and 6 require a number of explanatory variables for forest establishment and extent of plantation forestry respectively. Based on the literature review, the data for variables that might explain investment decisions and the extent of plantation forestry are specific to individual properties and landowners, and need to come directly from these landowners. To do this, data for the study was obtained in a postal survey of landowners in early 2000. The questionnaire was divided into four sections covering different areas of interest.

The first section included a range of questions about the property. These include property-specific questions such as the size of the property, ownership structure, length of time on the property, and type and area of current land uses. Landowners were also asked their perceptions about the relative profitability of forestry on the property, perceptions about the total area that would be most profitable under forestry, and the factors that limit establishment or expansion of forests.

The second section asked questions about the landowner's perceptions of forestry as a land use. Questions included the physical effects of forestry on farming activities, such as the effect of plantation forests on soil erosion, soil fertility and water yield and the relative profitability of forestry. Questions also covered expectations about log prices relative to farm product prices over the next 20 years, and the effect of income tax and district council policies on forestry investment. Landowners were also asked about their experience with different agricultural or forestry activities.

The third section of the survey was only for those who had plantation forests. It asked questions about reasons for plantation ownership, when forestry activity began, sources of information about forestry, prior experience with plantation forestry and membership in the Farm Forestry Association. The fourth section contained demographic questions such as the respondent's age, occupation, education, income, and place of residence.

The survey sample was based on landowners in the Hurunui, Clutha, Selwyn and Tasman District Councils in the South Island. Two sources were used to generate the sample population. A key consideration was that to answer questions about the differences between those who have and have not planted, the survey had to include respondents in both categories. The first data source consisted of a random sample of 600 landowners (150 in each district) obtained from Quotable Value New Zealand. Since this sample was likely to contain only a few respondents with plantations, a second survey population was developed from members of the Farm Forestry Association in each district. The questionnaire was pre-tested for clarity or misleading questions before the main mailing. Out of 840 questionnaires mailed, 405 landowners responded, of which 344 questionnaires were eventually useable for regression analysis.

RESULTS

A wide range of data was collected in the survey. The data were screened using ANOVA for continuous, ratio and interval variables, and the adjusted residuals test for ordinal variables. Only the variables found significant in those tests were used in the regression models.

The Plantation Investment Decision (Probit Model)

Out of the 344 useable surveys, 234 were from landowners who had plantations, and 110 were from landowners with no plantations. Table 1 shows the list of variables used in the probit regression model. Suitability of the variables in the probit regression model was examined using various tests. The variables had no multicollinearity problem, and the results of Lagrangean multiplier tests as suggested by Verbeek (2001) showed that the model was free of omitted variables and heteroskedasticity problems. However, the results of Chi square tests for log likelihood ratio statistics shows that some of the explanatory variables in Table 1 were redundant in the probit regression model. The redundant variables were dropped in the final model and included LOGINCOM, FERTIL, SELFEMPL, GRAINPRO and BEEFPROF.

Table 1
Variables Used in the Probit Estimations

Variable Description	*Units*	*Variable Name*
Planted forest (dependent variable)	yes 1, no 0	PLANT
Landholding size	logarithm of hectares	LOGLAND
Landowner perceives that forestry tax policy encourages forestry	yes 1, no 0	TAXINF
Expectation of future stumpage price	increase relative to other farm products 1, otherwise 0	STUMPRIC
Land ownership type	if partnership 1, otherwise 0	TENURE
Period running the property	years	PERIOD
More than 50 per cent share of land in dairy farming	yes 1, no 0	DAIRYDUM
Landowners' experience in grain production	yes 1, otherwise 0	GRAINEXP
Landowner's off farm income level	percentage	OFFINC
Landowner's income level	Logarithm of NZ Dollars	LOGINCOM
Perception about forestry effect on soil fertility	if decrease 1, otherwise 0	FERTIL
Non-farm self employment	if self-employed 1, otherwise 0	SELFEMPL
Forestry profitability relative to grain	if lower 1, otherwise 0	GRAINPRO
Forestry profitability relative to beef	if lower 1, otherwise 0	BEEFPROF

LIMDEP output from the restricted model of the probit regression is shown in Table 2. All variables in the model are significant and the signs of these variables are as expected. The regression results identify some specific factors that influence the decision about whether or not to establish plantations. Property-specific factors are of paramount importance in determining the probability of planting. The positive relationship of landholding size, years of ownership, and off-farm income indicates that the large scale and/or long-term landholders and those less dependent on farming are the most likely adopters of forestry. Not surprisingly, there is a negative relationship between the planting decision and experience in grain production or perceived profitability in dairy farming, reflecting the generally higher profitability of those activities and the lower relative profitability of forestry. Landholders working in partnerships were more likely to have planted forests. A related factor is current tax policy towards forestry and whether landowners believed it was encouraging of forestry.

Table 2
Results of the Planting Decision (Probit) Model

Variable	*Coefficient*	*Std. Error*	*z-Statistic*	*Significant Probability*	*Mean of X*
CONSTANT	–1.947	0.450	–4.325	0.0000	2.220
LOGLAND	0.7677	0.168	4.567	0.0000	0.473
PERIOD	0.016	0.006	2.348	0.0189	18.040
TENURE	0.509	0.160	3.171	0.0015	0.131
TAXINF	0.768	0.235	3.269	0.0011	0.363
STUMPRIC	0.384	0.174	2.206	0.0274	0.276
DAIRYDUM	–0.728	0.220	–3.300	0.0010	0.192
OFFINC	0.009	0.003	3.408	0.0007	37.245
GRAINEXP	–0.751	0.174	–4.356	0.0000	0.267

Log likelihood -168.23
McFadden R-squared 0.22
Percentage correct prediction at 0.5 success cutoff 82

The Extent of Plantation Forestry

Out of the 344 useable survey responses, 53 were from landowners who did not have any forest plantations, but indicated that they had potentially plantable land, and 218 were from landowners with plantations. As discussed in the data section there were additional variables for the truncated regression model. The variables examined in the truncated regression model are listed in Table 3.

Table 3
Variables Used in the Extent of Land Use in Forestry (Truncated) Estimations

Variable Description	*Units*	*Variable Name*
Extent of land use in plantation forestry (dependent variable)	percentage	PLAND
Landowner perceives that forestry tax policy encourages forestry	yes 1, no 0	TAXINF
Landholding size	Logarithm of hectares	LOGLAND
Land share in sheep and beef property	percentage	SHEPBEEF
Expectation of future log (stumpage) price	increase relative to other farm products 1, otherwise 0	STUMPRIC
Landowner's income level	Logarithm of NZ Dollars	LOGINCOM
Farm in Tasman District	yes 1, otherwise 0	TASMAN
Non-farm self employment	if self-employed 1, otherwise 0	SELFEMPL
Resident on farm	yes 1, otherwise 0	RESIDENCE
Share of off-farm income in total income	percentage	OFFFARM
Use published information for forestry advice	yes 1, no 0	PUBLISH
Finance problems for forestry	yes 1, no 0	FINANCE
Cash flow objective for forestry	yes 1, no 0	CASHFLOW
Forestry profitability relative to beef	lower 1, otherwise 0	BEEFPROF
Forestry profitability relative to dairy	lower 1, otherwise 0	DAIRY
Land ownership type	if partnership 1, otherwise 0	TENURE
Period running the property	years	PERIOD

A number of tests were done to check for problems in the regression model. Some of the variables encountered multicollinearity problems, including landholding (LOGLAND) with off farm income (OFFFARM), and place of landowner residence (RESIDENCE) with land area used in sheep and beef production (SHEEPBEEF). Considering landholding size and land area used in sheep and beef production are more important in forestry decisions, the variables off farm income and place of land owner residence were subsequently dropped from the regressions. There was no simultaneity problem between area under forestry and income (area under forestry determining income or vice versa) which was tested using the two-step River-Vuong and Blundell method as suggested by Wooldridge (2001). The results of Lagrangean multiplier tests for omitted variables and heteroskedasticity showed that the model was free of these problems. However, the results of Chi square tests for log likelihood ratio (LR) of the unrestricted and restricted regression models detected that some of the variables in Table 3 were redundant. The redundant variables were excluded from the subsequent analysis and include CASHFLOW, PUBLISH, FINANCE, BEEFPROF, DAIRY, TENURE and PERIOD.

The results of the truncated regression model are shown in Table 4. The possibility of a sign change for any explanatory variable was examined by using an alternative estimation method (a logit model) as suggested by Wooldridge (2001). There was no statistical evidence of sign change associated with model misspecification. The coefficients signs are as expected and all are statistically significant. The influence of the selected variables on the extent of land used in forestry can be extrapolated from the results. In terms of financial considerations, the proportion of potentially profitable area actually planted is positively correlated with the perception that forestry taxation encourages forestry (TAXINF), and annual income. These relationships indicate that financial factors have had an impact on landowners' planting intentions. By implication, with sufficient financial support and greater awareness of tax rules, some landowners would have planted more of their land. The positive sign for the TASMAN and NONSELF variables indicate that region and occupation are also important factors determining the extent of area in plantation forestry. Similarly, the landowners who had expectations of increased log price in future were also more likely to have planted a greater proportion of the potentially profitable land in forestry.

Table 4
Results of the Extent of Land Use in Forestry (Truncated) Model

Variable	*Coefficient*	*Std. Error*	*z-Statistic*	*Significant Probability*	*Mean of X*
CONSTANT	–86.190	48.982	–1.760	0.0785	–
LOGLAND	–14.481	5.811	–2.492	0.0127	2.292
SHEPBEEF	–1.074	0.130	–8.202	0.0000	58.970
STUMPRIC	28.690	6.374	4.501	0.0000	0.440
TAXINF	12.799	6.327	2.023	0.0431	0.252
LOGINCOM	29.969	10.273	2.917	0.0035	4.592
TASMAN	11.549	6.526	1.770	0.0768	0.307
SELFEMPL	15.208	6.694	2.272	0.0231	0.151

Log likelihood = –779.24, Total observation = 344, Y variable >0 = 218

Property characteristics are also found to be important factors determining the extent of plantation forestry. Landholding size and land use in sheep and beef production are negatively correlated to the proportion of potentially profitable land in forestry that is actually planted. That is, the larger the property, the smaller the proportion of the potentially profitable forestry land that will have actually been planted. There are a number of reasons why this might be the case, including the magnitude of financial requirements for planting on larger landholdings relative to other capital demands, and the relative size of the forestry asset compared to other activities related to the property. The negative relationship of SHEEPBEEF factor indicated that sheep and beef business is a competing land use for forestry.

Double Hurdle Results

Comparison of results in Table 2 and Table 4 shows that selection of participation in forestry planting and extent of planting is a double hurdle decision problem. The determining decision variables are different except for expectations of higher stumpage prices (STUMPRICE) and a perception that tax rules are favourable for forestry (TAXINF). Land ownership type, period of landholding, land use in dairy production, experience in grain farming and percentage of off-farm income determine the decision to undertake plantation forestry. Income level, location of land, occupation, and land use in beef and sheep industry were determinants of extent of potentially profitable land use in forestry actually planted. Landholding size is positively related with probability of planting and negatively related with extent of planting. This result indicates different policy strategies are necessary to make landholders participate in forestry in the first place and to increase land use area in forestry plantations.

CONCLUSIONS

The objectives of this research were to understand the causes of land use change in plantation forestry by smallholders, to identify the key factors that influence the decision of smallholders to establish forestry plantations, and to identify the key factors that influence the decision about how much of that area identified as being potentially plantable is actually put into forestry plantations. This study treats the decision about whether to plant and extent of planting as a double hurdle problem. This type of approach has not previously been used in analysis of non-industrial forest landowners (*e.g.*, review by Amacher *et al*., 2003). The paper uses data from a survey of small landowners that asked questions about current land use, understanding about and intentions for forestry activities, and owner characteristics.

Out of the factors identified in this study as being important to the plantation decision, and to the extent of plantation forestry, the particular constraints identified are predominantly financial, with landowner income or access to capital through a partnership emerging as significant factors in determining the presence of forest plantations, and constraining the extent of plantations on farms. The results show that with sufficient access to financial resources and greater awareness of tax rules, some landowners would have planted more of their land. As such, efforts to encourage landowners to increase their plantations will likely need to focus on creating systems to link non-landowner capital with landowners. New Zealand already has legislation, in the form of the Forestry Rights Registration Act, which makes the legal aspect of joint ventures or partnerships relatively simple. The key problem is rather one of facilitating connections between those with capital and landowners. This type of system is not yet available in New Zealand.

One interesting result of the survey was the level of actual planting on each landholding compared to the area landowners identified as being potentially plantable. Out of the total land area covered by the survey, 29 per cent was identified by landowners as being potentially profitable in forestry. Out of this area, less than 50 per cent had actually been planted, indicating that the area of plantation forest on the small landholdings surveyed could potentially double if the constraints to planting identified in this paper were removed. Although the basis of the survey sample means that this observation cannot be extrapolated across New Zealand, it does give some sense of the potential for plantation forestry on these types of properties.

The size of plantations for respondents to the survey ranged from less than 5 hectares to more than 200 hectares. More than 55 per cent of sampled landowners had plantations that were less than 20 hectares and 75 per cent had plantations that were less than 50 hectares. For most properties, the potential for expansion arises from incremental increases to existing plantations on these properties rather than large-scale conversion to plantations

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