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Factors influencing Irish farmers' afforestation intentions

Keywords: agriculture, forestry, decision-making, logistic regression

1 Introduction

1.1 Policy Background

Due to its temperate north-Atlantic climate, the natural conditions for tree growth in Ireland are very favourable. The mean annual increment is almost double the European average (Kearney and O'Connor, 1993). Forest cover however is only about 12% and it is the Government's target to increase it to at least 17% by the year 2030 (DAFF, 1996). To achieve this target, planting levels of 25,000 hectares per annum to the year 2000, and 20,000 hectares per annum from 2000 to 2030, have been set in the Government's Forestry Strategy 'Growing for the future' (ibid). The majority of this afforestation is to be undertaken by private landowners, more specifically farmers. For this purpose, an afforestation scheme was launched in 1989 and continually improved over the years in order to encourage Irish farmers to afforest (see Figure 1 for premium and planting rates).

INSERT FIGURE !

Figure 1: Private afforestation rates (ha/year) and rate of annually paid farm afforestation premiums (Euros/ha) in Ireland 1990-2012. Source: N.N. (1990); Irish Farmers' Association (1991-1996); Irish Timber Growers Association (1997-2010); Forest Service (2010; Forest Service, 2012)

Currently the scheme covers all planting and establishment costs and pays an annual premium for the duration of 20 years to offset the loss of income from the time of planting until the first revenues from timber harvesting. The rationale behind this strategy is twofold: first, the achievement of the planting targets will lead to a critical mass of timber output that will facilitate the development of a range of processing industries. Second, by offering grants and premiums to farmers they are encouraged to diversify their businesses and create alternative income streams. Such alternatives are necessary as most farms in Ireland are not economically viable without EU subsidies. In particular, the market returns from sheep and non-dairy cattle farming do not cover all production costs (Hennessy et al., 2011); these farm types make up 76% of all farms in Ireland (CSO, 2012). Carbon sequestration as another

objective of the afforestation scheme has become increasingly important in recent years in order to meet the Government's internationally agreed climate change targets.

Initially, the interest in afforestation by farmers was high with planting rates reaching a peak of 17,000 hectares planted in 1995 (Forest Service, 2009) (Figure 1). However, since this time planting rates have been consistently and significantly below target. In the period from 1996 to 2009, only 48% of the targeted area of farmland was planted with trees (ibid). Despite continuous improvements in funding, planting rates have remained below target. Thus, the Department of Agriculture, Fisheries and Food stated in its Rural Development Programme for the period from 2007 to 2013 that *'the major difficulty with the [afforestation] programme at the moment is the low rate of take-up'* (DAFF, 2010).

The first objective of the study was to quantify the importance of the previously identified factors influencing Irish farmers' afforestation decision-making for the wider farming community in Ireland and to develop a model that would describe the likelihood that a farmer will afforest based on these factors. The second objective was to establish for what proportion of farmers a lack of detail information about the afforestation scheme's benefits is a barrier to planting and to identify which group of farmers should be addressed with such information in order to address that potential barrier. Finally, the results will be discussed as to their implications for policy-making to further encourage afforestation.

The paper will first review the literature looking at factors influencing farmers' afforestation decision. Second, data collection and the analytical tools are explained. Third we present the results in form of the two logit models developed describing A) the probability of a farmer to afforest and B) the factors influencing a farmer to change mind in favour of planting after being given detail information on the scheme. Finally the results are discussed and conclusion drawn with regard to policy recommendations.

1.2 Factors influencing farmers' afforestation decisions

A number of studies have been conducted to explain the shortfall in planting rates, mainly looking at the influence of economic and socio-demographic factors. Few studies included attitudinal factors such as farmers' values and their attitudes towards forestry.

69 The majority of studies tried to explain the shortfall in planting rates by comparing the
70 economic returns of afforested land to those of the displaced agricultural use. They were
71 based on the assumption that farmers' decisions to afforest are influenced by profit
72 maximisation goals. The results of these studies were mixed. For example Wiemers and
73 Behan (2004) employed a real options model to calculate forestry returns that would trigger
74 afforestation on various land-use types. According to that study, Irish farmers in the past
75 made economically optimal decisions with regard to afforestation. However Collier et al.
76 (2002), Behan (2002 cited in Wiemers and Behan 2004), Duesberg (2008) and more recently
77 Breen (2010) showed that forestry returns would exceed those from drystock beef and
78 sheep farming and that afforestation should have taken place to a greater extent if all
79 farmers were acting as profit maximisers. In 2005, farm afforestation was made even more
80 financially attractive given that farmers who planted continued to receive agricultural direct
81 payments on the afforested land. According to calculations done by Wiemers and Behan
82 (2004) and Bacon (2004), this reform should have had a positive effect on farm
83 afforestation. In reality however, planting declined from around 10,000 hectares in 2005 to
84 6,000 hectares in 2008.

85
86 Other studies looked at the relationship between farmers' afforestation intentions and farm
87 structure as well as socio-demographic variables such as farm size, enterprise type, off-farm
88 employment, education level, age, marital status, successor situation and region (Collier et
89 al., 2002; Farrelly, 2006; Frawley and Leavy, 2001; Hannan and Commings, 1993; Ní Dhubháin
90 and Gardiner, 1994). The only variable that consistently emerged as having an influence on
91 farm afforestation in Ireland as well as in the UK was farm size: farmers with larger than
92 average farms were more likely to plant (Frawley, 1998; Frawley and Leavy, 2001; Ilbery,
93 1992; Mather, 1998; Ní Dhubháin and Gardiner, 1994; Watkins et al., 1996).

94
95 Another research focus to explain Irish farmers' decision-making with regard to afforestation
96 has been attitudinal factors or the goals and values of farmers. Collier et al. (2002) and
97 similarly Frawley and Leavy (2001) found that farmers in general recognize the need for a
98 greater forest cover in Ireland, however they do not want forests on their own land or in
99 close proximity. As Fléhard et al. (2006) observed, some rural dwellers associated forestry
100 with bringing isolation and depopulation to their areas. This might be due to a lack of
101 integration of these plantations into the existing landscape, as Nijnik and Mather (2008) and
102 Nijnik et al. (2008) found in studies on the public preferences regarding woodland

development in Scotland that woodlands are to play an important role in the integration of aesthetic, ecological and socio-economic components in landscape management. In the authors' previous work on farm afforestation decision-making, farmers' most important reasons for not planting or planting were influenced by non-monetary reasons rather than by profit goals (Duesberg et al., 2013). For that previous research, 62 in-depth interviews with farmers were conducted. In these interviews the importance of producing food, land-use flexibility and the enjoyment of the work tasks related to farming were identified as the most prominent reasons for not planting (ibid). Similarly McDonagh et al. (2010) discovered that the main barriers to planting for Irish farmers was the inflexibility resulting from afforestation and their assertion that they needed all their land for agriculture. A number of earlier studies similarly found that the majority of farmers only considered afforesting land that could not be used agriculturally or that was 'good for nothing else' (Collier et al., 2002; Frawley, 1998; Frawley and Leavy, 2001; Hannan and Commins, 1993; Kearney, 2001; McCarthy et al., 2003; Ní Dhubháin and Gardiner, 1994; Ní Dhubháin and Kavanagh, 2003). This finding is underpinned by the fact that private forests in Ireland are mainly growing on land considered marginal for agriculture such as peat (30%), poorly drained gley soils (30%) or podzols (10%) (Farrelly, 2006). Similar findings were made in England, Spain, Finland, Scotland and Northern Ireland, where farmers were also more willing to afforest marginal land such as fallows, unimproved bog or rough grazing ground (Clark and Johnson, 1993; Edwards and Guyer, 1992; Marey-Perez and Rodriguez-Vicente, 2009; Selby and Petäjistö, 1995; Watkins et al., 1996). Furthermore, the majority of farmers afforesting in the UK indicated to have multiple reasons for afforesting, the most important of which was to enhance the landscape, while timber production only ranked sixth (Nijnik and Mather, 2008).

Few studies have been conducted to explore farmers' attitudinal barriers to afforestation of farmland. Burton (1998) studied the influence of farmers' self-identity on their participation in a community woodland scheme in England. He found that farmers gain little satisfaction from the management of woodland and thus are disinclined to establish one. In our own previous research mentioned above, we explored the values and goals underlying a farmer's afforestation decision and came to the conclusion that the majority of farmers make this decision based on intrinsic, expressive and social values about farming rather than on profit maximisation (Duesberg et al., 2013). According to Ní Dhubháin and Wall (1999), the negative attitude of Irish farmers towards forests arises, in part, from the historical

association of trees with land-owning gentry. Additionally, the extensive area of bogs that are found in many parts of the country resulted in peat being used as the primary fuel source rather than wood. This further contributed to the lack of interest in establishing trees and the development of a farm forestry tradition (ibid).

In the context of understanding the decision-making process with respect to Irish farm afforestation, structural, socio-demographic and attitudinal factors were examined. However, to date, no attempt has been made to combine explanatory factors from different areas to develop a holistic model explaining farmers' afforestation decisions. One sociological theory that attempts to overcome the dichotomy of sociological research focusing either on actors or structure, on the macro- or micro-level is Anthony Giddens' theory of structuration (Giddens, 1984). He argues that the social sciences should focus their analysis more on social practices rather than on individual experience or social structure only. According to Giddens' theory of structuration social practices such as land-use and land-use change are influenced by structure as well as by individual agents' actions (Giddens, 1984). He defines structure as the 'rules' (e.g. agricultural policy) and 'resources' (e.g. farm structure) being a condition to social practices, but also being the outcome of agents' actions ('duality of structure'). Agent factors that influence social practices for example are socio-demographics and attitudes. As social practices such as land-use change are influenced by both structure and agency factors there is scope to develop a model describing the combined effect of such factors on land-use change or more specifically on farmers' decision-making to change land-use, e.g. to forestry.

Looking at the more specific literature on the decision-making of farmers, Giddens' theory is paralleled by concepts of Battershill and Gilg (1997), Edwards-Jones (2006) and Burton (2006). These authors conceptualize farmers' behaviour and decision-making with regard to land-use change as being influenced by structural (government policies, financial situation, physical geography), socio-demographic (age, family structure, education), and individual farmer (agent) factors such as attitudes, goals and values.

2 Data

2.1 Data collection and survey design

The study set out to identify the factors influencing a farmer's afforestation decision. More specifically the study aimed at describing the combined effect of structural, socio-demographic and attitudinal factors on the probability to plant. For this purpose survey was distributed by mail in Spring 2012 to a random sample of 4,000 farmers in Ireland. The random sample was drawn from a list of 136,000 Irish farmers in receipt of direct payments, which represents approximately 97% of the Irish farming population. The mailing was administered with the support of the Department of Agriculture, Food and the Marine. Of the total number of survey forms administered, 1,529 forms were sent back resulting in a relatively high response rate of 38%. Having discarded forms with missing values, a sample of 1,077 responses was used for data analysis. The survey form consisted of four pages comprising questions about farm structure and socio-demographic variables, as well as questions regarding issues such as profit goals and farming values. Including goals and values into the questionnaire facilitated the analysis of the importance of structural and socio-demographic as well as attitudinal factors in a farmer's decision to afforest. The attitudinal questions were designed based on the previously conducted 62 in-depth interviews on the goals and values of farmers with regard to afforestation (Duesberg et al., 2013). In that study, three different profit goals were identified among Irish farmers – profit maximisation, satisfying profit, making no profit/hobby farmers – and a number of intrinsic, expressive and social values that play a role in farmers' decision-making for farming in general and with regard to afforestation. The three profit goals as well as the most important intrinsic, expressive and social values were included in the questionnaire. Participants were asked to choose from the three profit goals the one they would agree most with. Furthermore they were asked how strongly they would agree with statements representing the following intrinsic, expressive and social values using a Likert-type scale:

- Enjoyment of farming activities and lifestyle (LFST)
- Importance of food production (FOOD)
- Independence (INDI)
- Taking on new challenges (CHAL)
- Family tradition (TRAD)

The phrasing of the profit goal- and the farming-value-statements were based on typical representative quotes made by farmers during the previously conducted in-depth interviews.

204
205 Additionally, to establish whether a lack of detail information about the afforestation
206 scheme is a barrier to further planting, the questionnaire provided participants who
207 indicated that they would not plant with detail information about the benefits of the
208 scheme. Having been presented with this information, participants were then asked again if
209 they would be interested in planting to see whether receipt of the information had changed
210 their choice.

211 212 213 **2.2 Data analysis**

214 The assumption is that farmer decision-making with regard to afforestation is a ‘social
215 practice’ that is influenced by structural and individual agents’ factors. Thus, the study set
216 out to examine which farm structure, socio-demographic and attitudinal variables influence
217 the probability of Irish farmers considering the of afforestation under the State’s support
218 scheme. In addition, the characteristics of those farmers who changed their mind about
219 planting once they were provided with detail information concerning the afforestation
220 scheme’s benefits were also explored. In both situations, the variable of interest takes a
221 binary form, considering planting or not, hence logit models were used. Logit models have
222 been widely used to describe farmers’ behaviour, first from the late 1950s in adoption-
223 diffusion research and more recently in research on farmers’ uptake of multifunctional
224 farming or agri-environmental measures (Crabtree et al., 1998; Finger and El Benni, 2013;
225 Jongeneel et al., 2008; Mettepenningen et al., 2013; Poppenborg and Koellner, 2013;
226 Rodriguez-Vicente and Marey-Pérez, 2009; Sheikh et al., 2003; Wauters et al., 2010; Yiridoe
227 et al., 2010).

228
229 Under a logit specification the probability of a binary outcome is identified as:
230

$$231 \quad P_i = \frac{e^{\beta x_i}}{1 + e^{\beta x_i}}$$

232
233 where P_i is the probability of outcome i , x_i represents the independent variables or
234 characteristics related to outcome i , including a constant, and β represents the model
235 coefficients. The model can be estimated using maximum likelihood estimation. Given the
236 nature of the model, the coefficients are not directly interpretable. Thus, in this study,
237 marginal effects are also reported, which identify the change in the probability of choice at

the sample means given a unit increase in the variable. For dummy variables, the reported marginal effects describe the change in probability due to the inclusion of the variable versus its omission. Results from the qualitative interviews and statements from the survey can be considered as reporting about cause-effect relations as perceived by the interviewees.

3 Results

Two logit models were created from the collected data. The first describes farmers' probability to afforest depending on a number of structural and attitudinal variables. The second describes the characteristics of farmers who changed their mind in favour of planting on receipt of detail information about the afforestation scheme's benefits. Table 1 gives an overview of respondents' characteristics.

Table 1: Overview of participants' characteristics: enterprises

INSERT TABLE ONE

3.1 Probability to afforest

For each logit model, a number of independent variables were entered into the data analysis. Appendix 1 gives an overview of all variables surveyed. In the first model describing farmers' probability to afforest, eight variables turned out to be significant (Table 3). Table 2 gives an overview of the dependent and independent variables in the final logit model describing farmers' probability to afforest. Of the eight significant independent variables in the model, five were of structural and three of attitudinal nature (Table 2 & 3).

Table 2: Summary of variables in the logit model describing farmers' probability to afforest

INSERT TABLE TWO

Table 3: Logit model on factors influencing Irish farmers' probability to consider afforestation

INSERT TABLE 3

Structural variables

Past afforestation and farm size

The variable 'Past planting' was positively correlated to respondents' intention to plant. Farmers who already had planted some forest in the past were 12% more likely to plant in the future than those who hadn't (Table 3). Farm size was another significant structural variable in the logit model to explain farmers' probability to afforest (Table 3). Farmers with larger farms were more likely to afforest. Additionally the average farm size of those who had planted in the past was with 56 hectares above the national average of 33 hectares (CSO, 2012). This confirms findings of previous studies that had already shown the dominance of relatively larger farms among those where afforestation takes place (Frawley, 1998; Frawley and Leavy, 2001; Ilbery and Kidd, 1992; Mather, 1998; Ní Dhubháin and Gardiner, 1994).

Occupation and enterprises

Of the occupation variables entered into the logit analysis, only full-time farming was shown to be correlated to the afforestation decision: full-time farmers were less likely to decide in favour of afforestation (Table 3). Farming enterprises typically operated in full-time are dairy and tillage or mixed tillage farms. From all the enterprise variables entered into the analysis, only dairy farming turned out to be a variable of significance in the model. Dairy farmers were less likely to join the afforestation scheme and plant trees (Table 3).

Average forest cover

Farmers living in counties with above-average forest cover were more likely to consider afforesting their land (Table 3). The average forest cover per county ranges from 22 % in county Wicklow to 3% in county Meath. While county Wicklow is characterized by hilly terrain, which limits agricultural land-use, county Meath is a more or less flat midland county with fertile soils suitable for a wide range of agricultural land-uses. Forest cover is likely to reflect local soil types and climate and, consequently, the range and profitability of potential land-uses. Thus the fact that farmers living in counties with above-average forest cover are more likely to plant is probably correlated to these geographic parameters.

Attitudinal variables

The survey included two questions concerning attitudinal variables: Profit goals and general farming values. Respondents were asked which of the three profit goals they were presented with (maximum/satisfying/none) they would agree most with. None of these

profit goals was a variable of significance in the logit model – the likelihood of planting did not significantly increase or decrease depending on the profit goals. However, three of the five non-monetary farming value variables entered into the analysis turned out to have a significant influence on farmers' afforestation decision (Table 3).

The non-monetary farming value variable with the highest significance was the one representing the expressive value of taking on new challenges (CHAL) (Table 3). In the questionnaire this option was represented by the following statement: *"I like taking on new challenges and I have a lot of ambition for my farm and many plans about how I want to manage it in the future"*. Farmers who agreed with this statement were more likely to afforest. From the in-depth interviews we know that farmers who are inclined to taking on new challenges were also more willing to take risks and in general exhibited a more business-oriented, entrepreneurial thinking (Duesberg et al., 2013).

The two other attitudinal variables, which were significant in the model, were the 'Tradition' (TRAD) and the 'Lifestyle' (LFST) variables. Both were negatively correlated to the intention to afforest. The 'Tradition'-variable was represented in the questionnaire by the following statement: *"I regard the farm as a family asset that I'm keeping in a good condition to pass on to my successors one day."* Farmers who agreed with this statement were less likely to afforest. The 'Lifestyle'-option was represented in the questionnaire by the following statement: *"I enjoy the activities, work tasks and lifestyle related to farming"*. Those farmers did not want to see the farm business replaced by a forest because it would deprive them of an important source of satisfaction in their life. We also know from our previous study that for farmers who do not plant for lifestyle reasons making a profit from farming in general was less important.

3.2 Intention to plant after provision of detail information

The second logit model developed from the data concerned farmers who changed their mind in favour of planting on receipt of more detail information about the afforestation scheme's benefits. Over 87% of the respondents in general were aware of the availability of the scheme and this was not influenced by farmer characteristics. Respondents who had no intention of planting were provided with detail information concerning the benefits of the afforestation scheme and were then asked again whether they would consider planting. In total, the number of those interested in planting rose from 10% to 26%. Those who changed

their mind in favour of planting were analysed again using a logit model. Table 4 gives an overview of the dependent and independent variables in that logit model. The analysis showed that those who had planted in the past, were aged between 45 and 64 and were married with children were more likely to change their mind (Table 5). Dairy farmers and farmers living in counties with above-average forest cover were less likely to change their mind after being given more information (Table 5). Also the more respondents already knew about the scheme the less likely they were to change their mind.

Table 4: Variables of the logit-model explaining farmers changing their mind in favour of planting

INSERT TABLE 4

Table 5: Logit-model on factors influencing Irish farmers changing their mind in favour of planting

INSERT TABLE 5

4 Discussion and Conclusions

The study set out to model the probability that a farmer will afforest based on structural, socio-demographic and attitudinal variables. The second objective was to establish whether addressing a lack of detail information about the afforestation scheme's benefits would get more farmers interested in planting and, if so, who those farmers were. The chosen methodological approach proved useful as it allowed a more general assessment of the afforestation scheme than for example a strict application of the theory of planned behaviour (TPB). The TPB has been widely used in researching farmer behaviour, however has been criticised for not being capable to produce a broad enough picture of farmer motivation (Burton, 2004).

Farmers considering afforestation

As to the first objective, the data analysis showed that five structural and three attitudinal variables have a high probability to affect farmers' decision-making with regard to afforestation. This proves the importance of individual farmer factors, such as farming

values, in this specific decision-making situation. Farmers who liked taking on new challenges were more likely to plant, while farmers for whom farming lifestyle and family tradition was important were less likely to consider afforestation. To encourage more farmers to plant, those values need to be taken into account in policy development. For example, to get 'lifestyle farmers' interested in planting they would need to be shown how farmers can get involved in interesting work tasks around establishing and managing a forest. Addressing those farmers for whom family tradition is important could focus on the future value of a forest for their successors. From the results, we also know that profit goals did not have a significant influence on the decision to afforest, demonstrating that it is not primarily related to considerations about the comparative returns from farming and forestry.

There were five structural variables that turned out to play a significant role in the afforestation decision. Past planting, local forest cover and farm size had a positive effect; while dairying and fulltime farming had a negative effect on the probability to afforest. Similarly Ilbery and Kidd (1992) and Crabtree et al. (1998) in studies conducted in the UK concluded that farmers who have planted in the past were more likely to join an afforestation scheme. Farmers who had planted in the past not only were positively inclined to consider afforestation again, they were also more likely to change their mind in favour of planting (again) after being given more detailed information about the scheme. This indicates that the experience from past afforestation has been positive. This group could be easily identified and addressed through a simple information campaign in order to increase afforestation rates. Another advantage of encouraging past planters to afforest more land would be that larger forests might be created when planting fields adjacent to the previously planted areas. Our own previous research, as well as other studies, had shown that farmers would only afforest 'bad land' (Collier et al., 2002; Frawley, 1998; Frawley and Leavy, 2001; Hannan and Commins, 1993; Kearney, 2001; McCarthy et al., 2003; Ní Dhubháin and Gardiner, 1994; Ní Dhubháin and Kavanagh, 2003). Further research could reveal whether past planters intend to afforest remaining patches of 'bad land' or, if due to a positive afforestation experience, they would consider planting even better quality land, which would indicate an improvement in the attitude towards forestry as a farm enterprise.

The positive experience from planting could be passed on by word of mouth to neighbouring farmers, which might explain why farmers living in counties with above-average forest cover

were more likely to afforest. Another reason for this phenomenon could be that farmers living in counties with high forest cover in general have a more positive attitude towards forestry (Frawley and Leavy, 2001).

From a rural development perspective, one of the afforestation scheme's objective is to offer income support to those farmers who struggle to make a living from farming, which typically are small-scale drystock farmers (Hennessy et al., 2011). The study showed that drystock farmers are neither significantly inclined nor disinclined to planting. However, targeting small farms could be difficult, as the results showed that larger farms were more likely to be planted. A scheme initiating and supporting group plantings of small neighbouring fields could enable small-scale (or below average farm size) farmers to plant. This would also have the advantage of increasing the average farm forest's size, improving their value for forestry, nature conservation and recreation as well as the bargaining power of the forest owners once it comes to thinning and harvesting operations. In the Netherlands environmental cooperatives proved successful in motivating farmers to join agri-environmental and rural development activities (Renting and Van Der Ploeg, 2001).

Past studies in Ireland and the UK had already shown the dominance of relatively larger farms among those where afforestation takes place (Frawley, 1998; Frawley and Leavy, 2001; Ilbery and Kidd, 1992; Mather, 1998; Ní Dhubháin and Gardiner, 1994). There is however an interesting difference between Irish and UK farmers as to the farm size they consider big enough for planting. While Irish farmers in this study on average planted forests if their farm size was at least 56 hectares, farmers in a study undertaken in West-Nottinghamshire considered planting from a farm size of at least 100 hectares (Watkins et al., 1996). The overall average farm size in that area however was with 197 ha much bigger when compared to the overall Irish average farm size of 33 ha (CSO, 2012; Watkins et al., 1996). It seems that the farm sizes deemed big enough for planting are regionally flexible. An average farm size could be assessed as 'big enough' for planting if it is above the local average. As there is considerable difference in farm sizes within Ireland, a farm size 'big enough' for planting could change between counties.¹ The fact that there is regional flexibility in the farm sizes deemed big enough for planting raises the question if there also is a temporal and sectoral flexibility. Average farm sizes have continually increased in the past; in Ireland average farm size grew from 22 hectares in the 1980s (the decade where the first

¹ The average farms size in Ireland ranges from 22 hectares in County Mayo to 44 hectares in County Kildare

afforestation programmes were launched) to 33 hectares in 2010. Thus the average farm size reckoned big enough for planting could have risen over the years, too. Also farm sizes differ between enterprises with tillage farms averaging 56 ha and specialist beef farms averaging 28 ha (CSO, 2012), thus farm sizes big enough for planting could also be varying between enterprise types. As the farm size plays a pivotal role in the decision-making with regard to farm afforestation the regional, temporal and sectoral flexibilities in average farm sizes might have to be considered when developing strategies to encourage more farmers to plant. Further research would be needed to confirm these conclusions.

Another result of the study was that full-time and dairy farmers were less inclined towards planting. The latter is noteworthy as the average farm size of Irish dairy farms is with 55 hectares above the overall average of 33 hectares (CSO, 2012) and farm size had a significantly positive influence on the probability to afforest. One reason for this effect could be the comparatively high profitability of dairy farms. Dairy farming in the past has been the most profitable farm enterprise in Ireland (Hennessy et al., 2011). It is a highly specialised business that needs a high level of investment in machinery and technical equipment, which is typically financed by loans (ibid). Such sunk costs determine the course of the farm business for many years into the future, also termed as ‘path dependency’ by economists. Another explanation for dairy farmers being less likely to join the afforestation scheme could be that they typically operate on fertile or ‘good’ agricultural land (see above). As our previous research and other studies have shown, farmers in general are reluctant to plant such land. While dairy farmers might be less likely to plant, it is questionable whether such a group should be targeted when designing policy tools to encourage farm afforestation and whether it makes sense from a rural development perspective to offer alternative income streams to viable farm business such as dairy farms.

On the other hand, tillage farmers were not significantly disinclined to plant, despite them also typically, being viable businesses and operating on fertile land (CSO, 2012; Hennessy et al., 2011). One reason might be that fewer tillage farms run their businesses with loans compared to dairy farming (Hennessy et al., 2011). Also profit margins on tillage farms have been decreasing in the past due to the continuous increase in fertilizer and fuel prices. Another possible explanation could be a number of unusually wet summers and cold winters in Ireland. From personal communication with foresters in Ireland, we know that the interest in planting by tillage farmers rises after extreme weather situations. This is

confirmed by findings of Sutherland et al. (2012) according to which farmers are more likely to make major changes in farm management after trigger events. While other farm enterprises, too, suffer from bad weather the effect can be more devastating to tillage farmers, as crops can be irreplaceably destroyed by a single extreme weather event. Another reason for tillage farmers being less opposed to forestry might be that growing trees is closer to their understanding of an agricultural product than is the case for dairy farmers. As the average size of a tillage farm is 56 ha, which is significantly greater than the national average of 33 ha (CSO, 2012), and larger farms are more likely to be planted, targeting tillage farmers with afforestation campaigns could prove successful, especially after trigger events. Tillage farms typically operate on fertile soils, which would make them particularly interesting as sites for establishing forests of high nature value. Ireland offers a specific support scheme to create such forests. This scheme should be promoted when encouraging tillage farmers to afforest. As concluded above, however, the farm size big enough for planting could be flexible between enterprises. Thus a tillage farmer could consider 56 ha as being not big enough for planting.

Farmers changing their mind

The second objective of the study was to establish whether a lack of detail information about the afforestation scheme's benefits was a barrier to more planting, and if so, to whom specifically. In total, 16% of farmers changed their mind in favour of planting following the provision of such information as part of the survey. Encouraging 16% of farmers to join the afforestation scheme and plant could significantly increase the number of hectares planted in Ireland. Furthermore, such an encouragement could be achieved with comparatively simple tools such as mailings. Again, past planters were more likely to change their mind, which was somewhat surprising as one might assume that past planters already knew about the scheme's details. However, new benefits were added to the scheme over the years and past planting might have been undertaken some time ago. This again leads to the conclusion that past planters might be easily convinced to plant some more forestry through a simple information campaign specifically addressed to them. Employing such information campaigns after trigger events negatively affecting the course of the farm business could improve their efficiency (Sutherland et al., 2012).

In addition, married farmers aged between 45 and 64 with children were more likely to change their mind, which was interesting, as in the first logit model regarding intention to

plant, no socio-demographic variable emerged as significant. From our previous study, we know that the most important reason for planting, for those who already had planted, was generating an asset for their successors. Providing information about the benefits of the afforestation scheme might have demonstrated to farmers with children the value of a forest to them and their successors. Dairy farmers were less likely to change their mind in favour of planting, confirming the first logit model's results, which showed that they in general are less likely to plant. Farmers living in counties with above- average forest cover were less likely to change their mind, which is different from the first logit model in which they were more inclined to plant. One explanation could be that information about afforestation might be more easily accessible in those counties, for example through neighbours who have planted. Also, having seen neighbours planting, farmers might have seriously considered afforesting their own land and have already explored the conditions. Thus, farmers in counties with above-average forest cover might have rejected the afforestation option based on an informed decision. The detail information presented was not new to them and thus did not change their mind. The same explanation might apply to the fact that the more farmers knew about the scheme the less likely they were to plant.

To recommend more specific policy actions based on the study's findings (e.g. who exactly to address and how) the afforestation policy would need to specify more detailed goals. The Irish State's afforestation policy neither indicates regional focuses for further afforestation nor does it outline which farmers specifically should be encouraged to plant. From a rural development, but also from a forestry perspective, it would be necessary to outline regions and farm enterprises that future afforestation policies should focus on. Such planning could ensure that resources are concentrated on areas where the natural conditions would be most suitable for forestry and where local economies would benefit most from a strong forest sector.

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552 **Appendix 1: Overview of all variables entered into the modelling process**

553 **Insert Appendix 1**

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557 **References**

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