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Authors(s)	Duesberg, Stefanie, Upton, Vincent, Ní Dhubháin, Áine	
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- **1** Factors influencing Irish farmers' afforestation intentions
- 2
- 3 Keywords: agriculture, forestry, decision-making, logistic regression
- 4

#### 5 1 Introduction

### 6 **1.1 Policy Background**

7 Due to its temperate north-Atlantic climate, the natural conditions for tree growth in Ireland 8 are very favourable. The mean annual increment is almost double the European average 9 (Kearney and O'Connor, 1993). Forest cover however is only about 12% and it is the 10 Government's target to increase it to at least 17% by the year 2030 (DAFF, 1996). To achieve 11 this target, planting levels of 25,000 hectares per annum to the year 2000, and 20,000 12 hectares per annum from 2000 to 2030, have been set in the Government's Forestry 13 Strategy 'Growing for the future' (ibid). The majority of this afforestation is to be undertaken 14 by private landowners, more specifically farmers. For this purpose, an afforestation scheme 15 was launched in 1989 and continually improved over the years in order to encourage Irish 16 farmers to afforest (see Figure 1 for premium and planting rates).

17

18 INSERT FIGURE !

19

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)

24

25 Currently the scheme covers all planting and establishment costs and pays an annual 26 premium for the duration of 20 years to offset the loss of income from the time of planting 27 until the first revenues from timber harvesting. The rationale behind this strategy is twofold: 28 first, the achievement of the planting targets will lead to a critical mass of timber output that 29 will facilitate the development of a range of processing industries. Second, by offering grants 30 and premiums to farmers they are encouraged to diversify their businesses and create 31 alternative income streams. Such alternatives are necessary as most farms in Ireland are not 32 economically viable without EU subsidies. In particular, the market returns from sheep and 33 non-dairy cattle farming do not cover all production costs (Hennessy et al., 2011); these 34 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 inorder to meet the Government's internationally agreed climate change targets.

37

38 Initially, the interest in afforestation by farmers was high with planting rates reaching a peak 39 of 17,000 hectares planted in 1995 (Forest Service, 2009) (Figure 1). However, since this 40 time planting rates have been consistently and significantly below target. In the period from 41 1996 to 2009, only 48% of the targeted area of farmland was planted with trees (ibid). 42 Despite continuous improvements in funding, planting rates have remained below target. 43 Thus, the Department of Agriculture, Fisheries and Food stated in its Rural Development 44 Programme for the period from 2007 to 2013 that 'the major difficulty with the 45 [afforestation] programme at the moment is the low rate of take-up' (DAFF, 2010).

46

47 The first objective of the study was to quantify the importance of the previously identified 48 factors influencing Irish farmers' afforestation decision-making for the wider farming 49 community in Ireland and to develop a model that would describe the likelihood that a 50 farmer will afforest based on these factors. The second objective was to establish for what 51 proportion of farmers a lack of detail information about the afforestation scheme's benefits 52 is a barrier to planting and to identify which group of farmers should be addressed with such 53 information in order to address that potential barrier. Finally, the results will be discussed as 54 to their implications for policy-making to further encourage afforestation.

55

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.

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63

# 64 **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 Commins, 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 Fléchard 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

103 development in Scotland that woodlands are to play an important role in the integration of 104 aesthetic, ecological and socio-economic components in landscape management. In the 105 authors' previous work on farm afforestation decision-making, farmers' most important 106 reasons for not planting or planting were influenced by non-monetary reasons rather than 107 by profit goals (Duesberg et al., 2013). For that previous research, 62 in-depth interviews 108 with farmers were conducted. In these interviews the importance of producing food, land-109 use flexibility and the enjoyment of the work tasks related to farming were identified as the 110 most prominent reasons for not planting (ibid). Similarly McDonagh et al. (2010) discovered 111 that the main barriers to planting for Irish farmers was the inflexibility resulting from 112 afforestation and their assertion that they needed all their land for agriculture. A number of 113 earlier studies similarly found that the majority of farmers only considered afforesting land 114 that could not be used agriculturally or that was 'good for nothing else' (Collier et al., 2002; 115 Frawley, 1998; Frawley and Leavy, 2001; Hannan and Commins, 1993; Kearney, 2001; 116 McCarthy et al., 2003; Ní Dhubháin and Gardiner, 1994; Ní Dhubháin and Kavanagh, 2003). 117 This finding is underpinned by the fact that private forests in Ireland are mainly growing on 118 land considered marginal for agriculture such as peat (30%), poorly drained gley soils (30%) 119 or podzols (10%) (Farrelly, 2006). Similar findings were made in England, Spain, Finland, 120 Scotland and Northern Ireland, where farmers were also more willing to afforest marginal 121 land such as fallows, unimproved bog or rough grazing ground (Clark and Johnson, 1993; 122 Edwards and Guyer, 1992; Marey-Perez and Rodriguez-Vicente, 2009; Selby and Petäjistö, 123 1995; Watkins et al., 1996). Furthermore, the majority of farmers afforesting in the UK 124 indicated to have multiple reasons for afforesting, the most important of which was to 125 enhance the landscape, while timber production only ranked sixth (Nijnik and Mather, 126 2008).

127

128 Few studies have been conducted to explore farmers' attitudinal barriers to afforestation of 129 farmland. Burton (1998) studied the influence of farmers' self-identity on their participation 130 in a community woodland scheme in England. He found that farmers gain little satisfaction 131 from the management of woodland and thus are disinclined to establish one. In our own 132 previous research mentioned above, we explored the values and goals underlying a farmer's 133 afforestation decision and came to the conclusion that the majority of farmers make this 134 decision based on intrinsic, expressive and social values about farming rather than on profit 135 maximisation (Duesberg et al., 2013). According to Ní Dhubhaín and Wall (1999), the 136 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).

141

142 In the context of understanding the decision-making process with respect to Irish farm 143 afforestation, structural, socio-demographic and attitudinal factors were examined. 144 However, to date, no attempt has been made to combine explanatory factors from different 145 areas to develop a holistic model explaining farmers' afforestation decisions. One 146 sociological theory that attempts to overcome the dichotomy of sociological research 147 focusing either on actors or structure, on the macro- or micro-level is Anthony Giddens' 148 theory of structuration (Giddens, 1984). He argues that the social sciences should focus their 149 analysis more on social practices rather than on individual experience or social structure 150 only. According to Giddens' theory of structuration social practices such as land-use and 151 land-use change are influenced by structure as well as by individual agents' actions 152 (Giddens, 1984). He defines structure as the 'rules' (e.g agricultural policy) and 'resources' 153 (e.g. farm structure) being a condition to social practices, but also being the outcome of 154 agents' actions ('duality of structure'). Agent factors that influence social practices for 155 example are socio-demographics and attitudes. As social practices such as land-use change 156 are influenced by both structure and agency factors there is scope to develop a model 157 describing the combined effect of such factors on land-use change or more specifically on 158 farmers' decision-making to change land-use, e.g. to forestry.

159

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.

- 166
- 167
- 168 **2 Data**

169 **2.1 Data collection and survey design** 

170 The study set out to identify the factors influencing a farmer's afforestation decision. More 171 specifically the study aimed at describing the combined effect of structural, socio-172 demographic and attitudinal factors on the probability to plant. For this purpose survey was 173 distributed by mail in Spring 2012 to a random sample of 4,000 farmers in Ireland. The 174 random sample was drawn from a list of 136,000 Irish farmers in receipt of direct payments, 175 which represents approximately 97% of the Irish farming population. The mailing was 176 administered with the support of the Department of Agriculture, Food and the Marine. Of 177 the total number of survey forms administered, 1,529 forms were sent back resulting in a 178 relatively high response rate of 38%. Having discarded forms with missing values, a sample 179 of 1,077 responses was used for data analysis. The survey form consisted of four pages 180 comprising questions about farm structure and socio-demographic variables, as well as 181 questions regarding issues such as profit goals and farming values. Including goals and 182 values into the questionnaire facilitated the analysis of the importance of structural and 183 socio-demographic as well as attitudinal factors in a farmer's decision to afforest. The 184 attitudinal questions were designed based on the previously conducted 62 in-depth 185 interviews on the goals and values of farmers with regard to afforestation (Duesberg et al., 186 2013). In that study, three different profit goals were identified among Irish farmers – profit 187 maximisation, satisfying profit, making no profit/hobby farmers – and a number of intrinsic, 188 expressive and social values that play a role in farmers' decision-making for farming in 189 general and with regard to afforestation. The three profit goals as well as the most 190 important intrinsic, expressive and social values were included in the questionnaire. 191 Participants were asked to choose from the three profit goals the one they would agree 192 most with. Furthermore they were asked how strongly they would agree with statements 193 representing the following intrinsic, expressive and social values using a Likert-type scale:

- 194
- Enjoyment of farming activities and lifestyle (LFST)
- Importance of food production (FOOD)
- 197 Independence (INDI)
- 198 Taking on new challenges (CHAL)
- **199** Family tradition (TRAD)
- 200

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

Additionally, to establish whether a lack of detail information about the afforestation scheme is a barrier to further planting, the questionnaire provided participants who indicated that they would not plant with detail information about the benefits of the scheme. Having been presented with this information, participants were then asked again if they would be interested in planting to see whether receipt of the information had changed 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 Rodrìguez-Vicente and Marey-Pèrez, 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

$$P_i = \frac{e^{Dx_i}}{1 + e^{Dx_i}}$$

232

where  $P_i$  is the probability of outcome i,  $x_i$  represents the independent variables or characteristics related to outcome i, including a constant, and  $\beta$  represents the model coefficients. The model can be estimated using maximum likelihood estimation. Given the nature of the model, the coefficients are not directly interpretable. Thus, in this study, 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.

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# 245 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.

- 251
- 252

# 2 Table 1: Overview of participants' characteristics: enterprises

253 254

255 INSERT TABLE ONE

256

# 257 **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).

264

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

- 267
- 268 269

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

- 272 INSERT TABLE 3
- 273
- 274
- 275 Structural variables

### 276 Past afforestation and farm size

277 The variable 'Past planting' was positively correlated to respondents' intention to plant. 278 Farmers who already had planted some forest in the past were 12% more likely to plant in 279 the future than those who hadn't (Table 3). Farm size was another significant structural 280 variable in the logit model to explain farmers' probability to afforest (Table 3). Farmers with 281 larger farms were more likely to afforest. Additionally the average farm size of those who 282 had planted in the past was with 56 hectares above the national average of 33 hectares 283 (CSO, 2012). This confirms findings of previous studies that had already shown the 284 dominance of relatively larger farms among those where afforestation takes place (Frawley, 285 1998; Frawley and Leavy, 2001; Ilbery and Kidd, 1992; Mather, 1998; Ní Dhubháin and 286 Gardiner, 1994).

287

### 288 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).

295

# 296 Average forest cover

297 Farmers living in counties with above-average forest cover were more likely to consider 298 afforesting their land (Table 3). The average forest cover per county ranges from 22 % in 299 county Wicklow to 3% in county Meath. While county Wicklow is characterized by hilly 300 terrain, which limits agricultural land-use, county Meath is a more or less flat midland 301 county with fertile soils suitable for a wide range of agricultural land-uses. Forest cover is 302 likely to reflect local soil types and climate and, consequently, the range and profitability of 303 potential land-uses. Thus the fact that farmers living in counties with above-average forest 304 cover are more likely to plant is probably correlated to these geographic parameters.

305

### 306 Attitudinal variables

307 The survey included two questions concerning attitudinal variables: Profit goals and general 308 farming values. Respondents were asked which of the three profit goals they were 309 presented with (maximum/satisfying/none) they would agree most with. None of these 310 profit goals was a variable of significance in the logit model – the likelihood of planting did 311 not significantly increase or decrease depending on the profit goals. However, three of the 312 five non-monetary farming value variables entered into the analysis turned out to have a 313 significant influence on farmers' afforestation decision (Table 3).

314

315 The non-monetary farming value variable with the highest significance was the one 316 representing the expressive value of taking on new challenges (CHAL) (Table 3). In the 317 questionnaire this option was represented by the following statement: "I like taking on new 318 challenges and I have a lot of ambition for my farm and many plans about how I want to 319 manage it in the future". Farmers who agreed with this statement were more likely to 320 afforest. From the in-depth interviews we know that farmers who are inclined to taking on 321 new challenges were also more willing to take risks and in general exhibited a more 322 business-oriented, entrepreneurial thinking (Duesberg et al., 2013).

323

324 The two other attitudinal variables, which were significant in the model, were the 'Tradition' 325 (TRAD) and the 'Lifestyle' (LFST) variables. Both were negatively correlated to the intention 326 to afforest. The 'Tradition'-variable was represented in the questionnaire by the following 327 statement: "I regard the farm as a family asset that I'm keeping in a good condition to pass 328 on to my successors one day." Farmers who agreed with this statement were less likely to 329 afforest. The 'Lifestyle'-option was represented in the questionnaire by the following 330 statement: "I enjoy the activities, work tasks and lifestyle related to farming". Those farmers 331 did not want to see the farm business replaced by a forest because it would deprive them of 332 an important source of satisfaction in their life. We also know from our previous study that 333 for farmers who do not plant for lifestyle reasons making a profit from farming in general 334 was less important.

335

# 336 **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

344	their mind in favour of planting were analysed again using a logit model. Table 4 gives an
345	overview of the dependent and independent variables in that logit model. The analysis
346	showed that those who had planted in the past, were aged between 45 and 64 and were
347	married with children were more likely to change their mind (Table 5). Dairy farmers and
348	farmers living in counties with above-average forest cover were less likely to change their
349	mind after being given more information (Table 5). Also the more respondents already knew
350	about the scheme the less likely they were to change their mind.
351	
352	
353 354 355	Table 4: Variables of the logit-model explaining farmers changing their mind in favour of planting
356 357	INSERT TABLE 4
358	
359 360 361	Table 5: Logit-model on factors influencing Irish farmers changing their mind in favour of planting
362 363	INSERT TABLE 5
364	
365	4 Discussion and Conclusions
366	The study set out to model the probability that a farmer will afforest based on structural,
367	socio-demographic and attitudinal variables. The second objective was to establish whether
368	addressing a lack of detail information about the afforestation scheme's benefits would get
369	more farmers interested in planting and, if so, who those farmers were. The chosen
370	methodological approach proved useful as it allowed a more general assessment of the
371	afforestation scheme than for example a strict application of the theory of planned
372	behaviour (TPB). The TPB has been widely used in researching farmer behaviour, however
373	has been criticised for not being capable to produce a broad enough picture of farmer
374	motivation (Burton, 2004).
375	
376	Farmers considering afforestation
377	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 toafforestation. This proves the importance of individual farmer factors, such as farming

380 values, in this specific decision-making situation. Farmers who liked taking on new 381 challenges were more likely to plant, while farmers for whom farming lifestyle and family 382 tradition was important were less likely to consider afforestation. To encourage more 383 farmers to plant, those values need to be taken into account in policy development. For 384 example, to get 'lifestyle farmers' interested in planting they would need to be shown how 385 farmers can get involved in interesting work tasks around establishing and managing a 386 forest. Addressing those farmers for whom family tradition is important could focus on the 387 future value of a forest for their successors. From the results, we also know that profit goals 388 did not have a significant influence on the decision to afforest, demonstrating that it is not 389 primarily related to considerations about the comparative returns from farming and 390 forestry.

391

392 There were five structural variables that turned out to play a significant role in the 393 afforestation decision. Past planting, local forest cover and farm size had a positive effect; 394 while dairying and fulltime farming had a negative effect on the probability to afforest. 395 Similarly Ilbery and Kidd (1992) and Crabtree et al. (1998) in studies conducted in the UK 396 concluded that farmers who have planted in the past were more likely to join an 397 afforestation scheme. Farmers who had planted in the past not only were positively inclined 398 to consider afforestation again, they were also more likely to change their mind in favour of 399 planting (again) after being given more detailed information about the scheme. This 400 indicates that the experience from past afforestation has been positive. This group could be 401 easily identified and addressed through a simple information campaign in order to increase 402 afforestation rates. Another advantage of encouraging past planters to afforest more land 403 would be that larger forests might be created when planting fields adjacent to the previously 404 planted areas. Our own previous research, as well as other studies, had shown that farmers 405 would only afforest 'bad land' (Collier et al., 2002; Frawley, 1998; Frawley and Leavy, 2001; 406 Hannan and Commins, 1993; Kearney, 2001; McCarthy et al., 2003; Ní Dhubháin and 407 Gardiner, 1994; Ní Dhubháin and Kavanagh, 2003). Further research could reveal whether 408 past planters intend to afforest remaining patches of 'bad land' or, if due to a positive 409 afforestation experience, they would consider planting even better quality land, which 410 would indicate an improvement in the attitude towards forestry as a farm enterprise.

411

The positive experience from planting could be passed on by word of mouth to neighbouringfarmers, 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).

417

418 From a rural development perspective, one of the afforestation scheme's objective is to 419 offer income support to those farmers who struggle to make a living from farming, which 420 typically are small-scale drystock farmers (Hennessy et al., 2011). The study showed that 421 drystock farmers are neither significantly inclined nor disinclined to planting. However, 422 targeting small farms could be difficult, as the results showed that larger farms were more 423 likely to be planted. A scheme initiating and supporting group plantings of small 424 neighbouring fields could enable small-scale (or below average farm size) farmers to plant. 425 This would also have the advantage of increasing the average farm forest's size, improving 426 their value for forestry, nature conservation and recreation as well as the bargaining power 427 of the forest owners once it comes to thinning and harvesting operations. In the Netherlands 428 environmental cooperatives proved successful in motivating farmers to join agri-429 environmental and rural development activities (Renting and Van Der Ploeg, 2001).

430

431 Past studies in Ireland and the UK had already shown the dominance of relatively larger 432 farms among those where afforestation takes place (Frawley, 1998; Frawley and Leavy, 433 2001; Ilbery and Kidd, 1992; Mather, 1998; Ní Dhubháin and Gardiner, 1994). There is 434 however an interesting difference between Irish and UK farmers as to the farm size they 435 consider big enough for planting. While Irish farmers in this study on average planted forests 436 if their farm size was at least 56 hectares, farmers in a study undertaken in West-437 Nottinghamshire considered planting from a farm size of at least 100 hectares (Watkins et 438 al., 1996). The overall average farm size in that area however was with 197 ha much bigger 439 when compared to the overall Irish average farm size of 33 ha (CSO, 2012; Watkins et al., 440 1996). It seems that the farm sizes deemed big enough for planting are regionally flexible. 441 An average farm size could be assessed as 'big enough' for planting if it is above the local 442 average. As there is considerable difference in farm sizes within Ireland, a farm size 'big 443 enough' for planting could change between counties.<sup>1</sup> The fact that there is regional 444 flexibility in the farm sizes deemed big enough for planting raises the question if there also is 445 a temporal and sectoral flexibility. Average farm sizes have continually increased in the past; 446 in Ireland average farm size grew from 22 hectares in the 1980s (the decade where the first

<sup>&</sup>lt;sup>1</sup> The average farms size in Ireland ranges from 22 hectares in County Mayo to 44 hectares in County Kildare

447 afforestation programmes were launched) to 33 hectares in 2010. Thus the average farm 448 size reckoned big enough for planting could have risen over the years, too. Also farm sizes 449 differ between enterprises with tillage farms averaging 56 ha and specialist beef farms 450 averaging 28 ha (CSO, 2012), thus farm sizes big enough for planting could also be varying 451 between enterprise types. As the farm size plays a pivotal role in the decision-making with 452 regard to farm afforestation the regional, temporal and sectoral flexibilities in average farm 453 sizes might have to be considered when developing strategies to encourage more farmers to 454 plant. Further research would be needed to confirm these conclusions.

455

456 Another result of the study was that full-time and dairy farmers were less inclined towards 457 planting. The latter is noteworthy as the average farm size of Irish dairy farms is with 55 458 hectares above the overall average of 33 hectares (CSO, 2012) and farm size had a 459 significantly positive influence on the probability to afforest. One reason for this effect could 460 be the comparatively high profitability of dairy farms. Dairy farming in the past has been the 461 most profitable farm enterprise in Ireland (Hennessy et al., 2011). It is a highly specialised 462 business that needs a high level of investment in machinery and technical equipment, which 463 is typically financed by loans (ibid). Such sunk costs determine the course of the farm 464 business for many years into the future, also termed as 'path dependency' by economists. 465 Another explanation for dairy farmers being less likely to join the afforestation scheme could 466 be that they typically operate on fertile or 'good' agricultural land (see above). As our 467 previous research and other studies have shown, farmers in general are reluctant to plant 468 such land. While dairy farmers might be less likely to plant, it is questionable whether such a 469 group should be targeted when designing policy tools to encourage farm afforestation and 470 whether it makes sense from a rural development perspective to offer alternative income 471 streams to viable farm business such as dairy farms.

472

473 On the other hand, tillage farmers were not significantly disinclined to plant, despite them 474 also typically, being viable businesses and operating on fertile land (CSO, 2012; Hennessy et 475 al., 2011). One reason might be that fewer tillage farms run their businesses with loans 476 compared to dairy farming (Hennessy et al., 2011). Also profit margins on tillage farms have 477 been decreasing in the past due to the continuous increase in fertilizer and fuel prices. 478 Another possible explanation could be a number of unusually wet summers and cold winters 479 in Ireland. From personal communication with foresters in Ireland, we know that the 480 interest in planting by tillage farmers rises after extreme weather situations. This is

481 confirmed by findings of Sutherland et al. (2012) according to which farmers are more likely 482 to make major changes in farm management after trigger events. While other farm 483 enterprises, too, suffer from bad weather the effect can be more devastating to tillage 484 farmers, as crops can be irreplaceably destroyed by a single extreme weather event. 485 Another reason for tillage farmers being less opposed to forestry might be that growing 486 trees is closer to their understanding of an agricultural product than is the case for dairy 487 farmers. As the average size of a tillage farm is 56 ha, which id significantly greater than the 488 national average of 33 ha (CSO, 2012), and larger farms are more likely to be planted, 489 targeting tillage farmers with afforestation campaigns could prove successful, especially 490 after trigger events. Tillage farms typically operate on fertile soils, which would make them 491 particularly interesting as sites for establishing forests of high nature value. Ireland offers a 492 specific support scheme to create such forests. This scheme should be promoted when 493 encouraging tillage farmers to afforest. As concluded above, however, the farm size big 494 enough for planting could be flexible between enterprises. Thus a tillage farmer could 495 consider 56 ha as being not big enough for planting.

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# 497 Farmers changing their mind

498 The second objective of the study was to establish whether a lack of detail information 499 about the afforestation scheme's benefits was a barrier to more planting, and if so, to whom 500 specifically. In total, 16% of farmers changed their mind in favour of planting following the 501 provision of such information as part of the survey. Encouraging 16% of farmers to join the 502 afforestation scheme and plant could significantly increase the number of hectares planted 503 in Ireland. Furthermore, such an encouragement could be achieved with comparatively 504 simple tools such as mailings. Again, past planters were more likely to change their mind, 505 which was somewhat surprising as one might assume that past planters already knew about 506 the scheme's details. However, new benefits were added to the scheme over the years and 507 past planting might have been undertaken some time ago. This again leads to the conclusion 508 that past planters might be easily convinced to plant some more forestry through a simple 509 information campaign specifically addressed to them. Employing such information 510 campaigns after trigger events negatively affecting the course of the farm business could 511 improve their efficiency (Sutherland et al., 2012).

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513 In addition, married farmers aged between 45 and 64 with children were more likely to 514 change their mind, which was interesting, as in the first logit model regarding intention to

515 plant, no socio-demographic variable emerged as significant. From our previous study, we 516 know that the most important reason for planting, for those who already had planted, was 517 generating an asset for their successors. Providing information about the benefits of the 518 afforestation scheme might have demonstrated to farmers with children the value of a 519 forest to them and their successors. Dairy farmers were less likely to change their mind in 520 favour of planting, confirming the first logit model's results, which showed that they in 521 general are less likely to plant. Farmers living in counties with above- average forest cover 522 were less likely to change their mind, which is different from the first logit model in which 523 they were more inclined to plant. One explanation could be that information about 524 afforestation might be more easily accessible in those counties, for example through 525 neighbours who have planted. Also, having seen neighbours planting, farmers might have 526 seriously considered afforesting their own land and have already explored the conditions. 527 Thus, farmers in counties with above-average forest cover might have rejected the 528 afforestation option based on an informed decision. The detail information presented was 529 not new to them and thus did not change their mind. The same explanation might apply to 530 the fact that the more farmers knew about the scheme the less likely they were to plant.

531

532 To recommend more specific policy actions based on the study's findings (e.g. who exactly 533 to address and how) the afforestation policy would need to specify more detailed goals. The 534 Irish State's afforestation policy neither indicates regional focuses for further afforestation 535 nor does it outline which farmers specifically should be encouraged to plant. From a rural 536 development, but also from a forestry perspective, it would be necessary to outline regions 537 and farm enterprises that future afforestation policies should focus on. Such planning could 538 ensure that resources are concentrated on areas where the natural conditions would be 539 most suitable for forestry and where local economies would benefit most from a strong 540 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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