

Farm and farmer characteristics affecting the decision to plant forests in Ireland

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Abstract

Understanding the factors that influence farmers to enter forestry is important in order to develop efficient policies aimed at promoting greater rates of private planting. Using Ireland as a case study, factors affecting farmers' participation in farm forestry were evaluated. Specifically, a nationally representative panel dataset collected annually between 1995 and 2009 was used to model both farm and farmer related characteristics affecting the probability of farmers entering into forestry. Results suggest that there is significant heterogeneity among farm households in terms of farm forestry participation. Owners of larger farms and those in less-intensive farm systems were more likely to enter into forestry during the period 1995-2009. Age and the presence of children were negatively associated with farm forestry participation.

Keywords: *Farm forestry entry, forest policy, rural development, panel data.*

Introduction

Ireland has one of the lowest levels of forest cover in Europe at 11%, despite having a shorter rotation period for forestry than many other European countries (McCarthy et al. 2003). In 1996 the Irish government issued "Growing for the Future, A Strategic Plan for the Development of the Forestry Sector in Ireland". It set a target of achieving a productive forest area of 1.2 million ha by 2030, or 17% of the land area of the country (DAFF 1996). Up until the mid 1980s the State was the dominant force in Irish forestry as public afforestation accounted for almost 100% of the annual planting programme. Since then, the government has sought to significantly increase the rate of private planting through the introduction of a variety of government-supported packages to encourage private afforestation (Kearney 2001).

Much of the research on the factors affecting farmers' decision to convert land to forestry has investigated farmer behaviour in relation to policy objectives and farming context. As Wynn et al. (2002) point out, when it comes to modelling farmers' uptake of alternative non-primary agricultural related programmes, the emphasis has been on descriptive approaches rather than the quantitative modelling of farmer behaviour. Few attempts have been made to model the participation decision of farmers in forestry and most have done so using a static framework. Static binary choice models may be inadequate in analysing landowner participation in afforestation programmes. We used a panel data model for our estimation of farm-forestry participation in

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Ireland. Specifically, we utilised a 15-year panel dataset taken from the Irish National Farm Survey (NFS) that contained yearly information on approximately 1,200 farmers. Using this panel dataset, we examined the impact of both structural farm level variables as well as farmer characteristics driving farmers' decision-making in relation to farm forestry participation. There is a need to better understand the factors that affect farmers' decision making so that efficient policies and programmes can be designed to encourage greater rates of private planting. To provide a context for this study, some background information is also given on Irish forestry, especially the development of the private-sector planting programme.

Background

Forest cover in Ireland occupies just 11% (745,457 ha) of the total land area starting from a low base of 1% (70,000 ha) in 1920. This increase in forest cover is the direct result of successive government afforestation policies to promote the planting of forests. Prior to the 1980s private afforestation played a very small part of the overall afforestation programme accounting for 12,000 ha or 4% of the total area planted. Virtually all planting was carried out by the state (the Forest Service and its successor Coillte Teoranta, the Irish Forestry Board). Since 1980 a variety of incentives have been introduced by the Irish government and the EU to encourage private landowners to consider forestry as a worthwhile land-use alternative to agricultural production systems. These incentives are not available to the state sector. The result has been a dramatic reversal in the rate of afforestation between the state and private forestry sector (see figure 1). Since 2001, virtually all afforestation has been carried out by private individuals or institutions and private ownership of forest land has increased from 24% of the total forest area in 1980 to 46% (339,341 ha) in 2009 (Forest Service 2009).

The introduction of the Western Package Grant Scheme in 1981 marked the beginning of EU co-funded supports for private afforestation in Ireland. The EEC launched the Western Package Grant Scheme as an attempt to counter the depletion of forestry resources in the European community. The scheme was part-funded by the

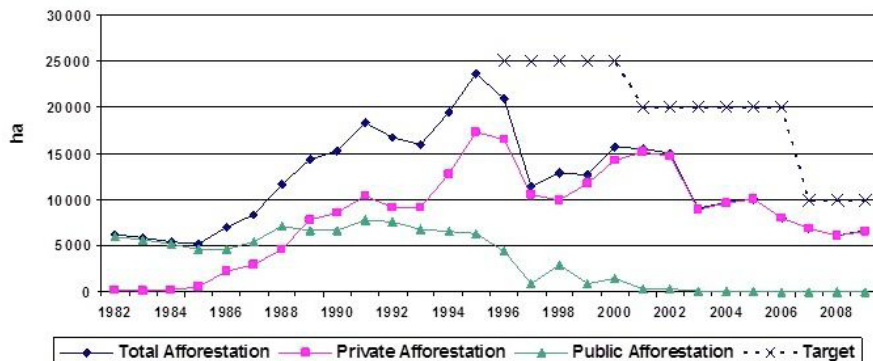


Figure 1: *Recent Irish afforestation levels.*

Irish government and made £18 million (€23 million) available in the form of grants to promote private afforestation. More specifically, the scheme provided grants to farmers that covered up to 85% of the establishment costs for converting to forestry and was available only in what were classified as disadvantaged areas in the Western part of the country. These supports for afforestation have since been improved and extended over time to all parts of Ireland. The “Forest Premium Scheme” was introduced in 1990 and it was the first scheme that attracted significant farmer interest. This scheme gave farmers annual payments for the first 15 years following afforestation on unenclosed land and 20 years on enclosed land, in addition to providing a grant to cover all the costs associated with forest establishment (Gillmor 1998, Farrelly 2008).

The introduction of the Forest Premium Scheme provided the most important new incentive for forestry development in Ireland to date. It provided compensation for loss of agricultural income for up to 20 years, coinciding approximately with the time that income from harvesting thinnings might begin to accrue. Forestry was then seen as an alternative to some traditional types of farming and the scheme applied to all of Ireland. The range of grants available differed based on the quality of land planted and the type of species planted. A further supplement was provided to landowners who planted areas greater than 6 ha. More recently the CAP Afforestation Scheme, introduced in 2003, increased the incentives to plant broadleaf species by offering a considerably higher premium payment than that offered for planting conifers.

The Forest Environment Protection Scheme (FEPS) was introduced on a pilot basis in 2007, with the aim of rewarding farmers who were already participating in an agri-environmental scheme namely REPS (the Rural Environment Protection Scheme). Farmers were encouraged to include additional environmental measures in their forests to improve both biodiversity and recreation potential. In addition to the normal afforestation premium, a FEPS premium of between €150 and €200 per ha for five years was made available to farmers in REPS who planted under the FEPS scheme. This meant that a REPS farmer who planted 8 ha of oak in FEPS could receive up to €759 per ha for five years, followed by €559 per ha for the remaining 15 years, with all premiums being tax-free. A plantation threshold area of between 5 and 8 ha applied. The scheme was designed to encourage greater uptake of farm forestry and initially proved very popular. In 2008 and 2009, almost half of all new planting was carried out under the FEPS scheme. However, since the closure of the REPS scheme in July 2009, participation in the scheme dropped to 40% by 2010 and is expected to drop further as farmers who are no longer in REPS are also no longer eligible for FEPS (Ryan 2011).

Factors affecting the decision to plant

Prior to 2005, Irish farmers could potentially avail of a number of coupled premium payments, such as the special beef premium or area-aid payments, to supplement their market-based income. These payments were decoupled from farm-production measures in 2005 to curb over-production and to reduce the trade-distorting and inefficiency effects of the CAP (Falconer and Ward 2000, Swinbank and Daugbjerg 2006, Howley et al. 2010). With the introduction of decoupling, payments that were

paid previously on the basis of the number of eligible animals, or area under a crop, were now replaced with a single annual decoupled payment, referred to as the Single Farm Payment (SFP). Of particular interest to the forestry sector was that this new system of support allowed farmers to plant up to 50% of their land and still receive their SFP. In 2009, forestry was deemed to be eligible for SFP, which meant that farmers could plant up to 90% of their land and still retain the full SFP. However, despite the potential gain accruing from grants, such as the forest premium, as well as the potential future market returns from clear felling, Irish afforestation levels have actually been declining from 10,030 ha in 2005 to 6,648 ha in 2009 (Breen et al. 2010).

McCarthy et al. (2003) examined the impact of various policy incentives, such as planting grants and forest premiums as well as the returns available from harvesting, on farmers' decision to enter into forestry. The study found that increasing the planting grant was a more cost-effective measure for increasing the rate of private planting than increasing the level of the forest premium. In comparison the effect of the financial returns from timber sales, while statistically significant, was relatively low, perhaps because it could take 40 years or more to realise these revenues.

Constraints within the planting approvals system such as planning regulations and the length of time taken for the approvals process are likely to exert a negative influence on participation rates in farm forestry. Perhaps one of the most significant factors behind farmers' reluctance to convert their land to forestry in Ireland in recent times has been the significant increase in the value of agricultural land from 1992 to 2007 (Breen et al. 2010). Conversion from agriculture to forestry is a permanent decision in Ireland, due to the legal requirement under the 1946 Forestry Act to replant after clearfelling. The requirement to reforest was introduced with the objective of protecting the State's investment in forestry and to discourage large-scale deforestation (Malone, 2008). Given the high prices that were paid for agricultural land in recent years (Ganly 2009), the requirement to replant acted as a major obstacle to afforestation. The recent decline in land prices evident since the start of 2008 could make forestry a relatively more attractive financial proposition and in turn lead to a boost in the level of private farm afforestation. That said, even when the high land prices that existed in Ireland from the late 1990s to 2008 are accounted for, it would appear that the core reason behind the relatively low levels of afforestation in Ireland is due to negative cultural attitudes towards forestry (McDonagh et al. 2010).

Behan (2002) has shown that in 2001 the net present value (NPV) of forestry returns in Ireland exceeded that of beef and sheep enterprises in all regions, particularly in the western regions of Ireland. The results of the NPV analysis, demonstrated that the potential financial returns from forestry generally exceeded that which could be obtained from cattle and sheep farming. Therefore from a purely financial perspective, there should have been a much greater uptake of farm-forestry than that which occurred. Frawley and Leavy (2001) found that Irish farmers perceived the main reason for not converting land to forestry was that their farm is "too small/need the land". More recent work conducted by McDonagh et al. (2010) echoed the earlier findings of Frawley and Leavy (2001). They found that of the 48% of the farmers who stated that they would not plant, the most important barrier to planting land was that

they “needed their land for agriculture”. This occurred despite the introduction of the single farm payment (SFP), which had allowed farmers to plant a large proportion of their land without losing any payments.

Earlier work conducted by Ní Dhubháin and Gardiner (1994) and O Leary et al. (2000) reported a negative cultural attitude on the part of Irish farmers towards forestry. For example, Ní Dhubháin and Gardiner (1994) reported that of those farmers who stated an intention to plant land in the future, 58% said that their land was good for nothing else; while 39% of those who said they would not plant believed they did not have suitable land for forestry (i.e. they felt their land was “too good for forestry”). Similarly O Leary et al. (2000) found that the main reason behind farmers’ negative attitudes towards forestry was not dissatisfaction with the low financial rewards, but rather a negative cultural bias towards forestry. Forestry has traditionally not been seen as an integral part of traditional agriculture and most farmers consider forestry only as an alternative land-use for their worst land. Negative cultural attitudes towards forestry have also been widely reported in other countries. Selby and Petajisto (1995), in a study conducted in Finland, found that there was a perception that converting land to forestry can sever the dynamic historical process involved in the creation of agricultural landscapes and thereby having a negative effect on local communities. Similarly in the UK, Watkins et al. (1996) found that most farmers did not want woodland on their farmland, as they saw their land as being exclusively a preserve for agricultural production.

Farm-forestry participation continues to be a topic of research internationally. Nagubadi et al. (1996) analysed private forest landowners’ participation in forestry assistance programmes in Indiana, USA. A probit model was used on data collected from a random sample of 329 Indiana landowners. The results of the analysis revealed that total land owned, access to government sources of information, and membership in forestry organizations all had a positive impact on the probability of landowners’ participating in private forestry programmes.

Other research carried out in the US aimed at modelling the major factors affecting private forestry participation included Bell et al. (1994), Straka et al. (1984), Konyar and Osborn (1990) and Joshi and Arano (2009). Bell et al. (1994), for instance, employed a random utility model to determine the probability that a landowner will choose to participate in the Tennessee Forest Stewardship Programme. Results from the study indicated that attitudes and knowledge of forestry programmes may be more influential in a landowner’s decision to participate than monetary incentives. Many of the empirical studies that have examined landowner participation in forestry programmes have relied on a simple static binary choice model. Independent variables included owner demographics (e.g., income, education) and land features (e.g. acreage). Using these models, landowner participation in private afforestation in the US has been found to be positively associated with total area owned, interest in timber production, income, and location of residence on the landowner’s woodland (Straka et al. 1984 and Konyar and Osborn 1990).

Methods

The data source employed for this research was the Irish National Farm Survey (NFS)

1995 to 2009, which was set up in 1972 and has been published on an annual basis since then. The NFS is collected as part of the Farm Accountancy Data Network of the European Union (FADN 2012). It determines the financial situation on Irish farms by measuring the level of gross output, costs, income, investment and indebtedness across the spectrum of farming systems and sizes. This information is made available to the EU Commission in Brussels and is a database for economic and rural development research and policy analysis (Connolly et al. 2009). A random sample of approximately 1,200 farms is surveyed each year and the farm system variable is broken down into six different farm systems.

The method of classifying farms into farming systems, used in the NFS is based on the EU FADN typology set out in the Commission Decision 78/463 (Connolly et al. 2009). The system titles refer to the dominant enterprise in each group based on Standard Gross Margins (SGMs). Within the NFS, the farm system variable is broken down into six different categories as follows: Dairying, Dairying and Other, Cattle Rearing, Cattle Other, Mainly Sheep and Tillage Systems. To examine the effect of farm system type on forestry decisions, we grouped the system variables relating to livestock production (either cattle or sheep) into one dummy variable (Livestock Production). We then compared the effect of being in either Livestock Production or in the Dairying and Other farm systems on the probability of entering into forestry, relative to being in the Dairying or Tillage-farm systems. We used Tillage and Dairy farm systems as the reference category, as these farms are relatively more intensive in nature and generally more productive than the Livestock or Dairying and Other farm systems (see Connolly et al. 2009).

Using the NFS data collected over the 15-year period from 1995 to 2009, the participation decisions of farmers in relation to forestry were analysed. Some farmers dropped out permanently from the survey, while others dropped out in one year but re-entered the following year, so the dataset was unbalanced. New farmers were introduced to the survey during the period to keep the sample representative and at approximately 1,200. On average farm respondents participated in the sample over the reference period for 9.36 years. Once a farm remained in the sample for 2 years or more (which need not be concurrent) it was used in the panel data model of farm forestry participation.

The dependent variable (farm forestry entry) took a value of 1 if a farmer has entered into forestry during the period 1995-2009, but was 0 otherwise. There were 90 individual farm households that entered into forestry during the reference period. The model was used to determine if there are any farm or farmer characteristics that distinguished farmers who entered into forestry from farmers that did not do so. Given the structure of the dataset, we were able to use a random effects model to control for unobserved heterogeneity (see Greene 2003 and Baltagi 2008 for a discussion of random effects models).

Results and discussion

The coefficient estimates and associated standard errors of the random effects logit model are presented in Table 1. All farm characteristics examined were found to be statistically significant at the 5 or 10% significance level. Firstly, other things being

equal, the larger a farm was the more likely that the owner had planted part of their land. This is in accordance with our a priori expectations, and is in agreement with the findings of Frawley and Leavy (2001) and McDonagh et al. (2011). That is, the main barrier to converting land to forestry was related to farm size; those farming smaller holdings felt that their farm was too small to accommodate forestry and believed that all of their land was needed for agriculture. The variable farm size squared was bordering statistical significance and was negative which would suggest that, while farm size has a positive effect on the decision to plant, this effect diminishes as farms get larger (i.e. the effect of going from 100-150 ha is less than going from 50-100 ha). These results also agree with recent NFS survey results for the cohort of farmers who were considering planting in the next three years (see Ryan et al. 2008, Ryan 2011). Almost half of the farmers who stated an intention to plant were livestock farmers on relatively large farms. Research results from other countries also confirm these findings (Miranda 1989, Loyland et al. 1995).

The results from the logit model also suggested that landowners entering into forestry are more likely to be drawing down premium payments from other farm activities such as headage payments, disadvantaged area payments, or since the introduction of decoupling, the single farm payment. This may reflect the greater awareness of the prevalence of subsidy payments to support agricultural activity or perhaps a greater willingness on the part of these farmers to engage in non-traditional farm activities that do not just provide a market return.

Both “Livestock” and “Dairying and Other” factors had statistically significant and positive effects on the probability of farmers entering into forestry (Table 1). This means that farmers in these more extensive farm systems are more likely to enter into forestry than farmers in the Dairying and Tillage farm systems. This is in keeping with survey research discussed earlier which outlined how farmers in relatively more productive farm types often feel that their land is too good for forestry, irrespective of the financial returns. In addition, relatively more productive farms would be under less pressure to consider alternative or perhaps less traditional ways of increasing revenue on the farm, such as converting land into forestry. Farmers with higher stocking rates were less likely to convert to forestry. This also would support the view that owners of relatively more intensive farm types are less likely to consider putting land into forestry.

In addition to structural factors of farms that may be associated with the likelihood of converting to forestry, the effect of farmer-specific variables on the probability of entering into forestry was also examined. Given the relatively long time frame for receipt of timber revenue from clear felling, it was hypothesised that older farmers would be less likely to consider forestry as a worthwhile investment. The results in Table 1 suggest that a farmer’s age has a negative association with entry into farm forestry. A negative relationship between age and forestry activity has also been reported in other studies conducted outside Ireland (Romm et al. 1987, Kuuluvainen and Salo 1991, Joshi and Arano 2009). Given that the average age of farmers is increasing in Ireland (e.g. more than one third are aged over 60), this is likely to be a significant barrier to increasing land in forestry use. It may therefore be worthwhile for policy makers to consider other investment models, whereby farmers receive at least

part of the payments from clearfelling upfront. Interestingly farmers with children were also less likely to have entered into forestry during the period 1995-2009. This could be attributable to the presence of a farm heir to continue on the farm business.

Conclusions

Forestry plays an increasingly important role in rural development, mainly because it helps to diversify farm income, but also through the provision of rurally-based employment, both of which contribute to rural stabilisation and viability. Irish forestry policy emphasises the importance of private planting and gives farmers a central role in the expansion of the national forest cover (DAFF 1996), but farmers' uptake of the forestry option has lagged far behind national targets. This study utilised a nationally representative panel dataset to provide a better understanding of the factors affecting the probability of farmers entering into forestry.

The results of previous research has determined that changes in the level of payments, the forestry market margin as well as returns from competing agricultural alternatives will affect rates of afforestation (Barrett and Trace 1999, Clinch 1999, Beach et al. 2005, McCarthy et al. 2003). This paper focused on examining the impact of characteristics of the farm and the farmer on the decision to enter into forestry. The findings suggest that larger farms, those in relatively less intensive farm systems and with lower stocking rates were less likely to enter in farm forestry. In addition to farm structural factors, this study also found that relatively older farmers and those with children were also less likely to enter into farm forestry. Modelling the factors affecting farmers' decision to enter into forestry enables the understanding of the differences between various types of landowners. This should in turn help policymakers and forest extension professionals to design policies and programmes that efficiently promote farm-forestry participation.

Table 1: *Random effects logit model of entry into Farm Forestry. Significant ($P < 0.10$) values are shown in bold text.*

Parameters	Coefficient	Std. error	P-values
Farm size	0.0129	0.0068881	0.061
Farm size squared	-0.0000364	0.0000222	0.101
Direct payments	0.0000144	6.84e-06	0.035
Livestock production (dairying and tillage farm system is the reference category)	1.291665	0.4504018	0.029
Dairying and other farm system (dairying and tillage farm system is the reference category)	0.9837207	0.5203648	0.013
Stocking rate	-0.8223182	0.2604429	0.002
Age	-0.0180621	0.0109809	0.100
Children (no children is the reference category)	-0.5045422	0.305396	0.099
Married (single is the reference category)	0.2678904	0.3248981	0.410

Practical implications

- Results suggest that owner and farm property characteristics strongly affect the probability of farmers entering into farm forestry.
- Farm size appears to play an important role with those in relatively larger farms much more likely to enter into forestry.
- Farmers predominantly involved in livestock rearing and those with relatively lower stocking rates are more likely to convert land into forestry.
- Older farm operators and those with children are less likely to plant.
- Identifying farmers most likely to participate in farm forestry can allow policymakers and extension services to efficiently target efforts at those most likely to adopt.

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References

- Baltagi, B.H., 2008. *Econometric Analysis of Panel Data*. John Wiley and Sons, Fourth Edition.
- Barrett, A. and Trace, F. 1999. The Impact of Agricultural and Forestry Subsidies on Land Prices and Land Uses in Ireland. *Policy Research Series No. 35*. The Economic and Social Research Institute, Dublin.
- Beach, R.H., Subhrendu, K.P., Yang, J.C., Murray, B.C. and Abt, R.C. 2005. Econometric studies of non-industrial private forest management a review and synthesis. *Forest Policy and Economics* 7: 261-281.
- Behan, J. 2002. *Returns from Farm Forestry vs. Other Farm Enterprises*. Paper presented at IFA Farm Forestry Conference, 8th November, Limerick, Ireland.
- Bell, C., Roberts, R., English, B. and Park, W. 1994. A logit analysis of participation in Tennessee's Forest Stewardship Program. *Journal of Agricultural and Applied Economics* 26: 463-472.
- Breen, J., Clancy, D., Ryan, M. and Wallace, M. 2010. Irish land use change and the decision to afforest: An economic analysis. *Irish Forestry* 67: 6-20.
- Clinch, P. 1999. Economics of Irish Forestry. COFORD, Dublin.
- Connolly, L., Kinsella, A., Quinlan, G. and Moran, B. 2009. *Irish National Farm Survey 2006*. Teagasc Publication, Athenry, Galway.
- DAFF (Department of Agriculture, Food and Forestry), 1996. Growing for the Future: Strategic Plan for the Development of the Forestry Sector in Ireland. Stationery Office, Dublin.
- Farm Accountancy Data Network. 2005. Concept of FADN [online]. Available from: http://ec.europa.eu/agriculture/rica/concept_en.cfm [Accessed July 2012].
- Farrelly, N. 2008. *A Historical Review of Trends and Patterns of Private Afforestation in Ireland*. RMIS 5504 Working Paper No. 1. Teagasc, Athenry.
- Falconer, K. and Ward, N. 2000. Using modulation to green the CAP: the UK case. *Land Use Policy* 17: 269-277.
- Forest Service, 2009. *Forestry Statistics*. Department of Agriculture, Food and Fisheries, Johnstown castle, Co. Wexford.
- Frawley, J. and Leavy, A. 2001. *Farm Forestry: Land Availability, Take-Up Rates and Economics*, Project report No. 4256, RERC, Teagasc.
- Ganly, R.J. 2009. *Land Market Review – Spring 2009*. Knight Frank, Dublin.

- Gillmor, D.A. 1998. Trends and spatial patterns in private afforestation in the Republic of Ireland. *Irish Forestry* 55: 10-25.
- Greene, W. 2003. *Econometric Analysis*. Fifth Edition. Prentice Hall, New Jersey.
- Howley, P., Donnellan, T. and Hanrahan, K., 2010. Potential impact of CAP reform post 2013 on the cereal and livestock sectors: An Irish case study. *Journal of Farm Management* 13: 731-746.
- Hynes, S., Farrelly, N., Murphy, E. and O Donoghue, C. 2008. Modelling habitat conservation and participation in agri-environmental schemes: A spatial microsimulation approach. *Ecological Economics* 66: 258-269.
- Joshi, S. and Arano, K.G. 2009. Determinants of private forest management decisions: A study on West Virginia NIPF landholders. *Forest Policy and Economics* 11: 118-125.
- Kearney, B. 2001. *A Review of Relevant Studies Concerning Farm Forestry Trends and Farmers' Attitudes to Forestry*. COFORD, Dublin.
- Konyar, K. and Osborn, C. 1990. A national-level economic analysis of conservation reserve program participation: A discrete choice approach. *Journal of Agricultural Economics Research* 42: 5-12.
- Kuuluvainen, J. and Salo, J. 1991. Timber supply and life-cycle harvest of nonindustrial private forest owners: and empirical analysis of the Finnish case. *Forest Science* 37: 1011-1029.
- Loyland, K., Kringstad, V. and Oy, H. 1995. Determinants of forest activities – a study of private nonindustrial forestry in Norway. *Journal of Forest Economics* 1: 219-237.
- Malone, J. 2008. *Factors Affecting Afforestation in Ireland in Recent Years*. Report for the Minister of state with responsibility for forestry. Available at <http://www.ifa.ie/linkClick.aspx?fileticket=N5243ioVRio%3D&tabid=615> [Accessed July 2012].
- McDonagh, J., Farrell, M., Ryan, M. and Mahon, M. 2010. New opportunities and cautionary steps? Farmers, Forestry and Rural Development in Ireland. *Rural Countryside*. *European Countryside* 2: 236-251.
- McCarthy, S., Matthews, A. and Riordan, B. 2003. Economic determinants of private afforestation in the Republic of Ireland. *Land Use Policy* 20: 51–59.
- Miranda, M.L. 1989. *The Relationship Between Forestry Investment and Profit-Maximizing Land Management: An Application to the Southeastern and Southcentral United States*. Paper presented at the natural resource Economics Workshop, North Carolina State University, Raleigh, NC.
- Nagubadi, V., McMamara, K.T., Hoover, W.L. and Mills, W.L. 1996. Program Participation Behavior of Nonindustrial Forest Landowners: A Probit Analysis. *Journal of Agricultural and Applied Economics* 28: 323-336.
- Ní Dhubháin, Á. and Gardiner, J.J. 1994. Farmers' attitudes to forestry. *Irish Forestry* 51: 19-26.
- O Leary, T.N., McCormack, A.G. and Clinch, J.P. 2000. Afforestation in Ireland: regional differences in attitude. *Land Use Policy* 17: 39-48.
- Romm, J., Tuazon, R. and Washburn, C. 1987. Relating Forestry Investment to the characteristics of nonindustrial private forestland owners in Northern California. *Forest Science* 33: 197-209.
- Ryan, M., Kinsella, A. and Cushion, M. 2008. *An Assessment of Farmer Intentions to Plant a Forest*. Agricultural Research Forum. Teagasc.
- Ryan, M. 2011. Outlook for forestry in *Outlook 2011- Economic Prospects for Agriculture*. Rural Economy and Development Programme, Teagasc.
- Straka, T., Wisdom, H. and Moak, J. 1984. Size of forest holding and investment behavior of nonindustrial private owners. *Journal of Forestry* 82: 495-496.
- Swinbank, A. and Daugbjerg, C. 2006. The 2003 CAP Reform: Accommodating WTO Pressures. *Comparative European Politics* 4: 47-64.

- Selby, J.A. and Petajisto, L. 1995. Attitudinal aspects of the resistance to field afforestation in Finland. *Sociologia Ruralis* 35: 67-92.
- Watkins, C., Williams, D. and Lloyd, T. 1996. Constraints on farm wood-land planting in England: a study of Nottinghamshire farmers. *Forestry* 2: 167-176.
- Wynn, G., Crabtree, B. and Potts, J. 2002. Modelling Farmer Entry into the Environmentally Sensitive Area Schemes in Scotland. *Journal of Agricultural Economics* 52: 65-82.