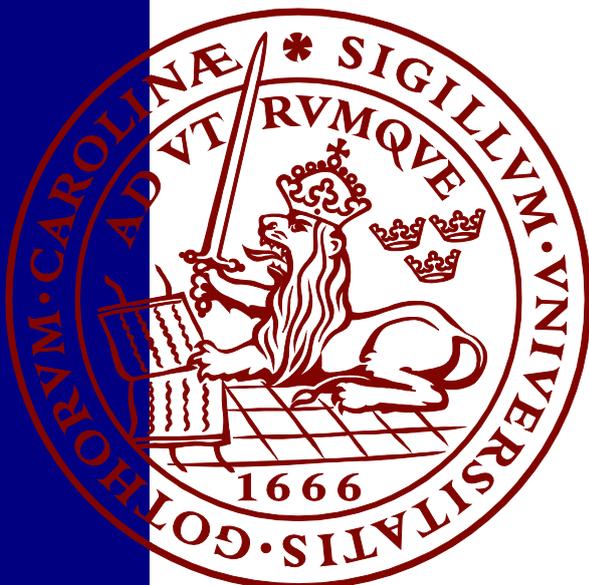


**A cross national comparative study on the utilisation
of private forestry in the development of local wood
energy supply chains.**

Cormac Woods

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LUCSUS

Lund University Centre for
Sustainability Studies



LUND
UNIVERSITY

A cross national comparative study on the utilisation of private forestry in the development of local wood energy supply chains.

Author

Cormac Woods

Email: cormac_woods33@hotmail.com

For the degree of

Master of Science

Thesis Supervisor

Kimberly Nicholas

Email: Kimberly.nicholas.academic@gmail.com

Lund University Centre for Sustainability Studies, LUCSUS

Geocentrum 1, Sölvegatan 10

P.O. Box 170, SE-221 00 LUND, Sweden

Phone: +46 (0) 46 222 48 09

Fax: +46 (0) 46 222 04 75

Abstract

Both Northern Ireland (NI) and the Republic of Ireland (ROI) have set ambitious targets for increasing the amount of renewable heat being generated. By 2020, NI is aiming for a 10% target, in the Republic a 12% target has been stipulated (DARD, 2010) (SEAI, 2007). In both countries the majority of the private forest estate has been created through establishment grants that began in the 1980s, the woodland is now reaching an age where it can potentially make a contribution to the supply of wood energy. I have used a mixed 'agency' and 'structure' approach in comparing the way that private forestry is being utilised in NI and the Donegal region of the Republic. The agency of individual private forest manager and the decisions they make are at the base of private sectors involvement in the supply of wood energy, for this reason I conducted a survey involving private forest owners in the two regions to compare the capacity of delivering the renewable energy resource. This has been accompanied by a more 'structure' based approach that deals with the specific conditions which have produced the variations in private forester behaviour. This involved an investigation of the respective institutional frameworks governing the development of private forestry wood energy including the relevant policies being implemented, the role of various public institutions and the support being offered by the respective forestry services. I have discovered major differences in the capabilities of private forest owners in delivering a wood energy resource in the two regions. In the analysis section I have used a transition management perspective to investigate the way in which the transformation towards increased use of private forest energy is being directed in both regions. In Northern Ireland a 'top down' approach to stimulating the bioenergy market through the central distribution of economic incentives is failing to involve the private forester in the transition process. In contrast a more local localised approach in Donegal that is focuses on organising and facilitating interaction processes among local actors is having a greater impact in the development of a private forest energy resource.

Word Count: 14,993

Key Words: Private sector forestry, bioenergy, transition governance, rural development

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Abbreviations

DCEN: Department of Communications, Energy and Natural Resources
 DETI: Department of Enterprise Trade and Investment
 DARD: Department of Agriculture and Rural Development
 RIS: Regional Innovation System
 WDC: Western Development Commission
 CDB: County Development Board

Introduction

On the island of Ireland there is an extreme reliance on fossil fuels. Imported fossil fuels make up 90% of the energy mix in the Republic of Ireland and 99% in Northern Ireland(NI) (DCEN, 2008)(DETI,2010) Facing a future of rising energy prices and tighter international regulations on

green house gas emissions there is an increasing imperative to implement solutions to reduce these dependencies. In this thesis I will be focusing on a solution that attempts to curb the reliance on fossil fuelled heating by designating a role for private forestry in the generation of renewable heat. I will be comparing the way in which wood energy from private forestry is being utilised as a renewable energy feedstock in two regions on the island of Ireland. The first region, Northern Ireland (NI) is a part of the UK and is situated in the north east of the island. In 2010, the population was 1.6 million. NI has its own parliament and devolved government (NISRA,2010). The second region, Donegal is part of the Republic of Ireland and is situated in the north west of the island. Donegal County Council is the local authority for the region. In 2011, the population was 160,297 (Central Statistics Office, 2011). The two regions are displayed in figure 1 below.

In the search for alternative energy pathways a particular pertinence exists in developing indigenous renewable energy resources to reduce a reliance on fossil fuels used to generate heat. Heating accounted for around half of all total energy within NI and 34% of total energy use in the Republic (DCEN, 2008)(DETI,2010) The main heating fuel in NI is oil, refined oil products account for 77% of overall heat demands (Consumer Council, 2012). In the Republic oil is also the dominant fuel for heating accounting for 55% of primary inputs (SEAI, 2009). This dependence on oil for heating is having untoward social consequences. Fuel poverty is defined when a household needs to spend more than 10% of their disposable income on energy in order to maintain an acceptable level of heat in their home (DECC, 2012). The dependence on the most expensive heating fuel has created a 44% fuel poverty rate in NI and 19% rate in the Republic (Consumer Council,2012) (IPH,2007). Environmentally oil is the most damaging heating fuel in terms of carbon emissions. For renewable heat to be deployed in Ireland it is essential that indigenous fuel sources are maximised.

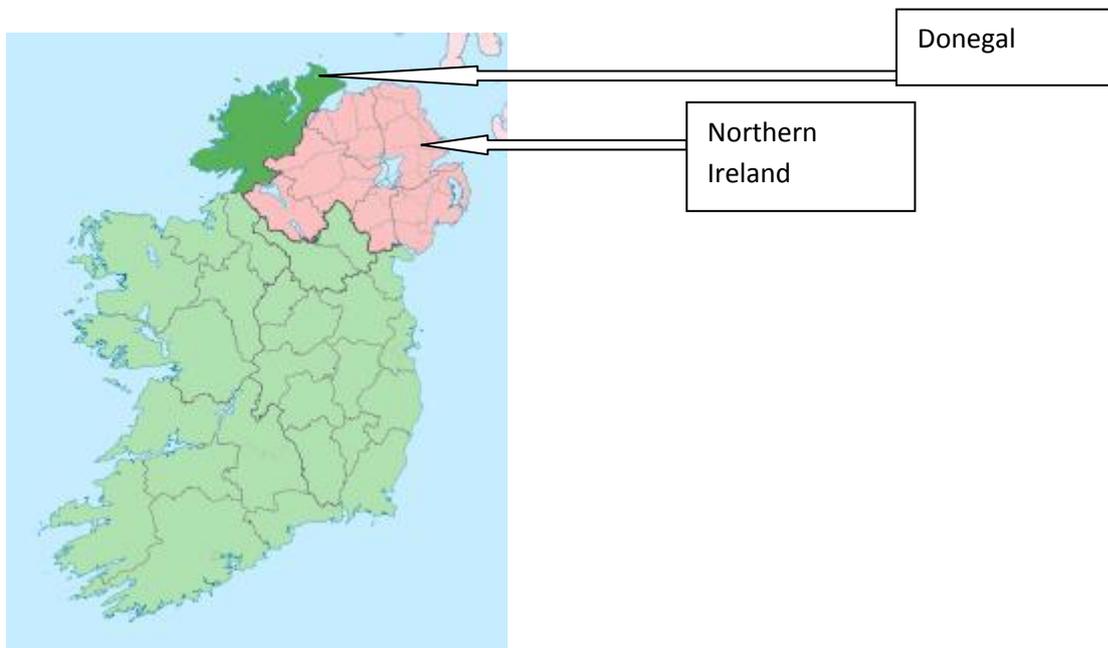


Figure 1: Map of Ireland indicating Northern Ireland and County Donegal.

Ireland's private forest is fast becoming a considerable wood and wood energy resource. Private afforestation was basically non-existent in Ireland until the 1980s. The vast majority of the private forest estate that exists on the island today was a result of financial grant schemes introduced throughout the 1980s and 1990s to encourage landowners to plant trees. Most of the 320,000ha private forest estate in the Republic has been planted in the last two decades; the vast majority of the 26,703ha private forest estate in NI has been planted after the introduction of the woodland grant schemes in 1988 and many areas are now entering the first thinning stage. Thinning is the removal of a proportion of trees from a forest, the removal of trees at intervals concentrates the volume growth on the remaining better spaced; better quality stems (Irish thinning protocol, 2010). Developing a wood energy from forest thinning will also encourage private forest owners to actively manage their forestry which in the long run results in a better timber harvest when the trees are fully mature. The benefits to rural development include increased local employment; improved farm profitability; energy security and local wealth creation (WDC, 2008). The private forest estate is only one of an array of resources that could be exploited in the attainment of renewable heating targets. In this thesis I will not be including the role that Short Rotation Coppice (SRC) is playing in producing wood energy. Even though SRC involves the growing of trees on private land, the willow and poplar being used are quick growing tree species and are grown exclusively as an energy crop. I will be concentrating on conventional forestry systems which can be defined as natural forests and plantations in which biomass for energy can be considered as a by-product alongside the production of timber (Richardson, 2002).

The comparative study will be structured in the following way. There will first be a section giving a background to private forestry in the two regions. This will include the size of the private forest estate and forecasts of future production. The methodology section will include a theoretical framework in which my use of transition theory will be presented; this section will also introduce my main research questions and the methods used. The comparative study will be structured within two main research questions. The first compares the role of the individual forest owner in delivering a wood energy resource. The second compares the institutional frameworks governing the transition in each region. This will include a comparison of policies and the role of various governmental institutions including the respective forestry services.

Literature Review

Research into renewable energy from Irish private forests is largely unprecedented. Niall Farrelly (2007) has conducted research into the opportunities and challenges in utilizing the farm forest resource. He highlights farm forestry as having the potential to be a financially important farm enterprise; in particular he makes reference to the market potential of the wood energy sector. Other than Farrelly, I found no literature that dealt with the role that private forest resource could play in Irish rural development. Faced with this absence of publications on the Irish context I looked to studies conducted into the role of private forest in energy production elsewhere. Ramo (2009) surveyed the expansion of wood energy among Finnish private forest owners and Rolf Bjorheden investigated the drivers behind the development of forest energy in Sweden. Bjorheden investigates the driving forces behind the doubling of forest fuel use in Sweden in the last 30 years to almost one fifth of the utilized energy. Likewise, Ramo surveys the factors that led to wood energy providing 21% of Finland's primary energy consumption in 2006 (<http://www.biomassenergycentre.org.uk>). In both countries the increased use of wood energy was policy driven. In both contexts heavy taxation of fossil fuels was the most effective policy instrument offering protection to the use of wood energy; there was also strong government support to research, development and the commercialization of forest chip. The positive attitude towards forest fuels in Sweden was driven by a reaction to the oil crisis and a growing environmental awareness within the society. The use of these studies in conducting research into the Irish context was limited by the fact that it is difficult to draw comparisons to an Irish context; both these countries possess vast biomass resources in the form of forests and have histories of large scale forestry. However, the Scandinavian studies gave me an awareness of a multi level of driving forces involved in alleviating society's dependence on fossil fuels. It also gave me an indication of the potential managing role of government in the transition towards increased use of wood as energy.

Background to Private Forest Resource

At 6.2% NI has less woodland cover than any other European country (Forestry Commission 2009). The Forest service estimated that the total woodland cover in NI in March 2010 to be 87,903ha. By looking at Figure 3 you can see that most of the woodland is in the west of the province. The total woodland figure includes 61,200 ha of wood land managed publically by the Forest Service and 26,703 ha of non-Forest Service woodland. (See Figure 2) The current figure has been reached by using the most recent inventory of private woodland done in the 1970s (Graham, 1981). The subsequent planting supported by the Woodland Grant schemes is added on to this figure. (NIEA, 2010)

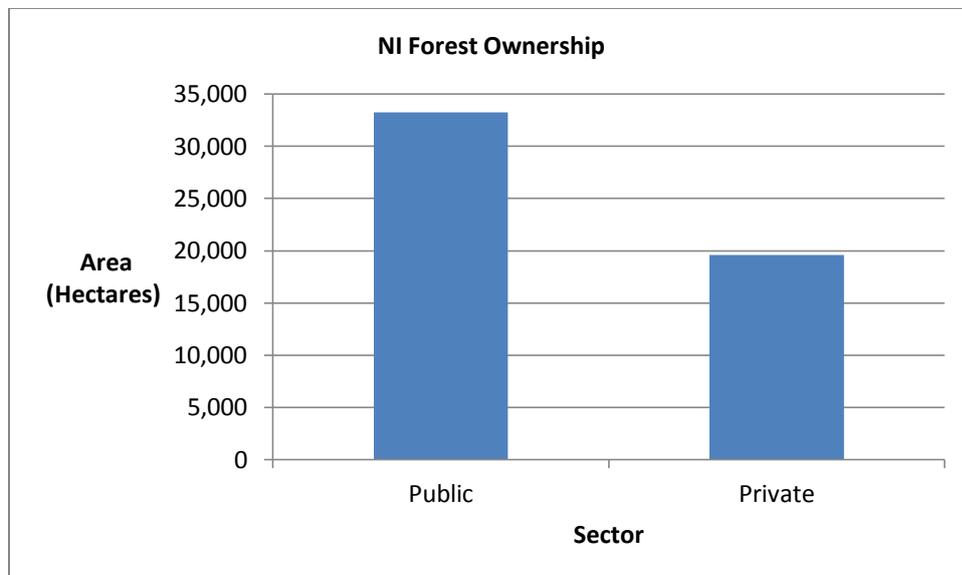


Figure 2: Graph comparing the amount of public and private forest estate in NI

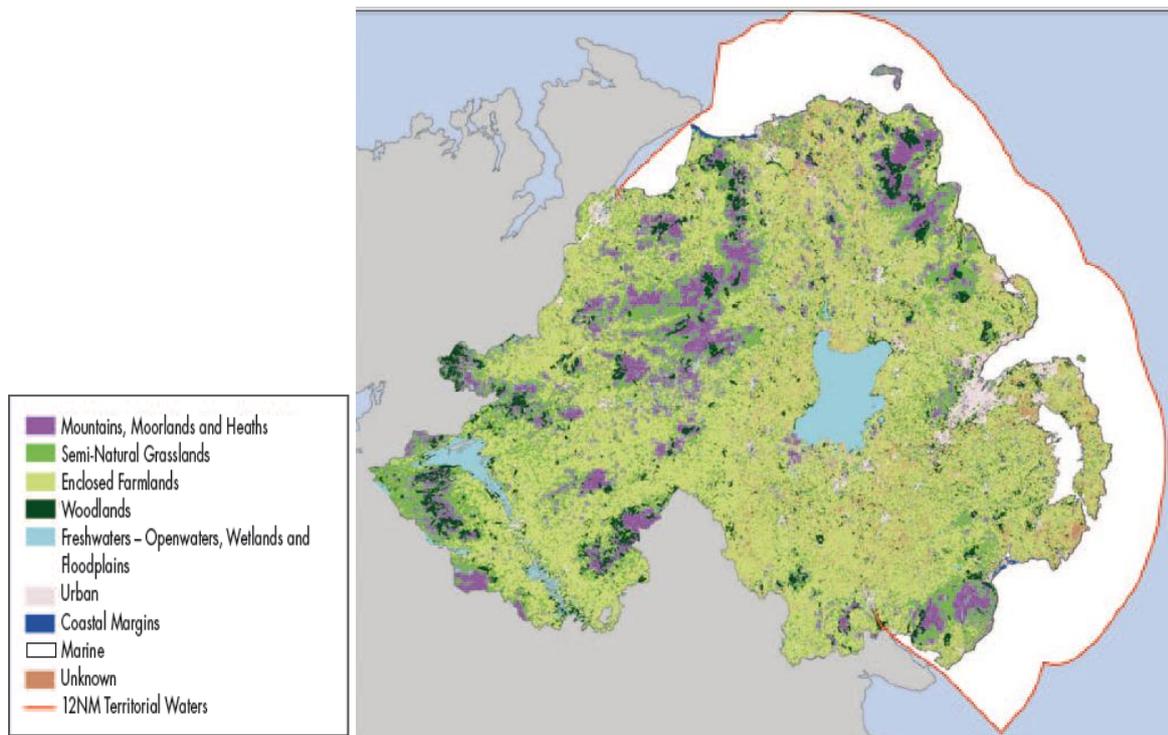


Figure 3: Land cover map of Northern Ireland showing distribution of all habitats including woodlands (NIEA, 2010)

The Forest Service NI has estimated the wood availability from private woodlands. These results represent estimates of volume potentially available, rather than a forecast of production. If managed accordingly NI private woodland in the period 2012 -2026 has the potential to annually produce 20,000 m³ of over bark standing. In the years 2012-2026 an estimated total of 320,000m³ will be available from private forest. The main source of raw material for wood energy is the small round wood, diameter 7-14cm. The timber forecast estimates that in the years 2012-2026 there will be 2,000m³ of 7-14cm available on an annual basis. In the years 2012-2026 an estimated total of 32,000m³ will available from private forest (DOE, 2011) In the Republic of Ireland the total national forest estate in 2009 was 730,000ha, this represents 10.6% of the total land area. The total forest estate for county Donegal is 52,810 ha. The total forest estate in Donegal can be split between 33,244ha publically owned and 19.57ha private sector (See figure 4) (Raslres, 2011).

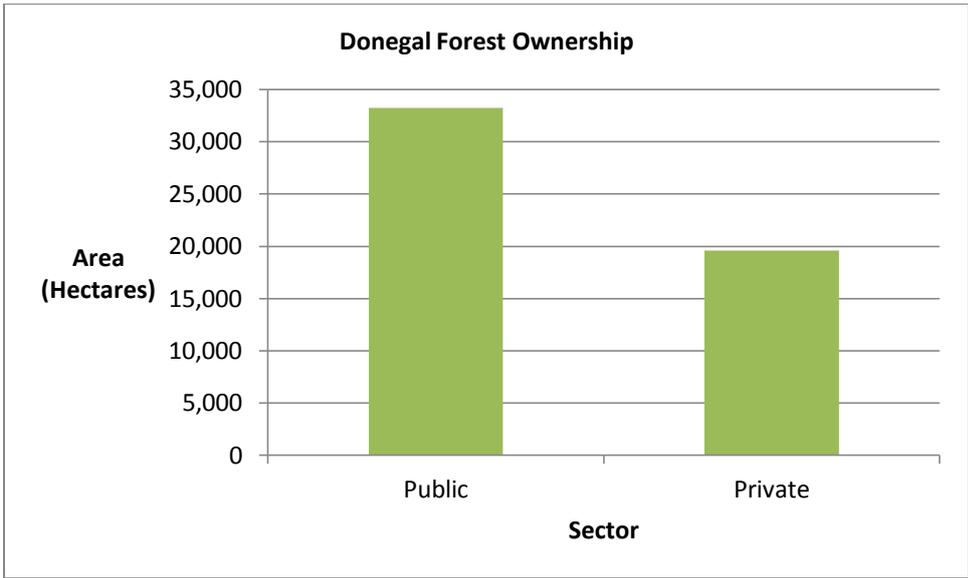


Figure 4: Graph comparing the amount of public and private forest estate in Donegal

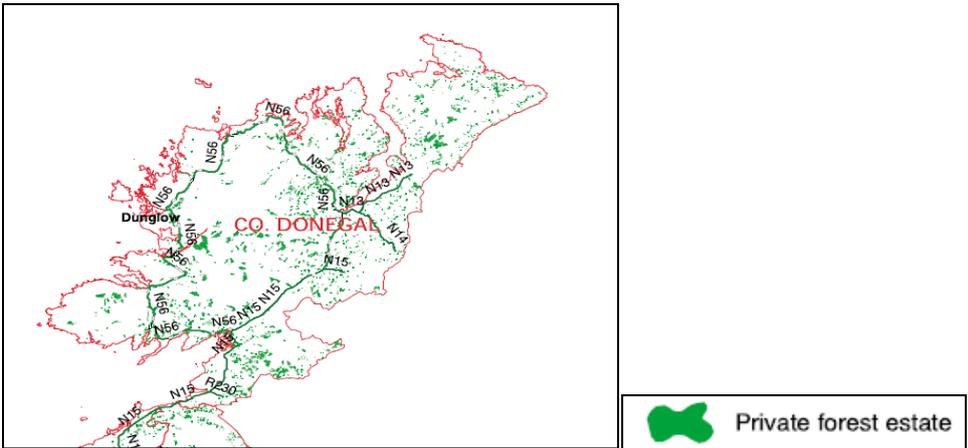


Figure 5: Map of private forest estate in Donegal

Forecasting data of the volumes of timber potentially available in private forests in Donegal are based on yearly estimations. The total potential production from 2011-2028 is 1,534,000m³. Estimates for each year can be seen in the table. There is also data available for the important 7-14cm category. Between 2011-2028 a total of 631,000m³ is available. Another potential raw material for wood energy is the harvesting of tree tips up to 7cm, less than 40% of the tip-7cm is harvestable, and this means that between 2011-2028, 101,000m³ of over bark is available in Donegal for the wood energy market (COFORD,2011)

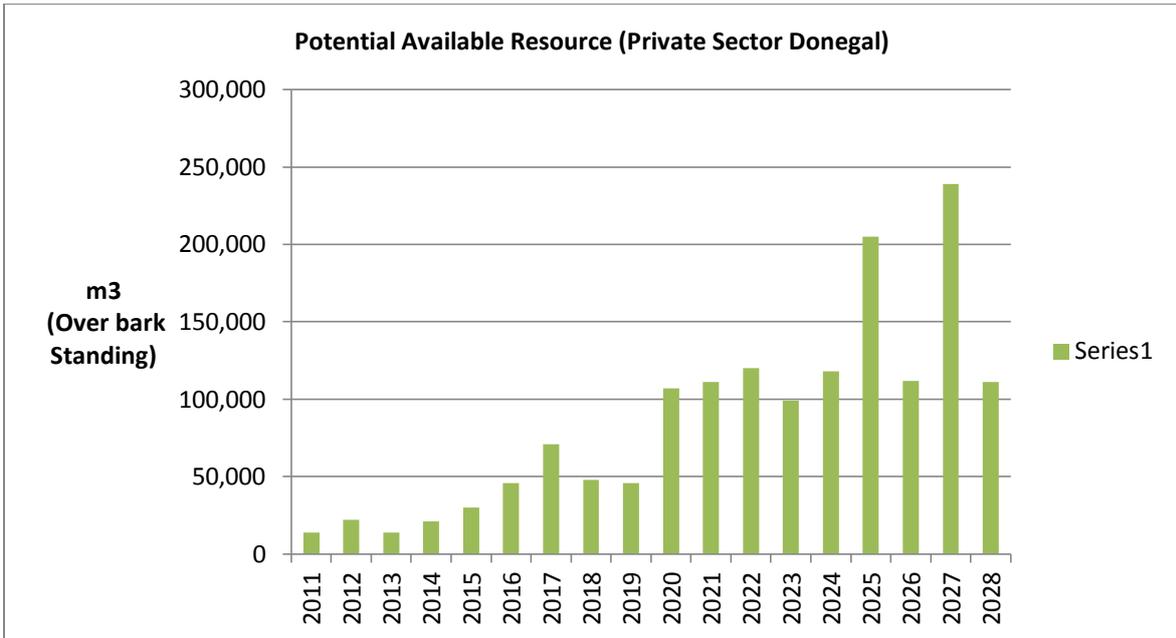


Figure 6: Forecast of potential total net volume production for private forests in Donegal 000m3 overbark standing.

In both regions there is a private forest resource that could be potentially used to supply the wood energy market. According to these statistics the availability of the resource in NI has greater potential to be a barrier. The amount of private forest is greater in NI (See figure 7)

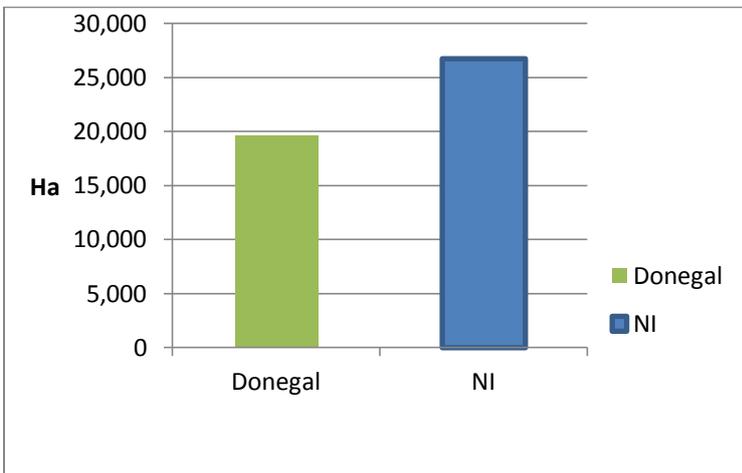


Figure 7: Comparison of total private forest estates in Donegal and NI

Despite a bigger private forest estate a comparison of the potential production forecasts indicates that Donegal has a much greater potential to supply wood to the wood energy market. (See Figure 8) These statistics show the potential of private forests in the two regions to supply wood energy; however, this in no way guarantees that the resource will be used to in the supply of wood fuel. A closer look at the role that individual private forest owners have in the two regions is necessary to enable me to compare the likelihood of this potential resource being utilised in the production of bioenergy.

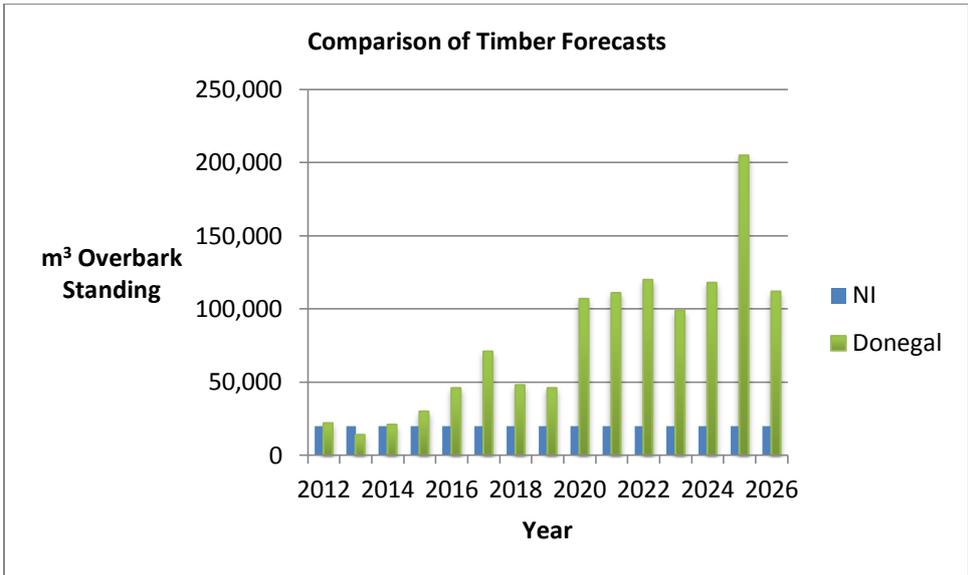


Figure 8: Comparison of forecasts of potential total net volume in Donegal and NI.

Methodology

4.1 Theoretical Framework

The study I have conducted compares the way in which private forestry resources are being incorporated into renewable energy supply chains in two neighbouring polities. The use of wood from private forestry can be considered one of many attempts at finding solutions to the global environmental problem of climate change which has created ‘an enormous challenge for science, policy and society’ (Elzen, 2005) Governments have become increasingly aware of the need for far reaching approaches to reduce the impact of human activities on global life support systems. The attempt to change societies use of energy towards renewable resources carries with it strong normative assumptions, in particular relates ‘to the larger goal of providing long term human well-being in the face of real bio-physical limits’ (Medowcroft, 2011) The changes that are required cannot be brought about by technological innovations alone but will require mutually reinforcing institutional and sociocultural transformations. In comparing the way in which private forest is being incorporated into wood energy supply chains I will be using a transition management governance perspective that builds upon this particular philosophy. Transition management is firmly rooted in traditions of system thinking which highlight the co evolution of the social and technical and which seek to understand the emergence and transformation of sociotechnical systems. (Shove, 2007) The normative underpinning of the transitions approach puts figuring out how the dominant sociotechnical regimes might be dislodged and how new configurations might become mainstream. In comparing the role that private forestry has in supply wood energy supply chains in the two regions I will be applying a mixed agent and structure based approach. ‘Agent based’ refers to the influence of the key actors in the transformation of sociotechnical regimes. According to Rotmans (2001) ‘agency influences how fast a particular transition will develop’. In this agent based approach I will be comparing the role of individual private forester in their ability to take action in providing a renewable energy resource. A ‘structure based’ approach recognizes that actors are embedded in structures; this approach recognizes that there are specific conditions which produce human actions or behaviour. In comparing the structuration processes involved in the development of the wood

energy sector in the two regions, I will be able to better understand the opportunities and constraints being implied to the private forest agent in the immediate contexts they face (Grin, 2011) A focus on structure will compare the governance strategies being implemented in each region, 'strategic governance can be understood as a dynamic process of the creation and implementation of policy, politics and administration' (Potucek, 2006). This will involve analysis of the various steering mechanisms and tools being used to incorporate private forestry into renewable heating supply chains in the two regions. Advocates of the transition management policy model believe that the structural changes in the socio-technical systems can be influenced in terms of its direction and speed (Rotmans,2001). Florian (2012) states that 'transitions will not come about spontaneously but government is supposed to play a role in the fostering of the processes'. The role of government in transition management is a plural one: facilitator, stimulator- controller- director (Rotmans, 2001). This role is carried out through negotiation and bargaining between interested state and non-state actors involving interdependent resources relevant to maintenance and change of the regime (Smith, 2005). Policy makers and other decision makers puzzle over how to identify possible and promising directions for transitions. 'In policy science three general policy paradigms exist. (i) the traditional top down model with a central role for national government and hierarchical relations,(ii)a bottom up or market model with a large degree of autonomy for local actors, and (iii) a governance or policy network model with shared rule making and agreements between interdependent actors with diverging values and beliefs' (Wiekzorek, 2005) In comparing the way in which private forestry is being incorporated into local renewable energy supply chains in the two regions I will be investigating the prevalence of each policy paradigm and evaluating the success of the particular instruments being used in governing the transition.

4.2 Methods

4.2.1 Research Question # 1: Compare the role of the individual private forester in delivering a wood energy resource in the two regions?

I felt that a questionnaire was a good way of gaining information from a variety of sources and would provide data which would allow me to investigate barriers that existed at the individual private forester level (See Appendix 1).The way I went about distributing the questionnaire and gaining access to participants in the two regions differed. I was wary of distributing the questionnaire via email as this could affect the validity of conclusions as the results may have been skewed by the participation of a younger, more educated sample population. In NI I contacted a private forestry company and they were willing to give me the telephone numbers of 20 clients that they had planted trees for. I employed a random sampling method to pick the participants. The questionnaire was administered through a telephone call to ensure response. In Donegal I contacted the national forestry service to gain access to private foresters in this area. I received the addresses of 30 private foresters and I administered the questionnaire via the post. I received 16 responses. I designed a questionnaire that allowed me to compare both the ability and willingness of private foresters to take part in the supply of wood energy. Multiple choice answers were provided for most questions. The questionnaire was designed to investigate different categories. The first category was designed to ascertain the individual's reasons for planting in the two regions. As the reasons for planting woodland are more than likely to be multi faceted I designed a question to ascertain the individual's priorities when initially choosing to plant. I also wanted to compare the level of management skills that the forest owners had as this would have an influence on the capacity of

producing wood energy. I compared opinions on the level of support being given by the respective forest services and finally included series of questions to gauge the knowledge of forestry markets that the individual forest owner had both regions.

4.2.2 Research Question # 2: Compare the strategies being implemented in each region governing the utilisation of wood energy from private forests?

4.2.2.1 Relevant Policies

Through document analysis of policy documents published by each government I will ascertain the role that private forestry has been designated in the production of energy. This will include an array of policies designed to promote the use of renewable energy. I will analyse the relevant government publications and assess the role that wood energy from private forestry has in attaining renewable energy targets. The specific documents in NI were 'Renewable Energy in the Land Based Sector. A Way Forward' (DARD,2010) and the Renewable Energy Action Plan (DARD, 2010). In the Republic the 'Bioenergy Action Plan for Ireland'(DMNR, 2008) and the 'National Renewable Energy Action Plan'(DMNR, 2009).

4.2.2.2 Policy Instruments

I will be comparing how policy instruments are used to develop bioenergy from private forests. This includes schemes to support the uptake of new biomass burning installations and also schemes to support fuel production and the development of forestry supply chains.

4.2.2.3 Implementation of Strategy

I will be investigating the role of specific government institutions in the implementation of strategies to utilise private forestry in renewable energy supply chains. This will include the following;

4.2.2.4 Central Government

I conducted a semi-structured interview with a representative of a inter departmental group responsible for increasing the use of renewable heat. I wanted to ascertain the role that private forestry had in reaching targets.

4.2.2.5 Significance of regional and local governance

To investigate the role that local authorities had in NI in promoting wood energy from private forestry I contacted nine district councils. I chose to contact the councils within the 3 counties that had the largest private forest estates. The three counties all were located in the western half of NI and include Derry, Fermanagh and Tyrone (See Figure 9) I wanted to know if these counties were involved in initiatives to promote the use of wood energy from private forests. To compare the level of activity in promoting wood energy by the local authority in Donegal I conducted a semi structured interview with a representative of the Local Authority.



Figure 9: Map indicating the counties of Northern Ireland.

4.2.2.6 Role of Forestry Services

An important institution involved in the architecture governing a role of private forestry in renewable energy enterprises is the respective forest Services. The role of the forestry services in developing the private sector resource was analysed through 2 semi-structured interviews with representatives in the two regions. Forest Service NI is an Executive Agency within the Department of Agriculture and Rural Development (DARD). The agency is subject to direction from the minister responsible for the department. To analyse the role that Forest Service NI had in developing wood energy from private forests I interviewed the 'Director of Woodland Development and Strategies'. Donegal being part of the Republic of Ireland the services available to private forestry have a different institutional structure. The Forest Service in the Republic of Ireland (ROI) has responsibility for development of forestry within the ROI. The role that the Forest Service has is complemented by Teagasc, Teagasc is a national organisation that provides research, advisory and training services to the agriculture and food industries. Teagasc have a department dedicated to forestry development. To analyse the role that state forest services had in developing wood energy from private forestry I interviewed the Teagasc Forestry Development officer for the North West Ireland. Both interviews were semi structured, I was keen to compare the support services available within the following categories. Firstly, investigating the level of knowledge services available would allow me to compare the availability of training programmes and advisory services in the two regions. I wanted to analyse the levels of support given to individual forest owners in conducting operations. I also compared the role that forest services in the two regions had in conducting up to date inventories and timber forecasts of private forestry. Finally, I assessed the role that the forest services had in marketing timber from private forests and specifically in the marketing of wood energy.

Results

5.1 Research Question 1

5.1.1 Results of Private Forester Questionnaire

In this section I will present the results of a questionnaire distributed to individual private forest owners in both regions. The presentation of the results will be based upon the specific way the questionnaire was categorised. The first section will present important background information of the two sample populations. Below the background information of the sample population is contained in a table.

	NI	Donegal
Sex		
Male	18	14
Female	2	2
Age		
<20	0	0
21>40	12	2
41>60	5	6
61>80	3	8
Occupation		
Farmer	11	8
Professional	5	2
Labourer	0	0
Retired	4	6
Unemployed	0	0

Figure 10: Background information of private foresters sampled in Donegal and NI

The sample population for the two regions was predominantly middle aged males. The level of retired in Donegal is expected when considering almost half of respondents are between 61>80. The most dominant occupation is farmer, which is also expected as grant schemes to encourage tree planting are largely aimed at the farming community. Below is a table containing the background information on the forest units owned by the sample population.

	NI	Donegal
Size of Unit		
1-10ha	16	6
11-20ha	3	6
21-30ha	1	2
>30ha	0	2
Species Composition		
Mono culture (Conifer)	5	15
Mono culture (Deciduous)	11	0
Mixed	4	1
Age of Plantation		
1-5	2	2
6-10	6	0
11-15	7	4
16-20	4	10
21-25	0	0
25-30	1	0

Figure 11: Background information on forest unit owned by sample populations in Donegal and NI.

The sample population in NI was dominated by the smallest category with 16 respondents having forest units between 1-10ha. I calculated the average size of plantation in NI to be 5.8ha. In Donegal the size of plantation was much more mixed. The average size of forest unit in Donegal was 21.5ha. It is important to point out that this average would have been increased with the inclusion of 2 very large units, the largest being 90ha and the second 45ha. There is major difference in the tree species planted. Over half of respondents in NI planted ash. In Donegal 15 out of the 16 respondents planted Sitka spruce. The average age of established woodland among respondents from NI is 10.7 years. This is similar to the average age of plantations in Donegal at 12.8 years old.

5.1.1.1 Reasons for Planting

The results for the reasons for planting in the two regions were varied. It was revealed that in NI 'reducing work from the farm' was the most popular priority, followed by making most 'economic use of the land'. This can be compared with the first priorities in Donegal, the most popular first priority reasons for planting in Donegal were to make an 'investment', second most popular first choice was to make 'economic use of the land'. (See figure 12 for comparison)

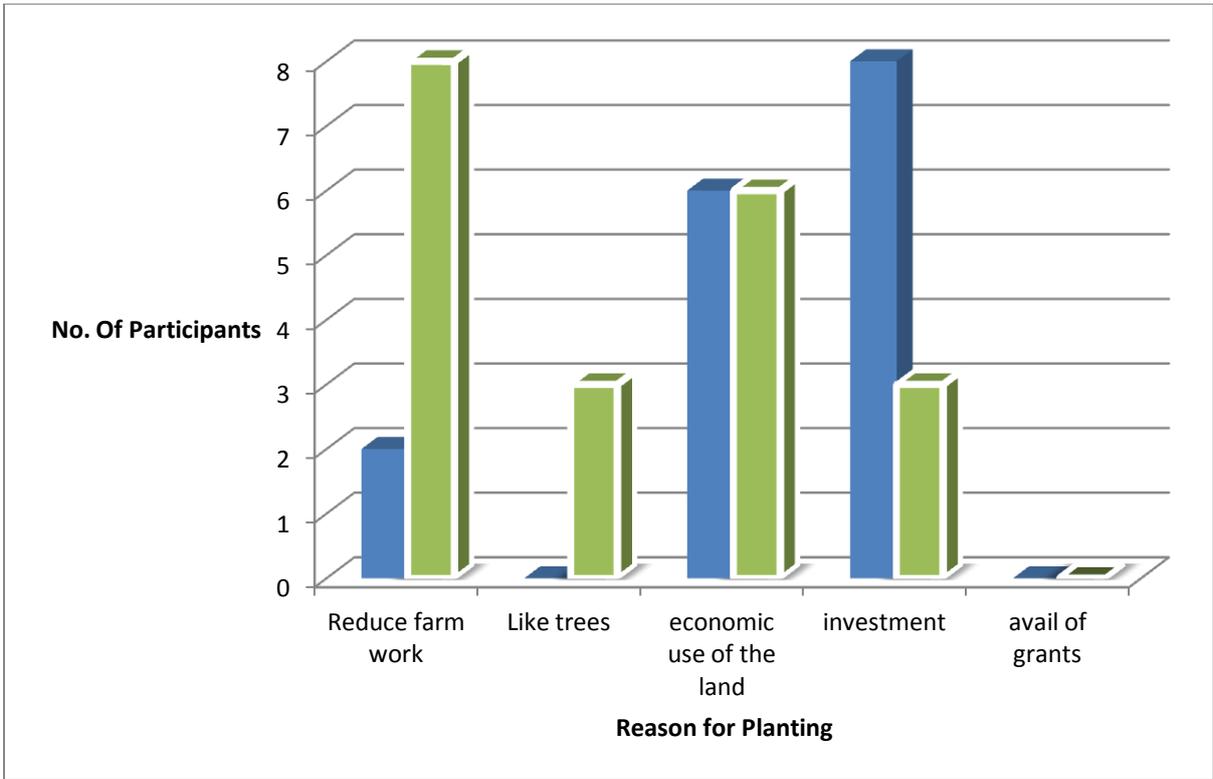


Figure 12: Graph displaying comparisons of first priorities when asked reasons for planting in NI (Blue) and Donegal (Green).

The data clearly shows that utilising the land for economic purposes is the major priority in planting trees. In both surveys no participants picked the availing of grants as a top priority. If short term financial gain was a reason for planting it would be expected that the forest owners’ prioritisation of attainment of grants would be a significant reason for planting. The type of economic investment that the plantations were offering was also confirmed with the predominance of participants indicating that a reason for planting trees as a ‘long term financial investment’ as opposed to short term availing of grants. This is confirmed with 90% of participants in NI and 87% of participants in Donegal indicating a ‘long term investment’ over ‘short term investment’ as a reason for planting. The long term financial motivation is also confirmed with the fact that 100% of participants in both regions stated that ‘production of timber for sale’ was a reason for planting.

5.1.1.2 Forest Management

In comparing the forest management capabilities that individual woodland owners had in the two regions I found that the respondents in Donegal were much more confident in their abilities. In NI, when asked judge their own forestry management skills, 70% felt that they had minimal skills, 25% felt they had basic and 5% felt their skills were advanced. This is in direct contrast to the results in Donegal were 12.5% felt their skills were minimal. At 62.5% the majority of participants in this region felt their skills were basic, with the remaining 25% regarding their forest management skills as advanced. (See figure 13 for comparison).

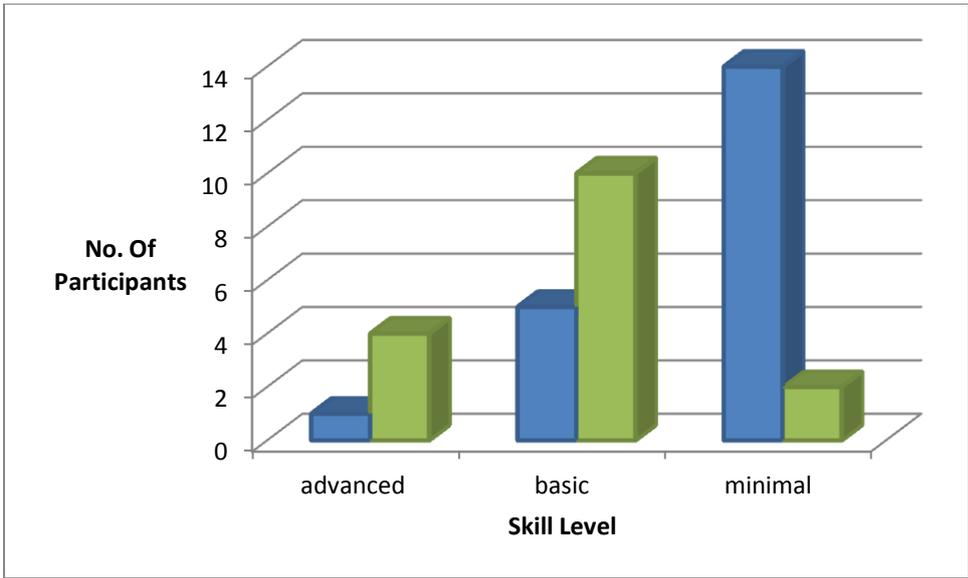


Figure 13: Graph displaying results for of self interpretation of management skills comparing forest owners in NI (Blue) with forest owners in Donegal (Green)

In Donegal there was a greater level of planning going into managing the woodland and the level of activity was much higher. In NI only 15% of participants had a management plan for their woodland, this compares to 75% in the Donegal region. In NI 60% of forest owners were engaging in no management activities, only 55% were aware of management activities that would influence the quality of the timber being produced. This contrasts to the situation in the Republic where only 12.5% of participants were engaging in no management activities and almost all of the candidates knew of activities that would influence the quality of the timber being produced at 80% (See figure 14)

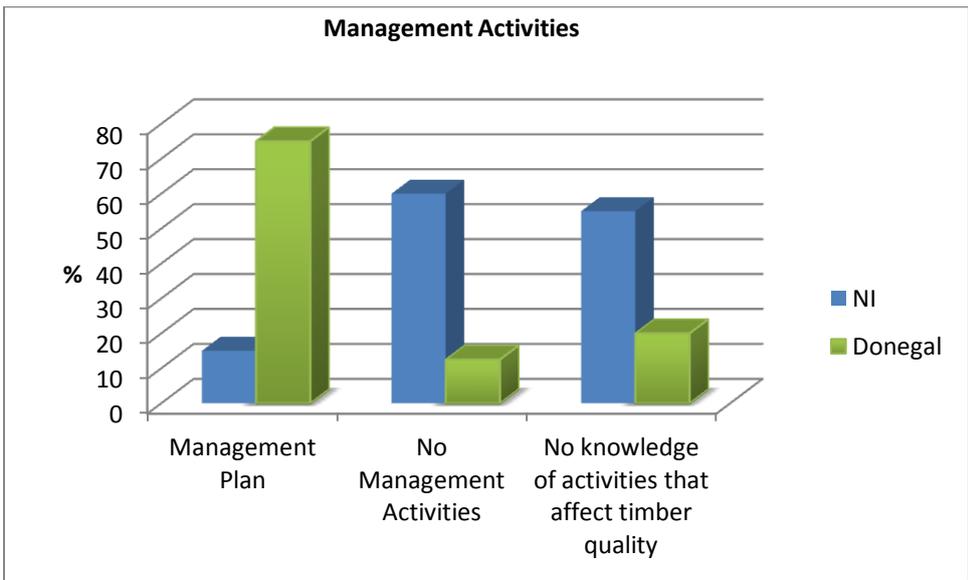


Figure 14: Graph displaying results of management activities of individual forest owners in NI and Donegal.

5.1.1.3 Support Services.

In comparing the way in which outside agencies are being utilised in the management of woodland units I found that in Donegal there was a much greater use of support services. The majority of participants in each region were aware of support services available, 75% in NI and 100% in Donegal.

Only 30% participants from NI had attended forestry training courses, interestingly five of the six participants who attended training in NI were trained across the border in the Republic. Comparatively, 75% of participants in Donegal attended training (See Figure 15).

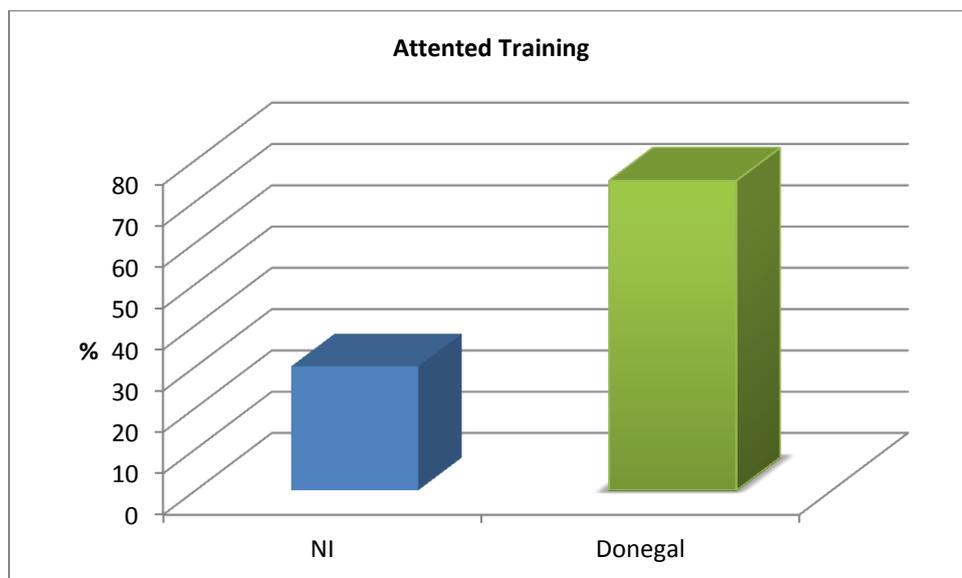


Figure 15: Graph displaying results comparing levels of participation in forestry training events amongst individual participants in NI and Donegal.

In NI 60% of participants did not know their local forestry advisor and only 15% had contacted the Forest Service for advice. An additional support service that was being utilised in Donegal came in the form of a forest owner cooperative. In Donegal 62.5% of participants were members of a cooperative, this compares to a complete lack of membership of forest owner cooperatives among my NI participants. Interestingly, this is despite the fact that 100% of the NI participants had no problem with cooperating with other forest owners in marketing timber.

5.1.1.4 Market Knowledge.

Market knowledge is of vital importance to bringing timber to the market and most participants have good knowledge of the processes involved in marketing. 70% of participants in NI had thought about marketing products from their forest, this relatively high figure is repeated in Donegal with 87.5% of participants having given it some thought. The ways in which the individual forest owners went about marketing their forest product was considerably varied. At 70% most participants in NI would go about marketing the forest product via a private company, 10% would use advertisements in local press and the remainder 20% did not know. In contrast to the situation in NI, at 43%, most participants in Donegal would market the timber through a forest owner cooperative, 31% would market their product at events organised by the forestry service between purchasers and producers, the remaining 25% did not know how to go about market their timber product. Asked to give an opinion on the level of support available in marketing products the 65% of the participants in NI felt the support offered by the Forest Service was poor, this compares to 12.5% in Donegal. In Donegal the majority of participants were satisfied with the level of support being given, 62% acknowledged that the level of support was 'good'.

5.2 Research Question 2

5.2.1 Relevant Policies

In both regions I have presented the policies that have relevance to the development of bioenergy supply chains from private forestry.

5.2.1.1 The National Level

The definition of goals at European level is an important driver for the goals and strategies at national level (Rand, 2006) Within the UK it is the responsibility of the devolved administrations to meet national targets in renewable energy; this includes the NI government. Being part of the Republic of Ireland, county Donegal is affected by policies of the Irish government. I will be analysing the national policies that have relevance to developing bioenergy at the national level in both regions, in particular a designated role for private forestry.

5.2.1.2 NI Policy

The Department of Enterprise, Trade and Investment (DETI) has an overall responsibility for NI energy policy in the devolved administration. In 2009 DETI published the Strategic Energy Framework that sets a target of 10% of heat generated by renewable sources by 2020 (DETI, 2009). Being a predominately agricultural society, there is focus on renewable energy in the land based sector within the region. The Department of Agriculture and Rural Development (DARD) in 2009 published 'Renewable Energy in the Land Based Sector, A Way Forward', based on this report the, 'Renewable Energy Action Plan' was published in 2010. I have analysed the reports to and discovered that the role that private forests play in developing renewable energy in the land based sector is minimal. The 2009 report was written in consultation with the Agriculture Stakeholder Forum on Renewable Energy (ASFRE), in the list of members there is no representation from either private or public forestry. The report details the primary sources of biomass, this includes, 'the first thinning of young trees as part of forestry management... that can yield significant volumes for a biomass market' (DARD, 2009). There was no designating between public and private forestry, and there was no attempt made to estimate the volume of biomass that this resource could deliver. The report called on the necessity of mapping studies that must 'focus on the feedstock and natural resource availability... to ensure the development of supply chain activities' (DARD, 2009). There is no indication of the particular biomass resource that will be targeted and to date mapping studies undertaken have not included the private forest resource. One of the only direct references to private forestry in the report stated that there would be an 'encouragement of both private and publically owned forest to optimise the opportunities presented by renewable energy in terms of forest development and management and to recognise the potential biomass value of forestry' (DARD, 2009). This was going to be achieved using a number of commercial models including, 'working in partnership, learning from the pilot projects, breaking down the barriers, smoothing out the wrinkles and developing best practice models' (DARD, 2009)

5.2.1.3 Republic of Ireland Policy

In 2007 the Department of Marine and Natural Resources (DMNR) published an Energy White Paper, 'Delivering a sustainable Energy Future for Ireland'. Strategic goal number 4 involved 'Delivering an integrated approach to the sustainable use of bioenergy resources'. Within this goal there was a

direct designation of a role for private sector forestry, the goal aimed to ‘accelerate progress in developing a reliable supply chain in the wood energy sector for the private as well as the national forest estate’ (DMNR, 2007). The white paper also included renewable energy targets. Of relevance to the forestry sector a 12% renewable heat target including 10% from bioenergy. The significant policy document in the Republic of Ireland to developing bioenergy resources is the ‘Bioenergy Action Plan for Ireland’ published by the Ministerial Bioenergy Task Force in 2007. The report stipulates an important role for woody biomass in the National Bioenergy strategy. The report identifies private sector forestry as the most realistic source of wood energy given that the public sector supply is already destined for processing. The ‘Bioenergy Plan for Action’ makes a commitment to maintain high levels of afforestation in the private sector to ensure a sustainable supply of wood fuel. These direct references to the role of private forestry in national energy policy can be contrasted to the absence of the role that it is playing in energy policy in NI.

5.2.2 Policy Instruments

In both regions there is an array of policy instruments that attempt to stimulate the market for wood energy. There are schemes that support both the uptake of new renewable energy installations and schemes to support the fuel production and supply chains. Firstly, support for installations in the Republic comes with the ‘Greener Homes Scheme’; this policy instrument provides assistance to home owners who intend to purchase renewable energy heating systems for their homes. The ‘Renewable Heat Incentive’ is a similar scheme in Northern Ireland that provides ‘Renewable Heat Premium Payments’ to domestic households that have decided to install renewable heat technologies. The incentive comes in the form of tariffs per unit of heat produced; they will be paid to the owner of the heat installation (DETI, 2009). There are also policies that are directed at the growing of private woodland that has relevance to the stimulation of renewable energy supply chains. In Northern Ireland the ‘Woodland Grant Scheme’ offers a payment for establishing new forest. The ‘Farm Woodland Premium Scheme’ encourages the creation of new woodlands on farmland; it supplements loss of earnings from taking the land out of agriculture through annual payments. In NI the ‘Forestry micro-enterprise grant’, offers payments towards the buying of new machinery and equipment involved in the handling, storing or installing of wood fuel systems. These schemes are funded by DARD through the Rural Development Programme. In the Republic Forestry grants are available to ‘sustain and promote private forestry in the agricultural sector’ (NDP, 2007). The payments are part of the forestry programme (2007-2013) funded under the National Development Plan (NDP).

5.2.3 Implementation of Policy.

In this section I will be presenting the role of various government institutions in the bioenergy development strategies

5.2.3.1 Inter Departmental group on Renewable Heat

The creation of an Inter Departmental group on Renewable Heat by DETI is a response to the commitment to 10% renewable heat and is an example of the way in which the NI government is hoping to achieve horizontal policy coordination among the different sectors relevant to the development of bioenergy. The Bioenergy Action Plan states, ‘the bioenergy sector in NI may not reach its potential if there are legal, regulatory, operational or administrative factors which may act as inappropriate obstacle to growth. In promoting increased use of bioenergy there is a need for policies from different Departments to be aligned to facilitate sustainable Bioenergy development’ (DETI, 2011) In an interview with a representative from the group he stated that ‘coordination

between Departments is necessary to highlight areas of mutual interest and to ensure that renewable heating market is developed to its full potential. Financial incentives alone are not enough to stimulate the market'. He believed the necessity for coordination lay in the fact that, 'other Departments will have an interest in renewable heat as it supports their own work' The ability of this central coordinating mechanism in developing bioenergy from private forestry is limited by the fact that there is no direct representation of Northern Irish forestry in the group. Forest Service NI as an executive agency within the Department of Agriculture is not directly represented. I asked the representative the extent wood from private forestry was being included in the potential resource and also what was being done to encourage the use of private forestry in energy supply chains, for both answers the representative directed me towards the Department of Agriculture and Rural Development. I found it interesting that even though the representative had previously stated that one of the main reasons for the Inter Departmental Group was to establish a renewable heat supply chain, Northern Ireland Forestry either private or public sector had no direct representation.

5.2.3.2 Central governance mechanisms.

A key feature of the bioenergy strategy in NI is the use of central governance institutions that target investment in renewable heating technology.

5.2.3.3 Invest NI

Invest NI is an important agency within DETI and are represented in the Renewable Heat group. The group plays an important role in the development of renewable heat in the province and is an example of the role that centralised governance mechanisms that are being deployed to develop the market. In a questionnaire sent to Invest NI I was interested to discover their role in developing renewable heat supply chains. They defined their role as 'assisting local companies develop and deploy relevant technologies for the market - as well as help companies develop solutions that will lead to savings in energy consumption costs being realised'. Within the bioenergy sector, Invest NI was working with 'approximately 50 equipment supply chain companies, actively doing business with many more expressing an interest to do so'.

5.2.3.4 Carbon Trust

The Carbon Trust provides interest free loans to businesses in NI to facilitate the investment in energy saving projects. Its stated mission is to accelerate the move to a low carbon economy. In NI loans are administered centrally towards the purchase of low carbon technology including biomass heating systems.

5.2.4 Regional local institutions

In this section I will present the role that regional and local institutions play in the implementation of bioenergy policy.

5.2.4.1 Regional Institutions: NI

A report published by the UK Department of Energy and Climate Change (DECC) in 2009 placed an important emphasis on the role that Regional Development Agencies (RDAs) had in building the partnerships needed to develop supply chains in renewable energy development. The RDAs were tasked with facilitating partnerships with the 'forestry service, local authorities and a range of local delivery bodies'. To date no such facilitation has taken place in Northern Ireland.

5.2.4.2 Regional Institutions: ROI

A similar emphasis on regional development is found in the Republic's National Development Plan 2007-2013. 'Balanced Regional Development means supporting the economic and social

development of all regions in their efforts to achieve their full potential’(NDP, 2007) The National Spatial Strategy (NSS) summarises balanced regional development as ‘developing the full potential of each area to contribute to the optimal performance of the State as a whole –economically, socially and environmentally (NSS, 2002) This ethos of decentralisation has had a major influence on the way bioenergy policy is being implemented. Bioenergy policy implementation in the Republic is largely the responsibility of regional and local level government. The Western Development Commission (WDC) is responsible for implementing development initiatives in western Ireland, including county Donegal. The WDC made a commitment to the development of renewable energy resources in the region with a strategic decision to focus on the development of the wood energy sector. A Wood Energy Action Plan for the region was formulated. This included the establishment of a Regional Wood Advisory Group aimed at bringing together relevant agencies. The Action Plan implemented between 2007-2010 included;

- a wood energy awareness campaign
- establishment of wood fuel supply chains,
- a suppliers database
- detailed wood resource assessment
- grants available to establish fuel processing depots, chippers and delivery vehicles
- Regional target of 100MW of installed capacity.

(WDC, 2008)

5.2.4.3 Role of Local government: NI

The role that local authorities in NI play in developing the wood energy supply chain can be contrasted with the role that the local authorities in county Donegal are playing. I presented the results of a telephone survey for 9 District councils that ascertained the level of involvement in schemes to promote wood energy at a local authority level in NI. I presented the results in the table below below.

Local Council District	Installed Biomass Technology	Using locally supplied biomass	Creating awareness of private forest resource	Implementing a strategy to develop local private forest supply chain
Coleraine	x	x	x	x
Magherafelt	✓	✓	x	x
Cookstown	✓	✓	x	✓
Dungannon	x	x	x	x
Fermanagh	x	x	x	x
Omagh	✓	✓	x	x
Strabane	x	x	x	x
Derry	x	x	x	x
Limavady	x	x	x	x
Totals	✓=3	✓=3	✓=0	✓=1

Figure 16: Results of telephone survey conducted with 9 Local authorities in NI to ascertain involvement in biomass development initiatives.

The results of the survey indicate that only three councils have installed biomass heating systems in council operated premises. These three councils are using woodchip sourced from local forest resources. The only council that was implementing an integrated strategy to develop a private forest supply chain was Cookstown, however this particular strategy was not based on conventional

forestry resources, it was based on encouraging local farmers to plant short rotation coppice and supplied chipped willow to a local leisure facility. The majority of councils surveyed were implementing no public procurement policies aimed at stimulating the supply of biomass at a local level. There are no councils implementing initiatives to encourage the use of woody biomass from private forests in the supply of renewable heat.

5.2.4.4 Role of Local Government: Donegal

The local authority in Donegal plays a major role in the institutional framework governing the development of a local private forest wood energy resource. A wood energy development programme promoted by the local authority involved both actions aimed at establishing a wood energy market and the implementation of measures to develop the local wood energy supply chain. The ability of Donegal County Council to implement these policies came when city and county councils were given the lead role and responsibility for the establishment of County Development Boards (CBD) in 1999. The first task of each CBD was to prepare an integrated county development strategy to cover the Economic, Social and Cultural development in each county or city. A long term commitment to the development of wood energy was made within the county development strategy. The strategy aimed to 'to encourage the reduction and replacement of fossil fuels with renewable sources within the county wherever possible' (An Strateis, 2002). The forestry vision contained within the strategy recognises the need to 'develop and manage forestry as a natural resource in an economic, social and environmentally sustainable manner' (An Strateis, 2002). This aim was to be achieved through the pursuit of objectives relevant to the wood energy sector including 'investigating systems to produce quality timber and value added products' and also the examination of 'opportunities for job creation/enterprise development projects throughout the county'. Of relevance to the development of farm forestry was the goal 'to optimise the benefits of renewable resources to the farming community' (An Strateis,2002) A Forestry focus group and later in 2003 the forestry forum was set up to bring relevant forestry stakeholders together. These collaborations culminated in the 'Forest Link Project' and have resulted in the installation of 15 wood burning boiler systems over 100kw, with a total capacity of 4.4MW (WDC,2008) . Forest inventories commissioned under the 'Forest Link Project' designated a potential role for the mobilisation of wood from smaller scale private forests. Through the structures provided by the forum a number of meetings were held in different locations throughout the county, the meetings were aimed at private growers and aimed to highlight the need for the development of a more structured supply chain and also to assess the willingness of the private sector to participate in this type of arrangement. It was from these meetings that the Donegal Woodland Owners Society was established. The group is a private led wood fuel supply cooperative which supports and promotes sustainable forest management and timber marketing and with over 10,000 acres of private forestry the cooperative is organised on the basis of 'ground up' structures.

5.2.5 Role of Forestry Services

The respective forestry services are important institutions in the development of private sector wood energy because of their role in providing support services. I have compared the support services available in each region

5.2.5.1 Knowledge Services

The role that thinning operations have in providing the wood energy resource has been highlighted. To undertake thinning operations a certain amount of forestry knowledge is required. I wanted to compare the services that were available to private forest owners in each region to help with the

lack of forestry knowledge. There is no specific advisory service available to forest owners in NI, private forest owners can request advice through telephoning or emailing a customer service department. In addition to the advice private forest owners can request information leaflets on various types of management activities. There was no training programmes available aimed at creating the necessary knowledge needed to manage the woodland or the necessary skills needed to carry out management operations. The representative of the Forest Service commented that because of the relatively small area of private woodland in NI, enquiries into woodland management are taken care of by private sector forestry agencies. The services available in Donegal were numerous. In table 4 below you can see the wide range of training courses that forest owners could avail of free of charge and are available in different locations throughout the country.

Course Title	
I.	Introduction to Farm Forestry
II.	Management of Young Plantations
III.	Management of Plantations Older than 4 Years
IV.	Amenity Woodlands
V.	Weed Control in Forestry
VI.	Introduction to Sustainable Forestry Management
VII.	Introduction to Hedge Planting, Management and Regeneration
VIII.	Formative Shaping
IX.	High Pruning
X.	Forestry Plants and Planting
XI.	Forest Fencing

Figure 17: List of courses run by Teagasc available to forest owners (Teagasc,2011)

One to one mentoring services are available to local development officers. The local development officers also organise group meetings between individual forest owners. In addition to the services that focused on general forest knowledge, wood energy workshops, technical training programmes aimed specifically at the knowledge needed to grow, process and market wood fuel were available.

5.2.5.2 Available Data

The development of a market for timber coming out of private forests is dependent on up to date information. The responsibility for creating this data largely lies with the forestry services. In NI the last formal inventory of woodland was taken in 1975. The estimation of private woodland in the region has been based on adding up the amount of grant aided forest creation since this year. This figure does not take into account the woodland that may have been created outside the grant scheme and also the woodland that may have been removed since then. There has never been a production forecast done for private forestry in NI, the level of timber being produced by private forests is calculated by information provided by end users in the timber processing industries. This can be contrasted with the information being made available by forestry services in the Republic. In 2007 the Irish government commissioned a 'National forest inventory'. In 2012 the 'FORECAST Project' funded by the Irish government has had the task of forecasting the private sector timber supply.

5.2.5.3 Supporting forestry operations

Forestry operations in private forests can be expensive to the individual owner. I wanted to contrast the support being given to private foresters to achieving economies of scale in thinning and harvesting operations. A common way to achieve these efficiencies is the setting up of cooperatives and timber producing groups. In NI there is no specific support being offered to private foresters to make thinning and harvesting operations more commercially viable. The Teagasc forestry development officer felt it was in his remit to help set up producer groups and organise 'clusters' of private forests in an attempt to achieve economies of scale.

5.2.5.4 Supporting timber marketing

Forest Service NI does play a role in advising private growers about the potential markets for their timber and they will provide potential end users that are interested in private sector timber with supply details. However, the NI Forest Service representative explained that 'It is very much up to the individual land owner to make contact and engage in business'. Teagasc play a similar supporting role, he agreed that it was inappropriate 'to act as an agent on behalf of a grower because his role is very much independent and non-commercial'. However, his role does extend to the setting up seminars and events between private forest owners, timber buyers, forestry companies and harvesting contractors. He explained that at these events people 'could meet up, get to know each other and hopefully do deals'.

5.2.5.4 Promoting wood energy

Finally I want to contrast the specific role that the respective forest services have in promoting wood energy. The Forest Service NI are involved in a number of schemes to promote wood energy, however, these are exclusively being targeted at the use of Short Rotation Coppice, there is no bioenergy schemes involving conventional forestry. The Forest Service representative was very cautious about supporting the development of wood energy. He explained that the development of wood energy 'has very much been market driven and where the market works, and the end user is assured the supply chain develops because there is a business opportunity'. He added that, 'one thing I would be very cautious of is making provisions for the entrepreneurial development of the business, whereas if one removes the risk of growing the wood, if one removes the risk of developing the supply chain, if one removes the risk of marketing the wood there is no entrepreneurship left and it is all underwritten by government... what government should not be doing is underwriting the whole scheme and development collapses because it is not sustainable'. In Donegal Teagasc was a central player in the development of wood energy in the region. The Donegal Wood Energy project was instigated and coordinated by Teagasc and had the aim of developing a market for thinning from private forestry. Below the table compares the support services available in each region.

Support Service	NI	Donegal
Advisory Services	✓	✓
Training programmes	✗	✓
Group seminars	✗	✓
Wood energy workshops	✗	✓
Up to date data	✗	✓
Setting up owner groups	✗	✓
Marketing advice	✗	✓
Sales Events	✗	✓
Promotion of wood energy from established wood land	✗	✓
Promotion of wood energy from short rotation coppice	✗	✓

Figure 18: Comparison of support services available to the forest owner in NI and Donegal

Analysis

In the analysis section I will be using a transition management perspective to compare the processes that are influencing private forest owners' participation in the production of renewable energy. The utilisation of private forestry in renewable energy supply chains involves transition process that contains multiple actors within a societal subsystem. Transition theorists highlight how the 'socio-technical regime forms the deep structure that accounts for the stability of an existing socio-technical system' (Geels, 2004). The regime has the power to structure the agency of actors because the effective development of a regime lies not simply in the agency of individual members, but the norms and procedures governing their structured relationships and interdependencies (Smith et al, 2005). In the first part of the analysis section I will be taking an agent based approach in investigating the results of the private forester questionnaire. In taking this approach I will compare the potential of the private forest owner to deliver a wood energy resource in the two regions. The transformation processes involved in this transition will ultimately be chosen by the private sector foresters; however governments can play a role in bringing about structural change in a step wise manner (Rotmans 2001). Therefore, in the following section I will be analysing the differences through an investigation of the possible structural conditions that have produced the variations I have discovered in the private forester survey. There will be a focus on the governance processes involved in developing bioenergy supply chains and on how conditions for enabling societal innovations for fundamental system change in the long term are being created (Florian, 2012) An identification of the structuration processes will involve firstly, a comparison of the respective forest services and secondly, the role that various state institutions are playing in steering the transformation of socio-technical systems. Finally, I will be evaluating the specific governance strategies being pursued in the two regions, in particular their ability to influence the transition to a socio-technical regime reliant on the utilisation of wood energy from private forests.

6.1 The role of Private forest owners

The role that the individual private forest owner is crucial in delivering the potential wood energy resource. In this section I will be using the results of the private forest questionnaire to compare the ability of the forest owner in the two regions in delivering a wood energy resource.

6.1.1 Size of Forest Unit

The substantial difference in unit size of the private forest resource in NI affects the ability of the forest unit to be used in the supply of wood energy. An average size of 5.8ha in NI can be compared with an average of 21.5ha in Donegal. This compares to a European average of 12.7ha. The smaller NI units will find it difficult to achieve efficiencies in thinning and harvesting operations because of plantation size. The sale of timber usually covers the cost of thinning and generates a profit for the forest owner. Because of the small size of forest unit, sales of the timber produced may not be a sufficient volume to cover expense involved in conducting thinning operations. This presents a major barrier to the production of wood energy from private forestry in NI, the forest owner may be unwilling to conduct the thinning operation if it is not cost effective. The much larger size of forest unit found in Donegal increases their opportunity in achieving economies of scale.

6.1.2 Importance of Cooperatives

The involvement with a cooperative greatly increases the Donegal forest owner's ability of achieving economies of scale in thinning operations. Given the smaller individual forest unit the necessity of participation in a cooperative is much more pronounced in the smaller individual forest units. Despite the fact that 100% of the NI participants declared an interest in being a part of a cooperative, no individual was a member of one. In Donegal, well over half the participants were members of a wood growing cooperative. Involvement in cooperatives increases the ability of the individual forest owner to supply wood energy as the membership of a wood growing cooperative enables the forest owner to share knowledge, machinery and achieve better prices for timber through joint marketing.

6.1.3 Species Composition

I discovered differences in the species of tree planted in the two regions and this has an effect on the capacity of the forest owners to contribute the wood energy markets. In NI my sample population was dominated by mixed broadleaved; in particular ash. In Donegal 15 of the 16 participants were growing Sitka spruce only. The ash tree is prominent because of fast growing qualities and the tolerance of most soils, including fairly damp. Sitka spruce is normally grown specifically for commercial purposes. It is particularly favoured for its fast growth on poor soils. There is no barriers preventing either of the species from being utilised as wood energy, however the Sitka spruce has a better 'yield class'. The yield class figure is the mean cubic metres growth, for each hectare of tree species for each year's growth (Forestry Commission) Ash usually has a yield class figure of 4-8, meaning that there will be 4-8 cubic metres per hectare per year. The yield class figure for Sitka spruce is almost double at 14 cubic metres per hectare per year. The predominance of Sitka spruce greatly increases the individual forest owner in Donegal's ability to conduct thinning operations because a greater revenue stream from thinning operations can be generated.

6.1.4 Long term Economic Investment

In both regions the results for 'reasons for planting' show a predominance of long term economic investment. Often woodland is planted in unproductive parts of the land holding and growing trees is a good way of putting this land to use. It is entirely expectant that making more economic use of the land to be significant reason for planting, however, I expected a major barrier to producing wood energy from private forests to be individuals who want to avail of the grants and have no motivation to produce timber. The results of the survey disproved this hypothesis. There were few owners prioritising the availing of grants as a reason for planting in both regions. On the contrary, I discovered that in both regions the forest plantations were part of long term investments and that the production of timber for sale was a significant reason for planting. In both regions the likelihood

that the timber being grown could contribute to the supply of wood energy is increased by the fact that a significant majority of owners are engaged in forestry as a long term investment and also the fact that all the owners are interested in making sales of timber.

6.1.5 Management Skills

In comparing the management skills of the private forest owners there was a big difference between the two regions. The production of wood energy from private forests is dependent on the capability of individual forest owners to know when and where to carry out management activities. Even though for participants in NI the sale of timber was a priority, in analysing the levels of forest management I discovered that 45% did not know any management activities that increased the quality of the timber, this compares to all of participants in Donegal knowing some interventions to increase timber quality. There are also big differences in confidence of forest owners in their ability to conduct wood land management operations. The majority of participants in NI felt they had minimal skills, very few had a management plans and just over half had never engaged in any management activities. The fact that 75% of woodland owners in the Donegal sample have a management plan and that the vast majority carry out management activities have implications on the potential of these plantations to contribute to the wood energy market. Wood energy from private forests is dependent on the carrying out of management activities in the woodland; in Donegal we see a much more active forest owner, consequently it is more likely that this forest owner will be looking for a market for the timber being produced through this active management and a possible outlet is the wood energy market. In NI, I have discovered a forest owner lacking the skills and knowledge necessary to carry out the management activities; this will have negative implications on the private forest being used in the supply of wood energy in the region.

6.1.6 Importance of support Services

There was a marked difference in role that support services were playing in the two regions. This can potentially be related to the different levels of knowledge and management skills that I have discovered. In a country where forest ownership is not a tradition, support services are key in providing advice and training to the private sector. The level of support has a significant impact on the awareness of private owners in managing the plantation for the production of wood fuel and specific training services aimed at private forest owners would greatly help with the lack of knowledge and skills required. The lack of confidence in forest management amongst NI participants discovered in the previous section may be explained by a lack of attendance in forestry training courses, and also the unawareness of advisory services offered by the Forest Service. In Donegal the high level of participation in forestry training along with the membership of forestry cooperatives means that support services are facilitating the creation of necessary skills and knowledge necessary to manage the forest plantations towards the production of wood energy.

6.1.7 Market knowledge

The results indicate differences in the way timber is marketed both within and between regions. The private forester usually does not specialise in the production of timber. Timber Sales are usually something that the private forester has to think about on a limited number of occasions because of the economics involved in small scales of production. If the private forester is going to contribute to the wood energy market, it is necessary to have a certain amount of market knowledge in order to do business. In both regions the majority of participants had given some thought to the products that their forest produced. In each region I discovered various ways that private forest owners would enter wood into the market. In NI it was done mostly through the use of a private company and in Donegal it was mostly done through the forest cooperative. In NI there is a high level of dissatisfaction with the support being offered by the forest service in marketing their

wood products. With no cooperative and a lack of support from forest services the private forester in NI is at a disadvantage in marketing products, this has ramifications on the potential of the private forest resource being used for wood energy in the region.

6.1.8 Bioenergy production potential.

Analysis of the results of the private forest questionnaire clearly show a big difference in the ability of the private forest owners in the two regions to act as agents in the transformation of a socio-technical regime locked in to the use of non-renewable heating fuel. In the next section I will be interpreting these differences in the context of the way that transition processes are being governed in the two regions, to do this an understanding of the relationship between agency and structure in the transformation of socio-technical regimes is necessary.

6.2 Structuration Processes

It is clear that private forest owners in Donegal are more capable of providing wood for energy purposes. In this section I will be interpreting these differences in the context of the way that transition processes are being governed in the two regions, I will investigate the structuration processes that are providing both opportunities and constraints to the private forest owner.

6.2.1 Role of government in Transition Management

In comparing the role that private forestry is playing in producing renewable energy in the two regions I believe that both the policies and the institutions they are being implemented through are having a significant bearing on the capacity of the individual private forest owner in taking part in the supply of bioenergy. Government plays a central role in regime transformation as change is shaped from within the regime itself, state actors rely upon non-state actors in the formulation and implementation of policy transitions are 'steered by the interests, values, cognitive structures and problem solving routines prevailing in the incumbent regime' (Smith et al, 2005). Transition theorists point to a two fold role for governments in transition management. The first is to realise content objectives; with regard to developing bioenergy resources the governments in the two regions are doing this through renewable energy targets and targets for carbon emissions. Secondly, the government plays a process role aimed at stimulating and organizing the transition process. (Rotmans,2001) In spite of a very similar approach to defining content objectives within the two respective governments their role in the transition process is markedly different. The structuration processes being implemented by each government are creating very different opportunities for the transition participants and are reflected in the different levels of mobilisation among private foresters towards the production of bioenergy (Rotmans 2001). I will firstly be looking at the significance of the support services being offered by the publically funded forest services. I will then pay close attention to analysing the contexts in which regime transformation is occurring within the two regions. I will be placing the governance strategies into appropriate paradigms distinguished by policy scientists. In NI I will be comparing the prevalent 'top down model' which gives a central role for national government and hierarchal relations and a 'governance or network model with shared rule making and agreements between interdependent actors with divergent views and beliefs', that I have found in the Donegal region (Wieczorech, 2005).

6.2.2 Significance of a supportive forest service

In analysing the results of the private forester questionnaire I believe there is a direct link between the ability of the private forest owners to conduct the necessary management operations and the

levels of support being made available by forest services in each region. The inactivity of the NI Forest service in providing training and education services to private owners can be linked to the differences in levels of knowledge that I have discovered. In NI the forest service representative stated, 'the achievement in efficiencies in management is up to the individual private owner'. Forest Service NI also has no role in clustering different private growers together and no role in the setting up of private forest owner cooperatives. This inactivity can be directly contrasted to the role that Teagasc plays in Donegal. The Teagasc forest development officer stated, 'because of the character of private forests it would be a very important aspect of my job to improve competitiveness for the simple reason that the private forest estate is extremely fragmented.... it would be very important to improve the economy of scale through the setting up of forest owner groups where people can work together'. The inactivity of Forest Service NI in conducting up to date inventories and forecasting estimations in the private sector also has huge implications on the ability of the private forestry resource to be considered in strategies to develop bioenergy resources. The Teagasc forestry development officer commented that the availability of 'correct, up to date and measurable data was essential in the ability to set correct policy objectives and coming up with an effective programme for delivering on those objectives'. The fact that this information does not exist for NI private forests makes it more difficult to include the resource in developing and implementing bioenergy policy at a national level and also in the ability to develop localized wood energy initiatives.

6.2.3 Governance Strategies

In this section I will be comparing the different governance strategies being implemented and evaluating the affect that this is having on the transition towards greater use of private sector bioenergy.

6.2.3.1 Northern Ireland: Top down Model.

The traditional top down model that gives a central role for national government and hierarchical relations involves an increase of the control of processes from a central steering unit. Usually this is achieved through standardized planning systems and regulation and the use of subsidies and financial incentives in a market model (Elzen,2004). I will be analysing how this model is being used to structure the transition process in the development of bioenergy resources in NI.

6.2.3.1.1 Renewable Heat Incentive (RHI)

The 'top down model' of transition governance can be seen in the issuing of the RHI by the NI executive. This financial tool is aimed at maximising the uptake of renewable heating technologies. This liberal free market approach can be found within the neo classical economics discourse in energy policy around market efficiency, externalities and market failures. The market failures associated with eco innovation create a risk that firms will lack the incentives to invest in the new technology. The RHI is central governments attempt at providing support to help overcome these risks of investing in low carbon technology and steer the transition towards increased bioenergy use by targeting demand. The thinking behind this policy initiative is that through a targeting of demand the supply of bioenergy will be stimulated.

6.2.3.1.2 Carbon Trust

The remit of the Carbon Trust has been defined as 'accelerating the move to a low carbon economy'. The Carbon Trust can also be found in within the neo classical economics discourse in energy policy.

Florian (2012) has argued that through the establishment of the Carbon Trust the need for business led, business focused support for low carbon technology were institutionalised. He adds ‘the need to institutionalise this neoclassical approach to energy policy came with the gradual movement towards devolution and greater autonomy for Scotland, NI and Wales and a divergence away from the centralist Westminster model where neo classical economics was the dominant discourse in energy policy’. The Carbon Trust contributes to the way in which the ‘top down model’ of restructuring socio-technical regimes has been institutionalised and again is targeting the demand of the bioenergy.

6.2.3.1.3 Policy Coordination

The transformation process put in place to develop bioenergy in NI has an emphasis on the central horizontal coordination between the relevant government departments. The institutional framework governing the utilisation of private forestry in wood energy supply chains involves an overlapping of objectives many of different policy domains including rural development, energy and agriculture. In NI Figure 19 displays the complexity of the institutional framework governing the development of wood bioenergy. Weiss (2010) states, ‘whether these policies are complementary, mutually beneficiary, duplicating, or contradictory depends among others on how goals, actors, instruments and procedures of these policies and sectors are coordinated at different levels’ Peters (1998) also stresses the importance of policy coordination. He states ‘its aim is to create a greater coherence in policy, and to reduce redundancy, lacunae and contradictions within and between policies’. The creation of the interdepartmental renewable heat group can be seen as an institutional innovation that created a significantly modified procedure in developing and implementing policy. This can be seen as part of a traditional approach of steering in public administration through an increase in control of processes from a central steering unit (Teisman, 2004)

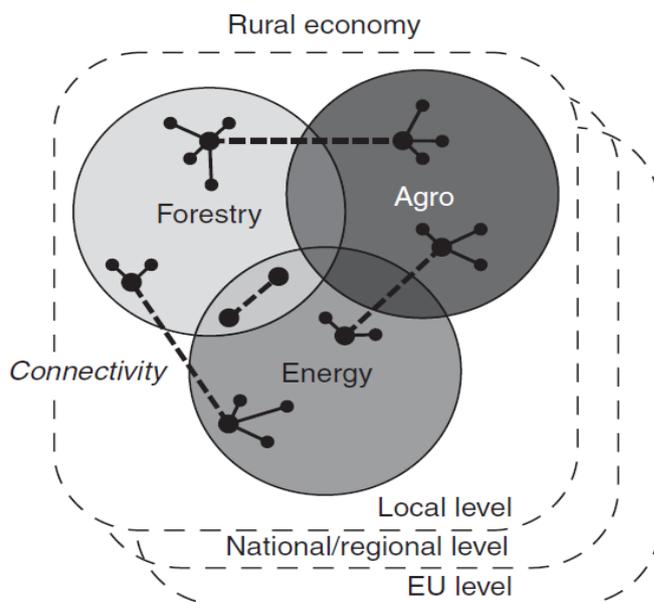


Figure 19: Diagram showing the landscape approach to integrated rural development policy.

6.2.3.2 Consequences of Central Approach

The top down approach is having detrimental consequences to the development of private forestry bioenergy supply chains for the following reasons.

6.2.3.2.1 Vagueness in policy

The issuing of central policy in the form of policy documents and action plans is the favoured method of governing the development of bioenergy in NI. In attempting to gauge the relevance of private forestry towards the development of renewable energy resources the action plan is vague. The development of biomass from private forestry was going to be achieved using commercial models including ‘working in partnership, learning from the pilot projects, breaking down the barriers, smoothing out the wrinkles and developing best practice models’ (DARD,2009) This is a very vague plan of action, it does not identify who the main stakeholders in the proposed partnership are, gives no detail of the type of barriers that are being faced and the use of the phrase ‘smoothing out the wrinkles’ is very ambiguous and gives no clear indication exactly what is involved. When the policy is being administered so centrally it is not being effectively communicated to the relevant stakeholders, the publication of these sorts of action plans is nothing more than rhetoric.

6.2.3.2.2 Departmentalism

By pursuing the development of bioenergy through a centralised government steering unit I have found that the government cannot escape a departmentalised approach and this is having severe consequences in the development of private forest bioenergy. In addition to having no direct representation in the renewable heat group for forestry, I discovered that the representative was not confident in answering questions about the role that private forest would play in the supply of bioenergy; he directed me towards another government department. Despite having the aim of coordinating policy through the renewable heat group I found that a highly departmentalised approach remained where each department has its own tasks and responsibilities, problems were being seen as narrowly as possible, independent from their context and independent from their connections with other problems (Teisman,2004). Despite being a central part of the renewable heat strategy the group had only met twice in 2011 and had no plan to meet in 2012, this is symptomatic of central departmentalisation where there is minimum amount of exchanges taking place between the boundaries between the departments and a process where problems are carved into pieces that are assigned to specialists who work in isolation.

6.2.3.2.3 Vertical Coordination

The ‘top down’ approach to developing bioenergy being pursued by the NI executive has consequences in the ability to cooperate between the different institutional layers and external cooperation with stakeholders. The institutional framework governing the development of bioenergy resources is also characterised by an array of institutional levels (See Figure 19 above). The EU at the Suprastate level dictates policy development at the national government level through the issue of policy directives and mandatory targets. This has significance to the way in which renewable energy policy is generated. The national government issues action plans and directives on the specific way the targets will be met. The national government also communicates with institutions at a Sub-state level and designates a role in contributing to the attainment of targets at a more local level. The central steering of the renewable heat agenda is causing difficulties in performing boundary crossing activities; this has been demonstrated by my survey of local councils and the virtual disengagement of local authorities and potential stakeholder’s in the development of bioenergy supply chains.

6.2.3.3 Transition Management Perspective

There is a growing consensus in governance research that ‘the power of central government to develop and implement policies in a top down manner has decreased’ (Loorbach, 2010) The ‘top down’ steering by government and the pursuit of a liberal free market approach to the development of bioenergy are increasingly being seen as ‘outmoded as effective management mechanisms to generate sustainable solutions at the societal level by themselves’ (Loorbach 2010). Medowcraft (2012) states that ‘precisely because they are open-ended, uncertain and partly emergent processes, sustainability transitions cannot be governed in a linear manner with simple objectives and targets following regular implementation models’. An alternative to established governance approaches has been presented by theorists in transition management. Theorists in transition management including Medowcraft (2012) suggest that a ‘planning control approach and the use of economic incentives are likely to be too weak and probably to general too promote system innovation’. Transition management is presented as an alternative to this type of ‘top down’ steering, transition management requires a new mode of governance that ‘reduces the lack of direction and coordination associated with governance networks in general and increase the effect of existing forms of government and planning in the context of long term change in society’ (Loorbach 2010). This approach ‘implies a new balance between ‘state, market and society and new ways to facilitate and make as effective as possible the informal network processes through which alternative ideas and agendas are generated’ (Loorbach 2010). In the next section of analysis I will be demonstrating how the ‘policy network’ model governing the development of bioenergy in Donegal has resulted in the ascendancy of self-directing alliances and the redundancy of the more traditional central steering in controlling the transition processes.

6.2.4 Policy network model: Donegal

The policy network paradigm implies a need to engage various types of actors into the governance process (Weiczorek, 2005) In contrast to the ‘top down’ model the government does not act as great commander enforcing change, network governance is governing with and through networks. Policy network involves the strategy of process management that aims ‘at organising and facilitating interaction processes among interdependent actors within networks in order to enhance collaboration and the realisation of win-win situations’(Florin, 2012). I will be analysing the strengths of using this model in developing bioenergy supply chains in Donegal.

6.2.4.1 Policy Networks and Bioenergy

There are particular logistical constraints that determine the success of this type of policy model with regards bioenergy. The availability of natural resources in a particular area is at the base of all innovations in the bioenergy sector. Woody biomass is characterised by a low bulk density, this causes restrictions in supplying the resource. ‘Stable economic ties to biomass suppliers within a delimited area surrounding the energy conversion systems are usually vital for securing constant and affordable feedstock supply’ (Gold, 2010) Consequently, the development of a wood energy supply chain is not only dependent on the abundance of the natural resource but on an awareness by local actors in their potential role in delivering the wood. The awareness of local actors in the Donegal region was delivered by the implementation of policies geared towards the creation of collaborative partnerships that included both the supply of the biomass feedstock and the eventual end users.

6.2.4.2 Decentralised systems of governance

The institutional support required to organise and facilitate the operating of the policy network model is promoted better through decentralised systems of government. In Donegal the formation of a bottom up partnership approach to the development of wood energy was reliant upon the institutional support being given by the local authority. The decentralised implementation of bioenergy policy is superior to the centralised 'command and control' policies seen in NI on several points. Local government is better placed to address aspects such as multi-actor involvement and the complexity of innovation processes (Proost et al., 2009) Local authorities are in a better position to detect local problems and develop locally tailored projects as they were closer to the economic and social realities on the ground (Proost et al, 2008). The local authority representative interviewed also pointed out the involvement of the local authority generated confidence amongst the relevant stakeholders which in turn supported the application of long term planning.

6.2.4.3 Mobilisation of local Actors

Actors must be mobilised in the direction of the transition objective. The government has to stimulate learning processes and provide the mechanisms for collaboration between the relevant stakeholders. The consultation process initiated by the county council in 1999 to guide and inform policy makers preparing the county development strategy involved bringing together the relevant forestry stakeholders in the region. The Forest Focus group involved interactive learning processes between the different stakeholders and it was through this partnership approach that the wood energy market was seen as a significant opportunity for forestry in the region. In an interview with a representative of the Donegal County Council involved with the development strategy the reason for this particular approach was alluded to, he said, 'The thinking behind the establishment of the City / County Development Boards was that agencies on the ground at that time were working on their own agendas, reporting up the line to their parent departments, very little collaboration was happening between groups, the CDB's were there to facilitate collaborative actions between all the stakeholders in each city or county, Forestry is an example of where that worked well, the various stakeholders have worked well together in developing forestry in the county'. The establishment of the Forestry Forum in 2003 involved the same partnership approach and had the task of delivering the relevant development objectives for forestry contained within the county development strategy. Through the CDB Forestry Group and later the Forestry Forum, the forestry sector was coordinated towards the development of wood energy in the region. Through localised learning processes local stakeholders were identifying common problems and opportunities and searching for solutions collectively.

6.2.4.4 Interactive Learning and Knowledge Networks.

In order for the policy network approach to be successful important micro interactions have to take place. 'Interactive learning and networks have to be crucial constituents of transition management' (Weikzorek, 2005) 'The policy networks paradigm implies a need to engage various types of actors into the governance process and start a process of vision building and learning' (Weikzorek, 2005) The development of wood energy in Donegal was conceived through networks that allowed for face to face interactions between the different stakeholders in the country with an interest in forestry. 'The Forestry Group' established in 1999 and the 'Forestry Forum' established in 2002 allowed for the creation of a space where knowledge exchange and accumulation could happen. The Teagasc forest development officer was also involved in the collaborations and confirmed the importance of

knowledge networks. He said, 'the expertise and knowledge that is available to all agencies is vital, when you start to combine all of that, gathering all this knowledge together is very important'. The organisation of knowledge networks is crucial to any collective action. 'This is only possible by doing, practising collectively' (Brunori et al, 2009) He adds, 'this is not an easy task. Actors have different interests, roles and path dependent behaviour. They are inspired by different sets of norms, values and hitherto experiences'. The function of the networking process is to attempt to break barriers and bring actors and their competencies together. This was confirmed by the Forestry development officer when referring to the advantages of the collaborative partnership approach to developing wood energy in the region. He said, 'many people underestimate the fact that every agency and every individual tend to feel that their approach and their path is the most important, but when you are sitting down with different organisations and agencies you are looking at it from slightly different angles, you actually realise that there are other very important objectives and parameters that you keep in mind and the more that you can discuss were your strengths and weaknesses are and were there might be an instance for potential conflict the sooner and earlier on you can figure out all those issues the more successful your strategy will be, and the stronger it will be'.

6.2.4.5 Transition Management Perspective

The ability of central government to steer transitions was questioned with reference to the NI development of bioenergy supply chains in the previous section. Termeer (2012) argues that 'it has become common in the field of public administration to promote a shift from hierarchical and well institutionalised forms of government towards less formalised forms of governance in which state authority makes way for an appreciation of mutual independence in policy relations'. Policy networks are new modes of governance that reduce the lack of direction and coordination associated with governance networks in general and increase the effect of existing forms of government and planning in the context of long term change in society (Loorbach, 2010). The underlying assumption in the network governance approach is that 'through intervening at the micro level of interaction, actors can negotiate agreements and bring about structural processes of change in a problem domain' (Termeer, 2012) In the development of bioenergy in Donegal an external entity of private and public decision makers was created through the Forestry Forum and the 'Forest Link Project'. These entities were given the responsibility for transition management. Far from becoming redundant the public authority had facilitating roles in building the networks, disseminating information and managing the agenda towards the most desirable and sustainable direction to be followed (Weikzorek, 2005).

Conclusions

The development of a wood energy market supplied by private forest resources has the potential to create a variety of benefits. Supplying wood energy has the potential to offer the private forest owner many benefits especially in providing a market for low value timber produced in thinning operations. Contributing to a wood energy market would allow thinning to be done earlier and generate revenue at an earlier stage of rotation, this would also have a positive impact on stand stability and ultimately increase the quality of the timber being grown allowing for the generation of increased revenue when harvesting in the future. An established wood market would contribute to rural development. The 'local loops' of demand and supply contribute to the regional economies by keeping investments within the local communities. Environmental benefits include the reduction of carbon emissions. Carbon sequestration could also be improved by providing incentives to land

owners to create more woodland. In this study both regions are dedicated to achieving the benefits that a transition to locally resourced wood energy would accrue, however the governance processes being implemented to achieve the transition is influencing the ability of the private forest owners participation in change. I have found that the following parameters are essential in enabling private forest to be utilised in energy supply chains.

7.1 Supportive Frameworks

The development of wood energy from private forests is ultimately dependent on the agency of forest owners to decide on management activities and wood markets. However, I have demonstrated the importance of structurization processes that provide support frameworks and play a vital role in motivating private foresters to manage and utilise their forests. The wood energy resource available in privately owned forests is mainly characterised by small ownership structures, owners with low motivation and limited skills/ knowledge on forest management. The differences in forest management activity in the two regions can largely explained by the availability of systems of support. In countries with no tradition of forestry, private forest owners are reliant on sound information on forest management options. In the Republic I have demonstrated the role of the 'Forest Services' in identifying knowledge gaps in private forestry. Through information campaigns and training schemes the capacity of the forest owner to foster wood mobilisation is being increased. The awareness amongst private owners of the possibilities of using first thinning for energy is being targeted. The lack of availability of this type of support in NI is creating a forest owner without the necessary levels of skills and knowledge necessary to begin mobilising timber from their plantations. The targeted distribution of up to date technical information is also essential to enhancing forest management practices and wood mobilisation. In the Republic inventories that identify the reserves of timber from private forestry are vital in being able to include these resources in the strategic planning necessary in the production of energy. The lack of appropriate data in NI makes it difficult to include private forestry in implementing bioenergy developmental action plans. I also found that forest owner groups were an important support instrument to cope with fragmentation of private forest properties and increase the market supply of wood. In Donegal the forester owner association is enabling private growers to achieve better economies of scale in the marketing of timber. The lack of forest owner association in NI inhibits the attainment of these advantages.

7.2 Transition Management Policy

The governance strategies being used in the transition towards greater use of private forestry in renewable heat supply chains has been contrasted. I have compared a more centralised steering approach of the NI government with a more localised focus on managing networks between the relevant stakeholders in Donegal. I have demonstrated the importance of a more localised approach. At the national level implementing initiatives to link the demand and supply of bioenergy becomes infinitely more complex, I discovered that a more effective way of enabling wood energy from private forests to contribute to EU and national targets on bioenergy is if the targets are translated into a regional and local context. Giving regional decision makers the ability to develop their own bioenergy resources allows development to take place in the most appropriate and effective manner because they have a greater awareness of local conditions and characteristics. This is particularly relevant in the development of the local loops of supply and demand necessary in the supply of wood energy, approached from a regional level stakeholders are better placed to achieve the efficient, sustainable deployment of the resource.

7.3 Need for Partnerships

The success of the policy network approach being taken in Donegal is due to its ability to facilitate the formation of partnerships. Partnerships are required in delivering wood energy from a private forest not only because of the fragmented nature of ownership of the resource but also due to the systematic harmonies between supply and demand that is necessary. The wood energy market is

vulnerable to disparities between supply and demand. The linear approach to developing the bioenergy market in NI focuses almost exclusively on issuing financial incentives to the end user in an effort to affect demand for bioenergy. These policies need to be reformed in order to take account the need to facilitate processes that produce partnerships and consultations across the entire supply chain. I have shown that the utilisation of private forestry in wood energy supply chains requires partnerships between forest owners and also effective cross agency working arrangements with end users. Effective partnerships create the harmony that is needed between supply and demand. Decentralised governance mechanisms are necessary in creating localised wood energy initiatives, in Donegal I found that these initiatives are fertile ground for the creation of reinforcing feedback loops. As partnerships begin to deliver tangible benefits to local communities a momentum in the project is created and the necessary partnerships are made more robust. Local government is ideally placed to spearhead initiatives by providing a coherent policy framework to promote development of the sector.

Appendix 1: Woodland Owner Questionnaire

Dear Sir/Madame,

I am currently conducting research on private forestry plantations as part of a Masters thesis. I would be very grateful if you could fill out the following questionnaire designed for private woodland owners. Information contained in this survey will only be used to contribute to my research and will not be shared. **Please tick the appropriate box where provided.**

Background information

- Sex: Male Female
- Age: <20 21>40 41>60 61>80
- Occupation- Farmer Professional Labourer Retired Unemployed
- Have you ever taken part in any agricultural training? Yes No
- Are you a member of any farming groups? Yes No
- If yes, which group/groups?

-
- Are you a member of any forestry groups? Yes No
 - If yes, which group/groups?
-

Description of forest unit

- Area: _____
- Species planted: _____

- Age: _____

Reasons for planting

-Prioritize your reasons for planting and owning a forest 1-5

- Avail of grants _____
- Investment _____
- Reduce farm work _____
- Make economic use of the land _____
- Like trees _____
- If other please state below

-Is your forest more for: -Short term financial gain? -Long term investment?

-What function does your forest provide?

- Monetary
- And/or non-monetary

Which statement is applicable to the plans for your woodland? Please answer yes or no.

- Production of timber for sale. Yes No
- Production of timber for domestic use. Yes No
- Recreation for family. Yes No
- Recreation for others. Yes No
- Cover for game and wildlife. Yes No
- Landscaping. Yes No
- Shelter. Yes No

To what extent is the potential income from timber a motivating factor?

Forest Management

How would you regard your forest management skills?

- Advanced
- Basic
- Minimal

Do you have a management plan for your woodland? Yes No

Do you own adequate machinery and tools to carry out management activities?

Yes No

What woodland management activities are being implemented in the woodland?

What woodland management activities would influence the quality of the timber being produced in your plantation?

Are you aware of services available to you that offer guidance/advice? Yes No

Do you know the forestry service adviser in your area? Yes No

Have you ever contacted forest service for advice on forest management? Yes No

Have you ever attended training courses on forest management skills? Yes No

Have you ever attended field days organised by the Forest Service? Yes No

If you have answered yes did you find these services beneficial and in what ways?

If you have answered no is there any particular reason for non-attendance?

Market Knowledge

Have you ever given any thought to the potential products that your woodland contains?

Yes No

If yes, which products could your woodland potentially provide?

How would you go about marketing your forest product?

What challenges does the private forest owner face in marketing forest products?

How do you think these challenges can be best overcome?

What is your opinion on the level of support available about marketing your wood resource?

Would you be opposed to cooperating with other forest owners in marketing your wood product? Yes No

If yes, what would be the main reasons for opposition?

If no, what would you consider the main benefits of cooperation?

Agricultural Change

Do you think the role that agriculture plays in society has changed in the last 20 years? Yes No

If yes, in what ways has it changed?

Are you comfortable with farm diversification? Yes No

What are the potential benefits of farm diversification?

What are the potential barriers to farm diversification?

The agricultural sector has a responsibility in combating global climate change.

- Strongly disagree Disagree Neutral Agree Strongly agree

Do you think private forest owners can contribute to reducing society's dependence on fossil fuels? Yes No

If yes, in what ways?

What are the major barriers preventing private forestry contributing to the wood fuel market?

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