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Forestry: A Growth Industry in Ireland

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Executive Summary

1. Forests are recognised as having a major positive affect on people's lives in economic, social and environmental terms. The issue facing the State and the forest industry is to what degree public and private capital can be combined to these socio-economic and environmental returns. *Growing for the Future*, The Strategic Plan for the Development of the Forestry Sector in Ireland was published in 1996 and set out annual targets for afforestation to 2030. The foreword to that Strategy stressed the need for sustained commitment to the annual targets so that a critical mass of roundwood production could be attained and the full range of benefits to the national economy maximised.

2. Since the Strategy was launched there have been changes to the operating environment, including the effective withdrawal of Coillte and most non-farmer investors from direct afforestation and the introduction of REPS. The impact of REPS was two-fold:

    a. It created a major competitive alternative to forestry that does not require any change of land use, and
    b. it extended environmental constraints to further large areas[1].

    In light of these changes the performance of the forest sector in delivering an average afforestation programme of 14,890 hectare (ha) over the first seven years[2] of the strategy is commendable. At the time the strategy was formulated the difficulty of convincing farmers to enter into a permanent land use change was underestimated. However, the continued promotional and educational activity sponsored by the Forest Service, coupled with the positive experiences of farmers who have entered the forestry scheme, has led, in 2003, to application levels in excess of 23,000 ha, well above the 20,000 ha target.

3. It is highly regrettable, therefore that this level of application coincides with a decision by Government to cut the public expenditure allocation to forestry by 27%, far in excess of reductions to many other, non-productive sectors. It is not evident that this decision was made with a full understanding of the benefits that accrue from State investment in forestry. This report, commissioned by IFIC[3], IFA[4] and the Self Assessment Companies[5], contains an independent strategic appraisal of the socio-economic benefits of State investment in forestry.

[1] Approximately 33% of the utilisable agricultural area is being farmed under REPS 1 guidelines and over €972 million has been paid to farmers in REPS 1 (to March '03) with a further €200 million under REPS 2.
[2] 1996-2002 inclusive.
[3] Irish Forest Industry Chain
[4] Irish Farmers' Association
[5] Self assessment companies provide certain applications services on behalf of landowners within Forest Service operational procedures and together with consultant foresters are the main service providers to the private sector.

4. The analysis illustrates that there is a benefit:cost ratio of 1.59 on public expenditure in forestry. The key benefit, which accrue from this expenditure are:
    - Sustaining of employment in rural areas, where labour markets are not saturated and alternative employment is not readily available.
    - Growing of a renewable resource. Timber and wood products are increasingly being specified ahead of other less environmentally friendly materials. Wood biomass is a renewable source of carbon neutral, green energy that can readily displace some of Ireland's 90% reliance on imported fossil fuel.
    - Creation of a carbon sink. Forests are recognised both by the UNFCCC and the National Climate Change Strategy as having a significant role to play in sequestering carbon and contributing to the attainment of Ireland's GHG emissions targets.
    - The forest sector supplies a range of wood processing facilities throughout the State and in Northern Ireland. The total value of the sawmilling and panelboard sectors exceeds €500 million p.a. Typically, these processing plants are located in provincial towns, contributing to regional balance.
    - Forests provide significant amenity and leisure benefits, enhanced by the Forest Service's best practice guidelines. This is illustrated by the fact that over 50 km of the Wicklow Way utilises forest properties.

    This report places a monetary value on these benefits and on the full costs that must be met by the State to realise these benefits. A sensitivity analysis shows that the net benefit remains positive, even when low values are assumed for CO_2.

    The approach taken in this report is defined not in terms of maximising the returns from forestry but in terms of maximising the economic returns from all the resources in the economy. As all opportunity costs are included in the calculations, a positive return from the expenditure of public funds in forestry to overcome a market failure indicates that it is correct that these funds should be spent in this sector.

5. The sustained realisation of these significant net benefits requires commitment to an appropriate level of funding. The main costs associated with achieving these benefits are afforestation grants, which can be considered as seed capital for this productive sector, and premium payments, which are a mechanism for replacing income foregone by switching to forestry as a land use options. The structure of the programme means that each year a greater proportion of the State's allocation to forestry is pre-committed to, what is effectively, current expenditure in the form of premium payments. The corollary of this is that a decreasing proportion is available for the essential capital expenditure necessary to deliver the afforestation targets specified in *Growing for the Future, the Rural Development Plan, the Programme for Government and Sustaining Progress*. Addressing this imbalance is one of the key recommendations of this report. Failure to separate current and capital expenditure means that there is an increasing contradiction in policy between

income protection and the maximisation of economic returns from further development of forestry.

6. In addition, the report concludes that the reduction in funding this year cannot be justified on economic grounds and has destroyed the opportunity to create a renewable resource. The cost-benefit analysis (CBA) shows that there is a loss of economic welfare resulting from the reduction in planting. Other unquantified costs also arise, mainly from the loss of policy credibility and the potential undermining of future negotiations with the EC on future European funding of Irish forestry programmes as a result of the reduction in non co-financed funding of the forestry measure of the Rural Development Plan 2000-2006.

7. Policy must avoid a stop-go approach. The continuity of scale within the many segments of the forest industry is vital. The long-term nature of the industry development outlined in the Government's forest strategy necessitates continuity of funding, protection from the vagaries of the annual budgetary process and regulatory stability. Adequate funds must be made available on a consistent basis to achieve the objectives set out both in *The Strategic Plan* and the *Rural Development Plan 2000-2006*. In this report it is recommended that any proposed changes in funding should be subjected to rigorous prior evaluation in terms of their impact on the likely attainment of the objectives that are set for the sector. Industry representatives should be consulted in any such process from the outset. Any consideration of State commitment to this major land based developmental sector should be in the context of alternative sustainable land uses.

8. In relation to market development, biomass to energy provides an important opportunity for Ireland and is one use of forest output where the carbon is 100% retained in storage through avoided emissions. It is recommended that this option should be promoted aggressively and the work already undertaken by COFORD expanded upon.

9. *Growing for the Future* recognises that the forestry sector in Ireland needs to develop to a scale that would allow it to compete internationally. Ireland has a significant advantage in softwood production and in particular Sitka spruce, a source of high quality fibre for the panel products and paper manufacturing industry. In order to ensure that the wood paying capability is maximised, an industry must attain critical mass and must be more integrated through strategic partnership or other possible forms of integration. Comparisons with Scandinavian forest industries suggest that Ireland would have to reach a level of raw material production of in excess of 10 million m^3 in order to be internationally competitive. The reality is that this level must be achieved in the shortest timescale possible, and not later than outlined in *The Strategic Plan*. There is need for a market driven research and development programme to ensure value is added and optimised all along the supply chain.

10. The cost-benefit analysis (CBA) shows that State investment in forestry gives a benefit:cost ratio of 1.59. This return compares favourably with many other capital investments of the State. The future of the forestry industry, and its

ability to maximise related benefits for all of society, relies heavily on the building of a strong public-private partnership approach, not only in terms of shared capital investment and sectoral development, but also in ensuring that a stable regulatory and policy environment is fostered, so that risk is minimised and return maximised.

1 Context of the Report

1.1 Historical Development of Forestry in Ireland

Ireland has some of the best climatic conditions for growing trees in Europe and a large market for wood and forest products close by in the UK (which imports 85% of its timber requirement[6]), but it also has the lowest proportion of forest coverage (at under 10%) in the EU. This level of forest cover is sub-optimal given that, there is currently an increasingly urgent need to find a better regional balance of economic development and income distribution, particularly in relation to rural communities. There are also difficulties looming in relation to meeting Ireland's commitments under the Kyoto treaty and there is the prospect of increasing pressure to reform the CAP on which the country's relatively large agricultural sector is heavily dependent.

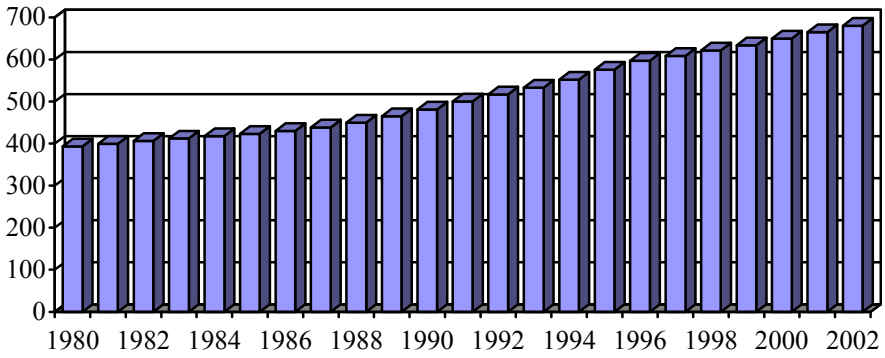
These circumstances provides the context in which forestry has been identified as a major potential land use and the pulp and wood products industries of increasing importance. A policy programme, which relies mainly on the provision of financial subsidies to the private sector, has been formulated and is being implemented. Landowners have responded with greatly increased investment in planting. However, at a time when the reasons for investing have become even clearer and supporting infrastructures have been encouraged and developed and attitudes have been turned around, there has been a severe cutback in the provision of public funds. This is seriously undermining development that has taken place and will restrict future growth.

A number of reasons have been put forward for the situation in which Ireland has a low starting point but high potential in the area of forestry. At the start of the 20th century, Ireland's forests had not begun to recover from the widespread felling that had taken place in earlier centuries. Gradually, the State took the leading role in developing forests. This role took the form of State ownership and management under the control of the Forest Service. The main emphasis was on production forestry based on coniferous species. In order to determine the most suitable species a series of field trials were laid down at the beginning of the 20th century, which clearly showed that exotic conifers, mainly Sitka spruce and some pine species were the most productive for the areas being planted. Government policy of the time was to plant marginal agricultural land, most of which was only capable of supporting a coniferous crop. As a result very little broadleaf forests were established during this period. More recent policy has begun to address this situation.

The late 1980s saw the application of greatly increased funds to the sector under a number of programmes largely funded by the EU and the establishment of Coillte Teoranta (Coillte) to manage the State's forest estate. The sector responded and the growth in forest area in Ireland was much faster after 1990, particularly as a result of privately owned planting. This forest expansion pattern is shown in Figure 1.1.

[6] Only Japan and China import a higher percentage of their wood product requirements.

Figure 1.1: Area under Forest 1980-2002 (000s ha)



The proportion privately owned, after falling below 25% in the early 1980s, recovered to just under 40% by 2000. Conifers continued to dominate planting, accounting for 84% of the total compared to an EU average of 57%, but the area under broadleaf forest also grew to exceed its 1900 area by the mid 1990s.

1.2 The Policy Background

The observation that the potential value of forestry to Ireland's economy was not being maximised, and the need to plan for a period of rapid growth in roundwood production led to the formulation in 1996 of a Strategic Plan for the development of the sector[7], hereafter referred to as *The Strategic Plan*. At the time, Ireland's productive forest area stood at 464,000 ha with a further 100,000 ha of wooded areas. This meant that Ireland's rate of afforestation was the highest in the EU but it remained the least forested country in the EU. About 50% of the forest estate was under 25 years old with just under 70% of the total in the ownership of Coillte. The main economic benefit arose from the key productive area of timber production, while other benefits – estimated to account for less than 10% of the value of timber – would arise in the form of amenity, leisure and the preservation of native flora and fauna. Output in 1995 was 2.2 million m^3, of which 1.4 million m^3 was sawlog and 0.8 million m^3 was pulpwood. Coillte accounted for 2.1 million m^3 of the total. *The Strategic Plan* remains the principal statement of forestry policy in Ireland. Franz Fischler, Commissioner for Agriculture and Rural Development, noted in his foreword to *The Strategic Plan*:

> *"Forestry by its very nature requires long-term planning. Its multi-faceted nature and its interaction with the environment and with other areas of economic and social importance require furthermore that plans for the optimal development of forestry at national level within the Member States be both comprehensive and integrated. I am pleased to note that Ireland's Strategic Plan meets both these requirements.*

[7] Department of Agriculture, Food and Forestry (1996) *Growing for the Future: A Strategic Plan for the Development of the Forestry Sector in Ireland*

> *Forestry is also by its nature an activity which presents particular difficulties in the area of funding. Typical minimum periods of rotation mean that the period between investment in the establishment and critical early management of plantations and the generation of a return on that investment, is very long relative to most areas of economic investment and thereby constitutes a disincentive to investment. Furthermore there is a substantial loss from afforested land in the years between planting and the generation of revenue from sales when thinning and ultimately final harvesting takes place. These factors are particularly acute in circumstances where the plantation owner is undertaking afforestation for the first time, as in the case of farmers in Ireland who undertake farm forestry, and where no past timber sales revenue is available to support ongoing investment in forestry.*
>
> *I acknowledge that implementation of the Strategic Plan for the Development of the Forestry Sector in Ireland requires a sustained and major programme of afforestation over the next three decades if necessary levels of timber output are to be achieved."*

This indicates that there was recognition at the time of the strategy formulation that long-term commitment would be required. It also draws attention to the key need for investment support to achieve net afforestation.

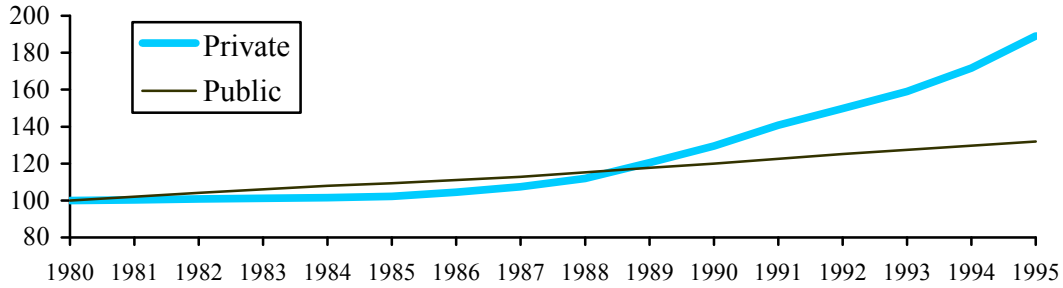
1.2.1 Earlier Initiatives

A number of policy programmes had existed in Ireland from the early 1980s to promote the development of the industry. These included:

- The Western Package Scheme introduced in 1981 to assist disadvantaged farms. Take-up was low due to characteristics of the target group and the lack of regular income offered by the scheme;
- The Compensatory Allowances Scheme introduced in 1987 to encourage alternative farm use. Again take-up was low;
- The Forestry Operational Programme and the Operational Programme for Rural Development (1989-93). A total of 80,000 ha was afforested by the private sector and Coillte under the programme;
- The Forest Premium Scheme introduced in 1990 which introduced annual payments to farmers to encourage planting on better quality land;
- Operational Programme for Agriculture, Rural Development and Forestry (OPARDF) 1994-99 and the CAP Forestry Accompanying measure which also gave rise to REPS. These introduced a range of grant and premium payments that favoured species diversification and alternative farm usage. The grant schemes were also designed to assist in forestry management projects and supports such as roads, nurseries, machinery, etc.

The OPADRF also introduced the target that was adopted in *The Strategic Plan* of an annual afforestation rate of 25,000 ha. Under these programmes, total annual afforestation rose from 5,476 ha in 1984, 5% of which was by the private sector, to 23,700 in 1995, 73% of which was private. The effect of change in policy and implementation on ownership category is shown in Figure 1.2.

Figure 1.2: Growth of Public and Private Forestry (1980 = 100)



Despite this growth in the period leading up to *The Strategic Plan*, it cannot be concluded that this could have been maintained in the absence of further policy development.

1.2.2 Strategic Development Plan

The Strategic Plan sets out the policy framework for the development of the sector. This can be summarised as:

- An afforestation target of 25,000 ha per annum up to 2000 and 20,000 ha p.a. in the period 2001-30;
- National average yield class of 18;
- A public to private afforestation ratio of 30:70 with an emphasis on farmer participation;
- Improved compatibility between afforestation and other farm supports particularly REPS;
- Reforestation to maintain the productive estate after clearfelling.

Additional sub-targets were also identified – such as a broadleaf target of 20%[8]. Total expenditure on grants and premiums up to 2030 of €3,955 million (IR£3,115 million) at 1996 prices was identified. The public to private ratio target is approximately what occurred in 1995 afforestation when 27% was public planting..

In *The Strategic Plan* there is some recognition also of other non-timber related benefits and costs with the impact on the environment particularly noted. The main external effects noted are tourism and amenity values. However, a value of only 9% of the timber value is placed on all these effects. In general, the approach taken in respect of environmental effects appears to be designed to emphasise the need to avoid negative environmental effects through appropriate regulation. The potential role of afforestation in CO_2 sequestration is provided with only brief recognition (paragraph 4.3.12).

However, there is recognition of some of the opportunity costs associated with an increase in forestry land use, in terms of lower agricultural output. This perspective leads to recognition of the main market failure identified in *The Strategy Plan*, which then provides the principal rationale for the investment of public funds in the sector. The argument is that provisions of the CAP mean that existing farm activities, such as

[8] Raised to 30% in more recent years.

sheep and cattle production – which would not be competitive with forestry in the absence of subsidies – are made attractive by the CAP, particularly given the very long payback associated with forestry. An important implication of this insight is that the opportunity cost of lost farm output through conversion to forestry is partly off-set since a similar level of return can be achieved by investment in forestry with a lower level of subsidy.

Afforestation Targets

The main argument for the targets used in *The Strategic Plan* is the need to achieve a critical mass in the industry if it is to be competitive and maximise the returns from forestry. In assessing these returns, *The Strategic Plan* placed the greatest emphasis on the value of timber stating that:

> *The ideal scale of the forest estate must be related to its principal function, which in Ireland is timber production*. (p.18)

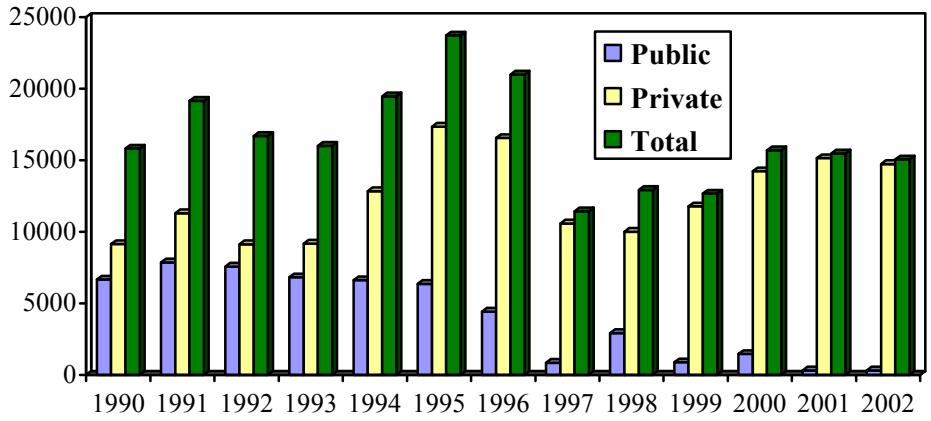
The increase in scale is required to bring about two effects: greater competition in the home market, leading to more efficient production, and the opportunity to realise economies of scale that exist in the sector. The research undertaken for *The Strategic Plan* indicated that these effects would be best achieved if Ireland had an annual output of a minimum of 10 million m^3 per annum and preferably if output rose to 12-15 million m^3. However, if there were no further afforestation beyond 1995, output would only achieve a level of 5 million m^3 in 2035. Recognising that the costs of rapid afforestation must be taken into account *The Strategic Plan* decided on the stated targets. *The Strategic Plan* recognised that financial sustainability at the silvicultural end of the sector in as short a time as possible was highly desirable not only if forestry in Ireland was to become market based and market driven but also to allow for the certain phasing out of the large scale financial support which "is now and will continue for some time to be, a dominant feature of forestry development in Ireland" – In other words *The Strategic Plan* recognised that only scale, with private sector investment, would ultimately lead to the elimination of the need for large amounts of public financing. Implicit in this was best use of EU funding.

The Strategic Plan recognises that forestry can provide a renewable resource over a forty-year cycle as an alternative agricultural land use and identified a target size for the industry. The attainment of this critical mass of annual roundwood production is the fundamental principle of *The Strategic Plan*. This level of production would enable the industry to be self-sustaining in the longer term as revenue from timber sales would be used to fund reforestation, which would be obligatory, thus maintaining the productive area under forest. The processing sector would also be able to optimise efficiencies of scale at this level of production and ensure that synergies between all elements of the value chain could be maximised. Any deviation from the afforestation targets specified will delay or prevent the attainment of critical mass.

One of the most notable features of development since *The Strategic Plan* was published has been the failure to achieve the target rates of afforestation. Although there are now some 14,000 private forest owners and the area of private forest established since 1982 totals 180,000 ha, annual afforestation averaged 14,890 ha in

the period 1996-2002 providing a total of 104,224 ha[9]. This leaves a deficit of over 55,000 ha (approximately 34%) when compared to the target of 160,000 ha in this period. While private afforestation in recent years has been insufficient to meet the target, it is clear from Figure 1.3 that the sharp decline in the rate of public afforestation in the late 1990s was the primary cause of the targets not being met.

Figure 1.3: Afforestation 1990-2002 (ha)



However, closer examination of the reasons for the non-attainment of the afforestation targets unveils a number of important causal factors:

1. The promotion of the REPS scheme, particularly from 1996 offered farmers an alternative scheme, but one which required no change of land use (relative to the dramatic, irreversible change required by the forestry schemes). Over €1,172 million has been paid out under REPS (to March 2003).[10]
2. The discontinuation of Coillte and the withdrawal of most non-farmer investors.
3. The decision to change from agriculture (a traditional built up over many generations) to forestry is a major one for any farmer. The promotional activity undertaken over the last decade has been aimed at changing the prevailing mindset. However, given the monumentality of the land use change decision, there is an obvious time lag between promotion and the decision being taken. Indications are that farmers are now more favourably disposed to forestry having witness the success of it as a land use option on neighbouring farms.
4. The significant environmental constraints that ruled out or deferred activity on significant land areas.
5. Inhibitors such as Social Welfare entitlement losses have not been addressed.

In fact when these factors are considered the level of programme achievement by the private sector has been quite remarkable given the changes in culture needed and the long term commitment required by farmers to put land into forestry. Prior to the announcement of a reduction in State funding for forestry in November 2002, there was growing confidence in the sector that the targets outlined in the plan were eminently achievable.

[9] In addition to annual reforestation of 6,000 ha.

[10] The adjustments proposed in strategic action 4.4.30 in *The Strategic* Plan, to avoid mutual exclusivity between REPS and forestry, have not been implemented

This confidence is underlined by two sources:

- Figures released to the industry by the Forest Service indicate that in addition to the 12,000 ha that will be planted in the current year, a further 12,000 ha of applications are in the system but cannot be processed due to the non-availability of funding. This would indicate that in the absence of financial constraints, the target of 20,000 ha would have been surpassed in 2003.
- Collier, Dorgan and Bell (2002)[11] concluded that 37,000 farmers own 490,000 ha of land that is available for forestry and if planted would not negatively impact either their personal income or national agricultural output.

If the rate of afforestation observed from 1997 to 2002 is extrapolated for a further 28 years up to 2030, then the total deficit would be approximately 240,000 ha. *The Strategic Plan* provides estimates of the economic impact of a failure to meet its target of annual output of 10 million m^3 from a national estate of 1.189 million ha. *The Strategic Plan* projected that, for a deficit of 300,000 ha, output would be reduced to the extent that employment would be 13% lower than its potential, equivalent to 3,500 jobs (in 2020). In addition, total value added by the sector would be lower than potential by 11% or IR£85.7 million (€109 million) in 1995 values. This projection excluded the significant carbon sequestration potential that would accrue from the 300,000 ha. These estimates may be considered to be indicative of the lost potential of the sector given the planting rates achieved in recent years. However, the targets stated in *The Strategic Plan* remain official government policy.

The pre-eminence afforded to timber value over other values – understandable given the development of the Irish economy and thinking on the environment at the time – means that *The Strategic Plan* seriously understates the value of forestry due to the importance – as shown later in this report – of carbon sequestration in forests. A role for policy exists therefore to incentivise investment in forestry so as to maximise the total potential returns from the sector.

The approach taken in this report is defined not in terms of maximising the returns from forestry but in terms of maximising the economic returns from all the resources in the economy. Thus, if all opportunity costs are included in the calculations, a positive return from the expenditure of public funds in forestry to overcome a market failure indicates that it is correct that these funds should be spent in this sector. Thus, the approach taken is to identify the returns from an extra hectare of forestry over and above what would exist in the absence of the incentives.

1.3 Overview of the Report

Chapter 2 of the report provides an overview of the industry currently and demonstrates the growth that has taken place. Most recent growth has been as a result of private sector planting. The commercial viability of Irish forestry is discussed and

[11] Collier, P., Dorgan, J., and Bell, P. 2002. *Factors Influencing Farmer Participation in Forestry*. COFORD, Dublin.

it is clear that the industry will not develop unilaterally. State incentives, are warranted if two tests are passed. A clear problem that policy can address must be identified to provide a rationale for intervention, usually described as a market failure, and it must be shown that the expenditure of public funds will lead to a net economic gain to the economy. This chapter also examines the impact of forestry in promoting the development of related value adding activities.

Chapter 3 is concerned with estimating the return to the economy that is provided by forestry. This analysis includes all costs and benefits whether they accrue to private individuals who undertake investment in forestry or to the wider economy. This appraisal is done in terms of the marginal return from an additional hectare of forest planted over and above what has been achieved in recent years and also on the basis of the Government's annual target of 20,000 ha. Chapter 4 extends this analysis by identifying the extent to which it is possible to assign the benefits that arise from the expansion of forestry in Ireland to policy over the past number of years and examines the effectiveness of the policy as designed and implemented. This section also provides an economic analysis of the potential impact of the funding cutbacks that were imposed on the sector in the most recent budget and that have affected planting rates, infrastructure development and woodland improvement this year. The cutback is treated as a policy decision and the effect is appraised in terms of a cost benefit analysis of this decision. In the evaluation it is assumed that the change in policy is for one year only and that the original strategy will be reintroduced in the next period. However, the extent to which this policy decision will have lasting effects is also examined.

The final Chapter of the report contains a summary of the main findings and recommendations for forestry policy that are designed to maximise the returns from the sector. In devising these recommendations a number of principles are followed:

- Public funds should only be spent in response to an observed and defined market failure that can be addressed;
- All expenditure should demonstrate a positive return to the economy; and
- The policy should be cost effective in the sense that it is both optimal and efficient thereby minimising the cost of achieving the defined objectives and maximising the returns from the policy intervention.

2 The Irish Forestry Sector

2.1 The Timber Growing Industry

Total forest cover in 2000 was 649,800 ha, or 9% of land area, with private forests accounting for an estimated 253,088 ha or 40% of the total. The public forest estate is owned and managed by Coillte. The distribution of this forest is shown in Table 2.1.

Table 2.1: Forest Estate 2002 and Afforestation (1997-2002) by Area (ha)

	Area under Forest					Afforestation	
	Total	% of total	Private	Public	% of total land area	Area	% of total
Leinster	162,218	23.8	68,553	93,666	8.3	18,763	22.5
Munster	270,278	39.7	120,308	149,970	11.2	37,738	45.3
Connaught	170,471	25.1	63,719	106,752	10.0	17,578	21.1
Ulster	77,362	11.4	30,390	46,973	10.0	9,174	11.0
Carlow	5,555	0.8	1,746	3,809	6.0	6,288	0.5
Cavan	14,726	2.2	7,276	7,450	7.1	174	3.2
Clare	46,275	6.8	22,964	23,311	13.7	3,496	7.9
Cork	79,188	11.6	30,359	48,828	10.1	9,272	10.7
Donegal	56,903	8.4	20,536	36,366	11.4	1,167	7.6
Dublin	3,593	0.5	1,811	1,782	3.9	2,791	0.2
Galway	54,418	8.0	15,660	38,758	9.0	2,466	4.2
Kerry	49,829	7.3	30,760	19,068	9.8	3,303	11.1
Kildare	8,472	1.2	4,465	4,007	4.8	4,949	1.4
Kilkenny	17,508	2.6	7,408	10,100	8.0	1,551	3.4
Laois	23,858	3.5	7,895	15,963	13.3	190	3.0
Leitrim	23,083	3.4	10,495	12,587	14.5	5,497	4.0
Limerick	22,614	3.3	10,938	11,675	7.5	1,478	5.9
Longford	7,187	1.1	4,016	3,171	6.3	259	1.9
Louth	3,125	0.5	1,695	1,429	3.7	2,470	0.2
Mayo	54,263	8.0	19,804	34,459	9.7	2,994	6.6
Meath	5,912	0.9	4,408	1,504	2.4	2,288	1.8
Monaghan	5,733	0.8	2,577	3,156	4.4	6,013	0.3
Offaly	18,326	2.7	9,086	9,240	8.8	2,004	3.0
Roscommon	18,316	2.7	9,986	8,330	7.0	1,981	3.6
Sligo	20,392	3.0	7,774	12,618	10.9	1,697	2.7
Tipperary	45,362	6.7	16,968	28,394	10.2	2,362	7.2
Waterford	27,011	4.0	8,318	18,693	14.4	436	2.4
Westmeath	11,618	1.7	6,907	4,711	6.3	2,627	2.4
Wexford	14,118	2.1	5,482	8,636	5.8	6,558	2.0
Wicklow	42,946	6.3	13,632	29,314	20.8	8,942	2.8
Total	680,330		282,970	397,361	9.3	83,252	

Source: Department of Communications, Marine and Natural Resources

This table shows that Munster is the most heavily afforested area in terms of both area and the proportion of the land under forest. The table also shows that Munster accounted for a greater proportion of afforestation in 1997-2002 than the proportion of total forest area while the reverse was the case in Connaught. The main reasons for this are the larger extensive farms in the southwest and the greater environmental and site-type constraints in the west.

Conifers remain the dominant type of planting accounting for a total of 70,564 ha of new planting in 1997-2002, just under 85% of the total. The relative importance of the main species is shown in Table 2.2.

Table 2.2: Species Planted 1997-2002 (area (ha) and percent of total)

	Sitka spruce	Pine	Norway spruce	Other Conifers	Oak	Beech	Other B'leaf	Total
1997	6,605	1,076	1,143	746	414	65	1,394	11,444
1998	6,914	1,045	1,429	1,466	535	67	1,473	12,928
1999	6,027	661	1,415	2,592	466	59	1,447	12,667
2000	9,336	677	1,539	2,117	328	42	1,657	15,696
2001	9,378	610	1,265	2,289	366	67	1,490	15,464
2002	8,818	449	1,183	1,785	563	97	2,159	15,054
Total	**47,077**	**4,518**	**7,974**	**10,995**	**2,672**	**396**	**9,620**	**83,252**
%								
1997	57.7	9.4	10.0	6.5	3.6	0.6	12.2	
1998	53.5	8.1	11.1	11.3	4.1	0.5	11.4	
1999	47.6	5.2	11.2	20.5	3.7	0.5	11.4	
2000	59.5	4.3	9.8	13.5	2.1	0.3	10.6	
2001	60.6	3.9	8.2	14.8	2.4	0.4	9.6	
2002	58.6	3.0	7.9	11.9	3.7	0.6	14.3	
97-02	**56.5**	**5.4**	**9.6**	**13.2**	**3.2**	**0.5**	**11.6**	

Source: Department of Communications, Marine and Natural Resources

Total roundwood output on the island of Ireland in 2001 was 3.14 million m^3, of which 87% was supplied by Coillte and 300,000 m^3 were supplied by forests in Northern Ireland. This means that the private sector in the Republic supplied 107,000 m^3. The Timber Industry Development Group (TIDG) report (2002) forecast that output of roundwood in the Republic would grow to 3.95 m^3 by 2005 and to 4.44 m^3 by 2010. This represents output growth of 37% in a decade. It is anticipated that supply from private sources will rise rapidly reaching 23% of the total by 2015[12] with Coillte's output stabilising at 3.3 million m^3 after 2010.

It is estimated that total employment in growing and supporting activities in 2002 was 6,241 people of which 2,375 were employed in growing (see Table 2.3 below for details). Using a Type 2 multiplier of 1.64, indirect and induced employment amounts to a further 3,994 meaning that a total of 10,235 jobs depend on the forestry sector in Ireland.[13]

[12] Gallagher, G. and O'Carroll, J. 2001. *Forecast of Roundwood Production from the Forests of Ireland 2001-2015*. COFORD, Dublin.

[13] Ní Dhubháin, A., M. Flechard, R. Moloney, and D. O'Connor (2002). *An Economic Assessment of the Contributions of the Irish Forestry Sector to the Irish Economy*. Regional Science Association.

2.2 The Timber Processing Industry

The output in Ireland of almost 3 million m^3 of roundwood per annum is processed into mostly between three product sectors: construction (40%), pallets (40%) and fencing (17%). Although the volume of Irish timber sold on the Irish market has grown, market share fell from 60% in 1990 to 42% in 2000. This share varies considerably between the different market segments with a share of 83% in pallets and 71% in fencing, but only 29% in construction. The market has experienced particularly rapid growth in the last eight years, with demand growing from 580,000 m^3 in 1992 to 1.24 million m^3 in 2000. In 2000, imports amounted to 854,000 m^3. The demand for timber is related to the level of house building and with the number of house completions in Ireland growing very rapidly year on year since 1993, from 21,391 to 49,812 in 2000 and a forecast requirement of 55,000 new houses per annum over the next 10 years, market conditions are good. The UK is the largest market for imported sawn timber in the EU. Competition is also increasing from both UK domestic sources and other competitors.

The use of forest output on the island of Ireland is detailed in Figures 2.1 and 2.2. In 2001, of the total timber output of 3.14 million m^3, sawmills handled 1.97 million m^3 of logs producing 890,000 m^3 of sawn timber with just over 1 million m^3 of residues. Stake production mills handled a further 180,000 m^3. The construction sector used 356,000 m^3 of wood output (40%), 95% of which was in the domestic market. Pallet production accounted for a similar volume but the export market amounted to 150,000 m^3 or 42% of the total in this product sector. Fencing accounted for most of the remainder with an export market of over 83,000 m^3. Pulpwood accounts for 970,000 m^3 (31% of total output). Power production, horticultural uses and direct exports accounted for 414,000 m^3 (20%) of this total with the remainder used by the panel board mills. This resulted in panelboard production of 895,000 m^3, 75% of which (670,000 m^3) was exported.

This activity represents value added in the Irish economy. Table 2.3 shows the breakdown of this employment by activity. Next to growing, the processing sector is the most important for employment with estimated employment of 2,461. An estimate of the value of economic activity in processing can be obtained from the CSO's *Census of Industrial Production* (CIP) 2000. NACE Codes 201 (Sawmilling and planing of wood) and 202 (manufacture of wooden board products) are used to represent the sector[14]. This equates to a slightly narrower definition of the sector than is used in Table 2.3 – which is based on direct data – but covers the most relevant activities[15].

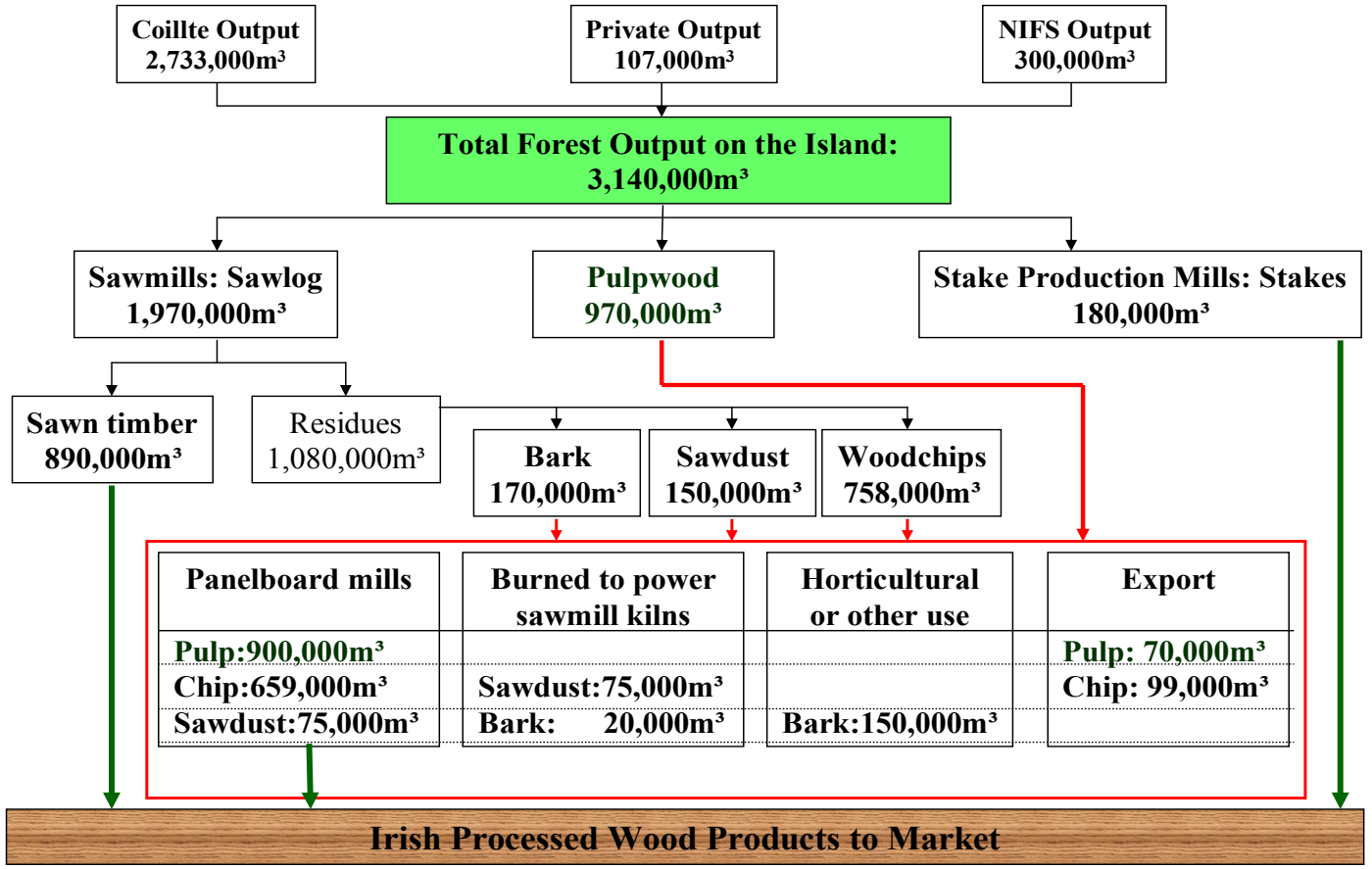
This CIP data show that a total of 2,179 were employed in these sectors in 2000, with 40 firms in NACE 201 employing 1,442 and 9 in NACE 202 employing 735. Gross output i.e. sales, was €413 million with net output i.e. value added, of €151.7 million

[14] Excluded are NACE sectors 203 (products for construction) 204 (containers) and 205 (other products of wood. If included, total employment in this industry was 6,249 in 2000, of which 50% was in sector 203.

[15] One reason may be that the CIP data include only industrial units with 3 or more employed thereby excluding the smallest operations.

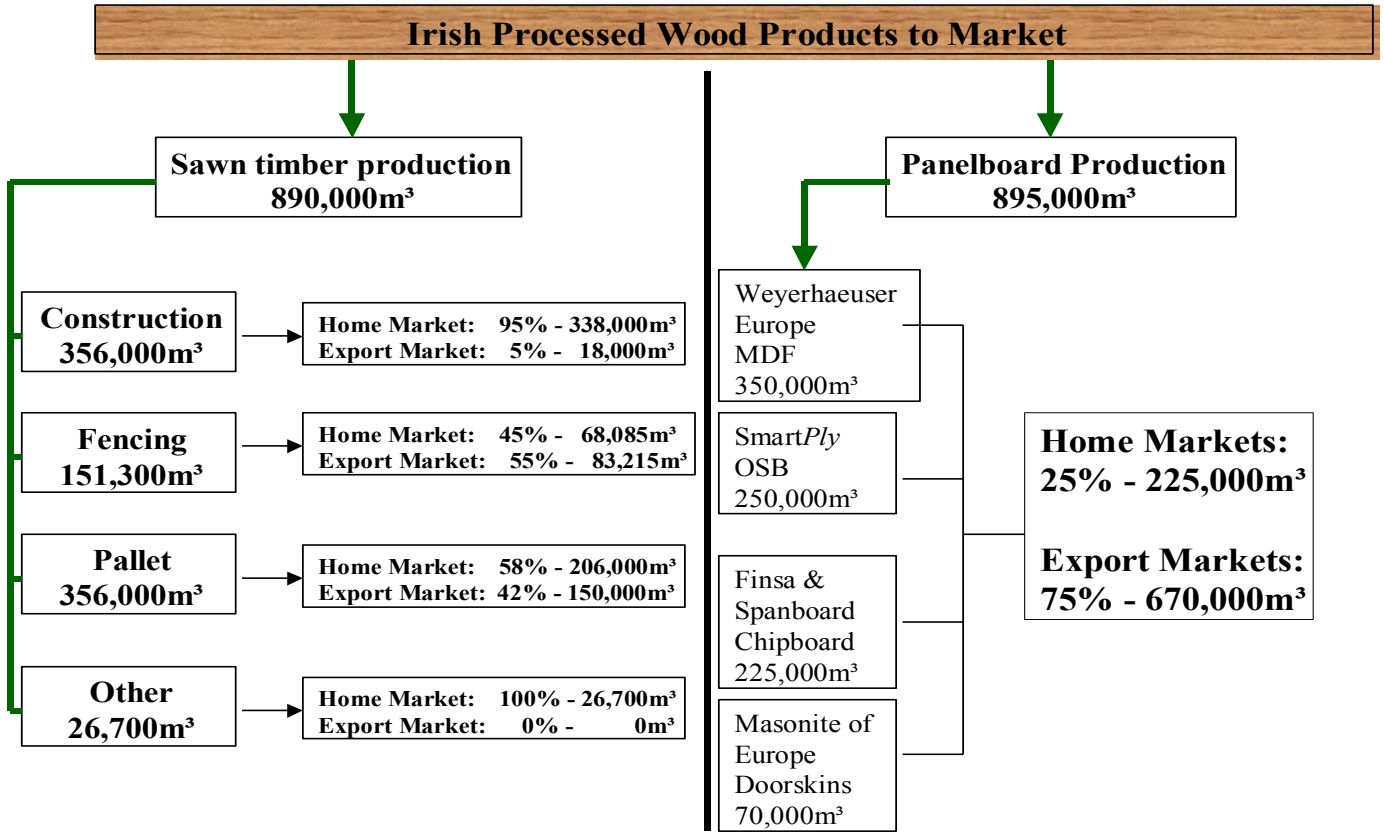
– €87.3 million in sawmills and €64.4 million in board manufacturing. Of this, wages and salaries amounted to €54.4 million. Sales per production unit in NACE 202 were about 3 times those in NACE 201 and the annual wages paid in NACE 202 at an average of €28,832 per employee were significantly higher than the €23,419 paid in NACE 201, reflecting the higher technological processes. This is reflected in higher net output per employee in NACE 202 at €87,336 compared to €60,545 in NACE 201.

Figure 2.1: 2001 Product Flow from Forest to Processor (Timber Input Volumes)



Source: COFORD (2002)

Figure 2.2: 2001 Product Flow from Processor to Market (Product Output Volumes)



Source: COFORD (2002)

Table 2.3: Employment in Forestry Sectors

Sawmilling	1,571
Panel Mills	890
Processing Sub-total	2,461
Crop Establishment	2,375
Harvesting & Logistics	1,405
Total	6,241

Source: Phillips (2003)[16]

An important issue relates to the extent to which this activity and wealth creation can be considered to be the result of the development of the forestry industry. In many respects, the growing and processing sectors are quite separate with different markets and skill requirements. In situations such as this, provided transport and transactions costs are low, then it would not be valid to attribute the value created at the processing stage to the existence of the primary product production. However, transport costs are high relative to the value of roundwood and wood residues. As a result, it would not be practical to develop these industries without a local, and effectively guaranteed, supply of forest products. Given this, it is valid to conclude that the wealth created at this stage is fundamentally dependent on, and results from, the existence of the forest-growing sector. The net value created for the economy by these activities is calculated in Section 3.2.5 below.

It is clear from the CIP data that the industrial structure of the sawmill and panelboard sectors is quite different. In total, the sawmill sector is made up of about 100 firms with a few large firms dominant, while the panel board sector comprises four large plants. The lack of scale of many of the smaller sawmills will inhibit their competitiveness in commodity markets going forward. The larger mills have sufficient scale to compete and have invested heavily in recent years. It is important that sufficient raw material is available to these mills to ensure adequate capacity utilisation in the future. For the panel board mills, the fibre properties of Sitka spruce offer significant production advantages. However, these mills are faced with the need to transport output relatively long distances to their main markets. The Irish market accounts for about 72% of the output of sawmills, but only 25% of panel board output.

The TIDG report noted that, as the sector grows over the next number of years, the volume of residues will also increase and finding economical markets for these residues is an issue that requires to be addressed. One potential market is to use these residues as a source of renewable biomass from which to generate carbon neutral green energy. The potential of this form of energy to displace imported fossil fuel is being addressed collectively by COFORD, the ITC and Coillte, and is discussed later in this report.

The report estimated the Irish sawn softwood market (ROI and NI) to be 1.48 million m^3, with a value of €266.6 million in the year 2000. It forecast that new markets for up to 306,000 m^3 per annum over 2000 will be required by 2005. For the panel board manufacturers for whom exports account for 75% of output competition from Eastern Europe is likely to be a major issue in the near future. It is clear from this that while

[16] Phillips, H. (2003) *Economic Impact of Forestry*. Unpublished paper, COFORD.

most attention has been focused on increasing the supply of timber produced in Ireland, considerable attention is also required in identifying and developing new markets. In addition, the Irish industry requires continued upgrading in terms of supporting infrastructure, integration, marketing and innovative supply chain management to compete.

2.3 Financial Appraisal of Private Timber Growing

Almost all afforestation in recent years has been undertaken by the private sector. However, forestry is not a commercially competitive option for landowners in the absence of supports. Table 2.4 shows a simplified projected cashflow from an additional hectare of new forest assuming a 6-12 ha plantation of 20% diverse species of yield class 20 with a 40-year rotation by a farmer. The timber income is presented net of extraction and marketing costs. The table also assumes that the grant received covers the costs planting and maintenance in the early years.

Table 2.4: Cashflow from an additional hectare of forest

Year	Premium	Timber	Total
0	404		404
1	404		404
2	404		404
3	404		404
4	404		404
5	404		404
6	404		404
7	404		404
8	404		404
9	404		404
10	404		404
11	404		404
12	404		404
13	404		404
14	404		404
15	404		404
16	404		404
17	404		404
18	404		404
19	404		404
20		210	210
25		700	700
30		1,400	1,400
35		2,660	2,660
40		21,758	21,758
Total	8,080	26,728	34,808

The table shows total cashflow of €34,808 (net of harvesting costs) for this hectare of forestry. When discounted back to year 0, the present value of this is €9,018 at a real

discount rate of 5% per annum and €7,402 if a discount rate of 6% is used.[17] This includes all premiums and grants. If the premiums were not available, the present value of the hectare at the time of planting would be only €3,983 when discounted at 5% and €2,768 when discounted at 6%. This would be insufficient to compete with the value of the land in alternative uses. Assuming that the grant just cover costs on establishment, this means that – on the basis that a discount rate of 6% is appropriate – the net value of the forest in year 0 is only marginally greater than the costs involved in establishing the forest, leaving aside the opportunity costs of lost agricultural output and agricultural subsidies.

Clearly, in the absence of State support for forestry, the volume of private sector investment would be minimal even if the use of land for forestry did not have to compete as an alternative with other uses. This means that if forestry is seen as desirable it requires state intervention. As argued elsewhere in this report, this in itself is not a sufficient argument for public investment in general and certainly not for any particular plan for this investment. The expenditure must show a positive return on the investment of public money and the way in which the money is spent must be efficient at addressing identified market failures.

2.4 Market Failure and Policy Intervention

The general direction of thinking in relation to forestry is that, ultimately, the development and delivery of forest products will increasingly be undertaken by the private sector. A corollary is that the importance of Coillte as a publicly owned producer of roundwood will decline relatively[18]. However, while private commercial firms will increasingly dominate forestry, this does not mean that an economic role for the public sector is negated. The role of the State can be identified in terms of market failures. By market failure it is meant that the prices that are paid for products and services are determined by the assessment of private costs and benefits by the direct participants in market based trades, but that these prices do not correspond with the outcome that would be produced by an assessment undertaken by an objective bystander who was in a position to assess the total impact on welfare in the economy of the trades in question. This divergence may occur for a number of reasons, but the most common is when the interests of society are different from those of private individuals.

When market failure is identified, there are three options open to the State. The first is to eliminate the private decision-making and mandate the outcomes through direct State intervention. Provided full information is available, this should overcome the

[17] The decision on the appropriate discount rate for the private sector is clearly a matter of judgement. With interest rates as low as they currently are it is clear that a case can be argued for a rate of 5%. However, it is highly unlikely that current rates will be typical of interest rates over the full period of any forestry plantation currently being undertaken. Furthermore, a social discount rate of 5% is assumed below and this is in keeping with recommended practice. It has also been widely accepted that due to issues of risk, time preference and lifespan, the private rate should logically been higher than the social rate. As a result, a case can be made for a higher discount rate and 6% is used to represent this.

[18] The future development and role of Coillte has been examined in other reports and is not discussed further in this report.

problem. However, this approach is often inefficient and the cure might be worse than the problem in terms of the ultimate impact on welfare. A variation on this is to regulate the sector in question and allow private trades. If done properly this can be an effective solution. The second approach is to allow the market to operate freely with private decision making, but to alter the incentives that determine these decisions so that the desired outcome is produced. This will usually be done through monetary incentives and is the approach that is most important in the forestry sector. However, it is far from a fool-proof approach and opportunities for rent seeking may be created. In addition, expectations may not be fulfilled and expenditure which cannot then be recovered does not produce the desired outcome. A final option is to do nothing.

A number of important market failures can be identified in the case of forestry and have guided the development of strategy in this area. These include:

- **Economies of scale:** historically, forestry in Ireland has tended to be rather dispersed both geographically and in terms of the supporting services. The existence of economies of scale in the sector has led to the idea that there is a critical level of mass that needs to be achieved if an efficient industry is to emerge. However, this is unlikely, if left to individual operators working alone. This idea has been very influential in the formulation of *The Strategic Plan* for the sector and is acknowledged to mean more than just an expansion of the volume of wood being produced. In addition, it requires co-ordinated marketing efforts and the development of efficient supply chains.
- **The long pay-back period:** this is probably the best known market failure in relation to forestry. The impact is that there is an incentive to cut the trees at a time that maximises the private returns but before the time when returns to society are maximised. The problem arises due to the different time frames that are adopted by the public and private sectors. Furthermore, a role for the public sector arises if different discount rates are appropriate.
- **Risk:** the long period of the investment also gives rise to a high degree of risk since investors are effectively forecasting over long periods. This risk is exacerbated by the existence of high entry and exit costs in the industry. In addition, there is very restricted flexibility to react to market changes: species cannot be changed in the middle of the cycle and the timing of harvesting relative to the length of the cycle has real limitations. The State, however, can reduce the aggregate risk by taking on some of the risk and adopting a portfolio approach across a wide number of investments at many different times.
- **Externalities:** the existence of externalities in the sector – outputs that are produced but for which there is no monetary payment – has long been recognised. Traditionally, these have been recognised in areas such as the leisure and amenity facilities forests offer and the creation of greater biodiversity. Attention has increasingly turned to the carbon sequestration role of forests. The role of the State is to internalise these effects by providing a mechanism whereby the producers can obtain the values of the outputs. The problem is that, since these effects are usually not traded, it is difficult to derive appropriate prices through which they can be valued. There have been important advances in this area in recent years and these are discussed further below.
- **Distortions introduced as a result of other policies:** the decision to invest in forestry, as with all decisions, is not based on absolute returns but on returns relative to alternative uses of the resources. In addition to mobile capital, the key

resource in forestry is land. However, the returns from land are not based on freely operating markets but on the provisions of the CAP which work to increase these returns. As a result, this area of policy intervention has an important impact on the decision to invest in forestry with the result that the private decision parameters are distorted against investing in forestry.

- **Need for R&D:** potential changes in the industry and market for timber over the growing cycle and the high projected rate of growth in Ireland mean that investment in knowledge development is required. However, because knowledge possesses high economics of scale in its use such that it is effectively a public good it is widely recognised that private investment will be inadequate. In other words, because knowledge can flow freely and because its returns are maximised when its use is maximised, there is little incentive for any private individuals to invest in a resource that others will benefit from.

Each of these areas of market failure provides a rationale for State intervention. However, while the identification of market failure is a necessary requirement for intervention, it is not sufficient to justify intervention. To deliver the correct decision it is necessary that the benefits of the policy outweigh the costs. In addition, to ensure that the intervention is efficient it is necessary to identify the relative importance of various features to ensure that the funds allocated are prioritised appropriately. This determination requires a cost benefit analysis (CBA)of the proposed intervention and is the subject of Chapter 3 of this report.

3 Socio-economic Appraisal of Forestry Policy

3.1 Methodology of CBA

3.1.1 Role and Approach of CBA

When the appraisal of an investment project concludes that it is commercially uneconomical, but features of the project suggest that there could be benefits from it going ahead, it is important to appraise the proposed project from the point of view of society in general rather than immediate investors. In some cases it is found that a project has the potential to provide benefits to society overall although these do not accrue to investors. In these cases, a comparison of the estimated monetary (and non-monetary) costs of a project or strategy with the corresponding estimated benefits, while useful, is really not sufficient to allow an estimation of the total costs and benefits that can accrue.

This is the case with the development of forestry. There are two problems. First, many of the benefits will not accrue to investors and are therefore not included in a commercial appraisal. As a result, a wider socio-economic cost-benefit appraisal should be undertaken. This requires that the full economic benefits and costs associated with a project or policy process should be brought into consideration. Second, the usual purpose for which cost benefit analysis is used is to guide decision making towards the best choice, from a range of possible alternatives or to demonstrate that the proposed course of action is an optimal one. However, this does not allow comparison with any alternatives. Accordingly, the most appropriate measure of cost to use is the opportunity cost, i.e. the benefits foregone from not pursuing some particular alternative. This is the approach taken in socio-economic CBA.

There are two distinct steps in undertaking a CBA. The first is the identification of the relevant costs and benefits that arise. It is essential that all costs and benefits are included even where these may not be the intended or direct result of the action. The second step is to apply the methodology through defining estimates for these costs and benefits, usually on a per unit basis. This is often problematic and missing data are not unusual, particularly where the costs and benefits are non-marketed. In instances where public policy is concerned, non-market values are often assumed. Techniques are available for dealing with this but some element of uncertainty is inevitably introduced. Finally, it is not unusual to identify costs or benefits for which no quantification is possible. In some cases a proxy value may be available, but it is often the case that these items are noted but cannot be included in the actual calculation.

CBA is always related to change. In the context of this project, the two changes considered are the planting of an additional hectare with forest – this chapter – and the impact of the decision to cut back on the funding allocated to forestry – discussed in

Chapter 4. The total impact of the annual target afforestation rate of 20,000 ha per annum is also calculated. Since the costs and benefits arise in a situation of change, the analysis is concerned with the comparison of an existing situation with one that will exist following the implementation of the change. As a result, the relevant costs and benefits to be included, as in any appraisal of change, are marginal costs and benefits. Where the change that is imposed does not have an impact on an existing cost the marginal costs is zero.

3.1.2 Defining Costs and Benefits

Socio-economic CBA, in assessing the economic impact of projects from the point of view of society, does so by attempting to assign a monetary value to all costs and benefits, both private and public. This often involves assigning a value to project outcomes which do not have market prices, such as, for example, the costs of environmental damage, or where it is considered that the market price is not a true reflection of the actual cost to society of the resource employed. This has traditionally been an important issue in relation to the cost of labour leading to the adoption of a shadow wage or social cost. Thus, a number of important methodological issues and judgements arise in undertaking CBA, which can have a significant impact on the outcome of the evaluation exercise, including the assignment of monetary values or 'shadow prices' where no market prices are available, the choice of a discount rate and the treatment of risk.

It needs to be recognised that while employment leads to income it is also the use of what may be scarce resources. The cost of this labour must be included in terms of its opportunity cost rather than its wage value. A full employment labour market in Ireland means that the shadow wage approaches its wage rate in most cases[19]. However, if there are productivity gains or higher income created as a result of forestry, although the numbers employed have not changed, then the equality of these two variables should not be assumed. In addition, if the employment is created in a rural area then the appropriate shadow wage will be less than the wage rate.

There has been much debate on the appropriate shadow wage in Ireland. Honohan has presented arguments that indicate that there is little basis in most cases for assuming any divergence between the two. However, Irish CBAs have commonly assumed values well below the wage rate and have been criticised for this[20]. As a working rule, the Department of Finance have recommended that an argument should be presented for any use of a shadow wage below the wage rate and that a rate below 80% should not be used. However, this conclusion may not be appropriate in all circumstances and recognition must be taken of the fact that higher value employment than would otherwise be available may be created in rural areas. In order to recognise both sides of this argument, a shadow wage of 80% of the wage rate is used in this appraisal where an appropriate argument can be made and the potential for greater gains due to the role of forestry in addressing regional imbalances is noted.

[19] See, for example, Honohan P. (1998) *Key Issues of Cost Benefit Methodology for Irish Industrial Policy*, Dublin: ESRI

[20] CSF Evaluation Unit (1997) *Cost-Benefit Analysis in the Community Support Framework: a Critical Review*

3.1.3 Discounting

The calculation requires estimates of benefits and costs that will arise in future years. It is necessary, before these estimates can be aggregated, to derive an appropriate discount rate for translating future benefits and costs back to today's value. The choice of discount rate used in private sector projects is generally closely related to the interest rate, or some multiple of the interest rate, relevant to financing the project. However, the appropriate social rate is the subject of much-debate. There is general agreement that it should be below the private rate. This is based on the view that society as a whole, since it has an infinite lifespan, is in a position to place a much higher value on the future than is the case for any individuals. In addition, it has been argued that policymakers on behalf of the state have an onus to place a higher value on the future in their public decisions than they would in respect of private decisions. Accordingly, a part of individuals' time preference needs to be eliminated when calculating the social rate.

There has been much discussion on how this should be operationalised in practice but it is generally accepted that an appropriate discount rate for society – the social discount rate – should reflect the alternative use of all funds. This has important implications, at least in theory, since it means that if a CBA of a specified policy is carried out using appropriate values and assumptions then there is no need to compare it with other projects. In practice it is very difficult to be sure that all values are appropriate and not all opportunity costs might be included. This problem is lessened if there is a general alternative use for funds that can be assumed in all CBAs and if a margin of error is built into the results. In Ireland, it has become commonplace to adopt repayment of the national debt as the alternative use of funds. The assumption is that the opportunity cost of the funds is the interest that could be saved on the national debt. This is usually taken to be 5% per annum of the funds involved and a real social discount rate of 5 per cent per annum is recommended by the Department of Finance[21]. This approximates the rate paid on public debt in Ireland – repayment of which is assumed to represent the alternative use, and thus the opportunity cost, of public funds – over the past number of years.

It is also necessary to identify a time period over which the costs and benefits that arise will be compared. The period for the evaluation should be a sufficient period for the benefits to accrue fully but needs to be limited to a period over which the discounted values remain meaningful. The Department of Finance have recommended 20 years for investment in infrastructure projects[22] but this may be problematic in this case of forestry. The crop planted in year one will have a growing life that exceeds 20 years and therefore, many of the benefits will not accrue within the 20 year period. The growing life of the crop is adopted in the evaluation below giving a total time period of 40 years. In effect, this is equivalent to assuming that the evaluation proceeds on the basis of a 20-year timeframe at the end of which the forest has a terminal value based on the difference between the discounted values of the future benefits, such as timber, and costs, such as harvesting, beyond this date.

[21] Department of Finance (1994) *Guidelines for the Appraisal and Management of Capital Expenditure Proposals in the Public Sector*
[22] CSF Evaluation Unit (1999) *Proposed Working Rules for Cost Benefit Analysis*

3.1.4 Costing Exchequer and EU funds

A further important point for consideration is the appropriate value to use for the social cost of public funds which have an important role in promoting the industry. The social cost of public funds refers to the fact that public funds ultimately arise from taxation and taxes tend to be distortionary. These distortions mean that the cost of raising a given value of funds in terms of the overall welfare of the economy will, on average, exceed the monetary value of the funds that are raised. This is also described as the deadweight loss of taxation. Similarly, where additional taxes accrue as a benefit of a project, the value of these taxes exceeds their monetary value. The argument is that – at least in theory – taxes, and therefore the deadweight losses, can be reduced by this amount elsewhere in the economy. That this might not happen in practice for a particular project is not an issue since it is a marginal argument i.e. that each additional unit of taxes created plays a role in allowing for taxes elsewhere to be lowered (assuming constant public expenditure and a constant fiscal balance).

In the 1980s it was calculated that the social cost may be as high as 2 i.e. for every €1 raised there was a cost to the economy of a further €1. In this environment, it was necessary that the benefit cost ratio exceeded two before any net benefits were received, unless this social cost was explicitly included in the calculation. The availability to Ireland of EU funds during the 1990s meant that the proportion of public funds used in investment could be valued at their monetary value since their expenditure did not imply matching taxation in Ireland. There is no doubt that this situation has changed radically. This was shown by the work of Honohan which concluded that the social costs of public funds had fallen to 1.5 meaning that the loss to the economy of each additional € of taxation raised had fallen by 50% since the mid 1980's[23]. This change is certainly in line with expectations. Furthermore, this reduction has proceeded in recent years, although it should not be concluded that the deadweight loss has been eliminated fully. Indeed, this is the rationale behind the reductions in income and other taxes in recent years, usually expressed as the removal of disincentives to make the supply side of the economy more competitive.

Taxes are now less distortionary in Ireland and the public finances have been in a strong position over the medium term. The combination of these two elements means that the funds that are invested could be borrowed by the state at preferential interest rates and paid back from future taxation. As a result, it appears appropriate that public funds should be valued at closer to their monetary value than these earlier estimates. A ratio of 1.3 to 1 for the social value of public funds to their monetary value is adopted in the appraisal where public funds arise in terms of subsidies and other expenditure paid from exchequer funds.

Not all expenditure in promoting forestry places a cost on the Irish exchequer since a sizeable proportion is met by funding from the EU. Money from EU funds has been important in Ireland in a number of areas other the past couple of decades and the general approach taken in such circumstances is that these funds should be fully included as a cost in the appraisal. However, since they do not place any onus to

[23] Honohan, P. (1996) *Methodological Issues in the Evaluation of Irish Industrial Policy*, Working Paper 96, Dublin: ESRI

increase taxation in Ireland they should be included at their market value i.e. as though they were private funds. However, this is considered to be inappropriate in the case of forestry. The assumption underlying the usual procedure is that the funds have an opportunity cost in that they could be used elsewhere in the Irish economy for some other purpose. However, with forestry funds, it is a lot less clear that this is the case. The EU funds enter the economy on the basis that they will be spent on forestry. If they are not spent in this sector then they are effectively lost. This suggests that the correct approach is to treat these funds as having no opportunity cost to the Irish economy as a result of their use in promoting forestry.

There are two possible arguments against this. The first is that the funds have to be raised somewhere and Ireland as a member state of the EU must therefore contribute a proportion of the funds. However, in practice, not only will Ireland's contribution be very small overall given the small size of the economy, but it is also the case that there is no perceptible marginal impact as a result of the funds being spent in Ireland. In other words, if they did not go into Irish forestry they would just be spent elsewhere. The second argument arises partly from this train of thought and is perhaps more meaningful in the longer term. It is that if the funds were not being spent in Irish forestry then Irish policymakers would take into account the smaller total inward flow of funds to Ireland and would attempt to revise some other area of EU policy to extract the funds under some other programme, probably with respect to agriculture or regional development. This suggests that even where the funds are specifically earmarked for expenditure in forestry and are lost to the country, there is still some opportunity cost in the longer run. This argument has some validity and it would appear appropriate therefore to attach some opportunity cost to EU funds. However, this is undermined if the use of funds under the forestry programme replaces premiums payments under the CAP. As a result, the appraisal does not assume an opportunity cost for EU funds, although it is prudent to bear these issues in mind in terms of the appropriate error intervals that should be applied to the results. Of course, if EU funds are used that would be available to the country in any case they are included at their nominal values.

In the appraisals below, it is assumed that the planting of forests at the rate seen in recent years will be sufficient to allow Ireland to draw down the available EU funds fully. The impact of this is that the appraisal of a marginal hectare – i.e. an additional hectare that is planted as a result of a policy incentive – assumes that the funds allocated must come fully from exchequer funds. However, EU funds play a role in the funds allocated to the 20,000 ha per annum.

These issues are relevant where the total impact of the forestry sector on the economy is being assessed. However, they are less relevant in undertaking an exchequer flow analysis. Essentially, this is a more straightforward monetary calculation where all flows are public funds or, at least, are being assessed from the point of view of a single entity – the Exchequer. This is the relevant basis where co-funding is not available. Therefore, all units are monetary units and the distinction between the social value of funds in the private and public sectors can be dropped. This is more in keeping with usual procedures where exchequer returns are presented in terms of their monetary values without reference to the potential social costs or values of these funds.

3.1.5 Using Multiplier Analysis

Increased economic activity in forestry can lead to secondary effects as the wages earned are re-spent and as inputs to the sector are paid for. Thus, the investment and its subsequent operation stimulates economic activity in the area, either through direct purchasing or employment, or through knock-on effects that arise from the first round of spending. It must be noted that the economic boom of recent years has meant that, as spare capacity in the economy is brought into production, the net value of these benefits has tended to fall since an increasing proportion represents displaced – rather then additional – economic activity. However, this aggregate view ignores the fact that economic activity is increasing regionally concentrated while many areas continue to experience much less vibrant economic conditions. In addition, even where no additional employment is created, higher value employment may result, i.e. the investment may increase labour productivity as new jobs replace old ones.

This feature of economic activity may be included in the appraisal through the introduction of appropriate multipliers. The methodology is based on Input-Output analysis and has been commonly used to estimate the total impact of many sectors of the economy. The methodology is based on the fact that a ripple effect ensues from any increased economic activity with the result that the total impact of the additional unit of activity is likely to be greater than the value of the original unit. The impact becomes less intensive at each successive iteration as demand 'leaks' out of the system through taxes, imports or savings, eventually disappearing.

However, while the use of multipliers is valid in determining the total impact of a development, their use requires caution. The first potential problem with using this methodology is that it is based on marginal values. It relates to the impact of an *additional* unit of activity. Simply applying the multiplier value that is found to total values, i.e. multiplying the impact of the additional unit by the total number of units of activity already being carried out, assumes that marginal and average values are equivalent. This is not necessarily the case, but the assumption that this is not generally a major problem has led to the mis-use of this procedure in many cases. A further serious problem lies with the interpretation of the results of multiplier analysis. The problem is that if every business undertook a similar exercise it is clear that the total value of economic activity that would be identified would be many times the actual value of the economy. The only legitimate interpretation that should be given to any figures calculated is that if the initial units of expenditure by the forestry sector were to disappear then the total impact on the economy would be provided by the estimates obtained through multiplier analysis.

No insight would be gained by applying multipliers to totals for employment or output in forestry to indicate the total value of the sector. However, when the analysis is confined to marginal effects only, as is the case in the CBA being undertaken here, then the methodology is legitimate. The interpretation of the results obtained in the case of the estimation of the marginal hectare is straightforward since this is by definition an additional unit of economic activity. In the case of the target of 20,000 ha afforestation per annum greater care is required. The appraisal clearly must be interpreted as the impact on the economy of afforestation at this level with a situation of no additional planting. In this case it is important to remember that as the economy has boomed additional activity has risked leading to overheating. In this case there is

a risk that the costs of the secondary effects may be greater than the benefits that result. To avoid making unsubstantiated claims for the sector a conservative approach is taken in the evaluation of multiplier effects in the CBA. However, a key point is that forestry is located in regions that are lagging economically and has a regional impact. The result is that it is meaningful to include the impact of forestry on the rural areas through multiplier analysis although, as discussed further in later sections of this chapter, the estimation of these effects is not straightforward.

Estimates of appropriate multiplier values are available for the year 1993. This is the latest year for which the necessary Input-Output tables have been compiled. These are shown in Table 3.1.

Table 3.1: Forestry Multipliers

	Indirect	Induced	Total effect
Output	0.271	0.721	1.992
Income	0.168	0.44	1.608
Employment	0.23	0.41	1.64

Source: Ní Dhubháin *et al*

Clearly, the economy has changed considerably since then but this does not mean that these impacts are less important. Similar linkages will still exist in the economy. What has changed is the actual final impact of an increase in demand in one sector on the whole economy as it permeates through. This is accommodated in this appraisal through the adoption of displacement rates that take account of the much tighter labour markets that now exist when compared with 1993. As a result, it is considered that the income multiplier is more appropriate than the employment multiplier in terms of the approach that is taken in this appraisal for identifying the impact.

3.2 Evaluation of Benefits

3.2.1 Timber Value

Valuing the timber produced is relatively straightforward compared to other costs and benefits since the value accrues fully to the producer and market prices are can be used. In addition, since Ireland is a price taker in timber markets and is likely to remain so, there is no difference between the per unit value that should be attached for the output of all forest and the marginal hectare. Forecast crop harvest volumes and timber values for the sale of timber for different harvest types are shown in table 3.2[24]. The forecast volumes are based on British Forestry Commission Yield Models for Sitka spruce, Yield Class 20, managed under an Intermediate Thinning regime. These assumptions are based on consultations with industry operators.

The net value is used in calculating the benefit. The implication of this is an assumption that while there is employment generated in managing the crop in later

[24] The timber values used in this table as outlined in ITGA Yearbook 2003 and are based on 2001 figures.

years and in harvesting, the displacement of the incomes and taxes that result is 100%. Given that harvesting does not take place until more than 40 years after afforestation this is the only viable assumption. In any case, the discounted value of this economic activity would be very small.

Table 3.2: Net Value of Timber Produced per ha[25]

Harvest Type	Year	Volume (m^3/ha)	Price €/m^3	Net Value (€/ha)
First Thinning	20	70	3.00	210
Second Thinning	25	70	10.00	700
Subsequent Thinning	30	70	20.00	1,400
Subsequent Thinning	35	70	38.00	2,660
Clearfell	40	473	46.00	21,758

These values need to be discounted and although the value accrues in total to the private individual, this analysis is being undertaken from the point of view of society. As a result, the discount rate is the social discount rate of 5% per annum. This gives a value of €4,183 per ha.

3.2.2 Incomes Earned

For the purposes of this analysis it is important that the costs involved in planting and maintaining the forest are allocated between labour and materials[26]. It is assumed that premiums are 100% income for labour although it is recognised that there is likely to be some expenditure by growers on materials during the lifetime of the crop. A more difficult issue is to allocate the initial costs – those associated with the payment of the grants in years 1 and 4 – between labour and materials. The grant paid is subject to VAT at 13.5% (grants were not adjusted when the VAT rate was increased in 2003). On the basis of information obtained from the industry, Table 3.3 shows the percentage allocation of the net of VAT grants between labour and costs. It should be noted that this allocation is made on the basis of first round expenditure so that for an item such as plants, while it is the case that the production of plants will involve labour, this is captured by the use of multiplier effects.

Table 3.3: Allocation of Grant, Planting and Maintenance, Net of VAT

Labour:	Planting	12%
	Fencing	6%
	Miscellaneous	3%
	Management	32%
	Cultivation	8%
Total Labour		**61%**
Materials	Plants	15%
	Fertiliser and Fencing	8%

[25] Net of standard costs associated with timber sales and harvesting.

[26] Although there will clearly be variation in this regard, it is assumed that the costs are equal to the grants and premiums paid since these represent income in this period and, in the aggregate, total costs must equal income.

	Management	8%
	Cultivation Machinery	8%
Total Materials		**39%**

Data from the industry show that the gross wage costs of planting and maintaining a hectare of forest has a discounted value of €5,524. This is calculated on the basis that the discounted value of the premiums that would accrue on the average hectare will be €3,877 while the proportion of the grant that accrues as direct incomes is equal to just under €1,647. Incomes in forestry will tend to be towards the lower quartiles of incomes in Ireland. On this basis, and in the absence of actual data, an average income tax rate – including PAYE, PRSI and levies of 20% – is assumed for incomes earned from the grant payment. This leaves a net income per hectare afforested of €5,195 and €103.89 million from the annual 20,000 ha[27].

This income will also give rise to second round multiplier effects. Applying the income multiplier to gross wages earned in forestry gives additional incomes of €3,358 arising in the economy as a result of a marginal hectare planted. Assuming that a general income tax take of 30% is appropriate for the economy as a whole then additional net incomes of €2,351 arise for each addition hectare afforested as a result of knock-on multiplier effects. The total indirect and induced net incomes from 20,000 ha will then be €47.02 million.

3.2.3 Tax Revenues

The most immediate tax revenue that arises is from the VAT that is paid at a rate of 13.5% on the grant received. On an average grant with a present discounted value of €3,121 per ha, this has a monetary value of just over €421. Following the convention of valuing public funds at 1.3 times their monetary value, this is worth just under €548 per ha. This is then valued at €10.95 million for 20,000 ha. Since this arises directly on payment of the grants there is no tax displacement involved.

Tax revenues also arise from direct and indirect incomes and from taxes on expenditure in forestry and expenditure arising for the indirect effects. Direct income taxes on the basis of the calculations above will have a discounted social value of €428.17 per ha – 20% of gross incomes from planting – and €8.56 million for the 20,000 ha. Income tax arising from indirect and induced employment – levied at 30% of gross income – will amount to €1,309.80 for the marginal hectare and to €26.2 million for 20,000 ha.

The data in Table 3.3 indicate that expenditure on material inputs other than trees amount to 24% of total costs in afforestation. Much of this expenditure will give rise to tax revenue from taxes on expenditure[28]. Analysis of CSO data on the Irish economy shows that expenditure taxes in 2001 amounted to €13 billion, equal to 11.4% of GDP. Applying this rate to expenditure on material inputs in forestry

[27] It is likely in practice that there will be economies of scale in large scale afforestation but the data for 1 hectare are taken to represent both average and marginal incomes. Incomes arising from supported activities in dependent sectors are dealt with in a separate section.
[28] This is not VAT which is assumed to be fully recoverable.

indicates a tax take with a social value of €96 per ha afforested, amounting to €1.92 million for the 20,000.

There will be indirect effects also in the case of an increase in afforestation. In this case it is appropriate to include the proportion of direct expenditure on plants since this will give rise to additional expenditure. Applying the GDP multiplier above indicates that these will amount to €1,044 per ha. Again, applying the average expenditure tax rate applicable to the whole economy to this – 11.4% – indicates that this will give rise to additional tax revenue with a social value of €155 in the case of the marginal hectare, amounting to €3.1 million arising from the annual 20,000 ha afforestation target.

3.2.4 Carbon Sequestration

It has long been recognised that forestry, and in the Irish case an increase in forestry, provides value to the wider economy in addition to whatever value may accrue to the investors. This externality is in effect a transfer from the investors to the wider economy. This arises in a number of ways generally concerned with aspects of environmental well-being and amenity value. Where such a positive externality exists, economic theory concludes that investment in forestry will be at a level that is optimal for the investors but is sub-optimal from the point of view of society. This problem can be addressed either through intervention – usually by the public sector – to transfer this value in whole or in part back to the investors. Often the only method available is through subsidies or provisions in the tax system, but in some cases it may also be possible to create a functioning or a quasi market to replace the transfer of the value from the investors by a trading mechanism. In this manner, the investor can capture the total value and the level of investment will approach the socially optimal level.

Appendix A discusses Ireland's commitments under the Kyoto Agreement and shows that without remedial action emissions of GHG will exceed the allowable levels. This means that there will be an economic value to CO_2 avoided under all reasonable projections.

Estimates of the potential role of forestry in avoiding excess emissions have been produced for Ireland. It is estimated that the rate of carbon storage in Irish forests of pure Sitka spruce is in the region of 3.36 tonnes[29] per ha per year[30]. More carbon is actually stored in soils than above ground but vegetation provides the means for the transfer of carbon between the atmosphere and storage. Under Kyoto, the impact of new forests since 1990 may be counted as net effects in terms of a country's total emissions. If planting targets were to be achieved, carbon sequestration by new forests in Ireland would offset approximately 43% of Ireland's projected surplus greenhouse gas emissions in 2012. This would involve sequestering 6.34 million tonnes of Carbon during the period 2008-2012.

[29] 3.36 tonnes of carbon is equivalent to 12.33 tonnes of CO_2

[30] Kilbride, C., K. Byrne and J. Gardiner (1999) *Carbon Sequestration & Irish Forests*. Dublin: COFORD

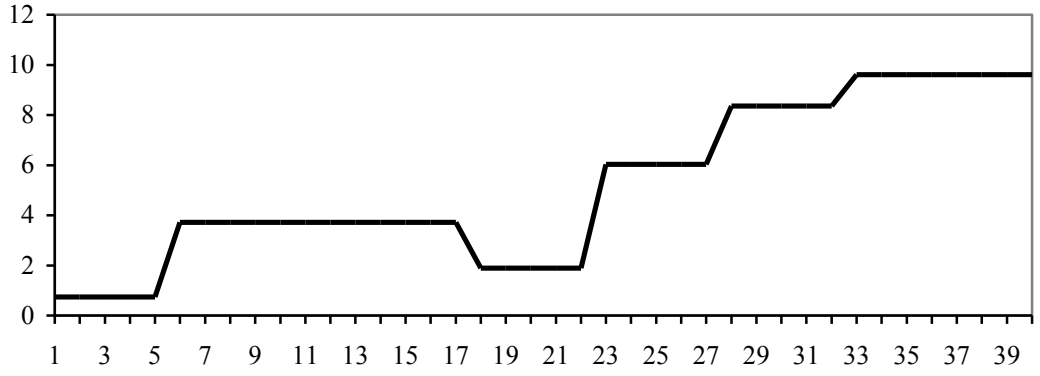
Research undertaken by COFORD has provided estimates of the annual CO_2 sequestration of a typical hectare of new forest as it grows. The analysis is based on a number of assumptions. The hectare was assumed to be composed of 80% Sitka spruce and 20% beech. The conifers have a yield class 16 and undergo intermediate thinning (equal to 56 m^3 per ha at 20, 25 and 30 years.) Four growth periods were identified and growth results from these assumptions are shown in Table 3.4. For the beech a yield class 4 was assumed and no thinning was undertaken.

Table 3.4: Conifer Volume Growth per ha (m^3)

Age	Cumulative Volume	Annual Incremental Volume	Volume after Thinning
0-17	75	75	75
18-22	156	81	100
23-27	262	106	120
28-32	382	120	150

Average growth rates from the Coillte estate for Sitka spruce and beech were used throughout. It is believed that average growth rates in private afforestation since 1990 are significantly higher but there is no objective way to determine this at present. As a result, the growth estimates are conservative and are likely to be revised upwards as more reliable area, inventory and research data become available. The estimates were derived using the International Panel on Climate Change approach (draft Good Practice Guidance). This growth results in the annual incremental CO_2 sequestration shown in Figure 3.1. CO_2 storage estimates are given net of emissions from soils, vegetation and thinning.

Figure 3.1: Annual Incremental CO_2 Sequestration (tonnes pe hectare)



Source: COFORD

The final requirement is to place a value on this CO_2 sink. Assuming the planting takes place in 2003 (year 0) at €40 per tonnes of CO_2 in the period 2005-07 and €100 per tonne thereafter, this analysis gives a discounted value of €6,000 per ha. This indicates the extent to which the environmental impact of forestry must now be stressed. However, it is not out of line with recent research that indicates that the returns from forestry's impact on CO_2 alone, when valued at €100 per tonne, is almost sufficient to offset the expenditure of public funds in promoting afforestation[31]. This

[31] Hendrick, E. and G. Gallagher (2003) 'National Carbon Accounting and CARBWARE. Paper presented to CORORD Industry Briefing Session *Forestry and Carbon*, 2nd April

report calculates on the basis of these assumptions that the value of CO_2 sequestration from 20,000 ha is €120 million.

3.2.5 Value Created in Processing

Section 2.2 above showed that total forest output of 2.84 million m^3 in the Republic of Ireland in 2001 was sufficient to support a processing sector with in the region of 2,200 employed. In order to ensure that consistent data are used it is assumed that NACE Codes 201 (Sawmilling and planing of wood) and 202 (manufacture of wooden board products) represent this activity. As argued in Section 2.2, transport costs mean that this activity would not exist without a local supply of timber so it is legitimate to assign the wealth created in this sector to the existence of the forest sector. The CIP data make it possible to identify this value in the static sense of what exists currently, but a much more difficult calculation is to estimate to what extent additional afforestation currently will lead to value in this sector when the wood is harvested. Furthermore, the projected values must be discounted back to present values if they are to be included in the CBA. This means that this is a valuable industry that is likely to grow as the supply of timber grows.

This value created in this industry can be identified in two areas of the CIP data: the wages earned and the net non-wage value added. The data show that a total of 2,179 were employed in these sectors in 2001 and the total wages amounted to €54.4 million. Non-wage net output was €97.3 million. In keeping with assumptions elsewhere in this appraisal, if it is assumed that a shadow wage of 80% is appropriate then this provides a net addition of €10.9 million from this source.

Estimating the additional value created by the remainder of net output is more difficult. The data are net of materials, fuel and services and so will include interest payments and depreciation. The margin represented by these values is 22% of gross output in the sawmilling sector and 25.7% in the panelboard sector. Clearly these are not profit rates but it is possible that profit after interest and depreciation could amount to 50% of these margins. This represents value creation. In the sawmilling sector it is assumed that 75% of this accrues to Irish residents but only 10% of the profit in the panel board sector accrues to Irish residents. However, a flat rate of 12.5% tax on profits is also assumed.

Section 2.2 showed that net output in NACE 201 was €54.1 million and in NACE 202 €43.2 million after wages and salaries in 2000. Applying the assumptions above – that 50% of this is profit, that 75% of profit in NACE 201 and 10% of profit in NACE 202 accrues to Irish residents, and that there is 12.5% tax on the remainder of the profit - provides an estimated contribution of €25.7 million in addition to the extra salaries. One potential argument against accepting this as totally additional is that it assumes that the funds invested into sawmilling would not have been invested elsewhere in the Irish economy if this opportunity did not arise i.e. there is no opportunity cost. However, since there is no constraint on the availability of funds in Ireland this assumption is arguable. If this argument is accepted then, the additional wealth arising in the economy as a result of the processing industry is €36.6 million per annum.

Forests planted today will support the processing industry in the future. The strategic plan targeted output of at least 10 million m^3 per annum, i.e. about 3 times the current rate. Since it is not projected that the price of timber will fall, this should mean that the value of the processing sector should also treble. Economies of scale, even if there is little technological progress should mean that there will be a reduction in the proportion of net value added that is accounted for by labour with a consequent increase in interest and depreciation payment i.e. payments for capital. Given that a sizeable proportion of the capital in NACE 202 is foreign owned then the value added in the sector will rise by somewhat less than 3 times the current level. Allowing for this gives an industry creating wealth of about €100 million per annum for Irish residents. To allow for the impact of thinnings it is assumed, based on the time profile in Table 2.4 above, that 1% arises in year 20, 3% in year 25, 5% in year 30, 10% in year 35 and the remaining 81% in 40 years time as a result of planting in the current year. This gives a net present value that can be attributed to the current year of €15.5 million. If it is assumed that this would be achieved with annual afforestation of 20,000 ha as targeted in *The Strategic Plan* then the value per ha is €774.

3.2.6 Leisure and Amenity Benefits

A number of other external benefits of forestry have also been identified. These generally come under the headings of leisure, amenity, tourism and protection of habitats and landscape. The Strategic Plan refers to these benefits and provides an indicative estimate that they may amount in value to in the region of 5-7% of the timber value. Clinch placed a value of £129 million (€164 million) on these benefits. Clearly, this is not insignificant. However, much higher estimates have been recorded in other studies. For example, a study of the economic impact of forestry in South West England found that leisure and amenity impacts were significant[32]. It found that while the direct value of timber production at in the region is around £17 million per year, representing less than 0.1% of regional output, other direct economic uses of Woodland and Forestry, including recreation, tourism and sporting activities, provide major returns. It was estimated that the gross value of these activities may lie between £300-375 million per year. This would be around 20 times the value of the timber produced.

This suggests a wide range of estimates and clearly even where accurate valuation methodologies are used the results will depend on issue such as the type of forest available, accessibility, demand for amenities and many other factors. Clearly placing a value on this is problematic. However, the objective of this study is not to place aggregate valuations on the national estate but to appraise the value created by afforestation. As a result, it needs to be asked to what extent additional afforestation adds to these values?

The first point is that a sizeable portion of the value assigned by Clinch arises from the potential impact of forests on tourism and forest visits. It needs to be considered if more forest cover in Ireland would add to the benefits that arise in this respect. It is the consultants' judgement that the additional benefit from these sources from more

[32] *South West England Woodland and Forestry Strategic Economic Study*

forest cover would be very small indeed. A second point that is very clear from *The Strategic Plan* is that there are both benefits and costs under this heading as a result of greater afforestation. Indeed, *The Strategic Plan* states that 'forestry can give rise to environmental problems' and the approach taken is to ensure that the incentive scheme minimises the negative impact of forestry on the environment[33]. As a result of these considerations, the conclusion reached is that forestry as a whole plays a positive role in terms of its environmental benefits but that as the area under forest cover grows the marginal addition is very low. The guided development of the sector is minimising the negative environmental impacts but the positive additions are low. As a result, no additional benefit is assumed to arise from a marginal hectare in this evaluation and it is considered appropriate that a fairly conservative approach should be taken to placing a positive value on the benefits that would arise under this heading as a result of an target afforestation of 20,000 ha per annum. As a result, a value closer to that contained in *The Strategic Plan* than the higher estimates is placed on this. The present value of timber that will be produced from 20,000 ha afforested in the current year was estimated at €79.67 million. A value equal to 10% of this is placed on leisure amenity and non-atmospheric environmental benefits. This gives rise to a benefit of €7.97 million.

3.2.7 Impact of Forestry on Rural Areas

Increasing attention has been paid to achieving a better regional distribution of economic activity, income and settlement patterns in Irish economic policy in recent years. However, the evidence of the past decade is that, apart from the important contribution made in this area through the reduction in unemployment, the development of the economy has not improved the distribution of income in the manner that might have been hoped. Just as the leading regions have gained most from growth, the stronger income groups have gained from rising prosperity. The potential benefits include issues such as a greater choice of where to live, less lost commuting time, lower congestion in leading regions and the welfare gains of participation in economic activity. However, many of the benefits of balanced regional development and enhanced social inclusion are not marketed. As a result, their evaluation is very difficult but clearly positive in terms of economic welfare.

Forestry has the potential to make a very direct impact on regional imbalance since it takes place in areas with few other options for sustainable wealth creation. However, it is difficult to identify the value of this in terms of a CBA. Efforts have been made to accommodate the impact of development on rural areas in CBA's but instances of the successful application of weights to recognise the different marginal utilities of income in areas with contrasting economic performance are rare. Earlier work by Kearney and O'Connor utilised household data and found that forestry made an important contribution to regional incomes and did not displace agricultural income to a major extent[34].

In this appraisal, recognition has been taken of the fact that forestry takes place in such areas through the use of shadow wages below the wage rate and the use of

[33] In the opinion of the consultants *The Strategic Plan* is too cautious with respect to the impact of forestry on the atmospheric environment but this is dealt with above.
[34] Kearney, B. and O'Connor, R. (1993) *The Impact of Forestry in Rural Communities*. Dublin: ESRI

multipliers although the economy in aggregate is close to capacity. The argument for using these procedures is that there are rural areas where productivity gains can lead to higher incomes where displacement is less than 100%. Thus, an idea of the impact of forestry on a rural area can be found by aggregating the net benefits that arise from a shadow wage below the wage rate and the use of multipliers. In other words, it is assumed that if there were no rural areas then this value would not accrue due to 100% displacement and scarce resources. Thus, the net benefits from incomes and income taxes and from the multiplier effects are included. In addition, it is appropriate to include some element of the expenditure taxes that are created. Most of these will relate to imported goods, but it is assumed that 20% arise from goods that are themselves supplier from rural areas to forestry.

Aggregating these values gives a result of an economic impact of €2,574 on a rural area from the planting of 1 hectare of forest. If it is assumed that all afforestation takes place in rural areas then this gives a net impact of €51.5 million in a year. Much of the processing of timber also takes place in rural areas. This means that the regional impact of forestry is enhanced along the lines identified in section 3.2.5.

While this provides an indication of the welfare effect of forestry on rural areas while staying within the guidelines that have been set down, it is not additional to the benefits that are identified. Multiplier effects and the impact of a shadow wage below the wage rate are fully included. However, it is at least intuitively clear that this does not fully capture the potential. The problem is that the methodology to quantify these additional effects is not adequately developed. This issue is discussed in greater detail in section 3.4.2 below and shows that there are additional benefits that are not fully captured by this static approach to understanding the economy.

3.2.8 Agricultural Subsidies Avoided

One of the arguments that has been put forward is that for every hectare that is transferred into forestry there is a saving of agricultural subsidies that do not need to be paid. As a result, this saving is a benefit that can be assigned to forestry. An alternative version of the approach compares the subsidy provided to the two land uses and places the net difference as the true subsidy given to forestry.

From the point of view of the flows of public funding over any period of time this argument has validity and clearly in an accounting sense the logic is correct. However, it would not be appropriate to include the savings from lower agricultural subsidies in this calculation. The reasoning leading to this conclusion is straightforward. While the expenditure of agricultural subsidies is clearly a cost, this translates directly into income for farmers. As such, there is an equivalent increase in incomes (benefits). Removing any part of the subsidy from the economy reduces the incomes by the same amount. Therefore there is an exact offsetting cost. If the reduction in agricultural subsidies as a result of the payment of forestry subsidies was included as a benefit of this calculation then the cost of this in terms of incomes would have to be included also. Clearly, this complication adds nothing to the analysis.

3.3 Evaluation of Costs

3.3.1 Public Funding Costs

It was argued above that funds provided by the exchequer are more costly than their monetary value would suggest. However, where the funds are provided by the EU and would not otherwise be available to the economy then they are essentially free to the economy. As a result, identifying the origin of funds is clearly very important but the complexity of the regulation in this respect means that there are difficulties in being precise. The context for the expenditure of funds is provided by the National Development Plan 2000-2006 (NDP). The main provision under the NDP is the Afforestation Scheme, under which total funding of €687 million over the 7 years of the plan is identified (€98 million per annum). Of this, €467 million is co-financed (75% EU funding) while the remaining €220 million is to come from exchequer spending. Thus, if all went to plan, 51% of total expenditure would come from EU funds. However, there are complications.

While there is a limit on the aggregate level of EU funding that is available it is possible that in any specific year the amount coming from the EU could be lower/higher than the average received over the course of the programme. This would be the case, in a year where particularly high levels of planting occurred, or conversely if the level of planting was particularly low. Second, this expenditure was identified on the basis of annual afforestation equal to the 20,000 target specified in *The Strategic Plan*. However, this has not been reached in any year to date. The result is that the total funding provided in 2000 and 2001 was well below the average – at €74.3 and €85.8 million. However, although planting in 2002 did not reach the afforestation target either, expenditure was close to the target at €96.3 million. This suggests a divergence between the viability of the afforestation targets in *The Strategic Plan* and the financial resources allocated under the Rural Development Plan of the NDP 2000-2006. Third, forestry receives other funding from four sub-measures in the BMW and S&E Operational Programmes. Two of these are co-financed to a level of 75% in the BMW region and to a level of 50% in the S&E region. However, these payments tend to be specialised in areas such as woodland improvement and harvesting infrastructure and, as a result, a typical area of commercial afforestation will not attract this funding. Finally, while premium payments are included in these funding schemes along with grants, they are calculated on an annual basis. In other words, the relevant payment is the annual amount that has been committed. However, in terms of the current calculation the relevant payment is the discounted value of all payments that will be received over the period for which the premiums will be paid. Clearly, this period exceeds the lifetime of the NDP for which expenditure decisions have been made. However, while there will certainly be negotiations in relation to the availability of future EU funding in this area – the eastern enlargement is clearly an issue of importance in this regard – there are also existing commitments in relation to the future provision of EU funds to meet premium payments that have been committed under the existing funding arrangements.

Despite this complexity it is clear that the origin of funding for the marginal hectare will be in part funded by the EU on the basis that it has the characteristics of an average hectare of afforestation. To identify the appropriate level for EU funding the following assumptions are made:

- The relevant scheme is the afforestation scheme only;
- Over the period of the NDP the expenditure estimates will be correct. This basically implies that although the targets are not being met, higher costs means that the full €687 million will be spent; and
- The existing commitments mean that the proportion of premiums for any identified hectare that is planted in the period 2000-2006 that originate in EU funds will be maintained for the full period of the payments.

The consultants recognise that the range for the provision of funds by the EU for any specific hectare can be 0% to 100%. However, for an average hectare, the recent situation suggests that these assumptions are at least as legitimate as any alternatives[35]. This means that, on average, 51% of funding comes from the EU. Furthermore, when these funds are provided by the EU means that they have zero opportunity cost i.e. they are not available for any purpose other than investment in forestry.

The question then is to identify which is the appropriate valuation to use. When assessing the cost of funds applied to forestry in general in a year, the correct valuation is to value the 49% of the funds that are provided by the exchequer at 1.3 times their nominal value. Thus, the total social cost of the funds being invested is 63.7% (i.e. 1.3 by 49%) of the total nominal value of funds. However, while this is valid when looking at the total, it is not valid when dealing with a marginal hectare since, on the assumption that the EU funds will be fully drawn down, any additional hectare will be paid for entirely from exchequer funds. Thus, the appropriate social valuation is 130% of the nominal value of the funds.

The incentives provided vary depending on the species being planted and whether the investor is a farmer or non-farmer. The maximum grants provided per hectare are

- €2,032 for Sitka spruce
- €2,159 for 20% diverse conifer mix
- €2,412 for 100% diverse conifers
- €3,809 for broadleaf species other than oak and beech
- €4,825 for oak
- €5,079 for beech.

These grants are payable following planting. In addition, a maintenance grant approximating to 33.3% of the first grant is paid in year 4 provided certain conditions are met. The grant payable cannot exceed actual costs and, in recent years, the costs often equal or exceed the maximum grant.

Annual premiums are also paid on a per hectare basis. Premiums are paid to farmers, who accounted for 91% of total planting, for the first 20 years of the plantation and

[35] Clearly, any shortfall in expenditure in any year will fall on the 100% exchequer funded element. This means that, in the light of the current cut-backs, this estimate is too low. Therefore, there is an in-built assumption in the results that the cutback in the current year is temporary and that the government will return to the strategy contained in *the Strategic Plan*.

vary from €210/ha to €499/ha on a sliding scale depending on the species and area. For non-farmers, the annual premiums are paid over the first 15 years of the plantation and are €171.41/ha for conifers and €184.11/ha for broadleaved species.

On the basis of these grant and premiums rates, and using data for the years 1997-2002 on the proportion of each species in the total planted and of the proportion accounted for by farmers and non-farmers, a weighted value for grants and premiums payments was calculated. The weighted grant is €2,449 on this basis, while the annual premium payable to farmers is €358.44 per hectare and €173.35 to non-farmers.

The values mean that for an average hectare displaying the characteristics of afforested land over the period 1997-2002, the total commitment made by the State is €10,023 per ha. When discounted at the social discount rate of 5% per annum this gives a cost of €6,998 per ha[36]. Since actual planting has fallen short of the strategy target in all these years it can be taken that this average value is also appropriate to apply to the marginal hectare. If the target afforestation of 20,000 per ha is achieved then the total commitment of public funds is €140 million. The EU commitment is €350 million over 7 years or an average of €50 million per year. This implies an exchequer commitment of €90 million in nominal value with a social value of €117 million for the 20,000 ha, equal to €5,850 per ha. The marginal social cost of additional afforestation which must be met fully from exchequer funds is €9,097.37 (i.e. €6,998*1.3) in present values, reflecting the social cost of funds to the Irish exchequer.

3.3.2 Direct and Indirect Labour Costs

The analysis indicated that the payment of wages for planting 1 hectare of new forest would provide gross incomes of €5,524 and net incomes of €5,194 when taxes are removed. This labour is not costless and a shadow wage to account for its opportunity cost is included at a value of 80% of the wage rate. It is considered that the regional dispersal of this employment plus the higher productivity of labour in forestry when

[36] A few simple calculations using this figure indicate an important issue in relation to forestry policy. Overall funding does not distinguish between grants – which are clearly related to productive investment – and premiums, which are income supports. Total investment in forestry under the Afforestation Scheme over the period of the NDP is set at €687 million. The stated strategy target is 20,000 ha per annum up to 2020. Assume that going forward all values including the government allocation increase at the same rate of inflation. If each ha implies a commitment of €10,023 by the State, then it is clear that an annual allocation of €98 million (average Rural Development Plan provision 2000-2006, 2000 prices) would be sufficient for only 9,780 ha. per annum. The full impact of this has not yet appeared because the scheme has only been running for a limited number of years. However, the commitment from previous years that must be met each year will continue to grow until almost 20 years into the programme when it will level off assuming a constant planting rate. When this constraint becomes relevant then any shortfall in the funding allocated to the sector will fall totally on the investment portion since premium payments are guaranteed. The only way that this problem can be avoided is to provide separate allocations, one to meet the cost of premiums already committed and one for net afforestation in the year in question. This calculation also implies that the total allocation needs to grow in real terms by a considerable amount for the foreseeable future if sufficient seed capital to achieve the targeted rate of planting is to be provided.

compared with the alternatives makes this assumption feasible[37]. This means that the social cost of labour is 80% of the wage rate for direct employment, equal to €4,156 per ha. It is not considered given the relatively low employment in the sector in total that there will be any deviation between average and marginal values. In this it should be noted that the shadow wage of 80% is also being applied to the incomes that are received by landowners in the form of premium payments. A value of €83.11 million arises for the social cost of direct labour over the 20,000 ha.

In the case of incomes earned from indirect and induced employment the regional and productivity gains are less certain and the tight labour market suggests that displacement is likely to be high. As a result, a shadow wage equal to 90% of the wage rate is appropriate. This means that the social cost of this labour is €2,116 for the marginal hectare and €42.32 million for 20,000 ha.

3.3.3 Displaced Taxes

Displaced taxes arise in two forms: profit tax and income taxes. Profits from forestry are tax exempt. However, it would be inappropriate to place a value on taxes foregone equal to the tax that would have been collected if this provision were not in place. The problem would be that this would ignore the fact that this provision provides an incentive to invest in forestry. In other words, the profits would not arise if the provision was not in place. The correct valuation to place on this cost is the tax on the profits that would be earned from this land if it were used for some purpose other than forestry.

Clearly this is not zero but some further consideration of the matter is required. It is a stated element of policy to wish to alter existing land use towards alternative uses including forestry. This means that there is a social benefit foreseen from the role of forestry in achieving this aim. However, this benefit is not included. Furthermore, it is clear that the trend in planting to date has only been partly successful in achieving this end with most planting taking place on land which is only marginally productive in other agricultural uses. The conclusion therefore is that, taking both these factors into account, the net cost under this heading is very small and, as a result, is not included in the calculation.

Displaced income taxes represent a more important item. As argued above, a shadow wage of less than 100% is justified on the basis that forestry takes place in relatively lagging parts of the country and has the capacity to pay higher incomes even where there is no net increase in employment. The conclusion reached was that displaced income should account for 60% of the total income earned. In addition, since incomes will now be higher on average, the proportion of incomes paid in tax will also rise. This suggests that the proportion of displaced income tax will be less than the proportion of incomes that are displaced. Highly disaggregated data would be required to allow a precise calculation of this proportion but these are not available.

[37] The shadow wage includes a value for the cost to the economy of producing this labour, not just the opportunity cost in terms of displaced output. For example, if the people involved made no economic contribution there would still be a cost in terms of then having less leisure and greater access to public services such as health. It is assumed that the 80% represent 60% displacement and a further cost of 20% of the wage rate.

To allow for these arguments, it is assumed that 50% of the income taxes that arise in forestry represent displaced taxes. The dispersed nature of Irish forestry also means that marginal and average values can be assumed to be equal. This gives a social value of €214 per ha and €4.28 million for 20,000 ha. There is also an opportunity related to the income tax that arises from indirect and induced employment. On the basis of the stated assumptions this will have a discounted social value of €1,048 for the marginal hectare and €20.96 million for the targeted annual afforestation of 20,000 ha.

3.3.4 Reduced Agricultural Output

The use of land for forestry, which is a permanent contract, means that it cannot be used to produce other agricultural products. Since the full value of the timber produced on this land is included as a benefit to the economy it is correct than the value that would have been produced on this land in some alternative use should be included as an opportunity cost of forestry. In identifying this value it is important to note that it is the value of output net of agricultural subsidies that must be used. As argued above these subsidies are both a cost in terms of public funds and a benefit in terms of income. More importantly for the logic of why the value should be assessed net of these subsidies is the observation that these funds do not represent value created on agricultural land but are value that is created elsewhere in the economy and then transferred to the agricultural sector. The fact that the actual payment is made in relation to land usage is a merely a regulatory feature that is unrelated to the actual creation of value.

It is necessary therefore to derive an estimate for the value created in Irish farming. Results presented in recent surveys suggest appropriate values[38]. These results are summarised in Table 3.5 and show that the subsidies received by Irish agriculture exceed 100% of family farm incomes.

Table 3.5: Payments as a Percent of Family Farm Incomes (1999 and 2001)

	1999	2001
Cattle	160	135
Sheep	145	111
Tillage	91	85

Source: Teagasc

The implication of these data is that the funds used in agriculture actually fall in value. For example, taking the outcome for cattle in 2001 when payments were 135% of farm income, total sales on a farm would have to be sufficient to attract subsidies of €13,500 of subsidies in order to provide an income of €10,000 for the farmer. The fall in the percentages from 1999 to 2001 reflect better weather conditions in the latter year rather than any underlying trend.

The payments received in dairying at around 20% of incomes are much lower. However, in this sector, prices in the EU are kept artificially above world levels through quantity controls. Clearly this is equivalent to a subsidy except the transfer is

[38] Teagasc National Farm Management Surveys, 1999 and 2001

done directly from consumers to agriculture. If equivalent subsidies were applied then the results for this sector would be broadly similar to those in other area of agriculture.

This has an important implication as regards the opportunity cost of farm production. In effect, this cost is negative. However, this includes only first round effects. The most important benefit to the Irish economy arises not from the value of the farm produce but from the use of this produce in the food industry in Ireland. Multipliers suggest that the impact of a marginal change in agricultural output and expenditure on the economy is greater than for other sectors including forestry. This means that the first round estimation of value undervalues agricultural production. For this reason it cannot be concluded that there is a negative opportunity cost i.e. a benefit to the economy, from reducing production. On the other hand it is clear that it would be inappropriate to place a high valuation on this cost. As a result it is assumed that the opportunity cost of the lower farm production on land that would have been used for agriculture is negligible.

This conclusion is given further credence by the observation that land moved into forestry does not result in a fall in agricultural output equivalent to the previous production of that land. The evidence suggests that additional forestry in Ireland has not been acting to reduce agricultural output[39]. The fact that forestry is possible on agriculturally marginal land means that it is possible for farmers to consolidate agricultural production into the better areas of farms and engage in forestry on the more marginal land. This is a clear efficiency gain in terms of land use, although it also means that one of the reasons for a forestry policy – to act to remove land from agricultural production – is not being achieved effectively.

3.3.5 Impact on Land Costs

The growth of forestry and the availability of incentives for afforestation mean that there are new commercial opportunities in land usage. This would be expected to increase the demand for land and, since the supply is set, it would be expected that the price of land would rise as a consequence. The potential for this has been examined in Ireland. The data show that the price of agricultural and forestry land has been increasing. In the period 1992-96 when the volume of annual afforestation peaked, forestry land increased by 37% compared to a 44% increase in the price of an average hectare of agricultural land[40]. This price increase is partly explained by a general move towards the use of better quality land in forestry but when the land is categorised according to quality it is clear that there have also been price increases within each category. However, the actual impact of this on welfare is not so clear[41]. First, this is a monetary change only with no real impact on the productivity of the

[39] See Kearney and O'Connor (1993)

[40] Barrett, A. and F. Trace (1999) *The Impact of Agricultural and Forestry Subsidies on Land Prices and Land Uses in Ireland*. Policy Research Series Number 35, Economic and Social Research Institute. They also note that these increases in the price of land occurred in a period when the general inflation rate was only 8.1%.

[41] Clinch does not attach much importance of this in terms of its impact of welfare and concludes that the benefits to farmers from the subsidies will outweigh and losses.

land. Thus, while there might be a redistribution of resources there is no overall impact on welfare. Second, while a farmer may experience a loss if he wishes to expand production into forestry but finds that increased land prices make this impossible, this is compensated by the fact that the land he already owns will have increased in price.

The link between the incentives and prices is also unclear. The Barrett and Trace (1999) research indicated that forestry grants have not led to an increase in land prices. Rather, grants paid to agriculture have pushed up prices across the board. Furthermore, these subsidies, REPS in particular, work to reduce forestry[42]. Although the level of subsidy paid to forestry is higher than paid under REPS, the take up of REPS has been much higher in the years examined, differing by up to a factors of 25. This is a somewhat surprising result and suggests that the factors that incentivise forestry are complex. The research found that the decision to undertake forestry involved a change in existing practices and that the perceived costs of the change, as distinct from the actual costs that the grants and premiums address, are high. These manifest in terms of what might be classed as a cultural objection to forestry – it is considered inappropriate to forest good land and forestry results in depopulation – lack of skills to undertake forestry and an unwillingness to commit land to a single crop for the long time period involved. As a result, Barrett and Trace conclude that 'the pool [of landowners] that is willing to convert to forestry may now be drying up' (p.41). The more recent work by Collier, Dorgan and Bell[43] suggests that there is a sufficient pool of land available to enable the targets set out in *The Strategic Plan* to be attained. They conclude that there are 37,000 farmers with a land pool of 490,000 ha of land that can be afforested.

Their research undertook a survey of farmers with more than 5 ha of land suitable for forestry. It found that forestry was most likely on larger farms and confirmed that marginal land was most likely to be used. Lack of suitability of land for other uses and the availability of premiums were the crucial determining factors. However, there was evidence that the premiums available are not competitive. The work also found that where the land was needed for extensification payments there was a disincentive to engage in forestry built into current farm policy.

3.4 Non-Quantifiable Benefits

An important aspect of CBA analysis is that it includes only those impacts that can be quantified in money values. In other words, only what can be measured is included. Clearly, this means that there will often be effects that are not accounted for. However, non-quantified impacts of the implementation of the relevant change should be included in the final assessment by decision makers and so it is important that these additional impacts are noted although not included in the evaluation.

[42] On this last point, similar results to Barrett and Trace were found by McCarthy, S., A. Matthews and B. Riordan (2002) *Determinants of Private Afforestation in the Republic of Ireland*. Trinity Economic Papers Series 2002/3

[43] Collier, P, J. Dorgan and P. Bell (2002) *Factors Influencing Farmer Participation in Forestry.* Dublin: COFORD

3.4.1 The Achievement of Critical Mass & Associated Scope for Economies of Scale

The potentially most important benefit that has not been quantified in the case of forestry policy arises form its role in achieving critical mass in the industry. The argument is that while each additional unit of activity has observed costs and benefits it also contributes to the achievement of the critical mass that would make the industry competitive and sustainable. Indeed, this is one of the most important market failures that the policy is designed to address. In terms of the structure of the analysis that is undertaken, the marginal benefits would exceed the average benefits identified under many headings with the result that as the estate grows the average benefits of each hectare would rise. The problem with including an evaluation of this effect is that, although it is important, there are no effective methodologies for the measurement of these dynamic effects. Economics has long been aware of these effects but because they ultimately depend on increasing returns to scale – as distinct from the assumptions of decreasing returns on which mainstream economics is founded – the economic tools for analysis and evaluation of this area remain poorly developed.

Due to the underdevelopment of these concepts and the way in which they might be valued, most policy appraisals of have traditionally relied on including only the direct benefits that arise, multiplier effects and what might be considered to be traditional externalities i.e. static in the sense that they can be assigned on a per unit basis as is done in the case of carbon sequestration. Other external benefits may be noted, but these are often not specified or quantified. It is not a unique situation that these potentially important effects are not included and there has been considerable attention paid to similar problems in recent years in respect of capital intensive projects. In the UK, the DETR investigated the extent to which wider potential interactions of investment in transport improvements and the economy should be included in economic appraisals[44]. The report concluded that major transport infrastructure improvements would be likely to have a positive and sustained impact on economic growth in the relevant area as a result of these dynamic externalities. A similar case can be made for a sustained programme of investment in forestry that attains a critical mass in the industry and allow for the exploitation of economies of scale.

3.4.2 Contribution to Rural Communities in Rural areas

The role of forestry in stimulating economic development in rural areas was discussed above and indicated that each additional hectare planted has a net impact on a rural area with a present value of €2,574; €51.5 million per annum from 20,000 ha. However, while this estimates the impact of the initial expenditure caused by forestry is included, a second potentially important impact of forestry arises from its possible longer term role in reversing decline in rural areas. The thinking here is somewhat similar to that which underlies the attainment of critical mass in an industry but the unit of analysis is a spatial area rather than an industry.

[44] *Transport and the Economy*, Department of the Environment, Transport and the Regions. August 1999. Norwich: HMSO

In recent years, the type of analysis that underlies traditional CBA as used in this report has been criticised as inadequate since it does not capture or explain the high growth of certain areas when compared to others or the apparent benefits to be found in concentration and agglomeration, particularly when such developments raise input costs for firms[45]. Two approaches to explaining this observation, one based on comparative advantage, the other on the existence of externalities, have been put forward. The comparative advantage approach says that total production costs are lower in cities if there are economies of scale in areas such as transportation, and cities may lower the cost of trade between firms and workers and between firms themselves if there are economies in the provision of local public goods such as local transportation, water, gas, electricity, and communications. This means that higher input costs are more than off-set. The alternative view is that externalities may actually generate cities by promoting area concentration. Firms and workers locate near each other to take advantage of externalities such as technological spillovers, labour market pooling, and non-traded industry-specific inputs. This is limited by the costs of density associated with greater exposure to disease, fire, crime, pollution, and congestion.

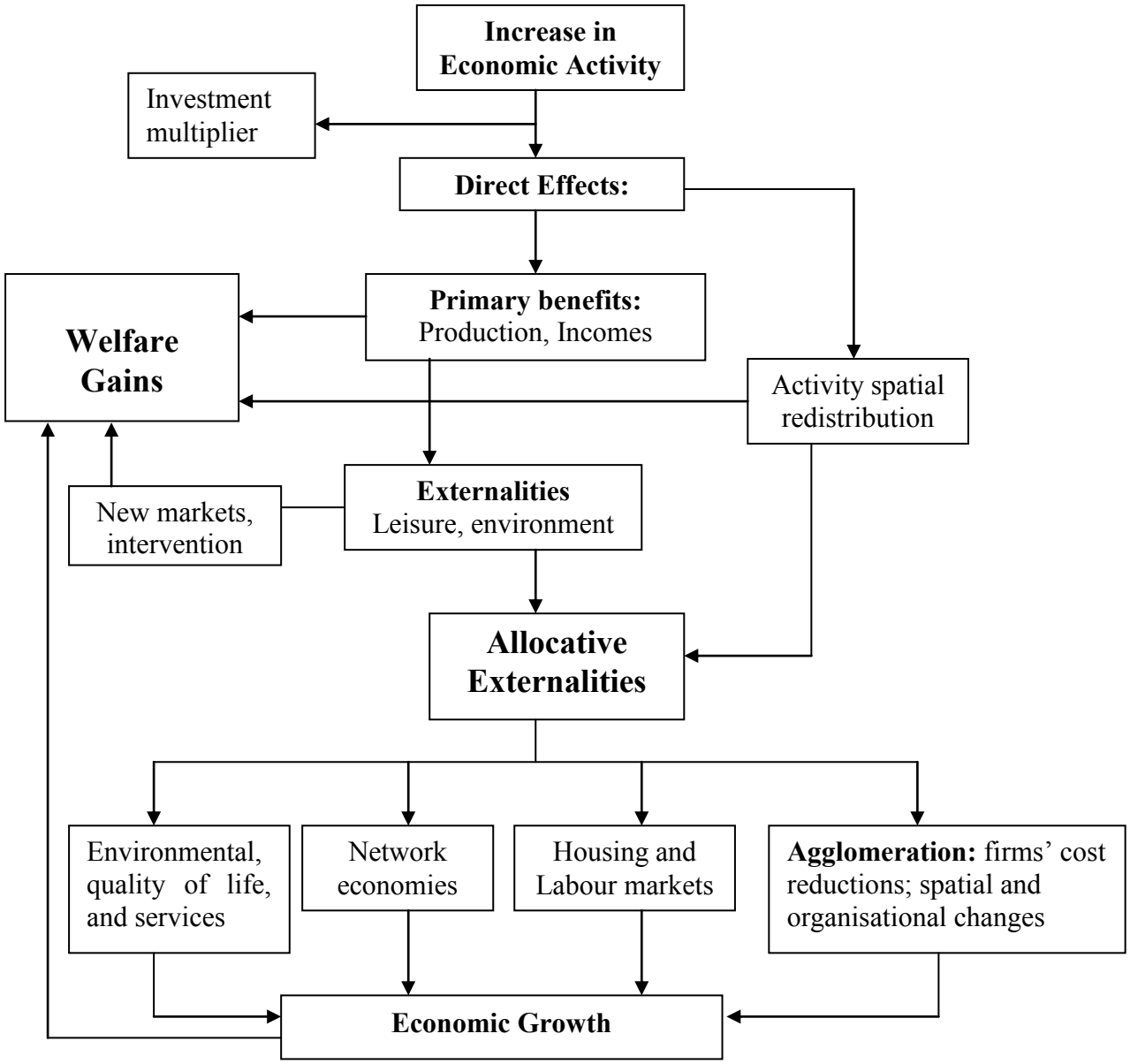
The role of externalities has obtained prominence in Ireland over the past decade due to the inclusion of concepts such as clusters and industrial districts in the intermediate objectives of industrial policy. The thinking is the same: geographical proximity (or other ways – such as the use of IT – to improve information flows) encourage spillovers and thereby improve productive capability and efficiency. Cities and their environs clearly provide a readymade environment for these developments while also contributing the benefits that arise in relation to trade. Because these externalities are by their nature dynamic and ongoing, the benefits persist and actually increase over time beyond the initial stage. In other words, there is a permanent boost to growth in one area and a persistent underperformance in another.

Only part of this effect is captured in traditional CBA, but the benefits associated with the dynamic effects are not well specified and are not immediately quantifiable. The approach outlined in Figure 3.2, based on the work of Banister and Berechman (2000) surveyed in the DETR report, suggests a conceptual mean that may enable a more precise identification of these benefits that would facilitate quantification. In summary, an initial impetus or slight starting advantage affects the decisions of firms and individuals in a number of markets where the impact is not captured by price changes. One example would be where the costs of a firm are reduced due to proximity to another firm or where scale economies arise due to proximity. These are generally referred to as allocative or technological externalities[46]. As is clear from this diagram, the existence of allocative externalities is the vital link between the initial impact and a sustained increase in economic growth.

[45] Wages, rents and service costs are typically higher in developed areas such as cities than in smaller towns and rural areas but firms still wish to locate in the developed areas.

[46] These are different from location responses to cost changes that are identified through the price mechanism. For example, the completion of the South Eastern Motorway will clearly reduce the cost for firms wishing to access the Sandyford area. This may have an impact on location, but the benefits are already included in travel cost savings. This may increase economic growth but to include this as a benefit would amount to double counting.

Figure 3.2: Total Impact of Investment on Economic Welfare



Source: Based on Banister and Berechman (2000) [47]

Most traditional CBA exercises estimate the value of 'Welfare Benefits' only; i.e. direct changes in consumer and producer surplus. Effectively, it is assumed that the allocative externalities are negligible. Multiplier effects are included but are treated separately in this approach because they are assumed to be once off at the time of the initial expenditure and do not result in a sustained increase in economic growth in the area. However, agglomeration economies, as examples of allocative externalities, result in on-going gains. The reverse situation, which has been seen in many areas of Ireland in recent decade where local depopulation leads to a fall below some critical level that is required to support local services, although some individuals requiring

[47] Banister, D. and J. Berechman (2000) *Transport Investment and Economic Development*. London: UCL Press

these services will remain, and subsequent further falls indicates their potential importance. However, these dynamic effects are not included in the evaluation.

3.4.3 Supporting CAP & Reform Thereof

A third type of non-quantified benefit is the extent to which forestry aids in achieving the objectives of agricultural policy. This has a very direct effect in the sense that as farmers move from agriculture to forestry expenditure under other areas of the CAP will fall as it is replaced by forestry premiums. This is potentially very important but its importance for this current evaluation may be limited. First, since the evidence suggests that farmers are planting tees on marginal land only and are not in general converting land in existing farm use to forest, the contribution of forestry to achieving the aims of the CAP remains largely unrealised in the Irish context. Second, since CAP funds flow into the country via the EU and similar arguments can be made in their respect as are made to determine the value assigned to EU funds in this project, the net effect of replacing one source of funding with another, in terms of the appraisal being undertaken, is small. However, there is a further less direct benefit in this area and it arises if the growth of forestry were to make further reform of the CAP more possible. There is a little doubt that such would entail benefits but their quantification is well beyond the scope of this project.

3.5 Summary of Results

Table 3.6 contains a summary of the results that have been derived in relation to the costs and benefits of afforestation on an additional hectare. The correct interpretation of these is that these benefits will accrue for every additional hectare that is afforested as a result of any alteration from a previous outcome and are lost for every hectare that is not afforested.

Table 3.6: Net Socio-economic Benefits of Forestry on Marginal Ha

Benefits	**Euro**	
Timber produced	3,983.48	
Direct net incomes	5,194.42	
Income tax on direct employment	428.17	
VAT on grant recovered	547.74	
Indirect net incomes	2,350.92	
Income tax on indirect employment	1,309.80	
Direct expenditure taxes	96.02	
Additional expenditure taxes	154.79	
Net value added in processing	773.49	
CO_2 sequestration	6,000.70	
Total Benefits	**20,839.51**	**20,839.51**
Costs		
Cost of incentives	9,097.37	
Social cost of direct labour	4,155.53	
Social cost of other labour	2,115.83	
Opportunity cost of direct income taxes	214.08	
Opportunity cost of indirect income taxes	1,047.84	

Total Costs	**16,630.66**	**16,630.66**
Net Social Benefits		**4,208.05**

This table shows that a net benefit of €4,208 per ha arises with a benefit cost ratio of 1.25. It should be recalled that this table values the grants and premiums paid to forestry as though they arise 100% from the Irish exchequer on the basis that the current level of afforestation will be sufficient to allow for a full drawdown of EU funds.

This shows that the availability of EU funds is not the deciding factor in relation to the returns from forestry. In addition, it applies a social weighting of 1.3 to all funds that are paid out or received by the exchequer.

Table 3.7 shows the total net economic benefits that arise from the annual 20,000 ha afforestation target.

Table 3.7: Net Socio-economic Benefits of 20,000 ha of Forestry

Benefits	**€ million**	
Timber produced	79.67	
Direct net incomes	103.89	
Indirect net incomes	47.02	
Income tax on direct employment	8.56	
Income tax on indirect employment	26.20	
VAT on grant recovered	10.95	
Direct expenditure taxes	1.92	
Additional expenditure taxes	3.10	
Net value added in processing	15.47	
CO_2 sequestration	120.01	
Leisure and Amenity	7.97	
Total Benefits	**424.76**	**424.76**
Costs		
Cost of incentives	117.00	
Social cost of direct labour	83.11	
Social cost of other labour	42.32	
Opportunity cost of direct income taxes	4.28	
Opportunity cost of indirect income taxes	20.96	
Total Costs	**267.67**	**267.67**
Net Social Benefits		**157.09**

In the case of this analysis of the total afforestation in a year, it is legitimate to base the calculation on the fact that not all the incentives are from the exchequer. The effect is that the average per hectare benefits, at €7,854, are above those for marginal afforestation. The calculation shows total net benefits of €157.09 million and a benefit cost ratio of 1.59 from annual afforestation of 20,000 ha.

3.6 Sensitivity Analysis

3.6.1 Value of CO_2 Sequestered

The value placed on the role of forests in CO_2 sequestration is clearly important in providing the outcome derived with a key variable being the value per tonne to be placed on CO_2. The benchmark value assumed that CO_2 avoided will have a value of €40 per tonne in the period 2005-07 inclusive and €100 per tonne thereafter. Table 3.8 shows the effects of alternative assumptions in this regard and also the impact of different time period to harvesting. The latter is warranted since the availability of income to forest growers as a result of the impact on CO_2 would provide an incentive to delay harvesting.

Table 3.8: Sensitivity of Results to Alternative CO_2 Sequestration Assumptions

	(€/ha)		20,000 ha (€m.)	
	CO_2 value	Net Benefit	CO_2 value	Net Benefit
Benchmark Value, 40 years	6,000	4,450	120.0	157.1
Flat €40, 40 years	2,446	986	48.9	86.0
Flat €20, 40 years	1,412	-48	28.4	65.3
No Value	0	-1,460	0.0	37.1
Benchmark Value, 45 years	6,587	5,127	131.7	168.8
Flat €40, 45 years	3,296	1,836	62.9	103.0
Flat €20, 45 years	1,105	9	29.4	66.5

These results show that in the absence of EU funds, the benefits of additional afforestation remain positive at values of greater than €20/tonne CO_2 when evaluated over 40 years. If it is assumed that a value of €40 per tonne will exist throughout the period then the net value of sequestration falls to €2,446 per ha and a net benefit of €986 per ha emerges. However, there are also factors that mean that the benefits could even be higher. The estimation was done over 40 years and this is about the period over which the commercial returns from Sitka spruce are maximised. However, sequestration continues beyond this point. If a working market for green credits was in operation then there would be an incentive for growers to maintain a longer growing cycle. However, this depends on the market allowing the benefits of CO_2 sequestration to be internalised. Clearly, the existing situation where grants are paid to off-set up front costs and premiums to make forestry attractive compared to other land uses does not address this situation. The potential gains from overcoming this market failure can be seen from the fact that if the period is extended to 45 years the value of CO_2 avoided at the benchmark price rises to €6,587 per ha. A further important issue is that the benefits remain positive at all valuations of CO_2, even €0 per tonne, when EU funds are available.

3.6.2 Income and Tax Displacement in Rural areas

The assumptions underlying the net benefits from direct employment are in line with the recommended procedures of the Department of Finance. Consultations undertaken in the preparation of this report indicate that the assumptions regarding displacement that underlie a shadow wage of 80% may be too high. Much of the

labour employed would not gain productive employment outside forestry and the evidence is that the premiums paid to farmers have not resulted in lower agricultural premiums overall. In recognition of this a sensitivity analysis was undertaken on the assumption that 25% of the income earned was directly displaced. As a result, a shadow wage of 50% was assumed.

This alteration would mean that the social wage per ha falls to €2,597 and the total social cost of labour for 20,000 ha falls to €51.9 million. This will also impact on the value of income tax that is displaced. If a lower rate of income displacement is the case then with 25% displacement the value of income tax displaced per ha falls to €107 and to €2.14 million for the 20,000 ha.

As a result of these alternative assumptions, the net benefits would rise to €5,874 for the marginal hectare with total net benefits of €190 million arising from 20,000 ha. This may provide a better indication of the impact of forestry in rural areas.

4 Appraisal of Irish Forestry Policy

4.1 Policy and the Net Addition to Welfare

The results as presented assign the value created in forestry to the policy implemented. However, it is important to examine if this is valid i.e. to examine the extent of deadweight that may be present. Deadweight refers to the causal link that exists between the incentives provided and the results identified. There are two aspects to this. The first refers to the extent to which the afforestation that occurred would have happened even if there were no incentives. The judgement of the consultants is that this would have been very low to the extent of being negligible. The data show that prior to the mid-1980s when incentives became available total afforestation by the private sector was only a few hundred hectares per annum and less that 10% of the total. It has now grown to over 15,000 ha per year with the incentives. The absence of the incentives would certainly reduce the investment to well below these levels. In addition, the range of subsidies for alternative uses has expanded in the meanwhile. This means that the deadweight element of the funds is negligible.

The second aspect of deadweight refers to the efficiency of the programme of expenditure and is often assessed in terms of the cost effectiveness of the expenditure. It does not question that the planting relied on the availability of funding, but questions whether the response to the funding applied is as great as it might be. Conclusions in this regard do not affect the allocation of benefits to the incentives. The consultants have concerns in this regard in terms of the best way in which welfare can be maximised. These arise from three sources. The first is that there does not appear to have been sufficient attention paid to the monitoring of public funds being spent to incentivise private afforestation. In other words, it is unclear if the costs are minimised while achieving the objective.

The second problem, as discussed further below, is that the grants paid to forestry must compete with those that promote other land uses. This has the effect of driving up the cost of the incentive required.

The third problem is that the programme is based on the maximisation of the timber value and takes insufficient account of other benefits in particular CO_2 sequestration. As this element increases in value the best way for producers to realise it would be through a mechanism that allows for the trading of green credits rather than subsidies that indirectly provide this value. Currently, since this market remains undeveloped and policy in this area is unclear, potential growers do not know if the value created by their plantation will accrue to them. Clarity on this matter would provide landowners with a much stronger impulse to plant. In addition as shown in the previous section, it is important that the way in which this value is transferred to producers provides an incentive to extend the growing period beyond what would be the case where the maximisation of timber value is the objective. However, the current policy environment discriminates against this by providing the subsidies at an early stage thereby providing an incentive to harvest early.

4.2 Economic Impact of Reduced Funding

In the allocations of public expenditure announced in Budget 2003, the funding provided for the support of forestry was considerably less than what would be required to maintain the development of the industry along the lines of recent years. Due to the fact that a considerable portion of that funding is already committed for premiums payments, any shortfall will impact totally on capital investment i.e. afforestation within the current year. As a result, this marks the most important change in policy in this sector in recent years, although the government have stressed that the official target of 20,000 ha of afforestation per annum remains the objective.

The rationale driving the cutback is unrelated to the current stage of development of the sector and is driven totally by perceptions regarding the overall budgetary situation. The expectation is that this cutback will reduce the exchequer contribution to the Forestry Scheme without impacting on the drawdown of EU funds. This is a realistic expectation and, as a result, the correct estimates to be used in valuing the impact of this cutback is the per hectare results obtained for marginal afforestation in Table 3.6 above. In addition, since there will be a change in afforestation as a result of this decision it is correct that multiplier impacts should be included in the analysis.

The total allocation to forestry in 2003 is €82.6 million. From within this it is necessary to pay pre-committed premiums and other expenses that exceed €45 million. When the guaranteed premium commitments are excluded, discretionary forestry expenditure in 2003 will be less than in 1997.

Some initial projections of the impact of this reduction in funding have been produced[48]. These indicate the total impact of the reduction in expenditure will be €57.71 million and the loss of 1,350 FTE jobs when multiplier impacts are included. Of this employment, direct nursery employment of 150 would be lost along with 410 other jobs in the forestry sector. The analysis indicates that approximately 94 full time jobs are lost for every €1 million reduction in government funding of forestry.

Calculating the economic impact of the reduction in funding requires an estimate of the difference between the area that will be planted in 2003 and what would have been planted had funding been maintained at the levels of recent years. The Moloney calculations were based on an estimate that this difference will be between 8,500 and 11,000 ha. Consultations undertaken in preparing this report indicate that total afforestation by the private sector in 2003 will be constrained to 12,000 ha with 2,000 ha of this funded from the 2004 allocation. Total afforestation in recent years was 15,000 ha per annum, but consultations suggest that this would have been higher this year with industry estimates ranging from 17,000 to 20,000 ha in total. This suggests the impact is somewhere between 5,000 and 8,000 ha.

[48] Moloney, R. (2003) *An Economic Assessment of the Impact of Reductions in the Afforestation Programme on the Irish Economy*. Unpublished paper, Centre for Applied Policy Studies, NUI Cork

An alternative approach to estimating this impact is simply to calculate the shortfall in funding this year and divide this by the average first year grant that has been paid in recent years. The calculations in Chapter 3 of this report indicated that the average first round grant has amounted to about €2,500 per ha in recent years. Using this estimate, the extra €15 million that would have been available had the 2002 allocation been maintained would have provided for an additional 6,000 ha. This is somewhat lower than the Moloney estimate but is in the middle of the range that is suggested by the consultations. As a result, this is considered by the consultants to provide an acceptable estimate of the impact of the cutback. The economic implications of this reduction in planting, equal to 6,000 ha this year, based on the calculations in this report, are shown in Table 4.1.

Table 4.1: Net Socio-economic Loss due to Reduction in Funding

Reduced Benefits	**€ million**	
Timber produced	23.90	
Direct net incomes	31.17	
Income tax on direct employment	2.57	
VAT on grant recovered	3.29	
Indirect net incomes	14.11	
Income tax on indirect employment	7.86	
Direct expenditure taxes	0.58	
Additional expenditure taxes	0.93	
Net value added in processing	4.64	
CO_2 sequestration	36.00	
Total Reduction in Benefits	**125.04**	**125.04**
Reduced Costs		
Cost of incentives	54.58	
Social cost of direct labour	24.93	
Social cost of other labour	12.69	
Opportunity cost of direct income taxes	1.28	
Opportunity cost of indirect income taxes	6.29	
Total Reduction in Costs	**99.78**	**99.78**
Reduction in Net Social Benefits		**25.25**

This calculation shows a net reduction in the economic contribution of forestry to welfare with a discounted value of €25.25 million. This results from a reduction in expenditure by the exchequer of €15 million in 2003. In fact, the actual exchequer saving is less than this. When the reduced tax take arising from the lower level of planting is taken into consideration, the net exchequer flow in 2003 shows a saving of €9.12 million in nominal values as a result of this cutback[49].

These losses are clearly important but there is a further impact that could lead to on-going costs. Many investors in the sector will suffer direct losses as a result of the reduction in planting. The most obvious example of this is in the nursery sector

[49] If 1,350 jobs are lost and these were all to claim benefits then Moloney estimates that there would be an additional outflow of about €4.5 million. However, this is not included in the calculation as it is considered that this is an unlikely outcome given the labour markets that currently exist.

where large numbers of plants have been and will be lost. This has a number of effects. First, there is a direct loss of income for nursery owners. Second, expectations will be revised with the result that there may be insufficient supply in future years. While this is obvious in terms of the tangible supply of trees, it also occurs throughout the sector where expectations are revised. This can be described as a loss of an institutional and industrial structure that has been created. Related effects will be felt as skills that have been developed at all levels may leave the industry and not return even if there is a recovery next year. A third potentially important loss relates to the credibility of Government policy. Trust is a very valuable economic commodity and the success of policy depends on trust in the stance and decisions of policy makers. Currently, the industry is faced with a situation where official policy remains the attainment of a target for afforestation that was within sight this year and a policy change that makes the level of recent years unattainable currently. This is despite the fact that the industry does respond to incentives, a clear rationale for incentives exists and, as shown in this report, there is a net economic benefit from government expenditure in this area even when it is assumed that all the funds are paid by the exchequer and exchequer funds are valued at 30% above their nominal value to allow for the distortionary effects of the taxes that are required to raise these funds.

4.3 Assessment of Current Policy

The CBA shows a positive return from investment by the State in forestry and a negative return from the decision to cutback on funding. However, it may still be the case that policy is sub-optimal. To provide a framework to examine this further, Figure 4.1 contains a SWOT analysis of forestry policy. It is important to recognise that this is not an analysis of the forestry sector although clearly there will be overlap.

In terms of the role of policy, it is not clear that the market failures that provide the rationale for the investment are being adequately addressed.

- The time preference issue is being addressed but switching costs still exist
- Need to alter existing farming is only being addressed in an inefficient manner through allowing for a cash crop approach;
- Need to provide supporting infrastructure is not being addressed;
- Critical mass is not being achieved, economies of scale not being fully realised.
- The emphasis on the value of timber rather than the total value of forestry means that incentives are likely to cause harvesting to occur before social returns are maximised

Figure 4.1: SWOT Analysis of Irish Forestry Policy

Strengths	Weaknesses
• Proven to stimulate private sector planting • Shows positive socio-economic returns • On-going EU funding • Support infrastructure and skills have emerged • Compatible with emerging regional policy	• Targets have never been reached • Cutbacks suggest lack of long-term commitment • Multitude of organisations • Over-capacity in the processing sector due to levelling off of log supply • Lack of separate budgeting for capital spending and premiums

• Deliberate targeting as an alternative for farmers • Tree growth rates 3 times higher than European average	• Incentives not competitive with REPS • Lack of monitoring of efficiency • Failure to create critical mass
Opportunities	**Threats**
• Positive outlook for timber demand • CO_2 sequestration increasingly important • Development of green credit markets would improve commercial viability • Amenity value and Environmental awareness increasing and may lead to increased willingness to pay • Energy from Biomass • On-going need for CAP reform	• Short-termism in policy outlook • Potential loss of credibility • Opposition to Kyoto threatening international treaties • Demands of the timber market

The most important issue that emerges is that policy is not currently addressing the issue of internalising the benefits created by CO_2 sequestration. This needs to be addressed through the development of a market for green credits that would remove this market failure. Forestry policy to date has been concentrated primarily on increasing the supply of future timber while protecting the environment, although as shown in this report, the economic aspects of environmental protection require re-examination. It is also now becoming clear that attention will need to focus to a greater extent on the demand for timber in the future, a point brought out strongly by the TIDG report. This means that innovative innovations will be required in the future. The development of energy production from Biomass is one such area. This option addresses two aspects of the issues facing the sector: it provides demand for outputs that may be difficult to market in the future and it provides an opportunity for the CO_2 content of wood to be retained 100% in terms of the avoided need to burn other fossils fuels that do not need to be extracted.

The opportunity presented by biomass has been discussed in recent research in Ireland[50]. The wood for use in energy production would arise from

- Sawmill residues
- Forest residues
- Pulpwood
- Whole tree chips from first and second thinning
- Recovered wood e.g. from construction and demolition waste

Table 4.2 contains projections for the volumes of these inputs that would be available and indicates that by 2015 a total of 1.3 million tonnes will be available.

Table 4.2: Wood Biomass Available ('000s green tonnes)

	2002	2005	2015
Pulpwood	168	095	732
Sawmill Residues	089	129	280
Other	209	223	291
Total	466	447	1,303

Source: COFORD

50 O'Carroll, J. Carbon Emissions Reduction Potential from Wood Biomass'. Paper presented to CORORD Industry Briefing Session, *Forestry and Carbon*, 2nd April

This volume of wood would be sufficient to generate about 50 MW of electricity rising to 132 MW by 2015. In doing so it would generate 26% of the 500MW target that is contained in the *Green Paper on Sustainable Energy*. If it is assumed that this output is realised at 90% efficiency then the yield would be 394 MWh of electricity per annum. The impact of this on CO_2 depends on the fuel that is replaced by the availability of biomass. Using standard emissions factors for various fuels, the potential reduction in CO2 emissions per annum is as shown in Table 4.3

Table 4.3: Potential Reduction in CO_2 Emissions from Wood Biomass Energy

	2003 (000s tonnes)	2015 (000s tonnes)
Peat	633.5	1,672.4
Coal	359.5	949.1
Oil	308.3	813.8
Projected Fuel Mix 2010	198.7	524.5
Gas – Simple Cycle	192.8	508.9
CCGT	136.4	360.1
CHP	93.8	247.7

Source: COFORD

If these emissions are valued at €100 per tonne then the potential value of emissions avoided is in the range of €25 to €167 million per annum. This is a very broad range and it is necessary to provide some judgement as to the most likely outcome. Ireland's demand for electricity will continue to increase and additional generating capacity is required in the short to medium term[51]. This indicates that the opportunity for biomass is not in displacing existing generation but as an option for generating the additional output required. This means that the best comparator fuel in assessing the impact of biomass is the fuel that would be displaced in this new capacity. While new peat burning stations are planned, the majority of new capacity will be gas powered with CCGT the most likely. This means that this is the fuel most likely to be displaced. On this basis, the potential for biomass is to displace 360,100 tonnes of CO_2 in 2015, giving a value to the economy of €36 million per annum[52].

This development would require a supportive policy initiative that needs to be carefully planned and implemented effectively.

The problem with outlining these possibilities is that existing policy does not provide adequate comfort to believe that the correct decisions will be made. The development of peat burning facilities is one obvious divergence from what might be considered to be a rational approach. In addition, as a result of the failure to reach stated targets and the recent cutbacks the credibility of the current policy approach in forestry si an important issue. Credibility requires a well-designed policy that is properly implemented. The matrix of potential outcome is described in a generic sense in Figure 4.2.

Figure 4.2: Generic Characterisation of Possible Policy Outcomes

	Policy Design	
	Optimal	**Sub-optimal**

[51] ESB National GRID (2002) *Generation Adequacy Report 2003-2009*
[52] This is not additional to the benefits already identified in this report.

Policy Implementation	**Good**	**NW** Market failures are addressed successfully at least cost A consistent, strategic, credibly approach is adopted CBA shows a positive return	**NE** Only partial success in addressing market failures Some success due to perseverance but costly due to deadweight Returns are positive but could be greater
	Poor	**SW** Market failures are addressed in initial period Policy is inconsistent and short term in outlook Credibility is lost and returns are uncertain	**SE** Policy fails to address market failures Inconsistency leads to loss of credibility and uncertain returns

The study suggests that forestry policy in Ireland up to recently should be placed in the NE quadrant i.e. sub-optimal in design but some success as it was well implemented. The problem as a result of the cut-backs is that implementation has now become poor. The characterisation described in the SE quadrant is appropriate. Credibility is being lost and the returns have become uncertain in general and very uncertain in some sub-sectors of the industry. The real danger is that allowing this situation to persist will mean that the losses that are identified in the CBA as a result of the cutbacks will be increased by the need to win back this credibility. In other words, if it was expensive to incentivise the move to forestry previously, there is a probability that this cost will increase. Thus, the net benefits of greater afforestation are lost and the cost of achieving any given level is increased.

The challenge therefore is to move to the NW quadrant. This requires that the impact of the cutbacks is reversed as quickly as is possible and that policy is developed in the medium term to remove the inefficiencies that exist. Among these, the most important is to create a working market for green credits. This would also provide an incentive for private growers to refrain from harvesting until the trees had reached nearer their socially optimal harvesting date. In addition, a greater examination is required of the appropriate role of the public sector.

5 Conclusions

5.1 Summary of Main Findings

Forestry is increasingly a private sector industry in Ireland relying on private investment. However, where market failures occur, the prospect is created that private investors will invest up to a level where private returns are maximised but not at a level where the returns to the wider society are optimal. In effect, Ireland would be failing to maximise the returns from its resources and a role for policy intervention is thereby identified.

This report sets out criteria in Section 1 for policy to be successful. It must be rational in terms of its objectives, feasible, consistent, and viable in the sense that it contributes to economic well being. Rationality depends on the identification of market failures to which policy is addressed. Six types of market failure in the forestry sector were identified that provide the rationale for policy intervention. These are

- Economies of scale
- The long pay-back period
- Risk.
- Externalities
- Distortions introduced as a result of the CAP
- Need for R&D

Irish policy has attempted to address these areas with varying degrees of success. The weakest areas would appear to be in relation to the need for a critical mass to allow for the exploitation of economies of scale – the sector has not expanded at the rate projected and while scale has increased the supporting features are not so evident – the need to address the impact of the CAP has not been fully achieved with only marginal land entering forestry and the value of the CO_2 sequestration externality has not been fully appreciated.. What this report has shown is that this outcome has been produced through a combination of the inefficient allocation of resources and insufficient resources being applied recently. It is possible that the former may not be fully eliminated – although the recommendations below would improve efficiency – but the insufficient public allocation has been based on an overly cautious estimation of the value of the externalities created by forestry. By far the most important is the CO_2 sequestration by trees, the potential value of which has become more tangible in recent years as a result of international agreements on greenhouse gases and international trading. In addition, it is increasingly clear that the delivery of this value to the producers can be achieved through market mechanisms rather then the transfer of funds through the public sector. However, the public sector has a major role to play in creating the markets for this to happen and in formulating policy in a number of areas to promote the efficient operation of these markets. In addition, the development of markets in this area would promote a longer growing period that would more closely align the interests of private producers and society.

The evidence to date suggests that there is a problem with the feasibility of Irish policy since the targets that have been set have never been achieved. The consultants are not in a position to say if the targets are optimal but it can be concluded that the

incentives provided have not been inadequate to achieve the targets. However, this is not necessarily the most important issue since private operators will soon adjust their expectations and make their decisions accordingly. This is the case as long as policy is consistent and a much greater problem arises if this is not the case. In general, there has been a good degree of consistency since the mid-1990s but this year has marked a major change. This has potentially serious implications in terms of the on-going credibility of the policy.

Forestry policy has contributed to economic welfare. The CBA of policy showed that achieving the target of 20,000 hectares of net afforestation annually would provide a net benefit to the economy with a discounted valuation of €157 million. This is an average of €7,854 per ha. For every additional ha that must be funded fully from exchequer funds, the benefit remains positive at €4,209. These results depend to a considerable extent on the role of forestry in CO_2 sequestration and for lower values of CO_2 avoided the returns from the marginal ha fully funded from the exchequer become negative. This is partly avoided if the growing period is prolonged through appropriate incentives and does not occur if EU funds are available. Optimising the value of carbon storage should be a major economic objective of afforestation in Ireland for the foreseeable future. The potential value of this has not been fully recognised in the policy approach and the emphasis on timber output may actually lead to a conflict of interests[53].

Both the design and the implementation of policy must be optimised. Irish forestry policy as it has operated is characterised in Figure 5.1. Although existing policy is characterised as sub-optimal, this does not mean it is bad. In fact, Irish forestry policy has many good features with the result that there are positive socio-economic returns, but it could be better. However, the calculations in this report show that the recent policy changes, in the form of a cut-back in funding, reduce the returns. In summary, this change means that policy is now also poorly implemented, leading to a loss of credibility, and the positive benefits of increased forestry in response to policy initiatives could be lost. In addition, payments should focus increasingly on internalising the environmental benefits.

The current cutback in funding for forestry was evaluated. This has caused major disruption and considerable losses in the sector and has led to a questioning of the Government's commitment to the industry that risks undermining the credibility of policy. The total allocation to forestry in 2003 is just €82.6 million. From within this it is necessary to pay guaranteed commitments to farmers and others, in the form of pre-committed premiums and other schemes, which exceed €45 million. As a result, when the guaranteed premium commitments are excluded, discretionary forestry expenditure will be less in 2003 than in 1997. Forestry would need to have received a total allocation for grants and premiums of €98 million to even retain its 2002 afforestation level. This extra €15m would incentivise the planting of approximately 6,000 ha thereby providing an indication of the shortfall that is being experienced. The calculations show that the potential impact of the cutback is to reduce economic welfare by €25.25 million in net discounted values. This achieves a net saving for the exchequer of €9.12 million. The consultants have not quantified the potential cost to

[53] It has been found that if a forest is managed to maximise its yield of timber and financial returns in the absence of markets for green credits then it will likely contain only 33% of carbon it could store if the trees were allowed to grow to maximum biomass. (Cooper (1982) quoted in Kilbride *et. al*.)

the State as a result of the loss of credibility in the sector. In addition, the impact that a reduction in national exchequer funding for a programme pre-approved by the European Commission will have on future negotiations for EC funding of forestry programmes in Ireland has not been evaluated, but should be considered.

Figure 5.1: Potential Outcome of Forestry Policy

		Policy Design	
		Optimal	**Existing**
Policy Implementation	**Good**	Market failures – time preference, externalities, critical mass – addressed through subsidies or new markets	Subsidies creating a competitive crop but lack of sufficient mass Costly due to deadweight Returns are positive but could be greater
	Poor	Private and public investment creates potential and emerging industry but inconsistent policy leads to private losses and lack of enthusiasm	Critical mass is not achieved, industry remains dependent and non-viable. Cut-backs cause private losses and possible unwillingness to invest in future Social returns are foregone

An important point is the failure to achieve the targets set out in *The Strategic Plan*. One of the major problems is that the grants paid to agriculture effectively compete with those to incentivise forestry. In addition, forestry must overcome perceived switching costs that are additional to the actual costs of planting. A number of possible policy initiatives can be identified to address this situation. The first is to reduce the subsidies to agriculture. This appears to be very unlikely to happen. The second is to increase the subsidies to forestry but Barrett and Trace (1999) indicate that the magnitude of the increase that would be required to overcome the perceived costs of switching would be excessive in terms of the impact on public expenditure. The third is to develop a much improved integration of forestry and agricultural schemes, with a particular emphasis on the interaction of forestry and REPS, to remove the competition that exists. A final option is to develop the necessary markets for green credits to ensure that the actual value that is produced by forestry accrues to the producers. In the longer term this would appear to be essential if the resistance to forestry is to be overcome.

One final point arising from the approach taken in *The Strategic Plan* that is worthy of comment, as it has played a large part in the determination of policy, is the apparent equation of forestry's economic value only with timber production. From this it is implicitly extrapolated that the primary role of policy is to increase timber production. Although *The Strategic Plan* states that

> *The case for forestry is made on the basis of its economic social and environmental benefit*. (p.16)

there is a tendency to include timber benefits only in the economic category and adopt a rather defensive tone with respect to environmental impacts. This study has shown that this is inappropriate on both counts. Economic values can be put on environmental impacts and the magnitude of the environmental benefits means that they are one of forestry's greatest strengths. When viewed in this manner it is clear that the role of policy in this area, as with all economic policy, should be to maximise welfare from limited resources. This is becoming increasingly important. Research indicates that the income elasticity of demand for the non-timber benefits of forestry is higher than for timber[54]. This means that, when valued form the point of view of society, the proportion of total value that is accounted for by non-timber benefits will rise as the economy develops and, over a sufficiently long period, the value of non-timber benefits could eventually out-weigh the timber values of forestry. This explains why forests are increasingly valued in developed economies for their non-timber values. The problem, however, is that to date there have been no easily workable methods to identify the value of non-timber output. As a result, the value of timber, which is easily observed through market prices, has dominated the official view of where the value lies. The development of green credit markets for greenhouse gases would represent a major step in addressing this imbalance. The challenge remains, however, to develop ways to value all the non-timber benefits and to ensure that these are fully incorporated into the information sets that are accessed by policy decision makers. In the absence of precise valuations it is just as important that decisions include the valuations of these benefits as are available.

5.2 Recommendations to Develop the Strategic Approach

The reduction in funding this year was not justified and has destroyed the opportunity to create a renewable resource. The CBA shows that there is a loss of economic welfare resulting from the reduction in planting, but other costs also arise from the loss of policy credibility. Policy must avoid a stop-go approach as inconsistency could increase the cost of incentivising investment in forestry in the future. It is recommended adequate funds must be made available on a consistent basis to achieve the objectives set out both in *The Strategic Plan* and the Rural Development Plan 2000-2006. It is recommended that any proposed changes in funding must be subjected to evaluation in terms of their impact on the likely attainment of the objectives that are set for the sector.

The current budgeting approach with respect to forestry is inadequate. Policy needs to recognise that the provision of seed capital in the form of grants must be allocated separately from the provision of income supports. It is recommended that a distinction in budgeting must be made between capital payments and premiums, which are current income. Joint budgeting means that the full impact of any cutback will fall on the capital expenditure.

In addition, the failure to separate the two functions means that there may be an increasing contradiction in policy between wishing to protect incomes and maximise the returns from forestry. For example, one result of the analysis in this report is that

[54] Bishop, J. (1998) *The Economics of Non-Timber Forest Benefits: An Overview*. Research Paper GK 98-01, International Institute for Environment and Development

the payments for forestry should work to extend the growing period but this is in conflict with the use of forestry as a means to protect incomes. As a result, it is recommended that forestry policy should be reviewed to emphasise the returns from forestry rather than its role in assisting in reform of farm payments in general.

The policy approach that has been adopted to date should be revised to recognise the importance of CO_2 sequestration by forests. At the centre of this should be a move to recognising and compensating for the CO_2 externality by promoting the development of a green credits market to internalise this value. This would be a move towards making forestry commercially viable on the basis of paying for all the value that is produced. It would also incentivise growers to maximise the social value of the forests rather than just the commercial value of the timber.

Biomass to energy provides an important opportunity for Ireland and is one of the few uses of forest output where the carbon is 100% retained in storage through avoided emissions. It is recommended that this option should be promoted aggressively. This is also important since it reduces the need to rely on international markets for wood products and would address some of the concerns raised by the TIDG report.

Finally, it is recommended that implementation of existing policy should be examined in terms of its efficiency in meeting its objectives. As part of this it is recommended that the appropriate role and approach of the State in developing forestry should be examined and redefined.

Appendix A – Carbon Sequestration

The traditional mechanism to address this issue in Ireland in forestry and in other sectors has been through non-market transfers in the form of subsidies and taxation provisions. This is not a socially costless process since there will clearly be administration costs, but even greater costs may arise from the fact that it is difficult to define precise values for the externalities in question and ensure that they are correctly targeted. This raises the prospect that not only will resources be used in undertaking the transfer but the impact of these resources may be lessened. In addition, this mechanism introduces an element of risk: for produces the risk is that policy can change but investments might be sunk, while the state also takes on risk in the form of an assumption that investors will respond as desired.

To a considerable extent, these risks are reduced if the value can be extracted by investors through a market based mechanism. Not only are the costs of administering the system likely to be lower – at the limit they should amount to transactions costs only – but so too are the risks greatly reduced for both parties. Crucially, from the point of view of the state, the value will only be extracted by the producers of value thereby greatly reducing deadweight. In addition, if the market is a closed system, there may be no actual expenditure by the state involved. For these reasons, the replacement of subsidies to address externalities by markets that internalise the value is highly desirable. However, there are two problems to be addressed. The first is to design and initiate a market where none has existed before. Essentially this can be reduced to the definition of a 'product' that can be traded and a series of trading rules. The second is to identify a starting price for the 'product' i.e. the externality, that reflects its value to society.

While issues such as the preservation of species of flora and fauna, and amenity values, are important in the case of forestry – these are dealt with in Section 3.2.6 above – by far the greatest potential value arises from the impact of forests as stores of carbon and of afforestation as a carbon sink. It is now becoming widely recognised that addressing the market failure in this case can best be done if a market can be devised that allows the producer to trade green credits based on the CO_2 eliminated by the forest as a means of acquiring the value that is produced. The problem is placing a value on these credits. Earlier work has placed estimates on these values in Ireland but the situation ahs changed considerably in the years since then[55].

Since it has been the case up to recently that there was no market mechanism to place a monetary value on the benefits of greenhouse gas reductions, three approaches have been used. The Damage-Avoided Approach values a tonne of CO_2 avoided by the cost of the damage that would have been done by global warming in the event that it had been emitted. The Offset Approach measures the value of not emitting a tonne of CO_2 using one method of production by the next cheapest alternative method. The Avoided-Cost-of-Compliance Approach measures the tonne of saved carbon by the avoided cost of compliance with a global/regional CO_2 emissions' reduction agreement. Recent developments mean that this is increasingly seen as the appropriate way to proceed given the difficulties that face Ireland in complying with

[55] Clinch, P. (1999) *Economics of Irish Forestry*. Dublin: COFORD

its Kyoto commitments thereby allowing for indicative estimates of what values should be placed on CO_2 emissions.

In late 2001 the European Commission adopted a 'climate package' in advance of the 7th Conference of the Parties to the Framework Convention on Climate Change in Marrakech[56]. This proposal has now been ratified by the European Council (9th December 2002) and will proceed to its second reading in the European Parliament. The Commission's proposed measures as contained in the draft directive were for the most part accepted, with some amendments. This Council agreement will achieve three aims. First, is will create a legal basis, in the form of an actual Directive, under which penalties for excess emissions as defined by the agreed Kyoto limits will be levied. Second, it means that member states are now presented with legally enforceable obligations on foot of the Directive. Finally, the decision means that fixed penalties for excess emissions have now been agreed. Given this, it is increasingly clear that the economic value of CO_2 that is removed from the atmosphere or avoided through lower emissions will be the value of the levies that will be applied for exceeding the target emissions of CO_2. These have been set at €40/tonne in the period 1/1/2005 to 31/12/2007 and at €100/tonne thereafter[57].

Under Kyoto, Ireland is committed to limit the growth in emissions of greenhouse gases to 13% above its 1990 output. The evidence is that, if a no change scenario is assumed, Ireland will not be able to meet its Kyoto commitments. As shown in Table A.1, Ireland's emissions of CO_2 in the base year of 1990 were 31.575 Mt with total emissions of greenhouse gases were equivalent to 53.752 Mt of CO_2[58].

Table A.1: Projected Emissions in Ireland ('000 tonnes CO_2 and CO_2 equivalent)

	CO_2	Other gases	Total Emissions	Net Total	Index
Base Year	31,575	22,177	53,752	53,752	100.0
1998	40,028	23,956	63,984	63,239	117.6
2000	42,675	23,568	66,243	65,252	121.4
2005	47,210	23,974	71,184	69,660	129.6
2010 Low	51,373	22,577	73,950	71,894	133.8
2010 High	51,373	23,790	75,163	73,794	137.3

Note: The high and low projections arise for two reasons. First, alternative assumptions regarding certain technical aspects of the Kyoto Protocol were used. These affect the calculation of non-CO_2 greenhouse gases. Second, the high outcome is based on Ireland realising only 50% of its planned afforestation up to 2010. The low result assumes that the plans are met in full.
Source: Department of the Environment and Local Government (2000)

If recent trends continue, the National Climate Change Strategy projects that by the year 2010, Ireland's net greenhouse gas emissions, calculated in accordance with the

[56] The climate package also committed Member States to introducing a trading scheme for greenhouse gases by 1 January 2005. The scheme will involve the issuing of certificates free of charge to certain industrial operators on the basis of emission caps. These can then be traded freely in the European Union as a whole. The Commission views this as an essential move towards complying with the greenhouse gas reduction commitments of the Kyoto Protocol.

[57] While the consultants are of the opinion that these values provide the most appropriate values to adopt in terms of a benchmark valuation, the importance of this issue means that a sensitivity analysis using alternative CO_2 values is undertaken below.

[58] *National Climate Change Strategy: Ireland* Department of the Environment and Local Government (2000)

Kyoto Protocol[59], will be in the range of 71.9 – 73.8 Mt CO_2 equivalent with 51.373 Mt of CO_2. Total emissions in this projection are between 33.8% and 37.3% above 1990, while emissions of CO_2 would be 62.7% above the base year. This projection means that Ireland would need to achieve annual emissions savings of the order of 11.154 to 13.054 Mt CO_2 equivalent per annum in the period 2008 – 2012 to stay within the 13% growth limit i.e. net emissions of 60.74 Mt CO_2 equivalent.

However, there may be reason to believe that this projection is a minimum estimate of the growth in emissions that may occur. In 1998, Ireland's emissions of CO_2 amounted to approximately 40 million tonnes and were growing at 5% per annum. A linear projection indicates that this will have grown to over 56 million tonnes in 2005 – an excess of 20 million tonnes – to 65 million tonnes in 2008 – an excess of 29 million tonnes – and to 79 million tonnes by 2012 – an excess of 43 million tonnes of CO_2. If it is assumed that emissions of other greenhouse gases remain at their 1998 level – which is roughly what is projected in Table 3.4 – then total emissions would be in the region of 103 Mt in 2012, an excess of 42 Mt. Applying a levy of €40 per tonne in the period January 2005 to December 2007 and €100 thereafter would lead to penalties as shown in Table A.2.

Table A.2: Projected Annual Penalties for Excess Emissions (Linear Projections)

	Emissions (Mt CO_2 equivalent)	Excess Emissions (Mt CO_2 equivalent)	Value of Penalty (€million)
2005-07	80 – 86	19 – 25	760 – 1,000
2008-12	89 – 103	28 – 42	2,800 – 4,200

It can be argued that this linear projection contains some possibility for overstatement since it implicitly assumes that no action is taken to adjust the pollution intensity of economic activity and that the full effect of the measures that have been introduced has been seen already. However, the important point for this present project is that even when known and planned policy interventions are included the excess emissions and therefore the liabilities are not eliminated. Under the projections contained in the *National Climate Change Strategy* the excess emissions valued at these rates would be in the range €1,100 to €1,300 million in 2010. The conclusion therefore is that for any foreseeable increase in forestry, the impact on net CO_2 emissions will have an economic value and the marginal value of CO_2 avoided can be approximated by these rates. It is clear from this that, even on the relatively optimistic projection, Ireland will exceed its allowed limits. Thus, while the precise economic implications of this remain open to interpretation, it is increasingly clear that there will be real economic costs involved and that the values placed on these by the European Council provide an appropriate indication of the economic cost of excess emissions and the values to be placed on avoidance.

[59] This allows for the emissions that are removed through new afforestation or other similar measures to be deducted from total emissions to provide the relevant figure for comparison with the target.