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A Review and Appraisal of Ireland's Forestry Development Strategy

Final Report

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Executive Summary

1. Forestry policy in Ireland is implemented in the context of the 1996 Strategic Plan – *Growing for the Future*. This was formulated against a background of Ireland being among the least afforested countries in Europe and in which most forests are State–owned. The Plan set targets for afforestation and contained objectives aimed at creating a competitive farm-based forestry sector in Ireland that would provide the inputs required to enable the establishment of a sustainable, value-adding processing sector.

2. Since 1996, there have been considerable changes to the context within which forestry policy is implemented, and the introduction of the CAP reforms in 2005 will see further significant change. This report provides a review of the existing strategy and identifies reforms required to achieve further progress given the changing environment. Specifically, the analysis:

- Reviews the existing strategy, incorporating assessment of value for money;
- Examines market developments including non-timber aspects of the sector;
- Identifies the impact of reform of the CAP; and
- Examines funding methods and structures.

3. The target set under the 1996 *Strategy* was that 20,000 ha per annum would be afforested after 2000. This was deemed necessary to create the critical mass required, to supply a competitive processing sector. The most noticeable feature of experience under the *Strategy* is that the annual rate of afforestation has fallen short of the target, with average annual afforestation of just over 14,000 ha per annum in the period 1996-2003. In addition, there have been other shortcomings. The targeted species mix has not been achieved, although the situation has begun to improve, and the scale of plantations is small. The prospective range of log sizes and species is inadequate to meet market demands and there are deficiencies in the information available to guide planning in the private sector. Forest management practices are often poor, particularly with respect to broadleaf species, and private sector thinning will be well short of its potential. There are also data deficiencies when it comes to assessments of the non-timber benefits of forestry.

4. It is estimated that there are in the region of 3,780 people employed in forest crop establishment and harvesting and in excess of 6,000 employed in timber processing in Ireland. In addition, research suggests that every 5 jobs created directly in forestry support an additional 3 jobs indirectly elsewhere in the economy. Forestry supports are crucial to the viability of the sector. However, creating €100 in grower income costs €121.60 in support payments. Nevertheless, this outcome is better value than what is achieved by some alternative competing land uses such as dry livestock farming (a competing land use), where the ratio is 1:1.4

5. It is estimated that the value of timber that will be produced from a hectare, which is planted with 70% conifers and 30% broadleaf species will be just over €16,000 per hectare, in current prices. The present value of this is €2,286 per ha., applying an annual discount rate of 5.5%. This valuation allows for costs incurred

and has placed a zero value on timber from broadleaf species. This value, along with premiums received under current regulations, would give rise to grower incomes of €2,378 million, in present value terms, on the basis of an annual rate of afforestation of 20,000 ha. in the period to 2035.

6. In addition, an estimate is made of the value of certain non-timber benefits associated with forestry, such as recreation and carbon sequestration. These are estimated to be around €88 million per annum, from the existing forest estate and there are opportunities to increase these considerably. Looking to the future it is estimated that non-timber benefits associated with afforestation of 20,0000 ha. p.a. to 2035 would amount to €859 million in NPV terms, using the same discount rate of 5.5%, p.a. In addition, the net value added of the processing sector has been estimated at €225 million in NPV terms.

7. The NPV of the supports to achieve these combined benefits of €3,462 million is estimated at €2,891 million. Thus, benefits exceed costs by €571 million in NPV terms. Benefits continue to exceed costs if the price of timber, the value assigned to non-timber benefits and the net value added in the processing sector are all reduced by 30%.

8. Turning to the future, it is concluded that 20,000 ha. per annum is the most appropriate minimum target to secure a sustainable commercial processing sector. If afforestation were to continue at an average of 13,000 ha per annum – about the rate experienced in recent years – then the period 2030-40 would see a major increase in output. The projections show total output in the region of 9 million, m^3 from 2031. Current capacity is estimated to be 3.26 million m^3 in sawmills and 1.77 million m^3 in panel mills. Clearly therefore, major investment will be required in additional processing capacity well in advance of this time. Although there may be some opportunities to expand this capacity incrementally through adjustments to working practices, the scope is insufficient to meet the gap. However, the projections indicate also that afforestation of 13,000 ha per annum would lead to a sharp contraction of output, by over 25%, after 2040. Against this prospect, it would not be reasonable to expect that the required investment would be forthcoming. However, if afforestation of 20,000 ha per annum were achieved then the volatility of output is considerably reduced and a much more stable level of output is achieved. This provides a much better background from which investment can emerge. In terms of the timing of the required investment, the projections show capacity deficits emerging in both sawmills and panel mills before 2020.

9. The report emphasises the importance of recognising the value of non-timber benefits associated with forestry and contains estimates of these. The analysis of non-timber benefits indicates that the potential of Irish forests to contribute under these headings was not recognised adequately under the 1996 *Strategy*. In certain respects – such as landscape and water quality – some planting has probably reduced welfare, although the performance has been better in recent years. However, there are no data and research is insufficient to draw precise conclusions. There is considerable potential for an afforestation programme to contribute to enabling Ireland to achieve its *Kyoto* commitments. Currently, the relevant regulations mean that although the impact of sinks cannot be traded under the EU trading mechanism, there is a value that will be realised in terms of a reduced requirement to purchase green credits in the

reference period. There are also opportunities to increase the positive recreational benefits of forests and the regulations in relation to preserving areas for bio-diversity enhancement in forests that will provide additional welfare compared to the alternative uses of land in agriculture. It is to be noted also that future EU policy is expected to contain a sharper focus on maximising this aspect of forestry. Hence, a lesser planting achievement than the target set out above could be a viable basis for support, providing the planting is undertaken in a manner that maximises these non-timber benefits.

10. A key issue in relation to the future of forestry in Ireland rests on the willingness of farmers to participate. Experience to date indicates that inadequate numbers of farmers perceive that there are adequate returns. A straight comparison of the monetary returns from forestry and alternative land uses shows that forestry is competitive. However, the difficulty is that the decision to plant is irreversible and so there is some risk attached. The return, when adjusted for these perceived risks appears insufficient. One important example of the impact of uncertainty is the fact that farmers have cited eligibility for extensification payments as a key reason for not engaging in forestry even though an analysis of stocking rates on Irish livestock farms clearly indicates that there is excess land held. This excess amounts to 400,000 ha that could have been planted without affecting payments and could be considered to represent the risk premium associated with forestry. However, reform of the CAP and the introduction of the single payments scheme are likely to change currently held perceptions considerably. In addition, farmers' ability to consolidate entitlements on part of their land is a crucial concession.

11. The analysis concludes that reform of the CAP will change the determinants of farmers' decisions with respect to forestry to an extent that will be sufficient to provide adequate land for an afforestation programme of 20,000 ha per annum. This is concluded on the basis that the impact of the changes will be sufficient to bridge the gap between the 14,000 ha per annum of recent years and the targeted 20,000 ha per annum. Uncertainties that previously surrounded eligibility criteria will be reduced considerably, forestry will become attractive for farmers with low entitlement values, and previously leased land is likely to be attracted into forestry. However, it is important that the perceptions of risk are addressed. Clarifying any issues that might emerge regarding the potential for forestry to impact on eligibility for agricultural payments will be important. In this regard it is considered that forestry payments should be indexed to changes in the value of payments under other agricultural schemes, including REPS, with allowance for accompanying changes in the regulations governing these programmes.

12. The analysis in respect of both the potential for sufficient land to become available to meet the targeted level of afforestation and the funding required by this programme is based on an assumption that support to growers is held constant at the level achieved under current regulations. If this level is not achieved, then there would be implications in relation to the potential for achieving the target. Whether the level of support is maintained is a decision for Irish policymakers. EU payments have been important in financing Irish forestry supports although forestry remains an area of competency for member states. Current EU proposals envisage considerable changes to EU Rural Development policy after 2006 and this could impact on eligibility for funding. Current proposals entail a reduced emphasis on supporting

afforestation with a much greater focus instead on improving the competitiveness of EU forests and on achieving environmental objectives through forestry. Under this revised scheme, Irish forestry policy would need to emphasise the quality of forests and recognise the wider non-timber benefits to a greater extent than has been the case to date, if it is to be in line with the proposed direction of EU policy and the new funding arrangements.

13. While EU rural development policy will be finalised following a period of negotiation, the proposed changes would affect Ireland to a greater extent than is the case for most EU countries. The Irish authorities will need to ensure that EU policy recognises the evolving nature of Irish forestry. If the supports provided to forestry were to fall in line with current EU proposals, it appears unlikely that the afforestation programme could be achieved. It will be important for the continued development of Irish forestry that sufficient flexibility is retained in relation to the ultimate level of supports that are provided by the State and also that specific measures, such as retaining grant support at 100% of the non-overhead costs of afforestation, are retained. There is also a good case that the broadleaf premium should continue to be paid over 20 years.

14. In the future, forestry policy will need to see revision of the view that forestry support payments are provided primarily as supplements to farm income supports. This view has dominated the approach to date of both policy and growers. In its place there will need to be a much greater emphasis on enterprise development. In addition, a greater distinction of forests into planting for productive purposes, planting to protect environmental attributes, and support for protection of certain types of forests is required.

15. The potential value of the State's commitment to forestry in the future is assessed under three scenarios:

- An afforestation programme of 13,000 ha per annum up to 2035. The total funding requirement is estimated at €5,185 million in the period 2005-59;
- A programme of 20,000 ha per annum up to 2035 with the existing support structure. The total funding requirement is estimated at €7,511 million in the period 2005-59;
- A programme of 20,000 ha per annum but with a revised premium payment structure. This revision would see the payment period for the farmers' compensatory premium reduced from 20 to 10 years, with the annual payment increased to keep the present value of the payments constant. The total funding requirement is estimated to be €6,950 million in the period 2005-54.

16. A revision of the premium structure in line with this third option is recommended. In addition to reducing the State's liability while protecting the present value of payments, this would be in line with the direction of EU policy and would provide for the introduction of initiatives to encourage better management of crops and access to timber by investment firms at a later date. The estimated total funding requirement of €6,950 million, has a NPV of €3,515 million, on the basis of a real discount rate of 4 per cent, p.a.

17. Three further new initiatives are considered and proposed in relation to future funding. The first alters the terms on which support is provided so that the

government acquires an option to buy the timber from the grower in year 10 when the farmers' compensatory premium has expired. The price to be paid should be such that the return to the grower under this option will be the same as the return that would arise if the grower retained the timber and sold it at the time of clear-fell. At the same time, the State would sell this timber. Crucially, this contract and brokerage reduces the risk associated with growing timber and allows the State to realise a gain from facilitating this operation. In addition, the incentive to manage the timber optimally is greatly increased. It is estimated that this initiative would generate €655 million or €181 million in NPV, to the Exchequer. Accordingly, the NPV of the public sector's commitment for a programme of 20,000 ha per annum with the revised premium structure would be reduced to €3,334 million in NPV terms.

18. The second proposal is in relation to the establishment grant. Grant payments account for 36% of the total commitment under the afforestation programme. There is no convincing economic rationale for the existing structure of invoiced expenses plus an overhead ranging from 25% to 40%. The funding commitment has been estimated on the basis of the 40% mark-up applying to all planting. Eliminating this would reduce the potential for deadweight and allow for more efficient expenditure. This revision would reduce the public sector commitment by €672 million or €364 million in NPV. Hence the NPV of the public sector cost would be further reduced to €2,970 million.

19. The third proposal is to ring-fence the value created as a result of reduced need to purchase green credits in order to meet the *Kyoto* commitments. In effect, this would be a diversion of expenditure away from payments to the foreign holders of such credits towards the forestry sector in order to create these credits in Ireland. On the basis of a mid-point value for carbon of €17.50 per tonne, it is estimated that this value would amount to €45.2 million for every 20,000 ha planting. The NPV of this proposal would be €659 million on the basis of 20,000 ha. p.a. Setting this against the cost above implies a further reduction in the NPV of the public sector commitment to €2,311 million.

20. In addition to the broad targets and proposals outlined above, any future strategy should incorporate the recommendations, which are listed below in summary format:

1. The strategic target should be afforestation of 20,000 ha per annum up to 2035. However, forestry policy and the support structure should be implemented in a manner that recognises that forestry is not a homogenous sector but includes both a commercial industry and a sector that produces public goods. Proposed plantations should be assessed and supports provided to achieve the wider aims implied by this recognition. The decision to approve individual plantations should involve greater consideration of the species to be planted, access to a public road, the size of the plantation and the size of individual plots, distance from sawmills, the amount and type of forest in the vicinity, and environmental constraints relevant to the site. Greater attention should be paid to achieving the broadleaf target in a manner that maximises the benefits of broadleaf species rather than a planting structure that just meets the target in a numerical sense;

2. The broadleaf target should be achieved in the context of county forestry strategies and should be achieved at the regional level and not necessarily at the level of plantation;
3. A much greater emphasis should be placed on undertaking research to identify and quantify the non-timber returns from forestry at national and regional levels, how these returns can be maximised within the existing estate and future planting, and the incentives that are appropriate to securing them. Effective mechanisms do not exist for allocating the non-timber benefits of forestry to growers. In recognition of this, it is recommended that the tax free status of forestry should be maintained. The authorities should re-examine the areas that have been submitted to date for designation under *Natura 2000* so as to identify opportunities for extension of this list with a view to including areas on which future afforestation could be undertaken. Some limited flexibility should be introduced into the regulation that 100% of forested land must be reforested but this should be introduced on the basis that decisions are applied to specific sites only and that reforestation is denied only on the basis that there would be identified and quantified losses;
4. The non-farmer premium should be paid to all growers for 15 years and the farmers' compensatory premium i.e. the value by which premiums paid to farmers exceed those paid to non-farmers, should be paid over 10 years. The annual value of the farmers' premium should be increased so as to keep constant the present value of the payments to farmers, when discounted at the risk free discount rate. Forestry premiums should be indexed to changes in payments under other agricultural supports that affect land usage including entitlements under the Single payment scheme and REPS, with allowance for any accompanying changes in regulations. The position in relation to eligibility for certain agricultural payments under the CAP reform should be sufficiently clarified to ensure that uncertainty is reduced as far as possible;
5. Areas in excess of 12 hectares should attract a higher differential than they currently do in terms of the supplement to premium payments that is provided and the rate at which the supplement is payable should also be higher for plantations in excess of 25 hectares. These payments should be achieved by reallocation of resources within the current budget, i.e. there would be no net additional cost to the exchequer;
6. The payment structure in relation to establishment grants should be revised and the overhead element of the establishment grant should be eliminated;
7. Payment of the maintenance grant should be subject to a much greater extent than in the past to ongoing maintenance of the plantation to required standards. This should be monitored for a defined period beyond the current 4 years, and the grant should be subject to a claw-back if it is identified that the plantation is not being maintained. There should be more rigorous and consistent enforcement of regulations in relation to eligibility for premium payments for broadleaf species that depend on ongoing assessment of the management of the crop. Payment should be withheld to an extent that the threat of this sanction being applied provides an adequate incentive to improve standards;
8. An examination should be undertaken to identify appropriate targets for the Native Woodland Scheme, the NeighbourWood Scheme, the Reconstitution of Woodland Scheme and the Woodland Improvement Scheme. This should be undertaken in the context of emerging proposals for the reform of EU policy, and the funding to achieve these targets should be provided. Appropriate

measures should be identified and implemented to deal with problems associated with establishing forests in areas with high populations of deer and grey squirrel;

9. The understandable emphasis that has been placed on afforestation in the implementation of policy over the past decade must now be complimented by a new emphasis on the development of markets, training and good management practices to support the viability of the industry. A Forestry Development Forum should be formed comprising relevant interests to drive the development of the enterprise approach that is required, while ensuring that the industry matures as a sustainable forest sector that will maximise the wider benefits of forests. Secretariat resourcing should incorporate the technical skills available in TEAGASC/COFORD. The Department of Agriculture and Food should undertake an examination of current and projected future supplies of roundwood. This should extend to related market dynamics such as current cost structures in marketing and measurement of roundwood;
10. Priority should be given to developing the data held by the Forest Service into an accessible format and comprehensive spatial information on species, age and location of plantations and on the supply of thinnings should be available to the industry. Consideration should be given to outsourcing the work involved in producing this information, should it be decided that adequate resources cannot be allocated within the Forest Service on an ongoing basis;
11. The development of county forestry strategies should be promoted and these should be used in the determination of plantation characteristics such as species mix as discussed above. An examination should be undertaken in relation to improving integration among all those engaged in aspects of land use and decisions in relation to forestry should be compatible with this objective. The incorporation of the Forest Service in the Department of Agriculture and Food itself should facilitate the achievement of a more integrated approach to land use;
12. The Forest Service is organised around a dual structure, which is not unique in the Civil Service, and is deployed to undertake the administrative and technical functions of the Service. An efficiency audit of the Forest Service should be undertaken as part of the HR review, which would examine the extent to which this structure is optimally efficient. The Forest Service should also commit to publishing a regular report e.g. every 1 or 2 years, on progress with implementation of the forestry strategy and that this report should be used to inform ongoing adjustments to the strategy. Furthermore, the Department of Agriculture and Food should commit to ensuring that the Forest Strategy is fully reflected in the Department's business plan and its Annual Reports. Forestry legislation should also be updated in areas such as the integration of EU Directives and felling procedures and should be reviewed regularly;
13. Linkages should be formed between government and non-government organisations to agree a framework to deal with ensuring access to appropriate private forests for recreation and the provision of such access and basic requirements for recreational purposes should be linked to the provision of funding to the forests involved;
14. The State should adopt a multi-annual budgeting policy in relation to forestry so as to promote a consistent approach;

15. A contractual mechanism should be devised that will apply to all applications for forestry support. The effect should be to confer on the State an option or right to purchase from the farmer the timber in the plantation from year 10. The price should be such as would maintain the return on investment by the farmer – measured by IRR – that would be obtained if the farmer managed the crop to maturity and sold the timber. As a follow-on to this initiative, a mechanism should be devised to allow the State to sell timber that has been acquired to an entity either in the private or public sector that has an interest in owning and managing the forest to maturity. Funds thus raised should be allocated to part fund the afforestation programme. The potential saving in terms of green credits that will have to be purchased to enable Ireland to fulfil its commitments under *Kyoto* should be fully included when calculating the commitments of the forestry strategy. The savings from the reduced need to purchase green credits made should be ring-fenced and allocated to forestry in advance of estimating the budgetary impact of the forestry strategy.

1. Introduction

The Irish forestry sector has changed considerably in the past 15 years or so in terms of its size, potential and the policy environment within which it operates. Forestry policy is determined in broad outline by the targets and objectives that were set in the *Strategic Plan for the Development of the Forestry Sector in Ireland* (1996). Research in recent years suggests that considerable progress has been made in providing the basis from which the sector can realise its potential contribution to the economy and living environment in Ireland. However, the sector needs to continue to progress through a phase of ongoing growth if it is to achieve a critical mass, which has been identified as a key requirement for success.

There have been many changes in the situation since the Plan was formulated. These include reform of the CAP, the perception of competition between forestry policy and REPs, the recognition of environmental benefits and costs from forestry, and the increasing need to ensure that public funds are being spent in a manner that maximises returns. The Terms of Reference for this study calls for review of:

- The current strategy, incorporating an assessment of value for money;
- Market developments including non-timber aspects of the sector;
- The impact of reform of the CAP; and
- Current funding methods and structures.

The Terms of Reference require examination of questions under three major headings:

1. What is the optimal role for Irish policy in developing the Irish forestry sector and maximising the returns to the economy – including non-market benefits – from this sector?
2. Given that the private sector will have a major role to play in terms of land use decisions and investment, what is the most efficient way in which to incentivise the private sector to undertake investment in forestry to achieve the optimal outcome and maximise returns?
3. As providing incentives implies the expenditure of public funds, what is the most efficient and sustainable way in which these funds can be raised so as to minimise the costs to the economy?

The first question entails establishing an optimal role for the State in promoting forestry, including appropriate targets for annual afforestation and the overall size and structure of the national forest estate. The analysis begins with a review of current Irish forestry policy. This is contained in Section 2 of this report. This is essentially a review of *Growing for the Future* and experience under this plan, but also includes reference to other studies in the sector. This strategy recognised that there are economic impacts of forestry in addition to the timber that is produced. However, the creation of a competitive and wealth creating forest sector is at the centre of the strategy. Section 3 examines timber markets and presents projections for the development of these markets. The non-timber benefits of forestry are examined in Section 4. Together, these sections provide a projection of timber supply and demand in the market, a basis on which the value of timber and the non-timber values can be

determined, and an indication of any constraints to maximising the potential of the sector.

Examination of the second question, regarding the most efficient way to incentivise private investment and maximise returns, centres on the land use decision, primarily by farmers. Section 5 examines the decision facing the farmer by identifying the returns that can be obtained from a defined area of land under different uses. An important issue is that the provisions of the CAP are changing. This will have implications for the relative returns from various land uses and on the overall potential supply of land for forestry.

With this work completed, it is possible to identify an optimal – and feasible – policy approach in terms of the appropriate targets for the sector going forward. This is set out in Section 6. The third question requires examination of the way in which the required funds can be raised and three options are proposed and evaluated.

Finally, Section 7 draws together the findings of this analysis in the form of a set of recommendations to improve the effectiveness and efficiency of forestry strategy to produce a more competitive industry for the future and maximise value for money spent in promoting the forestry.

In carrying out the work outlined above the consultants received assistance and guidance, which they wish to acknowledge with gratitude. Firstly, to the members of the *Inter-departmental Liaison Committee*, Chaired by the Department of Agriculture & Food. Secondly, to the many organisations and individuals who made written and oral submissions.

The views contained in the Report are the responsibility solely of the consultants.

2. Review of Forestry Sector Policy and Performance

2.1 Main Elements of Policy

An increasing emphasis in Irish economic policy in recent decades on attaining value for money from expenditure of public funds and in maximising sustainable wealth creation of natural resources led to a review of policy in relation to forestry in the mid-1990s. This was based partly on a perception that the potential economic value of forestry was not being maximised, and that sustainable development in the future required planning for a period of growth in roundwood production. This review led to the formulation in 1996 of a *Strategic Plan* for the development of the sector[1]. At the time, Ireland's productive forest area stood at 464,000 ha with a further 100,000 ha of wooded areas. Ireland's rate of afforestation at the time was one of the highest in the EU but the country remained the least forested 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.

Growing for the Future was formulated in the context of increasing awareness of the environmental and social values of forestry, a decreasing ownership role of the State throughout Europe and developing regional and global regulatory frameworks for forestry. Against this background and recognising Ireland's low forest area and ongoing reforms within the agricultural sector, the main objective of the *Strategy* was defined as:

> *To develop forestry to a scale and in a manner which maximises its contribution to national economic and social well being on a sustainable basis and which is compatible with the protection of the environment.*

Despite recognition of the importance of environmental sustainability, the potential environmental benefits of forestry were not given a high priority in the *Strategy*. The main potential economic benefits were seen to arise primarily from the production of timber. Other benefits were recognised to arise in the form of amenity, leisure and the preservation of native flora and fauna but the value of these was estimated to account for less than 10% of the value of timber.

The Plan represented a major shift from earlier policy, which had concentrated on afforestation mainly by the State. Farm forestry (rather than forestry by the State) was targeted as the principal vehicle for future afforestation.

Timber output in Ireland in 1995 was 2.2 million m^3, of which 1.4 million m^3 was saw-log and 0.8 million m^3 was pulpwood. *Coillte* accounted for 2.1 million m^3 of the total. The *Strategy* outlined a number of objectives including:

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

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

Additional sub-targets were also identified, such as a broadleaf target of 20%, (now raised to 30%). Total expenditure on grants and premiums up to 2030 of €3,955 million, (IR£3,115 million at 1996 prices) was identified.

The stated policy aim was to achieve a productive forest area of 1.189 million hectares. In addition, there was a target of achieving the volume yield necessary to reach the mass of timber output that was identified as a critical requirement to enable a competitive industry to emerge in Ireland. Another objective was to increase farmer planting, in particular, in the interests of rural development. The plan identified a critical mass of timber production necessary for the sector to maintain competitiveness and contribute to national development on a sustainable basis. This was 10 million m^3, per annum, (or 12 to 15 million m^3 preferably,) and was to be achieved on the basis of a productive forest estate of 1.2 million ha by the year 2030. This level of production was considered necessary to generate true competition and the operation of market forces and to support a range of processing industries. If these targets were met, it would mean that 1% of the total land area of Ireland would be afforested every three years. This would place forestry as the second most important land use in Ireland, putting forestry and agriculture in direct competition for land.

Several of the fundamental targets that were set have failed to be achieved. In summary these are:

- The annual afforestation targets;
- The ratio of public to private afforestation; and
- The achievement of adequate improvement in the compatibility of the forestry programme with other farm supports.

In addition, the species mix has not been as targeted, although there has been progress in recent years, and there are specific weaknesses as discussed below in features of the sector that inhibit both the competitiveness of the sector and its contribution to the environmental and rural development objectives.

2.2 Afforestation Experience and Farmland Use Issues

The *Strategy* concluded that deviations from the afforestation targets would threaten to delay or prevent the attainment of critical mass in the timber industry and this in turn, would undermine the economic value adding potential of the sector. However, annual afforestation rates have been consistently well below the targets. This is shown in Table 2.1 along with the distribution of afforestation between the public and

private sectors in the period 1996-2003. The annual shortfall has averaged almost 9,000 ha per annum. While the private sector planting showed relatively good progress at about 90% of implicit target, there has been a collapse in State planting. This latter was due to a decision of the European Commission that *Coillte Teoranta* is a public entity and as such could not claim the premium provided for in Article 2(1)(c)[2]. This decision became effective from 1st August 1996. The effect was to remove Coillte from competing in the marketplace for land for afforestation. Looking forward it is reasonable to assume that afforestation by Coillte will be very small with planting confined to its reforestation commitments.

Table 2.1: Public and Private Afforestation 1996-2003

	Target	Outcome			Shortfall	Ratio
		Total	Private	Public		public:private
1996	25,000	20,982	16,556	4,426	4,018	21:79
1997	25,000	11,444	10,583	861	13,556	8:92
1998	25,000	12,928	10,002	2,926	12,072	23:77
1999	25,000	12,667	11,776	891	12,333	7:93
2000	25,000	15,696	14,231	1,465	9,304	9:91
2001	20,000	15,463	15,147	316	4,537	2:98
2002	20,000	15,054	14,735	319	4,946	2:98
2003	20,000	9,097	8,969	128	10,903	1:99
Totals	185,000	113,331	101,999	11,332	71,669	10:90
Mean	23,125	14,166	12,750	1,416	8,959	

The progress achieved in private planting reflects the relative position, in terms of advantage or disadvantage, of forestry supports relative to other farm support schemes. This view is supported by work undertaken by Teagasc, which shows that two variables – the relative returns from forestry and alternative land uses and the level of afforestation in the previous year – explain 78% of the variation in afforestation in any region of the country in any year[3]. Thus, the increases in the annual rates achieved in year 2000 to 2002 were achieved on foot of improved grant and premium payments for forestry, while returns from agriculture were adversely affected by poor beef prices. Cutbacks in funding for forestry in 2003 resulted in a reduced planting programme.

In the period 1996 to 2003, farmers (including part-time farmers) accounted for just under 93,000 ha, 91% of the total private afforestation, and 82% of all afforestation. Afforestation by farmers was identified as particularly important in developing the sector. The aim of policy in this respect is to ensure the required contribution of farm forestry to national afforestation and output targets with particular emphasis on securing its potential benefits for farm families and the rural community. To this end, the *Strategy* aimed to:

- Maintain the relativity of forestry supports to other farm supports;

[2] This decision was made under Article 2(2)(b) of Regulation No 2080/92. Although the decision was appealed to the European Court of Justice, the ruling in October 2003 upheld the decision of the Commission and viewed Coillte as a public undertaking and as such not eligible for premium payments.

[3] Behan, J. and K. McQuinn (2003) *Projecting Farm Forestry in Ireland*. This work is reviewed further later in this report.

- Make payment of forest premiums from year four onwards subject to conditions so to ensure proper management[4]; and
- Adjust REPS to allow farmers, where circumstances permit, to avail of both schemes in a complementary manner.

In addition, the need to improve knowledge in the sector was noted. To this end, the *Strategy* identified a need to recruit professional forestry staff to Teagasc. This was in order to advise on a range of issues relating to forestry, and to review Teagasc and Forest Service training courses to improve uptake by farmers while encouraging the development of training courses and long term management contracts in the sector[5]. There is no doubt that a body of expertise resides in Teagasc. This has been used to aid farm forestry. ***However, consultations have identified that there remains a deficit of knowledge at farm level regarding the potential returns from forestry, the correct management of plantations, and optimal harvesting and marketing management. As a result, this remains an area where progress is required***.

As already noted above, the relative returns from forestry compared with other land uses is a key determinant of the planting decision. The average ratio of direct payments received from afforestation compared to 'cattle', 'cattle and other' and 'mainly sheep' was 83%, 91% and 95% respectively in the period 1996 – 2000. ***Direct payments for afforestation have been consistently lower than for low-income farm systems, although grant and premium payments have kept pace with inflation over the period. However, the gap has been closing. Furthermore, when the opportunity cost of labour is included in the calculation of relative returns – the lower labour content in forestry means that there is a relative return from the income that can be earned from alternative use of the farmer's labour – the relative returns ratio is approaching unity[6].***

Although farmer participation in forestry has grown, the rate of afforestation has been far short of what was targeted under the *Strategy* and aimed at by policy. EU payments to farmers have made the decision to opt for forestry a complex one for individual farmers. For example, research has identified that the biggest barrier to forestry is the increased livestock extensification payments[7]. Under this scheme

[4] The payment of premiums is not linked to the quality or scope of on-going management of the crop. However, all applicants must submit a management plan at Form 3 stage for plantations which are 10 ha or greater or where over 5 ha of broadleaves have been planted. When plantations are 10 years old and before the 11th premium payment, an updated plan must be submitted. As a parallel development, the market is beginning to provide a range of services targeted at farmers and providing for the long-term management of the crop through to the end of the rotation. However, in the absence of some form of group co-operation, these products are unlikely to be relevant to areas of less than 10 ha.

[5] Teagasc now employs nine regionally based advisors specialising in forestry and, in conjunction with the Forest Service, offers introductory courses aimed at people who may be considering planting land. Teagasc also runs short courses, field days and information sessions on the skills required in subsequent forest management.

[6] The rate at which labour in alternative use is valued is clearly important. Behan & McQuinn *op. cit.* found that the ratio of returns was approaching unity when the minimum wage was used and noted that an argument could be made that the average industrial wage might be a better measure for many regions. This would improve the relative standing of forestry and indicates that other factors are important in the decision. The non-reversibility of the decision to plant trees has been identified as important as discussed further below.

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

farmers receive a top-up payment of €80 per animal where stocking is less than 1.4 livestock units (LU) per hectare. If the farmer plants and by doing so increases his stocking to between 1.4 to 1.8 LU per hectare then the extensification payment is halved while stocking greater than 1.8 LU per hectare receives zero payments. The impact of this is analysed in greater detail in Section 5.3 below. In addition, this COFORD research identified conflicts between forestry and agriculture at national policy level, at organisational level in relation to promotion of afforestation and at individual farm level. The main blockage preventing afforestation is the relativity between payments under competing land use schemes. Further factors militating against afforestation relate to (a) reductions in land value following afforestation, (b) requirements for continuation of land in forestry forever and (c) lack of targeted and proactive promotion of forestry. It is also likely that changes in policy regarding species mix being planted will defer the achievement of critical mass while uncertainty regarding the security of supply from farmer and private owned plantations will have an impact on the investment decisions in the timber processing sector.

Despite some modification in REPS 2, there is a widely accepted perception that afforestation is still at a disadvantage in terms of payments and treatment of entitlements[8]. A revised REPS scheme, REPS 3, with higher payment rates, increased maximum payments[9] and opportunities for more intensive farmers to join has been developed and is likely to affect farmers' decisions in relation to any planned change of land use into forestry. Furthermore, from January 2005, the single payment scheme and the de-coupling of payments from land and livestock will come into operation.

However, the cessation of the extensification premium and the concessions for afforestation under the single payment from 2005 onwards will see the possibility for REPS participants to plant land that was formerly held to enable stocking levels. The special concessions for forestry, allowing up to 50% of area to be afforested without impacting on the single payment entitlement, is expected to favour afforestation by farmers. However, while REPS 2 provides for improved integration of forestry into REPS plans, with planners obliged to identify at least 2 ha of land suitable for forestry, there is no obligation to plant and the afforestation and REPS schemes continue to be mutually exclusive. As a result, the situation in relation to land use decisions by farmers going forward is likely to remain complex and may differ considerably from experience in the past. This is dealt with in greater detail below in Section 5 of this report.

[8] Although forestry has been recognised as a viable farm enterprise, land designated for afforestation remains ineligible for many EU farm subsidy schemes, in particular, REPS 2, Farm Retirement Scheme, Area Aid, and Installation Aid supports.
[9] REPS 3 - €8,550 maximum payment versus €6,600 for REPS 2.

2.3 Timber Industry Developments

2.3.1 Harvesting and Transport

An aim of policy is the development of an efficient, economically viable, safe and environmentally compatible harvesting and transport sub-sector, which optimises wood yield consistent with good silvicultural practice and cost effectiveness. Actions identified in the *Strategy* to promote this objective included the introduction of guidelines to address operational, silvicultural, environmental and safety issues, the provision of grant assistance for mechanised capacity based on identified needs, research to aid in adapting machinery for Irish conditions, development of supporting infrastructure and training.

The Forest Service has introduced Environmental and Safety Guidelines in recent years. The grant programme for harvesting machines was suspended in 2000 as it was deemed to have achieved its objective[10]. No research has been undertaken on adapting harvesting machinery to suit Irish conditions, for example, to identify modifications and changes in specifications that would reduce the ground pressure of the machinery. Work has also begun on testing information systems linking harvesting machines with sawmills. Training in harvesting and related areas was supported but the budget cutback in 2003 saw this funding effectively withdrawn[11].

A 2003 review of the current cost structure of timber supply identified major costs in relation to harvesting and haulage and presented strategies for the reconfiguration of the timber supply chain to improve efficiency and reduce cost[12]. However, implementation of the findings, which were initially to be on a pilot basis, stalled. Notwithstanding, the findings of this report have implications for the future viability of the harvesting and haulage sector. A report commissioned by the IFCA and published in 2004 also drew attention to the poor financial standing of many of the harvesting and haulage contractors and warned that, in the absence of reform, capacity could be lost[13]. A properly planned forest road network is essential for efficient and economic harvesting. The Forest Roading Scheme operated throughout the period and some 823 km. of forest were grant aided, although less than 20% of roads and funding went to the private sector. About €1 million is being spent annually on specific forestry related road improvements and Coillte has identified forest property and designated transport routes to all Local Authorities to facilitate a more integrated and co-ordinated approach to road upgrading.

[10] The ESRI's *Mid Term Evaluation of the NDP* also recommended that resources for the scheme should be reduced as it did not address any apparent market failure

[11] The Irish Forest Contractor Association has completed the design of a new modular training program with FAS that would offer a career path for operatives within the sector. The scheme is awaiting funding.

[12] COFORD (2003) *OptiLog: An Efficiency Analysis of the Sale, Purchase, Harvesting & Haulage of Timber in the Irish Forestry Sector*. Report by Purser Tarleton Russell Ltd. and Henry Phillips.

[13] Bunyan, J.J. (2004) *Practices and Procedures in the Timber Raw Material Supply Chain Sector of Irish Forestry*.

This brief review indicates that there are issues in this industry requiring attention. These include the viability of contracting businesses in the harvesting and haulage sector, the need to implement the strategies outlined in OptiLog report, and improving road access to private plantations.

2.3.2 Sawmilling and Market Share

The total market for sawn wood in Ireland is estimated as 1.65 million, m^3. While Irish produced sawn timber is versatile and suited to a wide range of uses, it does not cover all categories of use demanded by the market. Thus, the market that is accessible to Irish timber is smaller at approximately 1,140 m^3. Irish timber has a 65% share of the accessible market being dominant in the pallet and fencing markets. The market share of Irish producers is shown in Table 2.2. Virtually all the saw-logs processed in Ireland are sourced from forests certified as being sustainably managed and over 95% of sawn material that is produced has chain of custody certification[14].

Table 2.2: Market Share of Home-grown Softwood.

	Total Market ('000 m^3)	Accessible Market ('000m^3)	Supplied by ITC mills ('000m^3)	Share of Total Market	Share of Accessible Market
Construction	1,200	700	413	34%	59%
Pallet	250	250	182	73%	73%
Fencing & Other	200	190	144	72%	76%
Total	1,650	1,140	739	45%	65%

Source: ITC *Annual Review* 2002

Another aim identified in the *Strategy* is to develop an internationally competitive saw-milling sector, based on sound commercial principles. A need to implement radical changes in the log sales system, including electronic auctions, open competitive bidding, transparent reserve pricing, standardised log measurement, provision for forward sales, and periodic independent audit was identified. A role was also identified for Coillte proposals for equity investment in sawmills and for Forbairt to provide assistance to mills in product research and development and in promoting and maintaining standards. Arising from this, a new log sale system, incorporating a reserve price mechanism was introduced in 1996 and was followed by fortnightly electronic auctions in 1997. A report by Merrill Lynch (2000) recommended that the reserve price mechanism be reviewed to reflect the changing dynamics of the domestic market and to facilitate penetration of the UK market. Standard procedures for the measurement of logs were introduced in 1997. The post sale measurement, a volume weight procedure, is subject to independent monitoring and audit every six months. However, Coillte's proposal for the purchase of one of the largest processors of saw-log in Ireland was prohibited following a recommendation by the Competition Authority.

[14] The chain of custody refers to all the changes of custodianship of forest produce and products made during the transportation, processing and distribution chain from the forest to the final end user. Certification is increasingly important across all timber markets but especially in the UK.

Irish saw-mills are mainly family owned companies that have restructured and rationalised over the past decade, in the face of commercial pressures and strong competition from imports. There has been significant investment in recent years with over €100 million being invested in technology and additional capacity since 1999. In the past four years sawn output to the Irish market has increased by 37% and at 361,000m^3, exports to the UK, including Northern Ireland, have doubled.

Prices for roundwood in Ireland have remained relatively high in recent years in comparison to those in Great Britain. Depending on the size category, prices can be up to four times the average achieved in Britain. This price difference has encouraged the import of roundwood from Scotland by a number of Irish mills. Prices in the two economies in 2002 and 2003 are shown in Table 2.3. This indicates prices in Ireland in recent years, particularly for the larger sizes have been a multiple of those in the UK. This is partly a function of exchange rate movements, which saw the UK£ particularly strong against the Euro in this period, but real industry issues are also important. One factor has been the growth of exports from Scandinavian countries to the UK, which has forced prices down. However, competitiveness issues in the Irish industry cannot be discounted.

Table 2.3: Comparison of Sawn Log Prices, UK and Ireland (2002, 2003)

	2002			2003		
Log Size	UK	Ireland	Ratio	UK	Ireland	Ratio
< .074	4.91	7.04	1.43	6.07	19.15	3.15
0.075 to .0124	3.79	10.43	2.76	5.11	7.31	1.43
0.125 to 0.174	6.06	11.99	1.98	4.67	12.43	2.66
0.175 to 0.224	7.44	12.60	1.69	6.07	22.06	3.63
0.225 to 0.274	6.54	16.45	2.51	5.86	21.31	3.64
0.275 to 0.424	9.23	20.53	2.22	6.71	26.40	3.93
0.425 to 0.499	11.56	31.02	2.68	7.39	29.08	3.94
0.500 to 0.599	11.49	34.51	3.00	11.33	35.68	3.15
0.600 to 0.699	14.13	38.59	2.73	8.89	38.71	4.36
0.700 to 0.799	15.26	40.67	2.67	11.01	45.07	4.09
0.800 to 0.899	19.37	42.98	2.22	17.91	43.37	2.42
0.900 to 0.999	14.27	45.27	3.17	15.50	45.20	2.92
1.00 and over	17.03	46.34	2.72	16.73	46.61	2.79

Sources: ITGA *Yearbook 2004*; Forestry Commission 2004

Supply, as outlined in the Coillte forecast (2000) remains flat and is slightly less than in previously published forecasts for certain of the larger log size categories. While not all mills are operating a double shift, there is capacity to absorb an additional 300,000m^3 of logs over and above the forecast, plus estimated 2004 imports of 200,000 m^3. Going forward, additional investment in capacity will be required in both the saw milling and panel mill sectors. This is discussed in detail in Section 3.3 below.

Clearly price is a major issue arising from this review. In addition, there is a requirement for larger log sizes and for a greater range of species to allow for an increase in the available market. In addition, projected growth of output will require new investment in processing capacity in the medium term future.

2.3.3 Forest Products Industries

A stated aim of policy is to promote the establishment and continued development, in line with expected wood supply and demand, of a range of complementary primary, secondary and tertiary (including non-wood) forest based processing industries. The intention is to provide outlets for all the output of Ireland's forests and to maximise the share of domestic and export markets which can be captured by such output. The *Strategy* identified actions to pursue processing opportunities, support viable commercial initiatives based on indigenous hardwoods and other added-value initiatives, and called for a representative Forest Industry Development Group to be established to review and make recommendations on development of markets.

The Timber Industry Development Group (TIDG) was set up in February 2000 to look at the development of the sector and reported its findings in November of the following year. The TIDG report identified as a priority the need to build scale and a unity of purpose across all facets of the industry. Towards this end it recommended the establishment of a Chief Executive Forum to progress identified issues in respect of scale, supply chain management, R&D and residues/pulpwood. However, Government has not adopted the TIDG report. As discussed in Section 6 below, the industry is unlikely to be of sufficient scale to absorb planned increases in the availability of industrial roundwood. Going forward, attention is required to consider alternative uses for output, for example, energy from bio-mass through local generation.

2.4 Forestry and the Environment

A core aim of policy is to ensure that forestry is compatible with the protection of the environment. The *Strategy* proposed a reduction in the threshold, above which planning permission for planting was required, to 70 ha. It proposed also that environmental protection measures should be better integrated with forestry planning. It also called for environmental data to be incorporated into the Forest Information and Planning System (FIPS) and for a public information process to be established. In addition, it called for new guidelines on wildlife, habitat, harvesting, amenity and use of chemicals and herbicides to be introduced and for a National Sustainable Forestry Plan to be formulated.

In 2000, the Forest Service introduced guidelines on harvesting and the environment, water quality, archaeology, bio-diversity and the landscape. These were added to in 2001, with aerial fertilisation guidelines and again in 2002 with forest protection guidelines. Also, in 2000, the Forest Service issued a *Code of Best Forest Practice: Ireland*, setting out practice guidelines for all forest operations. Compliance with the suite of guidelines and the Code of Practice (CoP) is a condition of grant aid.

In May 2001 the Forest Service outlined proposals for the introduction of new Strategic Management and Environmental procedures encompassing (i) regional forest plans (RFPs), (ii) changes in EIA rules and the introduction of sub thresholds for afforestation, (iii) consultation with prescribed bodies, (iv) public consultation and (vi) an appeals procedure. The rationale for the new procedures related to a

combination of (a) the judgement of the Commission of the European Communities in relation to the transposition of Council Directive 85/337/EEC, (b) the Planning and Development Act 2000 and (c) Ireland's commitment to sustainable forest management (SFM). New procedures came into force with the passing of The European Communities (Environmental Impact Assessment) (Amendment) Regulations, 2001 (S.I. No. 538 of 2001) which set out the requirements for Environmental Impact Assessment (EIA) for forestry. With regard to initial afforestation, the Regulations provide for the introduction of a statutory consent system by the Minister for Agriculture and Food (to coincide with initial afforestation being taken out of the control of Local Government (Planning and Development) (Amendment) Regulations, 2001 (S.I. No. 539 of 2001)). The forest consent system provides for mandatory EIA above a threshold of 50 hectares and also provides for the possibility of sub-thresholds, where a project is likely to have significant impact on the environment. Applications for afforestation are screened to identify environmentally sensitive sites on the basis of their potential impact on water quality, designated habitats, archaeology, landscape, size and any other site-specific environmental consideration.

The proposed RFPs were replaced by county-based Indicative Forest Strategies (IFS) in 2002. The IFS aims to classify each county on the basis of a GIS map outlining (i) preferred areas for afforestation, (ii) potential areas for afforestation, and (iii) sensitive areas for afforestation. The IFS may also provide guidance and make recommendations on other forestry activities such as harvesting and haulage.

Progress has been slower than expected and no county's IFS is as yet complete[15]. The IFS project is effectively on ice and has been this way since about October 2003 due to mapping resources being diverted to cross-compliance work and this is unlikely to be completed until about October 2004.

Work on the preparation of a National Sustainable Forestry Plan has not started and there are no immediate plans to initiate this work. However, in 2000, the Forest Service introduced the Irish National Forestry Standard based on the criteria and indicators (C&I) adopted at the Third Ministerial Conference for Protection of Forests in Europe held in Lisbon, 1998. Environmental data and archaeology were incorporated into the design of FIPS. These and similar data, for example data on soils and habitat cover, have been incorporated into the information systems available to the Forest Service. In addition, the planned National Forest Inventory will collect environmental data.

Policy aims also to maintain a healthy forest environment by identifying risks, particularly from abroad, providing technical advice and implementing EU Directives relating to forest protection[16]. In 2002, the Forest Service introduced Forest Protection Guidelines covering the most significant issues relating to forest protection. Compliance with the requirement is a condition of grant aid and activities associated with a felling licence. The major threats being monitored currently include Sudden

[15] Wicklow has an IFS but this was prepared outside the scope of the Forest Service IFS.

[16] The Forest Service implements the forestry aspects of the EU *Plant Health Directive* (77/93/EEC) and directives relating to marketing of reproductive material (66/404/EEC, 71/161/EEC) which were combined under a new Directive, operational from 2003 (1999/105/EC).

Oak Death from United States and Pine Wood Nematode. The greatest potential source of infection remains imported wood and wood packaging.

Species Mix

To improve the diversity of species in Irish forests and extend the range of potential end-uses policy has set targets for the species mix in planting. Considerable progress has been achieved in reducing dependency on Sitka spruce and in increasing species diversity in afforestation. The proportion of Sitka spruce now accounts for less than 60% of afforestation. Even though the original target for broadleaf species was never reached, it was increased to 30% in the CAP Rural Development Plan 2000-2006. ***Modifications to the grant and premium payments in 2000, with increases of up to 40% in grant payments, favoured broadleaf species, while the relativity between Sitka and diverse species was more or less maintained. However, despite the increased payments for broadleaf species and changes in the regulations regarding the minimum percentage of these species, targets have not been met***. This is due to a combination of the cessation of premium payments after 15 to 20 years – which is a considerable time before the owner could realistically achieve revenues from broadleaf thinnings – and the financial attractiveness and greater degree of certainty attached to conifer afforestation. The quality of land being afforested is also of some significance. Table 2.4 shows the proportion of broadleaf in planting in recent years.

Table 2.4: Proportion of Broadleaf Planting 1996-2003

1996	15.0%
1997	15.0%
1998	15.9%
1999	15.1%
2000	12.9%
2001	12.4%
2002	17.4%
2003	22.8%
Whole period	15.6%

Source: Forest Service. Figures for 1996/7 are estimates.

There is some concern regarding the quality and on-going management of planted broadleaf species. Some crops have been planted on marginal broadleaf sites while many areas are being neglected after year four, which coincides with payment of the second grant instalment. Furthermore, attaining the 30% broadleaf species target by 2006 together with increased planting of more diverse species will delay the achievement of critical mass, which underpins much of the *Strategy*.

Increasing species diversity also poses new challenges for the forest sector including silvicultural implications for mixed species management, the economic impact of switching species from proven performers and the technology to process and handle multiple species log intake. Within each species there is a need for a certain minimum future level of supply to enable industry to process and develop markets. No research has been undertaken into what mix of species is most suited to the land coming into forestry or what species offer potential for added value and a return to the grower.

Amenity and Recreation

Acknowledging the non-timber value of forestry, policy has aimed to encourage provision of public access to forests, having regard to the rights of owners, and the development of amenity forestry projects of local social and economic benefit. The Urban Woodland and Amenity Woodland Schemes were restructured and replaced by the NeighbourWood Scheme in 2001. The scheme will run until the end of 2006 and provides funding for local authority and amenity groups to develop local woodland amenities in and around villages, towns and cities, specifically for public access and enjoyment. Projects funded to date include small-scale woodland establishments beside residential areas, large-scale urban greening projects within greenbelts, and improvements and development work within existing woodlands in rural areas used by local communities for recreation.

The Forest Service also provides support for organisations and initiatives promoting an appreciation of trees and forests as for example Crann, Tree Council of Ireland, and Woodlands of Ireland. Coillte also operates an open forest policy allowing for public access. However, access to private forests is negligible and remains contentious in the light of fears over litigation and requirements under legislation. This is clearly an issue to be resolved in the wider debate of recognising the non-timber values of forestry and ensuring that this value accrues in an optimal manner.

Environmental issues in relation to forestry have received considerable attention and the issue has come to be perceived as a threat to the viability of the sector from a commercial point of view. For example, the increased requirement for bio-diversity on a site-by-site basis will reduce the productive area and reduce potential returns to growers as well as delaying the achievement of critical mass levels of timber production. It is certainly true that protection of environmental benefits comes at a cost to the owner but, since the benefits accrue to the wider economy, this cost is not recouped. An optimal policy would need to recognise and value these non-timber benefits and ensure that they are distributed to producers and the wider economy in an appropriate manner. This is a considerable challenge and is made more difficult by inconsistencies in policy. For example, the Native Woodland Scheme was introduced in 2002 with the aim of protecting and expanding Ireland's native woodland resource, which is of prime bio-diversity value but had suffered from neglect and clearance. Initial progress was dented by withdrawal of funding in 2003.

2.5 Other Policy Areas

2.5.1 Forest Management

Improving forest management so as to achieve the timber output and other objectives of the strategy has been an important aim. The Code of Best Forest Practice- Ireland was published by the Forest Service in 2000. Twenty farmer-owned forestry co-operatives have been established under the umbrella of the Western Forestry Co-operative and the Forest Development Association Co-op provides a prototype that could be replicated as a forestry business model for the sector. Such Co-ops have a

potential role in addressing forest management and marketing issues as discussed in this report. The Woodland Improvement and Forest Reconstitution Schemes provide grant aid to improve the silvicultural management of crops with the former directed mainly at broadleaf species.

By 2010 some 30,000 ha of privately owned forests will be due for first thinning. This assumes an average yield class of 18 and first thinning age of 18 and makes allowance (overall 40% reduction in area) for those plantations deemed unsuitable for thinning due to a variety of reasons including access and stability[17]. The self-assessment companies and others are beginning to focus part of their efforts in this area and the market is beginning to provide a range of services targeted at farmers and providing for the long-term management of the crop through to the end of the rotation. ***Economies of scale will be important and in the absence of some form of group co-operation, these products are unlikely to be relevant to areas of less than 10 ha.***

In 1999, the Irish Forest Certification Initiative (IFCI) was launched with the aim of preparing an Irish forest management standard compatible with and approved by the Forest Stewardship Council (FSC). A second draft management standard was the subject of public consultation in 2001. The IFCI then ran into difficulties, including funding, and a third draft standard is now expected in the second half of 2004. The Timber Standards Committee, comprised of sector stakeholders, advises on standards and maintains a watching brief for new standards, which will impact on the forest products sector. The standards setting protocol is fairly lengthy and consultative.

2.5.2 Inventory, Planning and R&D

Under the *Strategy*, policy targeted the development of a comprehensive inventory and planning system to provide forest resource, geographical and environmental data for management, control and planning purposes, including to establish a Forest Inventory and Planning System (FIPS). Work on developing FIPS began in 1997 and encompassed – (i) forest classification, (ii) ground survey, (iii) soils analysis and (iv) grants and premium administration system (GPAS). The purpose of GPAS was to have a map based system to pay forest premiums and grants which would be compatible with the forest classification system and also the Land Parcel Identification System (LPIS) in the Department of Agriculture and Food. ***Progress on the development and implementation of information technology (IT) systems within the Forest Service was the subject of the Report of Comptroller and Auditor General (2002), which identified major cost and time overruns and functional shortcomings. The GPAS project was terminated, prematurely in 2000. This followed rejection by the Government Contracts Committee of a proposed extension.***

The system that has been delivered, while capable of processing grant and premium payments, is limited in functionality. The area under forestry up to mid 1997 was mapped and classified, but these data were never updated as intended due to lack of functionality in GPAS. The ground survey, planned to commence in 1998 was not

[17] Phillips, H. (2004) *Realising the potential of private plantations*. COFORD

undertaken nor was the inventory of private woodlands. These are being replaced by a sample based national forest inventory (NFI) due to commence in the second half of 2004. While this will enable Ireland to fulfil international reporting requirements in the short-term, it will need to be repeated at regular intervals. Furthermore, the NFI does not have a forecasting module, which is necessary to plan future development of the sector, although the Steering Group overseeing the NFI has indicated a willingness to expand the NFI to include forecast functionality.

Due to the failure of FIPS there is no integrated database incorporating forest, environmental, ownership and administrative data. Furthermore, some considerable work is still outstanding to update, clean and migrate existing data to the required format and database structure. A new project, integrated forest information systems (IForIS), intended to replace GPAS, went to tender in 2003. While a successful tenderer was identified in June 2003, the award of contract was delayed until recently due in part to the move to The Department of Agriculture and Food which has a different IT platform than The Department of Communications, Marine and Natural Resources.

The current position means that a number of important issues in relation to planning and investment in the industry will be inhibited due to the absence of national forecasts. There is no forest management planning in current IT plans and a less than comprehensive FS strategy for information technology. Indeed, it remains to be seen to what extent IForIS will provide the Forest Service with a fully integrated information and planning system.

A five-year research and development programme (1996-2000) was introduced by COFORD in 1996. Research and development activity included genetics and tree improvement, silviculture, environment, harvesting and wood transport, forest product and processing development. R&D grew in all sectors of the forest industry as a result of Community Support Framework (CSF) funding for the COFORD and other programmes over the period 1994 to 1999. In particular, small and medium sized enterprise (SME) and third level involvement in forest R&D has grown. R&D expenditure by COFORD is budgeted to exceed €4 million by 2005. Total spending on research and development is difficult to calculate exactly but is estimated as being circa €6 million per annum or almost 1% of forestry contribution to GDP.

The mid term review of the current programme funded under the Productive Sector Operational Programme 2000–2006 shows that good progress has been made when assessed relative to a range of indicators. The total contribution of industry to COFORD research and development programme has averaged 35% and the uptake by industry has been in line with projections, although involvement by private growers has been slow.

2.5.3 Finance, Legislation and Regulation

The main aim of policy in relation to finance is to secure necessary public funding to facilitate full implementation of the Strategic Plan. This includes securing maximum EU financial support and adequate Exchequer funding to meet annual targets while maintaining the existing tax regime for forestry, and promoting private sector investment.

In the legislative area policy aims to ensure that legislation is sufficiently up to date and comprehensive to promote the development of the sector. A Forestry Legislation Review Group was established in 1999 and prepared a working draft Heads of Bill in 2003. The draft proposes the introduction of forest management planning and the simplification for felling approvals. ***However, there is a growing perception in the sector that the regulatory framework is becoming unwieldy and a barrier to the development of the sector.***

Policy also aims to support the commercial development of Coillte so as to maximise the benefits from public forestry and to promote the development of the sector. The *Strategy* identified a role for Coillte, which implies that it will be maintained in public ownership into the medium term. In recent years, Coillte has acquired Louisiana Pacific Ireland, now SmartPly and established a joint venture with GriffnerHaus of Austria to design, manufacture and market high quality, modular, timber buildings. It is clear that, given the non-involvement in new afforestation, that Coillte has expanded beyond its core activities and this raises issues regarding the role of the State in non core activities such as building and property.

2.5.4 Implementation and Monitoring

Departmental responsibility for forestry has changed frequently over the years but there is a strong rationale for its current location *viz*. the Department of Agriculture and Food. Effective implementation of the strategy requires that the Forest Service operates in an efficient and cohesive manner and that there are adequate resources available to undertake this role. Of particular importance for the sector going forward is to ensure that there are adequate resources to produce and maintain a comprehensive and accessible inventory of Irish forests and to make this information available to the industry. It is important also that the technical and administrative functions of the Service are integrated.

Monitoring of implementation and objectives is also required on an ongoing basis and it is notable that regular reports have not been produced regarding the implementation of the 1996 *Strategy*. Part of this process requires also that forestry strategy is reflected fully in the Department's business plan and in Annual Reports. It is also necessary that the needs of the sector are accurately articulated and integrated into the strategy. ***To this end, it is proposed that a Forestry Forum be created that will involve representation of main stakeholders, including the Department. In addition to identifying strategic issues and interventions required, this Forum should have a role in also monitoring progress with implementation of the strategy.***

2.6 Forestry and the Economy

Over 14,000 farmers are now engaged in forestry and virtually all current annual afforestation is undertaken by farmers and other private individuals. With 1,400 new entrants each year, the number involved is expected to be around 20,000 by 2007. The annual volume of timber produced from Irish forests is projected to increase from around 3 million, m^3 in 2002 to over 8 million, m^3 by 2030, of which in the region of 60% will come from farmer-owned plantations. Total roundwood output on the island of Ireland in 2002 was 3.3 million m^3, of which over 80% was supplied by Coillte and almost 400,000 m^3 were supplied by forests in Northern Ireland. Table 2.5 summarises some of the main economic values of the sector.

Table 2.5: Economic Summary the Irish Forestry Sector.

Forest Area (end 2002)	680,330 ha
Standing Volume (2002)	50,859,000 m^3 overbark
Average Annual Increment (2002)	3,353,000 m^3 overbark
Annual Felling (2002)	2,738,000 m^3 overbark
Ownership of Estate	42% Private, 58% Coillte Teoranta
Total Turnover	€763m
Total Direct Employment	6,241
Timber sales (2003)	3.4m m^3

Sources: United Nations (2003); Gallagher & O'Connell (2001); CSO (2004); Phillips (2003).

The 2002 Census of Population identified a total of 2,362 employed in forestry. Of this total, 836 were employed in the BMW region (35%), with a further 1,298 employed in the S&E region outside the Dublin/Kildare/Meath area.

Projections of output are developed in Section 3 of this report. These project that output will rise to just under 3.4 million m^3 this year and will exceed 3.5 million m^3 in 2006, and 4 million m^3 in 2012. This would represent output growth of 21% in a decade. It is anticipated that supply from private sources will rise rapidly reaching 1 million m^3 in 2017 (24% of the total) with Coillte's output stabilising around 3.35 million m^3.

Table 2.6 contains estimates of employment in forestry. This identifies total employment of 3,780 in crop establishment and harvesting in 2002. This does not include an estimate for the labour input by farmers in growing the crops.

Table 2.6: Employment in Forestry

Crop Establishment	2,375
Harvesting & Logistics	1,405
Total	3,780

Source: Phillips (2003)[18]

The growing sector is only the start of the chain of activity and the *Strategy* has emphasised the need to create a competitive industry in Ireland. An estimate of the

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

value of economic activity in the forestry industry can be obtained from the CSO's *Census of Industrial Production 2001* (CIP). Economic values for the relevant sectors are shown in Table 2.7[19]. These relate to 2001 as this is the last year for which CIP data have been provided. This is additional to the growing sector.

Table 2.7: Economic Measures of Ireland's Forest Industry

	Employment	Wages (€m.)	Gross Outpout (€m.)	Net Output (€m.)
NACE 201	1,374	31.0	264.7	110.8
NACE 202	732	20.6	153.2	50.1
NACE 203	3,048	57.6	293.7	118.3
NACE 204	394	6.5	38.7	13.1
NACE 2051	535	9.0	49.0	18.2
Total	6,083	124.7	799.3	310.5

Note: For NACE 203 in particular, a proportion of the wood used in the manufacture is imported.
Source: CSO (2004), Table 1

This table shows a sector employing in the region of 6,083 people with wages and salaries amounting to just under €125 million in that year. Approximately 50% of this is in NACE 203 which is the manufacture of wooden products for use in construction. Irish timber has a market share of about 34% in this market – see Table 2.2 above. Thus, assuming that the labour input is similar for both Irish and imported timber, this would suggest that about 1,000 of these people work on Irish timber. As a result, the employment in manufacturing and processing that is dependent on Irish timber is about 4,000 with about €87 million being paid in salaries in 2001. Gross output in these sectors was €800 million in 2001 with value added amounting to €311 million. If allowance is made for the high level of imports in timber for NACE 203 then the estimates are for gross output of €605 million and value added of €233 from using Irish timber[20].

Forestry is concentrated in the less developed areas of the country and the growing sector has good linkages to the economy. Most input is sourced in the economy and most labour is local. It is clear, therefore, that the growing sector would be expected to support considerable further activity where it is located. An estimate of the total impact of forestry on the Irish economy when secondary effects are included is provided by the application of appropriate multipliers to the sector. The multipliers indicate the secondary impacts on the economy of a 1 unit change in activity in the forestry sector. The calculated values for these multipliers are shown in Table 2.8. These show that the secondary effects of output of the sector are approximately equal to the initial value of output. For income and employment, the multiplier is approximately 60%. This means that an additional 5 jobs created in forestry will lead to an additional 3 jobs elsewhere in the economy as initial incomes are spent and new inputs for the expansion are sourced. If this is applied to total employment in all

[19] The definitions of the NACE codes are as follows: 201 (Sawmilling and planing of wood); 202 (manufacture of veneer sheets, plywood, laminboard, particle board, fibre board and other wooden board products); 203 (manufacture of builders' carpentry and joinery) 204 (wooden containers) and 2051 (other products of wood). It should be noted that as the CIP data include only operations with 3 or more people engaged it is possible that these estimates are somewhat on the low side as there are many small firms engaged in this sector.

[20] It can be noted that gross output per production unit in NACE 202 was almost 3 times the level in NACE 201 and the annual wages paid in NACE 202 at an average of €28,142 per employee were significantly higher than the €22,562 paid in NACE 201, reflecting the higher technological processes.

sectors – i.e. the total for Tables 2.5 and 2.6 – then this amounts to total employment of 16,175 in the Irish economy that is directly engaged in growing and using forest products or is engaged in related sectors.

Table 2.8: Secondary Economic Impact of Forestry

	Indirect	Induced	Total secondary
Outputs	0.271	0.721	0.992
Income	0.168	0.44	0.608
Employment	0.23	0.41	0.64

Source: Ni Dhubhain et al (2002)[21].

Clearly this is an important sector, but weaknesses have been identified in terms of the implementation of actions identified in the *Strategy* and the attainment of targets. The Agri-Food 2010 Committee carried out a SWOT analysis of the forestry sector.[22] This exercise identified the principal weaknesses of the sector as being:

- a poor perception of forestry;
- lack of land mobility between uses;
- low levels of farmers trained in forestry management; and
- structural imbalances at regional level.

In addition, short-term thinking and approaches in policymaking, a lack of monitoring, a failure to create a critical mass, a poor record of achieving targets and over capacity in the processing sector were identified as additional weakness of the sector. These need to be rectified if a sustainable and economically viable forestry sector is to be created.

2.7 Current Strategy: Overall Assessment & Value for Money Considerations

The overall conclusion of the assessment above is that many of the objectives of the 1996 *Strategy* were not achieved and there are many shortcomings, which have been uncovered. However, there are clear lessons, which can be taken from that experience and which could be used as a basis to overcome many of these deficiencies in the future. A more fundamental question, for the future, is what kind of strategy makes sense both from a value for money perspective and which contributes to achieving environmental and sustainability criteria? In the absence of publicly financed supports, forestry does not provide a sufficient return to most landowners to incentivise investment. Hence, the value for money question is extremely relevant. To emphasise this point it should be recognised that (as shown in Section 6) a continuation of the existing support structure, with afforestation reaching a target of 20,000 ha. per annum up to 2035, requires a total commitment of funds by the State of €7.5 billion. This comprises outstanding obligations and new ones, which would arise as a result of a planting programme of 20,000 ha. per annum over the period 2008-

[21] The results shown were obtained using Input-Output analysis and should be viewed as preliminary. Further research is necessary to disaggregate the forestry sector into various sub-divisions such as establishment, maintenance and harvesting.

[22] Department of Agriculture and Food (2000) *Rural Development Plan 2000-06*, Government Publications Office

2035. This amounts to a commitment of €3.52 billion in NPV terms, when a real discount rate of 4% p.a. is applied. In addition, there are strong economic arguments for believing that a rate of planting of 20,000 ha. p.a. is the minimum needed to achieve adequate critical mass to secure long-term economic viability of the sector.

Remaining with the value for money question, when the value of the grant, the premiums and of the timber sales are taken together, the analysis in Section 6 shows that the NPV of the income stream received by a farmer is €7,020 and €3,903 by non-farmers. This implies an average NPV of receipts of €6,736.35. The corresponding NPV of the average cost to the State of achieving this is €8,190[23].

This implies that creating value of €100 for the grower requires accepting a commitment in terms of public funds of €121.60. When placed in the context of data for the cost of other farm supports – discussed in Section 5 below – this outcome should be compared to that which would be achieved for dry livestock, which represents the alternative use of land. In this case, supports and subsidies amounting to €140 to €147 are required to provide the farmer with €100 of income.

However, the analysis above fails to recognise that the value of forestry to the State exceeds the value to the grower in two important respects. The first relates to the potential that is offered as a result of the availability of a local supply of raw material for the development of a value adding industry. Since this industry will typically be located in rural areas, this means that employment created from the development of forestry will be particularly valuable and important in achieving stated policy aims[24]. The economic importance of the forestry sector currently in Ireland has been outlined in Section 2.6. This identifies 3,780 people currently employed in the establishment and harvesting of crops but that the numbers employed in the processing and manufactures of timber of products greatly exceed this at 6,083. For every job in growing and harvesting there is approximately one additional job in processing and manufacturing based on forest output. In addition, when the total impact of the sector on the economy is included through multiplier analysis, there are an additional three jobs created in the economy for every 5 jobs created in forestry. Furthermore, the high degree of integration of the sector with the economy is demonstrated by the estimate that the secondary effects of an increase in output are almost as great as the initial impact.

The second way in which the returns to the State from the development of forestry exceed those to growers is through the non-marketed public goods that are produced. These are analysed in detail in Section 4 below and in Appendix 4. Since these goods are not priced in any market it is inherently difficult to provide economic values although it is clear that there are considerable benefits to society as a result of the impact of forestry.

[23] In arriving at these estimates, a real discount rate of 5.5% is used for the timber revenue but a risk free rate of 4% is applied to State funds.

[24] The role of forestry in achieving objectives in rural development policy at EU level has been stated repeatedly. For examples, see European Commission (1999) *Council Regulation 1257/1999 on support for rural development from the EAGGF*. OJ L 160/80, 26 June and European Commission (2004) *Proposal for a Council Regulation on Support for Rural Development by the European Agricultural Fund for Rural Development (EAFRD) COM 490 final*. In terms of Irish policy, the role of forestry in rural development is identified in Department of Agriculture, Food and Rural Development (2000) *Rural Development Plan 2000-2006: Ireland*

Values are estimated for the three most important – recreation, carbon storage and bio-diversity. Together, these produce a value in the region of €88.4 million per annum currently – using a mid-point value for carbon. In the case of the impact of forestry on the landscape there is potential for a positive impact but it is likely that the impact of planting to date is zero overall, due to some negative effects. Regarding water quality, it is estimated that there is a minor negative impact but that this can be minimised by adherence to regulations. Regarding the impact of forestry on health, it is not possible to quantify the effect but it is likely that there is a positive impact while there is likely to have been a limited negative impact on Ireland's heritage. Finally, there is a small positive value arising as a result of non-timber marketed goods. In all cases, these results should be read as the difference between forestry and the use of land in agriculture availing of REPS. Thus, it would appear reasonable to place a zero value of these non-quantified effects leaving a total value of €88.4 million, per annum.

Comparison of Costs and Returns from the Afforestation Programme

The total returns from afforestation therefore comprise the incomes achieved by growers, the value of timber benefits to society and a certain amount of the downstream value added in the timber processing sector.

As noted above, incomes of growers amount to €6,736.35 in NPV terms per ha afforested. When aggregated over the full period of the programme and discounted to 2005 – the base year for the calculations – then the NPV of incomes from the full programme is €2,378 million or €73 million on average from each 20,000 ha planted[25].

An estimate of the value of the non-timber benefits of the afforestation programme is contained in detail in Section 4. There it is shown that the value of carbon stored with 20,000 ha afforestation would be €45.2 million p.a. Realising this value over the course of the programme gives a NPV of €659 million[26]. Section 4 also provides an estimate of the value of afforestation from the point of view of bio-diversity. This indicates that afforestation of 20,000 gives a value of €1.6 million. Over the course of the programme this gives a NPV of €23.3 million. Section 4 also indicates that while the current recreation value of the forest estate is €37.6 million there is potential for this to grow to €79 with the appropriate measures. Assume that the afforestation programme has a positive impact through providing areas that contribute to the realisation of some of this value so that there is an additional €1 million added to the value for 20 years and that the value then levels off at this time. The total value thus rises to €57.6 million per annum realising about 50% of the potential identified. The present value of the addition to welfare would be €176.3 million. This gives a total additional value for the non-timber benefits of an afforestation programme of 20,000 ha. p.a. of €859 million[27].

[25] Note that this is the value of the incomes discounted to the base year rather than to the year of planting as included earlier.

[26] Although these are public goods and arguably a social discount rate of 4% should be used, the risk adjusted rate of 5.5% is used in deriving the present values.

[27] This may be an underestimate of the value of leisure and recreation since this value is created in perpetuity but is only included here for the period of the afforestation programme.

An important rationale in the Strategic Plan for the increase in afforestation is the creation of a value-adding processing sector in Ireland. An estimate of the potential value of this industry has been provided in earlier work[28]. This identified an additional net value added in processing amounting to €773.49 when discounted to the year of planting per additional hectare. Over the full course of the afforestation programme this would amount to a NPV of €225.5 million. The estimated economic costs and returns in NPV terms of an afforestation programme of 20,000 ha per annum up to 2035 are summarised in Table 2.9.

Table 2.9: Estimated NPV Costs and Returns of Afforestation Programme (€m)

Values created:	
Income from timber sales	690.1
Income from premiums	1,687.5
CO_2 sequestrated	659.3
Recreation and Leisure	176.3
Bio-diversity	23.3
Net value added in processing	225.5
Total	3,462.0
Supports provided	2,891.0
Net benefits	571.0

Thus, in summary the total returns in NPV terms, produced by an afforestation programme of 20,000 ha. p.a. comprise €2,378 million in incomes and €859 million in non-timber goods. In addition, the sector is a valuable source of employment in rural areas in both growing and processing timber with the potential for this to grow considerably during the course of the afforestation programme. The potential additional value added in the sector from processing the timber has been valued at €225.5 million in NPV terms. Together, these total to €3,461 million in value created by the programme.

The corresponding NPV of the State's commitments to afforestation up to 2059, with a revised payment structure, has been estimated as €3,515 million. However, this includes both commitments already entered into i.e. relating to afforestation in the years up to and including 2004, and future commitments. If the cost of future commitments only i.e. those that relate to the afforestation programme from which the identified benefits arise, are included, then the NPV cost to the State is €2,891 million when discounted at 4% per annum. This means that there is a net benefit of €571 million. If payments by the state are divided between income supports – premium payments – and investment – grants – then removing the income support element from both sides of the sum produces the result that a return of €1,774.5 million arises for investment of €1,203.5 million, a net return of €571 million or 47.5%. This means that a positive return on the investment is earned if the estimates for timber values, non-timber benefits and industry benefits are reduced by 30%.

[28] Peter Bacon & Associates (2003) *Forestry: A Growth Industry for Ireland*

3. Projections 2004-2075: Forestry Output & Timber Value

3.1 Overview of Timber Market Developments

It is estimated that the certified forest area world-wide covered 177 million hectares at the end of 2003[29]. In the UNECE region, which includes 90% of this forest area, total roundwood consumption in 2002 was 1.3 billion, m^3. This level of consumption is well within the allowable amount, with sustainable harvesting limits. Globally, the sector has been experiencing over-supply in a number of regions and products and this has depressed prices since the late 1990s. However, there has been a small upturn in recent years for sawn wood mostly as a result of strong demand in the US. Consumption of wood for energy has also grown strongly in recent years and this has placed some pressure on supply in markets for pulpwood for panel board manufacture.

The supply of timber in Europe has exceeded demand by a growing amount since the mid-1990s. Total demand for timber in the EU/EFTA region i.e. Western Europe is estimated to have been 486 million, m^3 in 2002 and is fairly flat. Over the period 1993-2002, demand in Western Europe grew at about 2.8% per annum with supply and demand approximately balancing in this area. Total consumption of sawn wood was estimated at 90.4 million, m^3, with wood panels accounting for a further 43.6 million, m^3 and paper using 79.3 million, m^3. This level of consumption is not expected to change much in the short-term[30]. Overall, Europe is a net exporter of about 7 million, m^3 per annum, although it is a major importer of wood chips. Supplies of timber from Eastern Europe have been growing much more rapidly at about 6.3% since 1993. Most states in the EU-15 are net importers – the main exceptions are Austria, Finland and Sweden – with the UK, at about 7.5 million, m^3 providing the import market. However, most East European states including the new EU members are net exporters.

Against this background of largely stagnating demand in Europe and growing supplies, prices have been depressed in recent years and have fallen since the mid-1990s for major species, in particular pine. The fall in the value of pine has been such that the price of spruce timber, which had a price differential against pine of up to 30% in the mid-1990s, is now close to the price of pine.

Current employment (in million of FTEs) in the forest and forest related sectors in Europe (including the CIS) is shown in Table 3.1 for 2000 with projections for 2010. This shows that employment in the sector is expected to fall, with an overall 6.9% decrease projected[31].

[29] Phillips, H (2004) *Global Forest Certification – 2004 Update*. Paper presented to InnovaWood Industry Conference, Dublin

[30] Koskinen, A. (2002) *European Sawn Softwood Markets*. Paper presented to UNECE Timber Committee Market Discussions, Geneva, October.

[31] United Nations (2003) *Employment Trends and Prospects in the European Forest Sector*. Geneva Timber and Forest Discussion Papers, FAO

Table 3.1: Employment in the Forest Industry in Europe and CIS in 2000 and 2010 (millions of FTEs)

	Employment 2000	Projected Employment 2010	Percentage Change
Forestry (ISIC 02)	1.40	1.28	-8.6
Wood Industries (ISIC 20)	1.47	1.41	-4.1
Pulp and Paper (ISIC 21)	0.92	0.83	-8.5
Total forest industry	3.79	3.52	-6.9

Source: UN FAO (2003)

It is projected that maturing plantations of Sitka Spruce will lead to a significant increase in harvesting potential and wood supply in the UK in the period 2003-2010[32]. Actual supply has lagged projected availability and industry capacity currently. The excess projected supply of softwood material will exceed 8 million, m^3 by 2010 with excess material in both pulpwood and logs. Increased supply and poor prices in local markets have driven exports particularly from Scotland with 200,000 m^3 in 2004. Part of the pressure in Scottish markets arises from historically high output in Scandinavian countries. Ireland is considered to be the only viable market for the export of this timber and while Irish log costs are similar to Scandinavian levels, the relatively underdeveloped supply chain increases the price of timber. As a result, imports can compete on price and while the Irish sawmills can compete in Irish markets they would not be able to export timber competitively to the UK given the current price structure.

Timber supply projections for Ireland are developed in the next section. The main factors driving demand for timber include developments in the construction sector, packaging and fencing. A growing economy should boost demand somewhat but the prospects are that it will grow somewhat slower in the near future than has been the case in the recent past. This is as a result of the likely slower economic growth compared with the 1990s and a slowdown in construction in the short to medium term. Against this background it is clear that the future performance of the Irish industry will depend on achieving some upturn in the demand for timber internationally, which has stagnated, and an improvement in the competitiveness of the Irish industry.

The low level of growth internationally has received a lot of attention. Timber consumption per capita in Europe is well below levels in North America although there is significant variation in consumption patterns in sawnwood and panel products[33]. With this in mind, the European Confederation of Woodworking Industries has been engaged in identifying a strategy to increase demand for timber in Europe. With a base case scenario of 1% growth per annum, the outlook has been described as 'bleak'. In addition, it was the case that there were no factors that would support an increase in demand in Europe overall [34].

[32] O'Carroll, C. (2004) *Future Supply/Demand of Forest Products in Europe*. Paper presented to InnovaWood Conference Dublin, April
[33] O'Carroll, C. (2004) *op. cit*.
[34] *Roadmap 2010 for the European Woodworking Industries: Action Programme*. Report prepared by CEI-BOIS in collaboration with Jaakko Poyry, Timwood and Indufor.

The strategy has identified a number of goals that are considered to be appropriate if the outlook is to be turned around. These are to:

- Double the share of wood-based material in construction;
- Alter attitudes towards and increase wood consumption across all areas;
- Create conditions for increased use of wood in packaging and transport;
- Promote understanding of the role of timber usage in sustainable development; and
- Improve co-operation among players in the sector.

While it is by no means certain that the emerging imbalance between demand and supply and subsequent downward pressure on prices in a number of timber markets can be eliminated, the general consensus emerging is that there is an opportunity and certainly an imperative to act to alter current trends. In this context, the outlook for timber over the next decade appears to be that markets will remain difficult but that in the longer term there are opportunities for growth. This longer-term perspective is important since, as shown in the next section, the output of Irish forest will grow considerably after about 2024.

In terms of forest products, the outlook is that competition in high value markets will continue to intensify. Table 3.2 shows forecast demand growth for timber products

Table 3.2: Forecast Growth of Timber Product Supply and Demand in Europe

	Production (% p.a.)		Consumption (% p.a.)	
	2002-05	2005-10	2002-05	2005-10
Sawn Softwood	1.4	0.8	1.2	0.7
Plywood	0	0	-1.0	-1.0
OSB	7	6	13	8
MDF	6	4	7	5
Particleboard	2	1	3	2
Fibreboard	-3	-2	-3	-1

Note: Includes Western and Eastern Europe
Source: O'Carroll (2004)

While the overall growth in demand for wood products in Europe will be slow, these data show that there will be considerable variation in growth rates between products. The newer products such as OSB and MDF will grow quickest and further analysis of the data also shows that growth in both consumption and production will be quickest in Eastern Europe. This higher growth profile for innovative products compared to more mature products is no surprise. As innovative wood products are introduced, substitution allows demand for these products to grow faster than the growth in overall wood consumption.

In the face of this outlook, the strategy being adopted by producers in Europe appears likely to be comprised of an increasing focus on producing high technology products while utilising low quality wood and fibre[35]. This means that the industry will be increasingly characterised by a situation where the value of outputs is determined by

[35] Whiteman. A. (2004) 'Outlook for global forest products markets: trends, driving forces and Europe's position in the global marketplace'. Paper presented to Innovawood/COFORD Conference, April

the process i.e. knowledge resources, rather than the value of the material inputs. In this context, innovation and marketing will become increasingly important. An implication is that the greatest increase in demand is likely to be for the lower value wood and fibres while demand for good quality roundwood will be constrained due to the availability of substitute products. This is likely to be reflected in slower growth in prices for good quality wood. Ultimately, the value in large trees will reside more in their appearance in a natural setting than in their timber content.

A problem with Europe being competitive in the low cost timber and fibre is that labour costs are much higher than in competitor countries[36]. As the main drivers of value in products increasingly reside in the process rather than the material inputs, this becomes more important as competitive production requires that the cost of inputs is reduced.

3.2 Projections of Supply of Irish Timber

3.2.1 Introduction to the Model

This section projects Irish timber output up to 2075 on the basis of recent planting rates and Irish forestry policy. A large number of variables are used in developing the projections. These are discussed further along with the structure of the model used in Appendix 2. There are three main projections based on different assumptions. In summary these are:

- Assuming net afforestation of 13,000 ha per annum beyond 2010 and afforesting on the basis of forecasts produced by Teagasc for the period 2004-10[37].
- Assuming net afforestation of 20,000 ha per annum from 2008, having increased gradually from its current level in the intervening period.
- Assuming net afforestation of 20,000 ha per annum from 2008 but with alternative assumptions as detailed below in relation to the proportion of broadleaf species in the total and the amount of thinning carried out in private forests.

These three projections can be summarised as broadly representing: output if planting rates were to continue at the level of recent years; output if planting levels reach targeted levels and a sensitivity analysis in relation to this latter scenario. As discussed in detail later in the report, the key issue in arguing that the higher rate of

[36] O'Carroll, C. (2004) *op. cit*.

[37] The Teagasc forecast from Behan, J. and K. McQuinn (2003) *Projecting Farm Forestry in Ireland*, Teagasc Working Paper. This work was done well in advance of the changes to the CAP regime and the introduction of the Single Premium and uses the FAPRI model before the model was recalibrated to reflect the impact of the changes. The benchmark forecast was 13,000 ha would be aforested in 2010 following a period of somewhat lower planting in the intervening period. Thus, the underlying assumption in using this work for this projection is that the changes to the CAP have no impact on farmer's planting decisions. As discussed below, this assumption may not be valid given the extent of the changes implied by the reforms, in which case it would not be appropriate to base output on this work going forward. This forms part of the rationale for the projection using afforestation of 20,000 in this section.

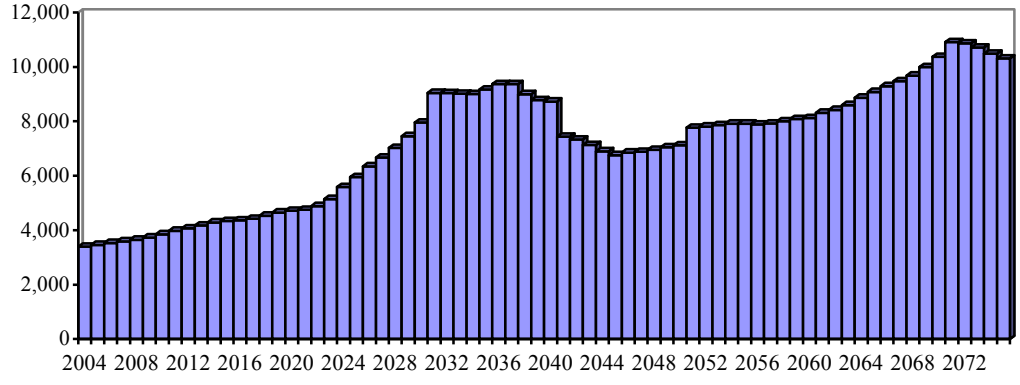
planting is feasible is the potential impact of the reform of the CAP. In deriving these projections it is implicitly assumed that the current level of forestry payments is held constant in real terms, otherwise it is unlikely that these planting levels would represent a relevant basis for the projections. In all cases, the Coillte 100-year forecast is used for production from public sector forests and it is assumed that there is 100% reforestation following clear-fell in both the private and public forests. Net afforestation is assumed to continue at the annual rate identified, up to 2035. It is assumed to decline thereafter, to zero in 2040. These dates were chosen, as this level of afforestation would achieve broadly a sustainable level of production in the long run i.e. beyond the time period covered in the projections, assuming 100% reforestation. Afforestation of 13,000 ha per annum would lead to 16% of the land area of the country being afforested in 2040 while 20,000 ha per annum would mean that 19.5% is afforested. In both cases the outcome is well below the European average.

As is always the case with a model such as this, where many of the underlying values are best estimates or averages, the results should be read as best estimates and are subject to error intervals. Given this, the results obtained provide good indications of likely developments and indicate the challenges and opportunities that will arise. The values obtained provide the basis for the estimates in relation to values, processing capacity and funding requirements in later sections of the report.

3.2.2 Projected Output with 13,000 ha Annual Afforestation

Figure 3.1 shows projected output if afforestation remains at the level forecast by Teagasc, i.e. if the CAP reforms have little or no impact on farmers' decisions in relation to forestry.

Figure 3.1: Projected Output with 13,000 ha Afforestation per annum (000s m^3)



Two aspects of this projection are particularly striking. First, after growing from a projected level of output of about 3.4 million m^3 in 2004 to 4.75 million m^3 in 2021, an annual growth rate of 2%, growth then accelerates to reach a projected level of 9 million m^3 in 2031, an annual growth rate of 7%[38]. The timing of this growth broadly

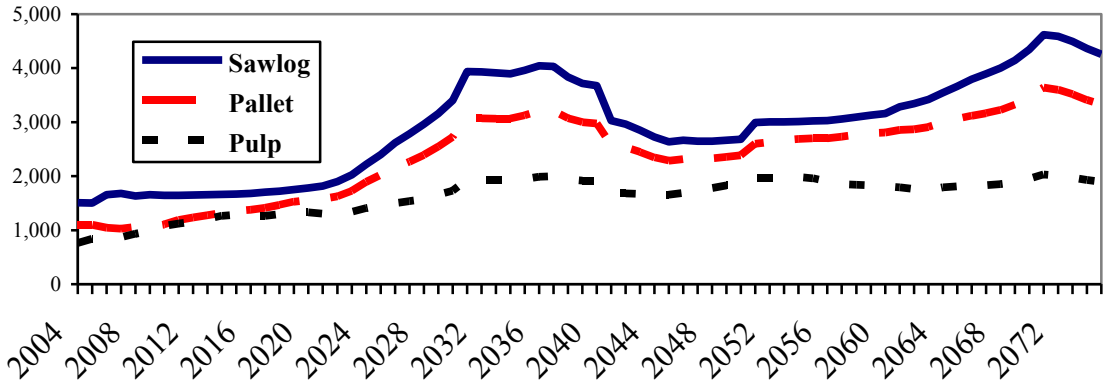
[38] Actual output has fallen below Coillte projections in recent years. It is unclear whether this is due to temporary factors or whether there are long term issues that would mean that the under supply would

coincides with the rotational maturing of conifers following the acceleration of planting rates in the private sector during the 1990s. Second, the peak level of output of 9.4 million m^3 in 2036-37 is not maintained and soon declines sharply. Allowing for the fact that output timing can vary – the projection is based on an 8-year smoothing average but further smoothing is possible – the projection indicates a broadly steady level of output in the years 2031-40 at about 9 million m^3. However, this falls to less that 6.8 million m^3 in 2045, a decline of 25% from its peak of 8 years earlier, with an average level of 7 million m^3 in the decade 2041-50. Output then recovers to exceed its earlier peak after 2067 as the cycle is reasserted in the second conifer rotation and production of some broadleaf species begins. Average output in the 10 years 2067-76 is projected to be about 10.2 million m^3 per annum. It is considered unlikely that long term output will be in the region of 9.5 to 10 million m^3.

This profile has important consequences in relation to the development of the sector. It is clear that there will need to be a huge up-scaling of processing capacity from current levels, (of around 3 million m^3 of output per annum) if the volumes of output beyond the next decade are to be processed[39]. This will require considerable investment. However, this rate of investment is unlikely to be forthcoming unless the trough in the period approximating to 2040-2060 is reduced so that the level reached in the 2030s is maintained and that this becomes the long run average level of output.

The model also indicates the output of timber from coniferous forests according to its potential uses[40]. This is based on analysis of log diameters as discussed in Appendix 2. Projected output according to the market segment supplied is shown in Figure 3.2.

Figure 3.2: Projected Output of Conifers by Market Segment with 13,000 ha Afforestation per annum (000s m^3)



persist into the longer term. In terms of these projections such a long term effect would reduce supply by perhaps 3 to 400,000 m^3 per annum i.e. around 10% of the projected Coillte supply. This issue is of most relevance in determining the adequacy of processing capacity in the economy and is discussed further in Section 3.3 below.

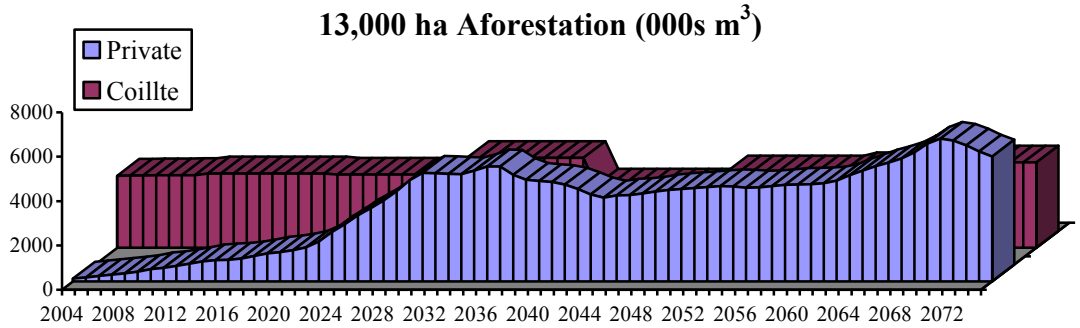
[39] Processing capacity is dealt with in detail in Section 3.3 of this report.

[40] It is not possible to do this for the broadleaf timber as the uses will depend on the species available. Inadequate data are available for the model. However, since total projected broadleaf output in 2030 is just 100,000 m3 rising to 200,000 in 2050, this is a very small part of the overall production – between approximately 1 and 3% per annum in this period and therefore less than what might be considered to be appropriate error intervals for these projections – and would not impact on the general trends being discussed.

In the period after 2030, when coniferous forests planted after 1990 will be maturing, saw-logs will account for 42% of output on average, material suitable for pallets for 35% and pulpwood for 23% of output by volume. However, a key issue is that the output of saw-logs is projected to show the greatest volatility in the period 2030-50 while the output of pulpwood is fairly constant. This has two implications. Firstly, saw-logs represent the most valuable timber and it is necessary to be able to enter markets and retain market share if value is to be maximised. Secondly, while the panel mill sector will experience some volatility in the quantities of material available, due to their use of sawmill residues, the analysis indicates that the sector most affected by the volatility in the projected outputs of material will be sawmills.

The growth profiles of output from private and public forests are quite different. This is shown in Figure 3.3. Output from Coillte forests is projected to be fairly constant apart from the period 2030-50. Over the full period, average Coillte production amounts to 3.45 million, m^3, with 3.25 projected in 2004, and in most years the projection is within 5% of this average. However, in the period 2030-40 output is projected to be 15% above the average while it will fall to 23% below the average in 2040-50. Comparison with Figure 3.1 indicates that these represent the peak and trough period overall so that the volatility in total output is partly the result of Coillte's production profile. The problem is that if the assumption of 100% reforestation is appropriate and given that Coillte's afforestation programme is virtually eliminated, there is not much that can be done to smooth this profile.

Figure 3.3: Projected Private and Coillte Conifer Production, 13,000 ha Aforestation (000s m^3)



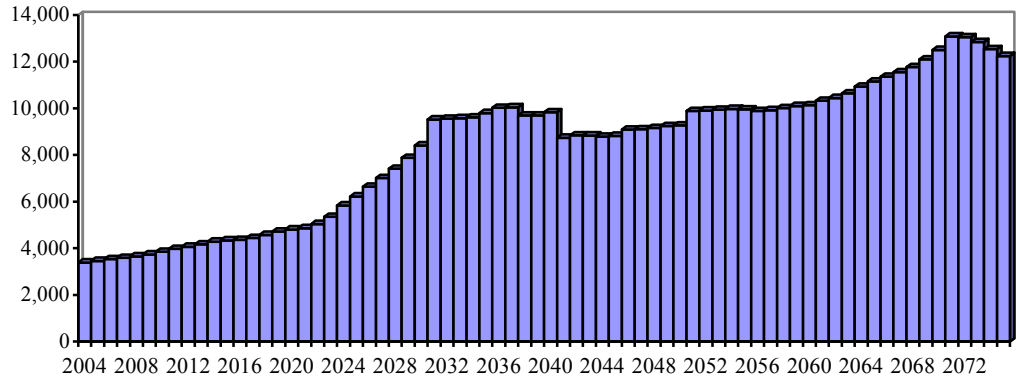
The production profile for the private sector is very different in the earlier and later parts of the projection. Output from private forests is responsible for the growth projected for the period up to about 2030 and contributes considerably to the peak and trough profile. Annual output falls from a peak of 5.2 million, m^3 in 2036 to 3.8 million in 2045. Average annual output of private sector conifers in the 2030s is 4.9 million, m^3 but falls to an average of 4.1 million in the next decade. This means that it may be possible, by altering the planting rates in the future, to impact on the volatility of the profile and thereby ease the problem of incentivising investment in processing capacity by reducing the fall in production after 2040. In the longer term, the projection indicates average annual output from private coniferous forests of about 5 million, m^3 or just below 60% of the total.

3.2.3 Projected Output with 20,000 ha Annual Afforestation

In this projection all the underlying assumptions are maintained except that annual afforestation by the private sector is projected to rise to 20,000 ha per annum, by 2008 and remain at this level until 2035, before declining to zero in 2040. This means that the output from Coillte plantations will be the same as in the previous projection.

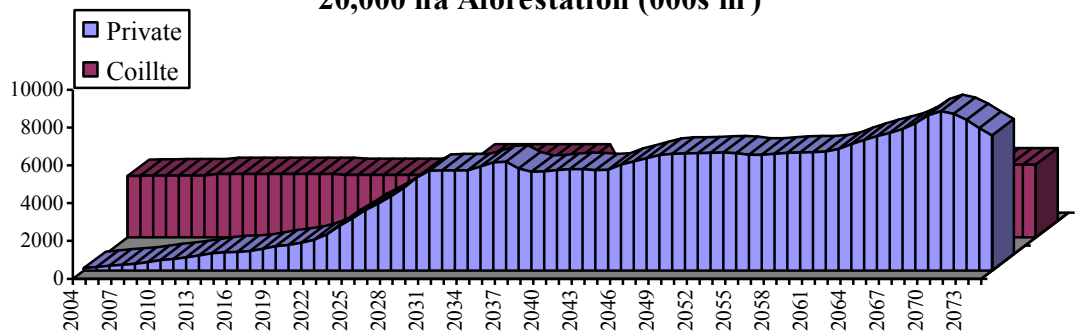
This revision gives the projected output shown in Figure 3.4. Output in the early years – up to about 2025 – is unaffected to any extent by the higher rate of planting. From this time onwards, private sector output of pulpwood increases as the higher planting rates begin to provide higher amounts of thinnings. Once again the initially slow growth in total output then accelerates to grow at about 6.7% per annum from around 2020 to reach 9.5 million m^3 in 2031 and peak in 2037 at 10 million, m^3. Output varies little in the years 2031-40 averaging 9.7 million, m^3 per annum and then falls to 9 million m^3 in the following decade. This fall, of about 7%, contrasts with the 25% fall, to 7 million, m^3 per annum, in the previous projection and means that forward planning by investors is possible against a much more stable projection of output. This conclusion is further strengthened by developments after 2040. Unlike in the previous projection, where output did not regain the level of the 2030s until almost 2070, annual output returns to its average level in 2031-40 by about 2050. As a result, the fall in output is much less and lasts for a much shorter time. After 2060 the projection indicates stronger growth in output than previously, as second rotation of conifers is clear-felled and broadleaf output increases and reaches a peak of about 13 million, m^3 in the early 2070, with a long term average output in the region of 12 million m^3.

Figure 3.4: Projected Output with 20,000 ha Afforestation per annum (000s m^3)



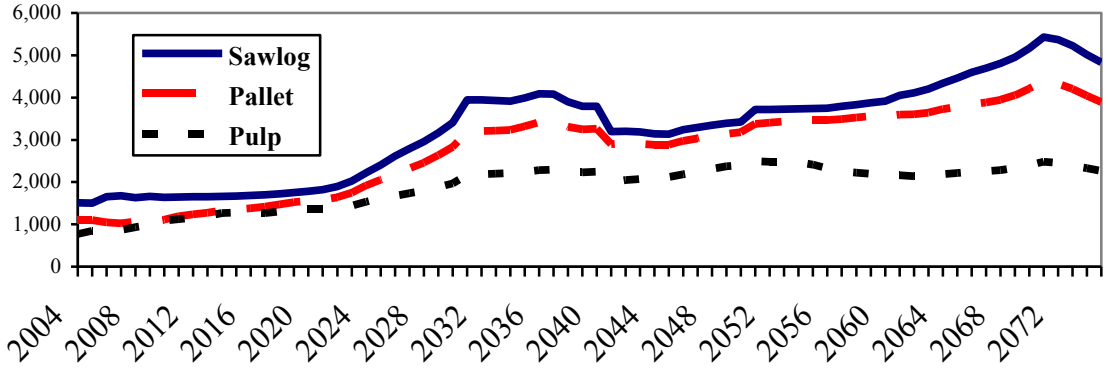
The outputs of the private sector forests and of Coillte are shown in Figure 3.5 and the source of the more stable profile becomes clear. The Coillte output remains as in Figure 3.3 but now private sector coniferous output achieves a sustained level of around 5 to 6 million m^3 for much of the period before rising towards the end of the period.

Figure 3.5: Projected Private and Coillte Conifer Production 20,000 ha Aforestation (000s m^3)



Finally, showing output according to the potential uses of the material produced indicates that output of sawlog material will be more stable than in the previous projection with slightly greater variation in the production of pulpwood.

Figure 3.6: Projected Output of Conifers by Market Segment with 20,000 ha Aforestation per annum (000s M^3)



The greater stability of output projected with this level of afforestation is considered to be an important issue that needs to be taken into account when assessing an appropriate target for annual planting.

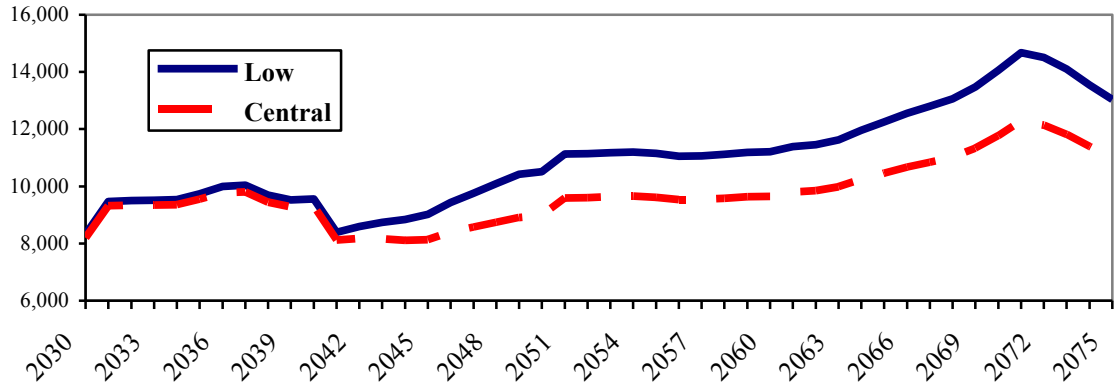
3.2.4 Sensitivity Analysis of 20,000 ha Annual Afforestation

Percentage of Broadleaf Species

So far, the projections are based on attaining a stable species mix in afforestation of 50% Sitka, 20% diverse conifers and 30% broadleaf species by 2006. The projection for output, with 20,000 ha afforestation was redone, assuming that the target level of broadleaf species in planting is 20% broadleaf and 30% diverse species. The resulting output levels of timber from coniferous forests are shown in Figure 3.7 compared to the levels under the original assumptions. Since there is virtually no impact before 2030 the series is shown from this date. The projection shows that altering this assumption has a considerable impact on the timber output of coniferous forests in

this period. In the period after 2044 when clear-felling of trees planted under the new targets begins, average annual production increases from 9.9 million m^3 per annum to 11.6 million everything else held constant. This represents an increase of 17% in timber output[41]. Notably, the trough in the 2040s is also somewhat less and recovery more rapid with timber output exceeding the average level of the peak period 2031-40 by 2047. There would be a small reduction only in the output of timber from broadleaf forests as a result of somewhat lower areas being thinned but, if the period was extended sufficiently to allow broadleaf species to be clear-felled then the reduction in broadleaf timber produced would be more obvious.

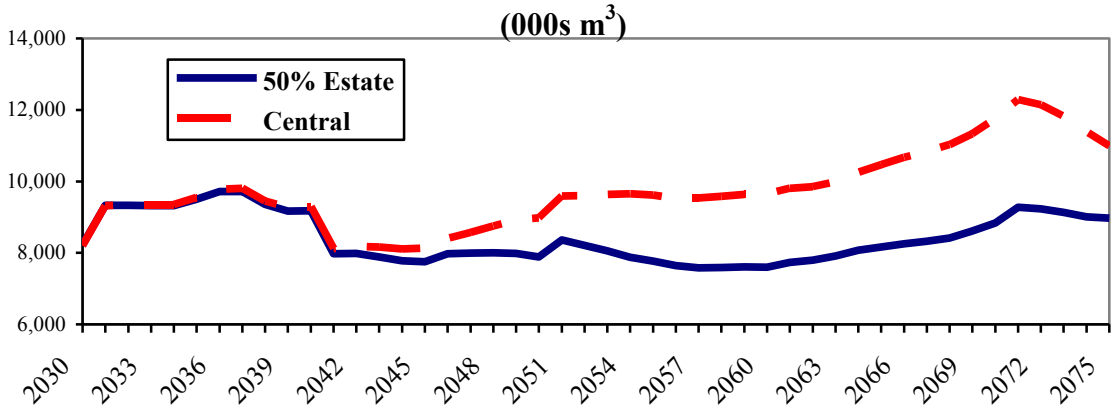
Figure 3.7: Projected Output with 20,000 ha Afforestation per annum, Central and Low broadleaf assumptions (000s m^3)



An alternative assumption is to recognise that there will be ongoing pressure in the future to increase the proportion of broadleaf species, perhaps to 50% of the national estate. While the precise trend in this regard is unclear, any increase in broadleaf targets would be likely to coincide with the timing of revisions to the Rural Development Plans. On this basis, the model was recalculated assuming that in the period 2007-2012 there is an incremental increase up to 40% of broadleaf species in planting and that in the period 2013-2019 this will increase up to 50%. However, planting for reforestation is unlikely to achieve these levels and, indeed, if all planting was 50% broadleaf the estate would exceed 50% broadleaf within 1 conifer rotation due to the much longer growing period of broadleaf species. As a result, a long term planting rate of 40% broadleaf for reforestation beyond 2040 is used to achieve a national estate of 50% broadleaf species in the longer term. Re-estimating the model on these assumptions provides the production profile, for conifer and broadleaf timber, shown in Figure 3.8.

[41] The effect of this alteration would fall disproportionately on the private sector as the construction of the projection model, on the basis of 20,000 afforestation per annum, represents an increase on previous planting rates. Achieving 20% broadleafs rather than 30%, i.e. a 33% lower target, would increase average annual private sector output by about 25% in this period.

Figure 3.8: Projected Output, 20,000 ha Afforestation per annum and National Estate of 50% Broadleaves in long term (000s m^3)



This revised assumption has a major impact on long term output. Average annual output in the period after 2044 falls, from the central projection of 10.6 million m^3 to 8.2 million, a fall of 23%. Importantly, while similar peaks occur in the 2030s although at a slightly lower level, due to less thinnings from broadleaf species, total output does not regain the level but achieves a stable long run average of just over 8 million m^3. If the projection could be sufficiently extended this average would rise, as clear-felling of broadleaf species would begin to have an increasing impact. However, this impact would be seen only well beyond the time period covered here.

Thinning in Private Sector Forests

Consultations undertaken in preparing this report suggest that thinning of private sector forests may fall well below the 60% level that has been assumed in these projections. This may be due to a number of reasons like, lack of adequate training in forest management, a perception of excess supply of pulpwood likely in the medium term, resulting in a disincentive to thin, as no market would be available. To allow for this, the model was re-estimated assuming that thinning takes place in only 40% of private conifer plantations. The impact of this on projected output from forests is shown in Table 3.3.

Table 3.3: Impact of Thinning on Projected Output (Conifers)

	Annual Output M^3		Difference
	60%	40%	
2004-20	4,017	3,786	-5.8
2021-30	6,304	5,911	-6.2
2031-40	9,452	9,106	-3.7
2041-50	8,429	7,929	-5.9

The model indicates that as a result of lower thinning in private forests, projected output falls by around 6% on average. However, this fall relates to a fall in supply of pulpwood from thinnings only. Timber size at the clear-fell stage will be affected by the rate of thinning so that the main impact of lower timber is likely to arise in the form of less good quality timber and a considerably higher proportion of pallet and pulpwood in the long term.

3.3 Projected Output and Processing Capacity

The two main processing routes for material are sawmills and panel board mills, with the panel board mills also using a large proportion of the residues of sawmills. Energy generation remains a fairly small use of forest outputs, but opportunities are present for the development of this market, as discussed below, particularly at the local level. Approximately 25% of logs are in the 7-13 cm top diameter size category, 35% have a top diameter of 14-20 cm, with 40% above 20 cm[42]. Sawmills generally use logs with a top diameter greater than 13 cm but also buy some timber below this diameter for producing stakes. Panel board mills generally purchase logs in the 7-13 cm range but also use lower grade material with larger diameters. In total, the processing sector in Ireland handled about 3.27 million, m^3 per annum in 2002.

Figure 3.9 shows the flows of material through the sector in 2002, in millions of m^3 and the uses of material in this period[43]. The data show that in 2002, a total of 3.27m^3 of forest output were processed by the sector. Sawmills processed 73.5% of this material as sawlog, with the remainder entering the panel mills as pulpwood. About 52% of the output of sawmills were in the form of residues or co-products, of which 75%, was used by the panel mills.

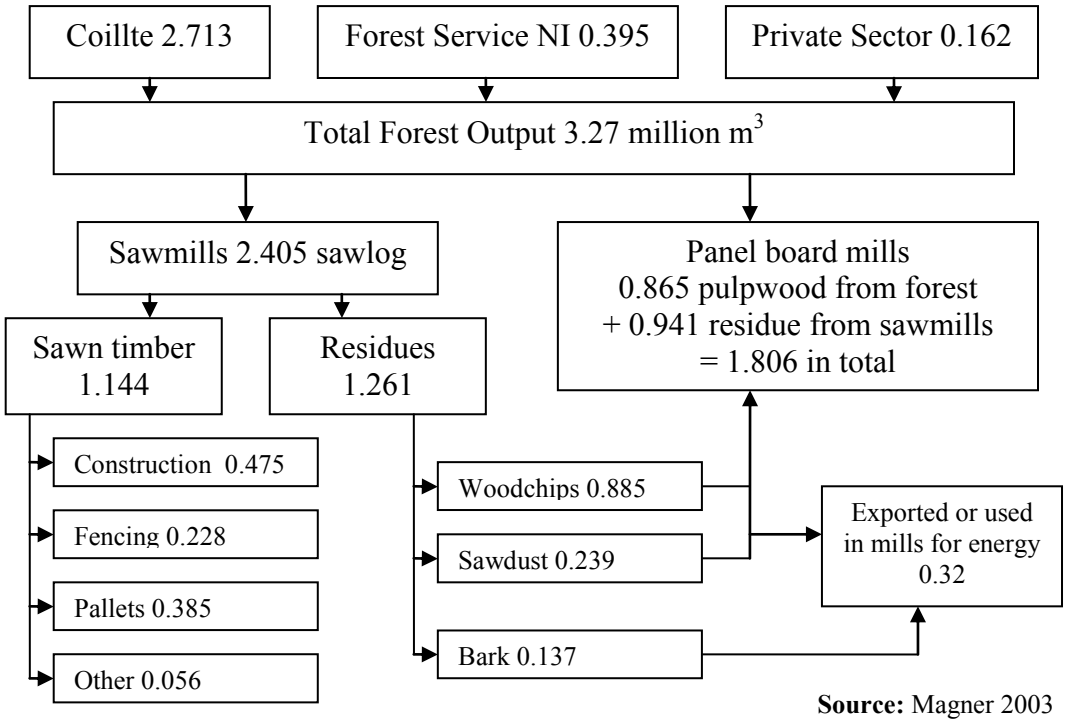
The consultants estimate that total wood processing capacity at present – for roundwood, residues and recycled wood – is just over 4 million, m^3 per annum, given current capital and working practices. However, since this includes both sawmills and panel board mills, which use residues from the sawmills, the capacity to process forest output is less than this. In addition, in drawing conclusions it is necessary to recognise that not all mills will be in a position to operate at 100% at all times and also that some mills, particularly in the sawmill sector may be in inappropriate locations to utilise the output competitively.

Total sawmill capacity for conifers is estimated under current conditions at 3.26 million, m^3 per annum. This is based on those sawmills which can move to a double shift, or which can introduce a twilight shift, doing so as required. Sawmills use 100% roundwood so this translates into capacity to process this amount of forest output. However, it is important to distinguish between roundwood of different sizes and qualities, since sawmills require only certain grades of timber.

[42] Irish Timber Growers Association *Forestry Yearbook* 2004

[43] Magner, D. (2003) 'Markets for Home Grown Timber: An Overview', *ITGA Forestry Yearbook* 2004. While these data are the most comprehensive available, some factors such as differences that may arise depending on whether the period taken is defined by contracted sales or invoiced sales, plus some flows of imports from areas other than Northern Ireland, mean that the data are best estimates of the scale of the flows. It is considered that these factors are not of a nature that would bias the relative importance of the various flows identified and that this figure is an accurate portrayal of flows. However, issues regarding the scale of flows and projected output estimates are discussed further below.

Figure 3.9: Outline of Timber Production and Processing in Ireland



Source: Magner 2003

Total capacity in the five operating panel board mills is estimated at 1.77 million, m^3. Three of these mills utilise a combination of roundwood, mostly small diameter pulpwood and residues – primarily the latter – while one mill uses roundwood only and one uses only residues. Total roundwood processing capacity is estimated at 779,000 m^3 per annum, while residue capacity is estimated to be the equivalent of 991,000 m^3. In addition, one mill sources 60,000 m^3 pulpwood for energy internal production[44]. Thus, processing capacity in aggregate is 4.1 million m^3 of forest output per annum.

Processing capacity in total is sufficient to handle current output and there is some spare capacity in the sawmill sector. The latter is estimated at just over 300,000 m^3. This is shown in Figure 3.10. However, the pulpwood sector and panel board mills are working close to capacity and there is some small excess availability of residues and pulpwood (Figures 3.11 & 3.12).

[44] In addition to the 991,000 m^3 of residues used in the panel board mills, the calculations also allow for the use of 240,000 m^3 of residues in heat production, 100,000 m3 in powering 25MW of CHP electricity production, and export of a further 200,000 m^3 in the form of white chips or pellets. This means that the model assumes that 50% of wood intake to sawmills is used in the form of residues. An adjustment of 26,000 m^3 is also included as the ITGA data indicate that the mills were in a position to use slightly higher volumes of pulpwood in 2002 than the estimates for this projection provide.

Figure 3.10: Sawmill Capacity and Output of Logs for Sawmilling 2004-30 (m^3)

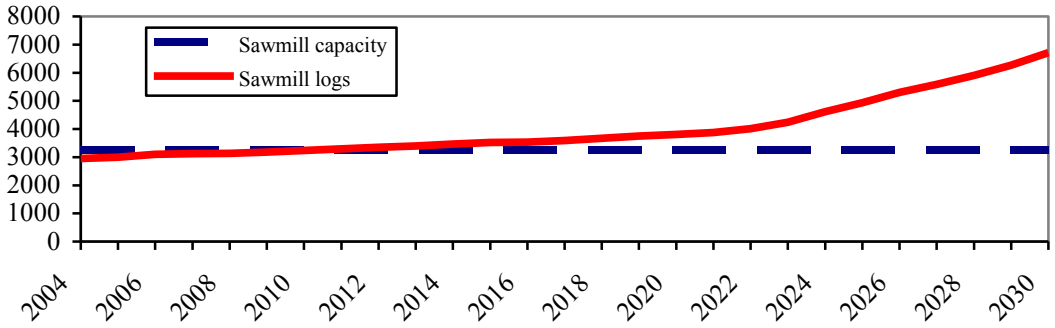


Figure 3.11: Pulpwood Capacity and Output 2004-30 (m^3)

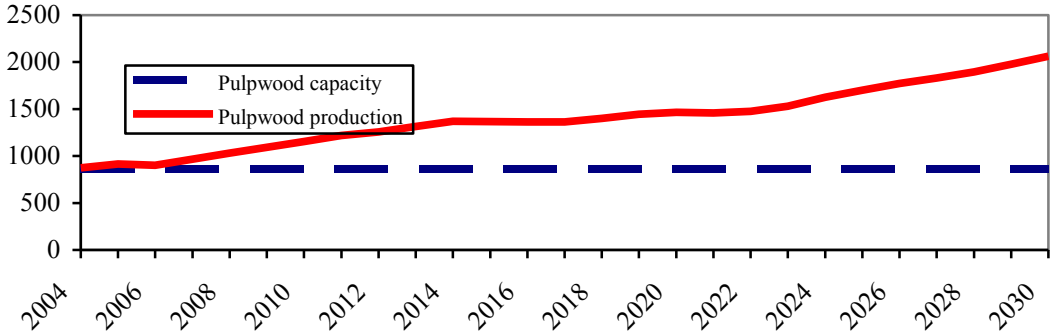
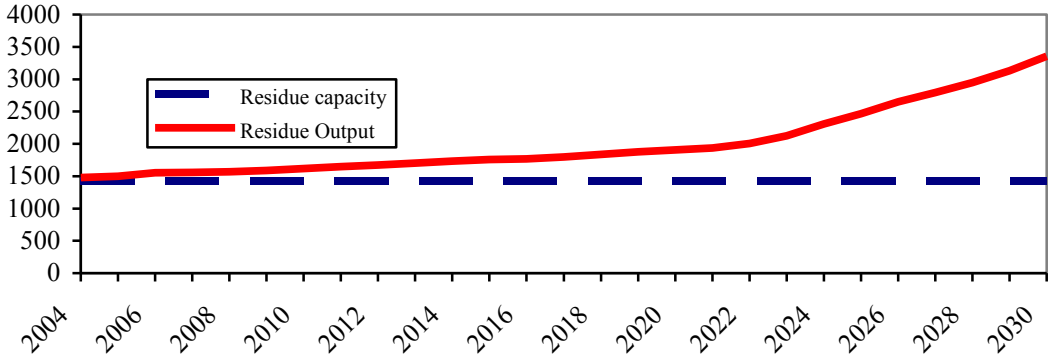


Figure 3.12: Residue Output and Capacity 2004-30 (m^3)



In the period up to 2030 this situation will change considerably as shown in the production projections in the previous section, and allowing for an ongoing input to the system from the Forest Service in Northern Ireland. The latter is estimated at 440,000 for 2004, rising to a plateau of 553,000 m^3 per annum from 2013[45]. Then

[45] Forecast production from Northern Ireland forests up to 2015 is based on Gallagher, G. and J. O'Carroll (2001) *Forecast of Roundwood Production from the Forests of Ireland 2001-2015*, COFORD: Dublin, while projected output after 2015 is based on discussion with the marketing officer of the Northern Ireland Forest Service (NIFS).

supply is expected to increase from an estimated 3.83 million, m^3 in 2004, to 8.77 million, m^3 in 2030.

This projection implies that capacity utilisation in sawmills will grow over the next decade and a small deficit will emerge. However, this will not exceed 100,000 m^3 until after 2012. Investment is not possible on an incremental basis – small projected deficits, of the magnitude indicated, can be accommodated through altered working practices – but additional investment will be required once the deficit exceeds this level. This implies that the saw milling sector will have sufficient capacity until about 2013 and that investment will be required to handle growth after this. This investment will add processing capacity of about 500,000 m^3 in the period up to 2020 but will need to rise quickly again after this, with in the region of a further additional 350,000 m^3 *per annum* capacity required in the period 2024 to 2030.

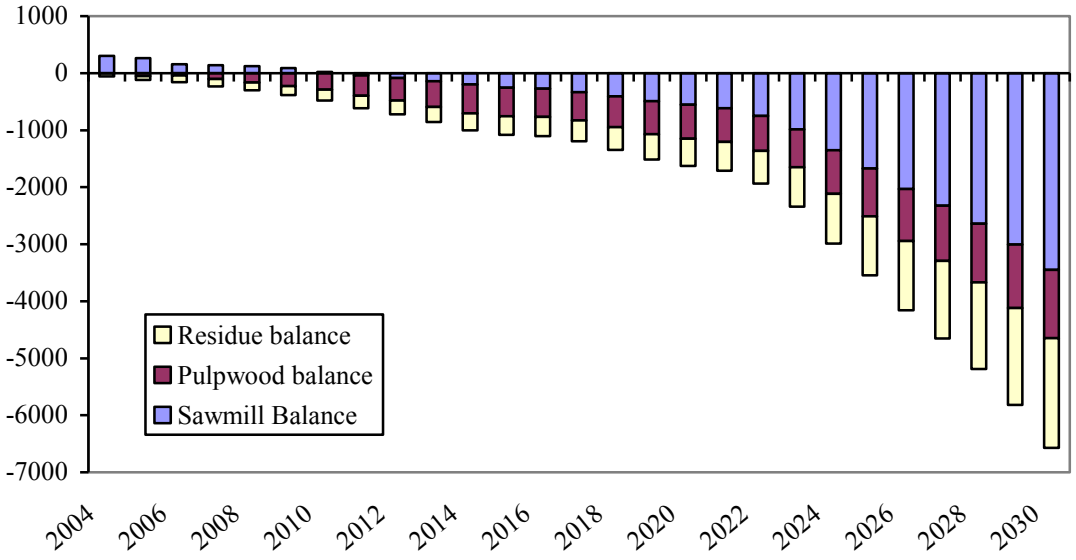
The deficits in relation to pulpwood and residues will also grow slowly in the first few years but will then accelerate as shown in Figures 3.11 and 3.12. By 2013, a combined deficit in processing capacity of about 475,000 m^3 is projected. This is likely to be the minimum that would be required to trigger new investment in the panel mill sector since these operations require large supplies to be competitive.

In the period up to 2013, considerable excess material is likely to be available and while incremental expansion of existing panel mills might utilise part of this volume, either new outlets or investment in new capacity – for example new product lines or continuous press lines – will be necessary. Failure to provide market outlets would reduce the output of pulpwood i.e. farmers would not thin crops, which would tend to undermine the viability of sawmills. Local energy production, coupled with expansion of existing panel capacity, would appear to provide the best way of achieving balance between supply and demand in this period, either through direct biomass or through production of pellets for export and use in energy production abroad[46]. It is worth noting that the deficit in this processing capacity is expected to emerge in the short-term.

In the absence of investment, the combined projected deficit in processing capacity will exceed 1 million, m^3 by 2020, 2 million, m^3 by 2025 and 3 million m^3 by 2030. In other words, investment in additional capacity to process in the region of 1 million, m^3 of material will be required every 5 years in this period. This outlook is brought together in Figure 3.13. This indicates a deficit of 3.45 million, m^3 in 2030 in sawmill capacity, 1.2 million, m^3 in capacity to handle pulpwood and 1.9 million, m^3 in capacity for residues. These deficits arise out of total production of 8.8 million, m^3.

[46] It is worth noting that while the use of forestry for energy production would provide markets that timber of variable quality e.g. thinning or short rotation broadleaves, the economic contribution of developing the industry in this direction would be limited. Panel mills provide employment with good levels of incomes for rural areas. The jobs provided by the use of forest output in energy production would be much less. As a result, there is a trade-off to be considered. While energy production would provide a means to place timber from thinnings into a market and provide income for growers in a period until additional investment in panel mills would be forthcoming, the longer term strategy must include additional investment in processing.

Figure 3.13: Processing Capacity Balances, Island of Ireland (000 m^3)



These projections have been developed on the basis of specific assumptions and it is necessary to build in some sensitivity element around these before conclusions can be drawn. Firstly, it is to be noted that current output of timber is actually less, than the projections would indicate should be the case. Various explanations have been forwarded for this but, in addition to the fact that the projections model must always be interpreted as a best estimate within error boundaries, the fact is that some of the timber that can be produced may not be accessible for harvesting. Total production in 2002 from forests in the Republic of 2.88 million, m^3 was 13% below the projected output of 3.3 million m^3. Reasons for the difference include harvesting losses, timber growing in inaccessible areas, and output proving to be unattractive to processors as a result of the species, location or harvesting type i.e. cable as opposed to forwarder. An important question when estimating the adequacy of future capacity is whether this situation is temporary or not. To allow for the fact that the long term level of actual production may be below the projected level, the model was recalculated. It was assumed that actual output would equal 93% of the projected level throughout the period, in other words, that about 50% of the current shortfall of output below that projected is due to causes that are likely to persist.

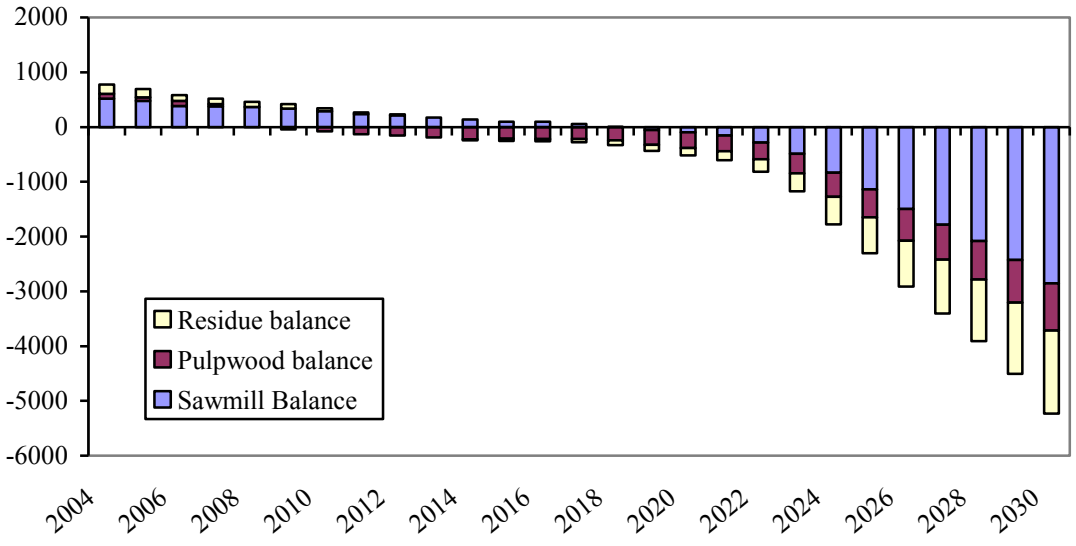
A second issue is that there may be opportunities for capacity to increase without further investment. Consultations indicate that one panel board mill has the capacity to increase production and the model was re-calibrated assuming that this production is brought into operation in the short-term. In the case of sawmills, the model was calculated on the basis of sawmills that are not currently working a double shift moving to this higher level of activity, where this is considered possible.

Third, consultations and the situation regarding the excess supply of pulpwood suggest that private thinning may fall well below the 60% level assumed. To allow for this, the model was recalculated assuming that thinning takes place in only 40% of private plantations.

Finally, there will be increasing pressure in the future for the proportion of broadleaf species to increase to up to 50% of the national estate. While the precise trend in this regard is unclear, any increase in broadleaf targets is likely to coincide with the timing of revisions to the Rural Development Plans. On this basis, the model was recalculated assuming that in the period 2007-2012 there is an incremental increase of up to 40% of broadleaf species in planting and that in the period 2013- 2019 this will increase up to 50%. However, planting for reforestation is unlikely to achieve these levels and, indeed, if all planting was 50% broadleaf the estate would exceed 50% broadleaf within 1 conifer rotation due to the much longer growing period of broadleaf species. As a result, a long term planting rate of 40% broadleaf for reforestation beyond 2040 is used to achieve a national estate of 50% broadleaf species in the longer term. Re-estimating the model on these assumptions provides the data for Figure 3.14.

It is clear that these assumptions have a considerable impact on the picture in the short to medium term but, while the timing of required investment is altered, considerable deficits on processing capacity emerge in all areas in the time period under review. Under these revised assumptions, there would be sufficient capacity currently in all sectors in the short to medium term, with considerable over-capacity, of over 500,000 m^3, in the sawmill sector. This would not be eliminated until about 2019, with investment required from 2020. There would be insufficient pulpwood capacity after 2008 and for residues after 2013. There would be sufficient material to facilitate investment in a processing facility of 500,000 m^3 from 2022 i.e. the period would be pushed back by about a decade compared to the base case.

Figure 3.14: Processing Capacity Balances, Island of Ireland under Revised Assumptions (000 m^3)



This projection is based on the combination of all the alternative assumptions noted above. The impact of assuming higher panel board capacity is straightforward and has a relatively small impact beyond the short-term. Similarly, the impact of altering the species mix is fairly small and the effect is really seen only after 2024. However, the projections are sensitive to the assumption of lower forest output, than the baseline projections indicate and to the proportion of thinning. If lower output is assumed but

thinning reached 60% then there would be sufficient sawmill capacity until about 2016 but deficits of pulpwood would appear by 2007, with sufficient excess material for a new facility handling 500,000 m^3 by 2015. On the other hand, if Coillte's output reaches its projected level but private thinning is only 40% of plantations then sawmills would reach capacity about 2012 and there would be insufficient material for this investment in panel mills until about 2018.

3.4 The Value of Timber

The value that can be assigned to the timber in a hectare of forest in Ireland will depend on a number of factors including timber prices, the characteristics of the timber and output per hectare and the time period to harvesting and marketing. In addition, it is necessary to deduct costs associated with harvesting and marketing the timber. A number of methodologies for the valuation of forests have been devised. These are discussed briefly in Appendix 3. Because of the long growing period, forest valuations are sensitive to the discount rate used and there has been ongoing debate on the appropriate one to use. Examples of discount rates from the literature are discussed in Appendix 5. This literature shows considerable variation in the preferred rate, but rates of between 3% and 5% have generally been used in relation to State forestry valuation in Ireland. In line with other calculations in this report, a real discount rate of 5.5% is used when valuing the timber as there are risks associated with the price that might exist in the future.

Appendix 3 provides information also on technical values related to the volume of timber that is likely to be produced and future timber prices. The underlying assumptions used to provide an estimate of the value of timber are consistent with those used in the production model above and relate to a hectare of conifers with a 40 year rotation. However, no reliable data from which to project the price of broadleaf timber could be found. As a result, it was assumed that broadleaf timber is revenue neutral in discounted values i.e. the costs incurred in growing the timber following establishment are equal to the revenue received from selling the timber when discounted to the planting date. Although the base for projecting prices is based on a 15 year average of standing conifer prices, the values returned relate to the value of a typical hectare that is planted assuming that the species distribution of 30% broadleaves is achieved. All values are in current prices, since it is assumed that the long-term price will continue to move in line with the CPI. Timber prices were reduced by 10% to cover the costs of measurement and marketing.

The model estimated the total timber volume produced per ha at 454 m^3 – including thinnings – and delivered a projected price of €30.35 per m^3. The total value of this timber in current values is estimated at €13,779 per ha with a present value of €1,383 per ha[47].

[47] The underlying assumptions for this value are comparable with those used later in the report to estimate the value of timber for forward selling except that a slightly higher insurance cost is included in the latter calculation. However, the value here relates to the NPV at the time of planting while the later valuation relates to an intermediate year in the growing rotation so the estimates produced are not directly comparable.

This value is not very sensitive to assumptions in relation to the price trend in timber. For example, if the underlying price is based on a 10 year price average, rather than 15 year average that is used here, then the projected value of the timber produced rises by only 4.2% to €4,859 per ha. As a result, in the absence of a major disturbance to the trend in prices over the past number of years, these estimates provide reasonably reliable indications of the future value of the timber being grown.

However, the value is sensitive to changes in the underlying assumptions, especially the Yield Class assumed, stocking rates and the discount rate. For example, using the risk free discount rate of 4% would increase the value by over 30%. If a more optimistic yield class 20 is assumed, then the NPV of the timber rises by 28%. While Yield Class 20 and above is certainly possible in Ireland, the consultants' judge that YC 18 represents a better approximation of the average growth rate.

4. Non-Timber Value of Forestry

4.1 Economic Analysis and Techniques

In the past, the main economic impact of forestry was seen as the value of timber produced and the effects of employment created in otherwise lagging regions. However, it is increasingly clear also that there are a number of impacts, primarily in the form of environmental and amenity effects, which are valuable in terms of their impact on living standards. The aim of this section is to make estimates of the non-market benefits (NMBs) of forestry. The main focus is on valuation of the three most important NMBs of forestry, namely: recreation, bio-diversity and carbon storage. In addition, a range of other NMBs such as water quality, landscape, human health and air quality, are considered. Values are assigned in as far as is possible by accessing relevant findings from research in Ireland and abroad. Where quantitative assessment is not possible the approach is a qualitative discussion of Irish forestry to indicate the likely impact of experience in recent years under these headings. Assessing non-market benefits is a complex area but one in which there has been a considerable literature developed internationally in recent years. In order to facilitate comprehension, a lot of material relevant to this section is contained in Appendix 4.

During the 1990s, there was a general development in forest sectors of Europe and North America towards multiple-use policies and management with less emphasis on timber production, and more on non-timber values[48]. Valuation of non-market impacts enables policymakers to integrate intangible aspects of forests into decision making. These valuations can help in a range of decisions regarding the design and location of forests, management and harvesting issues, education, awareness of benefits of the assets to ameliorate local anxieties against forestry development in regions[49]. The difficulty with valuing non-market benefits is that they are not traded and therefore are not priced[50]. As a result, since the producers of these benefits do not have a way to charge for their use, the correct incentives are not provided to decision-makers and the amount and type of forestry may be sub-optimal. This insight is not new and much of the regulation of the sector in recent years has the aim of achieving the optimal outcome. However, a regulatory approach is often perceived by growers to place constraints on their ability to earn returns on their investment while simultaneously perceived by the consumers of NMBs to insufficiently protect the environment. This is a market failure where the welfare arising from the outcome produced is less than what might be achieved.

[48] Liaison Unit in Lisbon (1998). Third Ministerial conference on the protection of forests in Europe.
[49] O'Leary et al (1999), *Afforestation in Ireland – Regional Differences in Attitudes to Forestry*. ESRS 99/10. University College Dublin.
[50] For, example, bio-diversity has value from direct uses, such as game shooting and indirect uses as an indicator of environmental quality. In addition there is a range of non-use benefits, including option values, i.e. being able to use in the future, existence values, i.e. being valued for the fact it exists, and bequest values, i.e. as an endowment to future generations. However, it is difficult to place a value on these effects and it is also difficult to ensure that those who create value are in a position to realise this value.

Information on the non-timber costs and benefits of forestry is required to reduce market failure and is most persuasive where expressed in monetary terms[51]. Developed by environmental economists, non-market benefits (NMBs) have been expressed by methodologies that assign monetary values to intangibles. The key advantage of monetary valuation is that it allows market and non-market benefits and services to be directly compared on an equivalent basis with financial returns from timber, rather than in an ad hoc or otherwise subjective way. These NMBs should also be included in cost-benefit analysis, to ensure an appropriate internal rate of return in investment is derived, and economic efficiency is properly assessed.

As most of the environmental outputs are not market ones they have no direct price. The values therefore have to be gleaned from indirect methods, focusing on attempts to reveal demand/preferences. The importance of ensuring that these values are properly included into the decision has resulted in the development of a range of techniques to provide values in instances where prices cannot be observed. Appendix 4 discusses these methodologies in detail. In summary, these rely either on using observed economic values, to indirectly place values on non-marketed activities, or on data collection where people indicate the value that they would place on certain characteristics in certain circumstances. These inevitably rely on information collected without the benefit of markets so that there will be opportunities for errors to arise.

The available research indicates that including non-timber benefits significantly augments the economic rates of return from forestry[52]. A limited number of relevant studies have been undertaken in Ireland but these are inadequate to fully inform policy. Values have been derived in other countries and, while value transfer is often practised, there are problems with this as discussed in Appendix 4. This is illustrated by a study, which undertook a questionnaire-based approach to assess regional differences in attitudes to Irish forestry[53]. This highlighted the contrasting perspectives of people in two regions of Ireland to forestry and the importance of awareness of local level concerns. The results show that the population with a greater disposition to forests had more of a forestry culture than their more cautious counterparts. The authors advocated developing a closer relationship with forests and forestry needs at the local level so conflicts are reduced.

[51] In practice, cost-benefit analysis of environmental protection/enhancement rests on a process of monetisation of priceless benefits. Human life, health and that natural world, and the well-being of future generations are priceless – not infinite in value, but fundamentally incommensurable with money. Nonetheless, acknowledging the theoretical weakness, questions will always exist regarding alternatives. See Ackerman, (2004) *Priceless Benefits, Costly Mistakes*, Global Development and Environment Institute, Tufts University. There is a danger that by focusing on valuation studies, the temptation is to convert everything to financial terms. It is perhaps better to emphasise the importance of those values which cannot be monetised.

[52] Pearce (1991) *Forestry Expansion – a study of technical, economic and ecological factors*. Forestry Commission Occasional Paper 47.

[53] O'Leary et al (1999), *Afforestation in Ireland – Regional Differences in Attitudes to Forestry*. ESRS 99/10. University College Dublin.

4.2 Overview of Non-Market Benefits

Recreation

Economic growth, development of efficient transportation networks, and increasing disposable incomes have led to a dramatic increase in demands for open space, forest resources, and the recreation associated with forested land. The economic aspects of this rapid transition are both significant and complex. Determinants of up-take of the recreational benefits of forests include visitor accessibility and visitor awareness of the resource.

Carbon Storage

Under *Kyoto*, Ireland is committed to limit the growth in emissions of greenhouse gases to 13% above its 1990 output. The indications are that, in a no change scenario, Ireland will be unable to meet this commitment[54]. Appendix 4 discusses in detail models for estimating the impact of forestry on net CO_2 emissions. This impact means that any reduction in net emissions through a increase in sinks i.e. forests, will assist Ireland in meeting the commitment. Since one option to meet this commitment is to buy credits, any reduction in the extent to which Ireland misses its target will have a monetary value in the sense of avoiding the expense of buying the equivalent amount of credits. This saving arises from forestry and part of the return to the State from the decision to invest in forestry is captured in this saving.

Bio-diversity and Conservation

Maintaining bio-diversity is a pan-European challenge with the current EU Bio-diversity Strategy adopted in 1998, which holds a 2010 target for halting the loss of bio-diversity, as well as its four Action Plans on conservation of natural resources, agriculture, fisheries and economic development. The importance of this issue has been recognised in the development of forest bio-diversity guidelines in Ireland[55]. The threats to bio-diversity in forest environments are usually related to intensive management. This reduces the number of species (a compositional aspect), the amount of deadwood, large trees, old and structurally diverse stands, large stands and intact areas (structural aspects), and alters important processes such as browsing by deer (functional aspects). Conserving bio-diversity is also being seen as an important objective of EU policy and this objective will play an increasing role in the determination of EU Rural Development policy in the future[56].

Landscape

Forested areas can make a region more attractive as a place to live and work. The aesthetic value of forests arises in terms of pleasure derived by individuals in contemplating a forest area. This depends upon the age of forests and other things

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

[55] Forest Service (2000) *Forest Bio-diversity Guidelines*. Further discussion is contained in McAree, D. (2002) *The Forest Service Bio-diversity Plan.* Proceeding of the Royal Irish Academy, Vol. 102B (3) pp 183-184

[56] See the discussion of EU proposals in this area in Section 5.4 below.

such as hills, valleys, streams, open spaces, which add to the aesthetic values of the forests. Nevertheless, landscape is a very complex good that can be valued from aesthetic, ecological, social, and subconscious perspectives and in different ways by different people[57]. For example, the removal of forest may uncover a more aesthetically pleasing scenic view. The aesthetic value of forests also depends on the location of the forest - densely populated area or sparsely populated areas - with the aesthetic value greater in the densely populated areas.

Water supply, Quality and Flood control

Forestry can affect the water yield and flow as well as the content of the water. Although forests rely on water for growth, this is largely as precipitation, and there is very little irrigation of forests except during the planting stage. The cultivation and drainage of soils during the establishment of a forest can also increase summer base flows and peak flows during moderate rainfall events. In terms of water quality, cultivation and drainage may also affect sedimentation and the turbidity of the water. This can result in disruption to water supply and water treatment plants, although it can be improved through forestry management to minimise soil disturbance. There is concern also over nutrient enrichment of soils, particularly if heavy rainfall follows the application of phosphate fertilisers or urea. The type of tree species and the age of the forest are factors affecting the quality and timing of water distribution. Forest cover can mitigate soil that would otherwise be lost via erosion, especially if land gradients are very high. Flood control benefits are pure public goods as people living in the vicinity of the forest, but also those down stream enjoy them. Generally, flood control benefits are valued, with some caveats, as equal to the difference between damages resulting with and without the flood protection services of forests. Nevertheless, practical problems, such as obtaining empirical data, arise in estimating flood damages and the benefits of forests in this regard.

Health

Research suggests that the health benefits of forest arise from three sources: the abundant evidence that physical activity produces long-term health benefits, the desire for silence[58], and the impact on reducing pollution. This suggests that the health effects due to the forest experience are valuable. However, there are barriers to the up-take of the forest experience, including walking distance from forested area and access to forested area. In addition, low income groups, ethnic minorities and people with disabilities are less likely to use the exercise facilities. As a result, programmes aimed at increasing the social and health effects are most likely to be successful in raising physical activity if they involve the community at all stages in design and implementation[59].

Heritage

With a significant requirement for land that, up to now, was not used in intensive agricultural production, it is not unexpected that an expansion of forestry would require that adequate consideration is given to the potential impact of this

[57] Hutchinson, G., Chilton, S & Davies, J, 1995. 'Measuring the non-use value of environmental goods using the contingent valuation method – problems of information and cognition and the application of the cognitive questionnaire design and method'. *Journal of Agricultural Economics*. Vol. 46 (1).
[58] Jensen (1999). *Forest Recreation in Demark from 1970s to the 1990s*. Research Report 26, DFLRI.
[59] Countryside Agency (2000). *Economic Benefits of Community Forestry*, Phase 1 Study.

development of Ireland's heritage. In anticipation of this, the Forest Service has produced guidelines to minimise the impact on archaeological heritage[60]. In general, it would appear that there has not been any great conflict in this regard and there is potential for forestry to aid in protecting certain sites through ensuring that the land is not brought into intensive agricultural use and, potentially through aiding in providing controlled access to sites. Ireland has significant areas of good quality semi-natural habitat of poor agricultural quality in the form of blanket and raised bogs, fens, upland and maritime grasslands and the landscape of the Burren. This land can be considered to be part of Ireland's heritage. However, it has been contended that it is having a considerable impact on Ireland's natural heritage interest and that this impact is almost completely negative[61]. The species that have been planted and the structure of support which incentivise farmers to plant the most commercially productive species were identified as major issues. In addition, the claimed lack of affinity with forestry as a crop displayed by many farmers leads them to plant on the land of lowest agricultural value, which may be the land of greatest value from the point of view of the natural heritage.

Marketed Non-Timber Outputs

Forests may produce non-timber outputs that have market values such as berries, fungi, honey, grazing rights, commercial recreation and game meat. These values can be significant at a local level but are generally undervalued.[62] Nevertheless, earnings by mushroom pickers tend to be low, with only seasonal employment prospects.

4.3 Estimating the Value of Irish Non-Timber Forestry Outputs

In determining the overall costs and benefits of forestry it is important to identify values for non-timber impacts in Ireland in so far as this is possible. However, the relative under-use in Ireland of valuation methodologies means that it is necessary to use some values from other sites and countries. These are discussed in Appendix 4. Since this can introduce errors unless it is carried out via a large-scale benefit transfer study the estimates presented should be treated as the best available.

4.3.1 Recreation and Leisure

There are considerable deficiencies in the available data to enable a value for recreation in Irish forests to be derived. Convery (1979) surveyed the number of visits to 6 forest sites in Ireland. His work indicated an average visitor number of 60,000 per annum – excluding Lough Key, which is outlying. This research also indicated that visitor numbers were growing at an average of 12% per annum, although again this varied from site to site. However, there have been considerable changes in the structure of forests and visitor sites since this work was carried out.

[60] Forest Service (2000) Forestry and Archaeology Guidelines
[61] The Heritage Council (2002) *A Review of the CAP Rural Development Plan 2000-2006*.
[62] For example, Dyke (1999) *Food from the Forest: Reforesting Scotland 21* estimated the turnover of companies involved in wild mushroom picking in Scotland at about £270,000 per year.

Clinch (1999) provided an estimate from analysis of *Bord Fáilte* data and the Household Budget Survey of 8.5 million visitors annually to Irish forests. This was based on underlying data from 1995. If a growth rate of about 3% per annum is assumed in the intervening period this would indicate a total of 11 million visitors in 2004.

A model providing aggregate value estimates for forest recreational values has been applied in the UK[63]. This work highlighted that including recreational values will positively alter the NPV of forest land. A major benefit of this model was that instead of basing the values on visits to the actual sites included, it based values on measures of congestion. This allowed the model to be used in Ireland on the assumption that visitors to Irish forests do not encounter congestion that would prohibit their ability to access the forest and enjoy the experience. This model was applied to Ireland based on data from four selected forest sites. These are the Wicklow/Dublin Uplands, Mid East Cork, Pettigo and Lough Allen. These sites displayed the attributes of having broadleaf species, conifers, larch and an area with a protection designation. The selected sites had records on all these attributes except for any data relating to yearly visits at each site. This is a key variable that is overcome by the assumption that congestion would not be a constraint on the enjoyment of visitors. From this, it is possible to derive an estimate of willingness to pay for the visit.

The model was calibrated for the prevailing species mix in Irish forests. It produced an estimate of a willingness to pay of €3.34 per person per visit in 2003 prices[64]. For a total of 11 million visitors this gives a valuation of €37.6 million per annum in 2004 prices[65].

Even though the data deficiency means that the value estimated must be treated with caution, the model produces other useful results in relation to the management of forests to maximise recreational values. The total forest area at a site has a positive effect on utility, which implies that an ideal forest is one, that is as large as feasibly possible i.e. the bigger the better. The percentage coverage in broadleaf species, larch and conifers are aspects that are interdependent. The recreational benefits of conifers, other than larch, are low relative to broadleaf species so, in theory, additional afforestation with 0% conifers would increase the recreational value. Both larch and broadleaf species have a positive effect on utility with larch having a slightly larger positive effect. Ideally, one would then want to increase the percentage coverage in larch and ensure that increases in broadleaf planting do not inhibit the planting of larch. The negative finding on older trees may well be an indication of the impact of poor management of maturing forests, particularly where conifer clear-felling has occurred nearby. Along with the identified positive role of protected areas and avoiding congestion, this also points to the importance of good recreational management in maximising the value. Indeed, the UK study indicated that the

[63] 'The recreation value of woodlands' in *Social and Environmental Benefits of Forestry: Phase 2*, Report to the Forestry Commission (2003).

[64] The model was designed for UK conditions. An exchange rate of £0.668 per € is used. It is also assumed that personal monetary valuations can be transferred.

[65] Attention is drawn to the underlying assumptions when interpreting these values. Congestion would reduce the estimate considerably and the value is quickly eliminated as sites become congested. However, this is not thought to be much of a problem in Irish forests. Furthermore, if there has been no growth in visitor numbers since the Clinch estimates then the value is reduced to €29.1 million.

presence of a nature reserve (or equivalent protected area) has the strongest impact on value among all the variables surveyed.

The positive impact of larch is worth noting. In the region of 8% of the Irish national estate is larch and it is considered to provide good timber to industry. This indicates that the perception of a trade-off between forest uses such as recreation and optimising the value of timber production does not apply to all species and opportunities exist to increase value in respect of both objectives. The finding of a positive relationship between forest size and recreational value is also noteworthy. One of the main identified problems of the Irish forest estate as it has developed in recent years is the relatively small average area of private plantations. This means that larger plantations would increase both the commercial timber values and the recreational values of forestry.

The model was also re-calibrated to identify the maximum value that could be obtained if the forest estate was designed to maximise recreational values. This theoretical maximum value was estimated at €79 million per annum. This would require a species mix that was comprised of broadleaf and some diverse conifer species, such as larch with no Sitka spruce so is not an attainable outcome in commercial forest currently. However, this estimate provides an indication of the sensitivity of recreational values to species mix i.e. the willingness to pay for recreation in the forests and the valuations approximately double. Moving towards this potential does not mean that every forest must possess this desirable mix. Rather, given the construction of the model, it would require that there are sufficient mature forests with the required species mix and adequate facilities – in particular easy access and car parking – to allow visits by all who wish to do so without fear of congestion. Given the relatively low population density of Ireland, this does not appear to be an unattainable potential in the long run, but will require that forests are planted with the specific objective of providing maximum recreational values.

However, the UK work indicated that people change their visit behaviour to forests substantially if an entry fee is charged. If forest visits are reduced then, except where there had been congestion, the value falls. As a result, it is important that the resource is available to users at a low private cost. This usually implies a zero entry fee, except where chargeable facilities are provided, and good access to reduce travel costs.

4.3.2 Estimated Value of CO_2 Sequestration by Forests

The estimates of the carbon storage potential of forests (see in Appendix 4) indicate that forestry has a potentially important role to play in terms of Ireland meeting its commitments under the *Kyoto* Agreement. However, while *Kyoto* allows for carbon sequestration by new forests since 1990 to be included in the calculation of net emissions for the first reference period, the area has proven to be controversial. The result is that carbon sequestration by forest sinks is omitted from the emerging EU carbon trading scheme. The outcome of this development is that:

- Firms have a clear financial incentive to meet commitments and can trade credits to do so;
- Afforestation cannot be used as the basis for credits to be traded;

- Countries can use net afforestation since 1990 in calculating their performance under *Kyoto*; and
- Enforcement on countries will be partly in terms of adverse consequences in the calculation of provisions to meet commitments in successive reference periods after 2010 and in terms of honouring commitments into which they have entered.

As a result, no formal mechanism is emerging for the monetisation of the benefits of carbon storage in forests although these benefits are recognised under *Kyoto*. However, countries which wish to meet their commitments can either reduce the net emissions through expanding forestry or buying green credits. This is very important. It means that Ireland, which will have difficulty in meeting commitments, has to choose either to pay the future market price for green credits or reduce emissions and avoid this cost through expanding forestry. As a result, although it appears that forest sequestration of CO_2 will not result in green credits that can be traded, it is legitimate to argue that the value of CO_2 stored in forests is equivalent to the value placed on it in a developed market for the trading of credits.

The emerging market for green credits has begun to provide an indication of the value of net emissions avoided. Initial estimates from the UK suggested that these credits could be worth in the region of €43 per tonne[66]. However, there is a possibility that prices include at this level a high-risk premium as firms react to the new situation and that, as the market develops, the risk would gradually be reduced and the price fall. Furthermore, the outcome produced in the UK may not be indicative of what would happen in an EU-wide situation. In one sense the EU agreement on the value of levies on firms provides an indicative price for excess emissions and certainly provides a ceiling. However, estimates of the actual value of credits have identified lower values. Recent estimates have identified a price in the range of €10 to €15 per tonne but as the time for meeting commitments nears there is an expectation that this could rise due to the prospect of excess demand in the EU[67]. In Ireland, the ESRI has adopted an intermediate value of €20 per tonne in its economic forecasts.[68] Taken together, these considerations indicate that a price estimate for excess carbon in the €15 to €20 per tonne range appears reasonable.

Two further points also should be noted. First, under the *Kyoto* provisions, only net afforestation since 1990 should be included in these calculations. Second, since reforestation is mandatory, it is legitimate to claim that afforestation in advance of the end of the 1st reference period at the end of 2007 will lead to carbon storage of the equilibrium level up to that point. Thus, it is not necessary to value annual sequestration and discount this back to a base year but rather the total value of the carbon that will be stored by the new forest planted at that point can be included in the valuation[69].

[66] *The Energy Review*. Report by the Performance and Innovation Unit to the Cabinet Office, February 2002. London: HMSO

[67] Estimates based on pointcarbon.com (Various dates) *Carbon Market Europe Monitor*

[68] ESRI (2003) *Medium Term Review 2003-2010*

[69] This assessment of the situation in relation to the calculation is based on consultations undertaken in preparing this report.

Two estimates can be made of the value of carbon storage by afforestation since 1990. The first is based on work being undertaken in COFORD in advance of calculating Ireland's performance in meeting its *Kyoto* commitments. The carbon storage estimate is based on afforestation in Ireland since 1990 and takes account of the full effects of removing the timber during harvesting. The model used typical Irish planting and growing conditions and assumed that afforestation of 15,000 ha per annum will be maintained in the period up to 2010. The model estimated that Irish forests planted since 1990 will sequester 1.5 to 1.7 million tonnes per annum on average. If planting were to reach its target of 20,000 ha per annum in the period from now to 2010 it is reasonable to increase this estimate slightly to 1.6 to 1.8 million tonnes per annum. At a carbon value of €15 per tonne this would amount to a total value of €24 to €27 million per annum in this period, rising to €32 to €36 million at a value of €20 per tonne[70]. However, the model that was used to produce these estimates is for one rotation only and since the equilibrium level is unlikely to be reached within one rotation this is an underestimate of the equilibrium storage levels.

The COFORD work, discussed in the appendix, has provided an estimate for equilibrium net carbon storage in forests of 129.2 tonnes per ha. As discussed, this is lower than estimates that have appeared in the literature previously and does not include carbon in products. On this basis, the carbon that will be stored as a result of afforestation of 20,000 ha in a year will amount to 2.58 million tonnes. The value of this is €38.8 million at €15 per tonne, rising to €51.7 million at €20 per tonne, with a mid-point of €45.2 million. This provides the best estimate of the range of the value that can be assigned to carbon storage from the target level of Irish afforestation using the equilibrium approach. Since this is an annual level of afforestation, then this would be the annual value of carbon storage in Irish forests under the targeted level of afforestation. However, it should be recognised that if afforestation is lower, then this will be reduced proportionately and will be eliminated if there is no additional planting. Since 1995, leaving aside the lower level of planting in 2003 as a result of the budgetary cutback, afforestation has been running at about 14,000 ha per annum. Thus, the value of carbon sequestration in Irish forests current at 129.2 tonnes per hectare and a mid-point value of €17.5 per tonne is €31.65 million per annum.

The COFORD model also allows for an indication of the impact of different types of planting on sequestration. If the area for bio-diversity enhancement is reduced to 10%, from the 15% used in the model, then storage rises to 137 tonnes per ha and the value to €48 million at the mid-point price with 20,000 ha afforestation, an increase of 6.2% or €2.8 million per annum. If the proportion of broadleaf species in the mix is reduced to 20% from the 30% used in the model then the storage rises to 134.6 tonnes per hectare and the value increases by €1.9 million or 4.2%. Thus, in achieving one increase in the value of the non-timber benefits there are implications for other values.

4.4.3 Bio-diversity and Conservation

Although it has been claimed that forestry has impacted negatively in terms of bio-diversity, it is important to distinguish between the absolute impact of forestry as it

[70] As discussed earlier, this does not include carbon stored in products and assumes a zero balance for soil carbon.

has developed in Ireland and its impact relative to what could be achieved in an ideal situation. There is a case that the failure to develop a fully integrated national land use strategy and local forestry strategies means that the impact is negative relative to what could be possible. However, it is a lot less clear that the impact has been negative in terms of the alternative to forestry i.e. agricultural use. However, it is difficult to identify quantitative estimates of this impact[71]. What is clear is that there is considerable potential for forestry to make a significant positive contribution to bio-diversity.

In an attempt to place a value on this potential in the UK, the research focused on the public's willingness to pay (WTP) to increase the area of forests managed under each of four forest management standards. Three of these are designed to offer increasing levels of plant and animal bio-diversity at the expense of commercial timber production[72]. This design is interesting since it provided respondents with standards against which to measure their opinions of the potential impact of forestry. Respondents were asked to compare and rank four different combinations of forest management standards, any of which could be used to manage an estate of 300,000 ha. Each combination was made up of a list of the percentage of forest that could be managed under the each of the following management standards:

- Standard 0 - Do nothing and maximise timber production
- Standard A - A basic standard of bio-diversity conservation
- Standard B - The 'desired' standard of bio-diversity
- Standard C - Conversion to native woodland.

The work identified an estimated WTP per household for an additional unit (1% of forest cover) of Standard A forest – i.e. forestry with a basic standard of bio-diversity conservation – varied between 30.3 and 33.4 pence per year. This increased considerably for Standard B, which amounted to the respondents' desired amount of bio-diversity conservation in the forest where WTP varied between 51.7 and 56.4 pence per year. The study found that WTP was lowest for Standard C forest, which implied conversion to native woodland, since this meant that there were substantial costs identified. Here, WTP varied between 18.5 and 20.7 pence per household per year. One possible explanation put forward for the lower WTP for Standard C is that the experimental design meant that respondents were encouraged to reflect on likely outcomes and costs. These results are currently being used by the UK Forestry Commission to value bio-diversity in forests.

The results of this study suggest that substantial values could be generated if the Forest Service were to continue to develop afforestation practices that promote an increase in bio-diversity across a large area of commercial forests. Multiplying the relevant WTP values by the number of households in the UK derived aggregate bio-diversity values. While recognising the difficulty of transferring values such as these,

[71] According to Nunes, P. and J. van den Bergh (2001), 'Economic Valuation of Bio-diversity: Sense or Nonsense', *Ecological Economics* Vol. 39, (2) pp 203-222, any estimates should be critically regarded and treated as lower bound estimates due to the complexity of bio-diversity.

[72] Garrod, G & Willis, K (1997). 'The non-use benefits of enhancing forest bio-diversity: a contingent ranking study'. *Ecological Economics*, Vol. 21, pp. 45-61. A face to face survey across Britain at 146 sampling points produced a total of 648 useable responses. The payment vehicle used was increased taxes..

the work certainly suggests that there is considerable potential value created by forestry.

To identify meaningful values, assume that the bio-diversity impact of Standard 0 forest is similar to the impact of commercial agriculture on a particular hectare of land. However, REPS has the impact of improving the environmental/bio-diversity impact of agriculture and land already in REPS is considered to represent the most likely land to be afforested. It is assumed that REPS land achieves Standard A. Forestry that is undertaken in compliance with Forestry Service guidelines is assumed to represent Standard B. Standard C values are not included in the analysis as the results suggest that local and specific factors may be important in determining the lower values. Approaching the issue in this way means that forestry both has the potential to improve on the outcome that can be produced by agriculture and there is the potential to achieve a lower return if the forest does not achieve Standard A.

Analysis of the mix of species and consultations with relevant personnel suggest that planting in the past decade has not always achieved Standard A but that current afforestation is moving towards achieving Standard B. It is projected that 2006 will see the achievement of the targeted species mix of 30% broadleaf and there is also good compliance with issues such as areas for bio-diversity. Thus, it is assumed that future afforestation will achieve this standard. On this basis, using mid-point estimates, the UK study equates to an increase in welfare of 33.2c per household for each 1% increase in forest cover of Standard B (in 1997 prices)[73]. Allowing for inflation increases this to 42.5c per household per percentage.

The target is for 20,000 ha afforestation per annum. This is equivalent to an increase of 2.9% in the national estate each year. Census 2002 showed that there were 1.288 million private households in Ireland in that year. On this basis, the afforestation programme has the potential to increase Irish welfare by €1.6 million per annum for each 20,000 ha planted. If the afforestation programme underlying the projections in Section 3 is implemented then the total addition to welfare would have a discounted net present value of €23.3 million.

It should be noted that this is not an estimate of the value of bio-diversity in Irish forestry but an estimate of the additional welfare per annum from the afforestation programme. It is not possible to identify an overall estimate for the estate from the methodology used in this programme. However, if it is assumed that 10% of the existing estate complies with the higher standard then this would indicate a value of €5.6 million for the contribution to bio-diversity compared with the use of this land under REPS.

These values are well below those estimated in the UK as the calculation is done here with reference to the next best use of the land i.e. REPS. Thus, they are additional to what could be achieved under an alternative use. An alternative approach to valuing bio-diversity also suggests that this estimate may be somewhat conservative. The EU approach adopts a compensatory model for protecting bio-diversity. This approach identifies the ecological requirements for bio-diversity and estimates the cost in terms

[73] This is the difference between the mid-point values for Standard A and B at a Euro/Sterling exchange rate of 0.668

of the compensation that would have to be given to growers to achieve a particular outcome. The implicit assumption of implementing this approach is that the benefits are as great as the costs involved. In the model for the production projections in Section 3, the required area for bio-diversity enhancement (ABE) was set at 13% of the total area. To achieve this, the grower would theoretically need to be compensated for 13% of the potential timber value of the hectare. The analysis in Section 6 below places a NPV of just under €2,200 on a hectare of forest. The ABE value assuming that the regulation means that 13% of this area is not planted would value bio-diversity at €286 per hectare. Thus, assuming there are 20,000 ha planted each year, the annual value of bio-diversity from forestry over alternative use of the land would be €5.7 million i.e. 3.5 times the value derived above. The discounted NPV of the bio-diversity enhancement of the total programme would now be €83 million. In practice however, it is likely that a part of the area identified for bio-diversity enhancement would not have been planted in any case because of factors such as power lines and road edges. However, if the ABE regulation adds even 4% of the total area to the area available for bio-diversity then the implicit value would exceed the value that has been derived above. However, since the approach being taken in this report is based on the valuation of public goods rather than the compensatory approach from which this estimate is derived, the earlier estimate of €23.3 million is used as the value of contribution of the afforestation programme to bio-diversity enhancement.

4.3.4 Other Non-Timber Values

Landscape

Due to the lack of available Irish data/surveys valuing landscape aspects of forest areas is a difficult task. Research in the UK allowed respondents to identify preferences for different forest characteristics[74]. Of the preferences investigated, the strongest were for plantings that mixed trees and open space and where spacing of trees was random rather than regular. If these preferences were translated to the factors that determined the forest configurations used in the experiment, it might be expected that respondents would prefer the shape to be 'more organic' rather than 'basic'; scale to be 'small' rather than 'large'; structural variety to be 'high' rather than 'low'; and species variety to be 'high' rather than 'low'. However, preferences for forested landscapes compared with the non-forested alternatives were only found for broad-leaved woodland in a peri-urban setting.

A previous study eliciting economic values in the UK estimated the public's WTP values for the three preferred individual forest characteristics, namely selective felling, organic shapes and diverse species mix, and also for an 'ideal' forest, which combined all three individual characteristic values[75]. The study identified similar results for forest characteristics. The mean WTP for the 'ideal' forest, which was

[74] Forestry Commission (2003). *The Social and Environmental Benefits of Forests in Great Britain (Phase 2)*

[75] Taylor, K., P. Reaston, N. Hanley, R. Wright and K. Butler. *Valuing Landscape Improvements in British Forests*, ENTEC UK Ltd, in association with Environmental Economics Research Group, Stirling University and Wood Holmes Marketing.

hypothesized to comprise all three of these preferred characteristics was between UK£29 and UK£38 per household per year in 1996 values. A further study estimated that an average household was willing to pay £226 per year for views of urban fringe broad-leaved woodland on journeys[76]. While this is a high valuation, the underlying work was highly specific and only households with a view to desirable forests provided this valuation.

Given the site-specific nature of this work, it is not possible to transfer these values to Ireland. However, the work does indicate that there are considerable positive values to be derived from forests as a result of their contribution to the landscape. The reverse is that inappropriate afforestation will not only fail to deliver these values i.e. there is an opportunity cost, but by altering the landscape may destroy value. Consultations undertaken in preparing this report indicate that there certainly have been instances of such impacts. However, it is impossible to place any value on this in the absence of precise data. The best that can be stated is that some Irish forests add to the value created while others destroy value under this heading[77]. Furthermore, it is apparent that as the forest area has grown and become increasingly commercially oriented in recent decades, the potential for harmful planting has grown. As a result of these considerations it is concluded that the potential of Irish forestry to enhance the landscape has not been realised and a zero value is assigned to the impact in the absence of data to the contrary.

Water Supply and Quality

The concerns about effects of forestry on water supply and quality include concerns regarding aerial fertilisation of areas where mound drains discharge directly to receiving waters, possible implications for the free movement of migratory fish and potential adverse impacts on angling from forest debris. These values are not transferable to the Irish situation and can only be used as indicative values. Work described in Appendix 4 has attempted to place values on these effects in the UK. This work found some negative impacts but these were fairly small compared to impacts such as recreation or CO_2.

Most of the potential adverse effects can be avoided. Indeed, it can be argued that, to a large extent, the potential negative externalities from forestry with respect to water quality are already being internalised through adherence to standard operating procedures based on best practice and Forest Service guidelines, water quality monitoring, collaborative studies and the FSC certification process[78]. In addition, most Irish water is not susceptible to acidification and, although some studies have identified impacts on nutrients in water following clearfell, other research has failed to

[76] Garrod, G (2003). *The Landscape Benefits of Forests*. Report to the Forestry Commission.

[77] One important point to be made, that also applies in terms of the impact of forestry on water and bio-diversity, is that the regulation that clearfelled forests must be 100% replanted risks perpetuating the harmful initial effects of inappropriate forestry. While there are good reasons for this regulation, it will be important during periods of reforestation of land planted in the 1980s and 1990s in particular, that some flexibility is available so as to ensure that the initial damage is not replicated in successive rotations.

[78] Crowley, T. (un-dated), *Forests and Water Quality: A Land Users' Perspective*. Forest Service (2000) *Water Quality Guidelines* and *Aerial Fertilisation Guidelines*.

find any such effects[79]. As a result, it is concluded that the impact of the forestry programme going forward will be a small negative value.

The introduction of the Water Framework Directive (WFD) has significant implications for forestry in the Ireland. The WFD's drive towards 'good' ecological status for all surface and ground waters means that any adverse impacts on water by forestry will be punishable by law. It is clear that the River Basin Management Plans will require changes to forest design, planning and management in certain River Basin Districts, i.e. those areas that are most susceptible to the negative impacts of forestry. This requires close co-ordination with the River Basin Management Working Groups. The development of River Basin Management Plans will require close partnership between the forestry sector and other stakeholders and will eventually lead to a schedule of costs and benefits to assist policy going forward.

Health

The perceived impact of forest ecosystems over large temporal and spatial scales will be strongly influenced by the sites and characteristics of the forest and its location[80]. A UK study focusing on the health effects of pollution absorption of trees estimated a reduction in health costs (or increase in benefits) attributable to pollution absorption by woodlands. The study looked at a limited spatial distance and the impact of woodland on pollution levels over longer distances was unclear and lacking in research. Net pollution absorption by woodland was found to have reduced the number of deaths brought forward by air pollution by between 59-88 deaths and between 40-62 hospital omissions in the study area. While values were identified as a result, it is not possible to transfer these to Ireland as the range was too varied and the evaluation was site specific. Nevertheless, the results indicate that in the presence of air pollution, and particularly where there is high population density near to forests, forests have a positive impact on health. It is also likely that there would be positive health effects if the availability of forests promoted an increase in exercise.

4.3.5 Summary of Estimated Non-Timber Values for Irish Forests

This analysis shows that while there will inevitably be difficulties in placing precise estimates on the value of public goods for which operating markets and prices do not exist, the values that can be assigned to the non-timber outputs of Irish products under reasonable assumptions are substantial. Table 4.1 provides a summary of the values per annum that have been identified[81].

The analysis provides an estimate that the total non-timber benefits of Irish forestry are currently worth €88.4 million per annum – using a mid-point value for carbon –

[79] EPA (2004) *Ireland's Environment 2004: the State of the Environment*

[80] Powe, A & Willis, G (2002). *Mortality and Morbidity Benefits of Air Pollution Absorption by Woodland. Social and Environmental Benefits of Forestry Phase 2*. Report to the Forestry Commission.

[81] It is worth reiterating that while these are real values in terms of assessing the impact on society, the values do not accrue as income to growers. This is the market failure that can result in under investment if not adequately addressed. In the absence of mechanisms to transfers these values directly to growers in the form of incomes, the main rationale for forestry supports in the future is to address this issue by providing incomes to the growers responsible for providing these benefits.

with the potential to grow to around €126 million under the targeted planting programme, if guidelines are applied strictly. In some cases, these benefits will be realised annually in perpetuity, for example, the leisure and recreation benefits. In the case of carbon, these arise as long as net afforestation is taking place and further benefits should not be assigned to subsequent reforestation once the equilibrium storage level has been reached. In other cases such as bio-diversity and, potentially, landscape and heritage, the values arise in perpetuity and are likely to increase over time as average incomes rise and greater values are placed on the conservation of species, natural landscapes and heritage sites.

Table 4.1: Estimated Values for Non-Timber Goods in Irish Forests per annum

	€ million per annum
Leisure & Recreation	Currently €37.6 million with the potential for up to €79 million – without further growth in visitor numbers – if adequate mixed species forests and facilities are provided.
Carbon Storage	At average afforestation rate of 14,000 ha per annum in recent years, the annual value is currently €31.65 million. This would rise to between €38.8 and €51.7 million per annum in the 1st *Kyoto* reference period for carbon values of €15 to 20 per tonne with afforestation of 20,000 hectares per annum giving a mid-point estimate of €45.2 million per annum.
Bio-diversity	Current estate contribution estimated at €5.6 million. Estimated at an additional €1.6 million per annum from the afforestation programme with a discounted value of €23.3 million from the total programme compared from the use of the land in REPS but alternative approaches suggest that this may be an underestimate of the potential contribution.
Landscape	Potential for positive impact if guidelines strictly applied but some earlier inappropriate planting offsets this so zero impact overall.
Water quality	Some relatively minor negative impact but this will be minimised by adherence to regulations.
Health	Not quantified, but positive impact in addition to atmospheric benefits already identified.
Heritage	Not quantified, but some negative impact appears likely.
Marketed goods	Small positive value.
Total	€88.4 million per annum.

Assigning a zero overall value to the aggregate impact on the landscape, water quality, health and heritage underlies the current estimate. The guidelines strictly implemented would ensure that the potential harmful effects of planting an inappropriate species mix on inappropriate soils and sites would be eliminated while promoting the inherent benefits of forestry under these headings so that net benefits would arise over time. However, experience over the past decade indicates that promoting this agenda may be perceived to conflict with the attainment of maximum commercial timber values.

4.4 Improving Knowledge on Non-market Benefits and Policy

In principle, NMBs can be described as public goods in that they can be enjoyed by everybody, and the fact that one-person benefits, does not usually affect the enjoyment of anyone else. This public good aspect contributes to the overall welfare of society and therefore should be an important part of the remit of the Forest Service role to provide multi-purpose forestry, thus ensuring good value for money for exchequer resources. The valuation studies undertaken outside Ireland indicate that the value of eco-systems services provided by forests could even exceed the value of timber and products derived in some circumstances. Failure of investors to realise the value created by the non-market benefits of forestry is likely to mean that under investment will result, and this conclusion provides the rationale for the payment of premiums to attract targeted levels of planting.

The non-marketed environmental benefits of regulated farm activity are a key argument underlying REPS. Increasingly, policy abroad is recognising explicitly that a similar argument can be made in relation to forestry. Publicly buying or leasing ecological services from landowners would provide a strong incentive to reforest and to manage forest land for a range of environmental attributes increasingly demanded by the public.

To date, the approach taken in the absence of valuations has been to provide quantitative regulations, which operate nation-wide, to ensure that forests comply with what is considered to be best practice. It is far from clear however, that these are optimal in terms of maximising the non-timber benefits while costly in terms of the timber returns. In addition, as is the case with all regulations, where they are not supported by appropriate incentives, there is a tendency for compliance to fall below 100%. The evidence is that afforestation has come increasingly into line with the regulations, but there are concerns that poor management practices as the plantations mature might undermine the realisation of the full benefits. Furthermore, the lack of a basis on which the issue can be debated – the relative valuations of timber and non-timber products would provide this basis – means that afforestation is increasingly opposed and perceived to be detrimental to the interests of many. This is a potentially damaging situation since it may inhibit the attainment of an appropriate level of afforestation.

To date, there is a perception of a trade-off between promoting the commercial aspects of forestry and maximising its non-market benefits. However, recognition of the full value of forestry promotes the development of the sector provided these values are properly reflected in the policy overall. To achieve this, Ireland needs to commission its own studies to determine clearly the NMBs. The main potential gain to the Forestry Service of conducting additional studies would be to help it demonstrate the benefits of managing different types of forests. Thus, the benefits of non-commercial forests can be compared with coniferous plantations etc, providing information that can help the Forest Service make decisions about, for example, restoring or replanting native woods. The full valuation results can also be used in determining or influencing pricing, land use and incentive policies. Alternatively, with further research, it would be particularly cost effective to develop an approach based on benefit transfer. This would allow estimates of marginal and total value to be

placed on a range of forest management activities at forest, regional and national level.

Key issues remain to be resolved in order to develop a strategy that incorporates NMBs as well as the market benefits of forestry. These include:

- Identifying the relative cost of non-market environmental benefits 'purchased' through REPS compared to forestry;
- Identifying the optimal incentives and incentive structure in forestry to maximise the total returns;
- Determining an appropriate balance between coniferous versus broadleaf planting, with the latter seen to hold greater bio-diversity and amenity values, in particular as some broadleaf species can contribute more in terms of carbon storage in the long term[82];
- Identifying the real value of softwoods when NMBs are included;
- Assessing the impact of planting in Irish peri-urban areas in terms of pollution absorption improved air quality and the landscape benefits of woodland, and the need for car parks. This has implication for planning in relation to afforestation; and
- Detailing the role of planning in maximising the non-market benefits of forests.

The Forest Service is well positioned to take leadership and fund the development of studies of non-market forest benefits. These studies should be tested and output values compared internationally to improve validity. The results should be consistently applied by other agencies, to allow for comparative assessments and possible inclusion in national accounts.

[82] Dewar, R. and M. Cannell. (1992) 'Carbon sequestration in the trees, products and soils of forest plantations: an analysis using UK examples'. *Tree Physiology*, Vol. 11 pp 49-71 and Kilbride *et al* (1999)

5. Afforestation in the Context of CAP Reform

This section examines the incentives to engage in forestry primarily from the point of view of the decision facing growers. The existing financial situation is presented first. Then, changes that have been agreed under the Fischler reform of the CAP are discussed. The potential impact of these reforms on the availability of land for forestry is analysed. Finally, EU proposals that would impact on the future structure of payments to forestry are examined.

5.1 Private Returns from Forestry and Alternative Land Uses

5.1.1 The Existing Payment Structure

Financial support to forestry is provided for a number of reasons, including to increase the area under forest in Ireland, to provide the raw material for a timber industry to emerge, to create non-timber benefits of forestry and to support incomes for farmers whose land is taken out of agriculture. The importance of this final point was recognised in the 1996 *Strategic Plan.* The main rationale offered in thee Plan for the investment of public funds is the implications of provisions of the CAP, which makes farm activities, which would not be competitive with forestry in the absence of subsidies, attractive. This is particularly so given the very long payback associated with forestry. The structure of forestry supports reflects this latter feature.

Payments comprise of capital grants and annual premiums. The grant is designed to cover the cost of planting and maintenance in the initial years. While the costs are controlled and the level of payments may vary according to the nature of the site and the entity undertaking the work, the net effect should be that there is no actual cash outflow from the grower arising from planting. Current (maximum) grant payment rates are shown in Table 5.1.

Table 5.1: Forestry Grant Payment Rates (€ per hectare)

	Planting	Maintenance
Unenclosed Land	2,032	698.50
Enclosed		
Non Diverse Conifers	2,032	698.50
20% Diverse Conifers	2,159	698.50
Diverse Conifers	2,413	762.00
Broadleaves other than Beech & Oak	3,810	1,143
Oak (75-100%)	4,825	1,524
Beech (80-100%)	5,079	1,651

Grant payments do not distinguish growers as between farmers and others. However, the situation is more complex in the case of premium payments as shown in Table 5.2. This shows that payments to farmers are much higher than other growers for similar

activity. The greater non-timber benefits of non-Sitka/Lodgepole plantations are recognised also with higher payments made in respect of diverse and broadleaf species. In addition, for planting on enclosed land, farmers are entitled also to receive, a supplement of €12.70 per hectare where the plantation is greater than 6 hectares and €25.40 where the plantation exceeds 12 hectares.

Table 5.2: Forestry Premium Rates (€ per hectare)

Farmer Rate over 20 Years	
Unenclosed Land	209.51
Enclosed Conifers	
Non Diverse Conifers	336.48
20% Diverse Conifers	391.08
Diverse Conifers	416.47
Enclosed Broadleaves	
Ash/Sycamore	441.87
Oak/Beech	473.61
Non-Farmer Rate over 15 Years	
Conifers	171.41
Broadleaves	184.11

Although premium rates that were offered at the time of planting in the past were lower than is the case currently, revisions to the rates have been backdated. This is particularly important for plantations made before 1994, after which premium rates increased by in the region of 150%.

In effect, it is possible to characterise premium payments as comprising two elements: a basic premium payable to all to encourage forestry and the creation of non-market benefits and a compensatory payment to farmers in recognition of the income foregone from alternative land uses in agriculture. This reflects the origin of EU forestry policy in the CAP reforms of 1992, where promotion of forestry was argued on the basis of timber and non-timber benefits and due to the potential to move land out of agricultural production.

Given the stated target of 20,000 ha afforestation per annum, a key question is, whether these payments are adequate to achieve this target, in the context of the major reforms to farm payments that have been recently agreed. Other questions centre on whether the particular payment structure is optimal from the point of view of ensuring planting is undertaken and forests managed in a manner that will support the emergence of a competitive timber industry in Ireland. Another question is whether it supports the creation of an optimal forest estate from the point of view of providing a desirable balancing of the timber and non-timber benefits of forestry.

5.1.2 Impact of Support Payments on the Forestry Decision

Afforestation in Ireland has fallen well short of the targets contained in the 1996 *Strategy*. As shown in Table 2.1 earlier, in the period 1996-2003 afforestation fell behind target by a cumulative of almost 72,000 ha, or 8,000 per year. Average private afforestation was 12,750 ha per annum with a peak of over 15,000 in 2001. The data

suggest also that, with the exception of 2003, the situation started improving from 1999, when there were increases in premium rates. Irish afforestation in this period can be criticised also for a concentration on conifer species, which reflects the emphasis in the 1996 *Strategy* on timber production rather than non-timber benefits, and some planting on inappropriate sites. At the same time, the average plantation is small and dispersed and weaknesses have been identified in the development of supporting infrastructure and management requirements. As a result, there is a risk that the emerging forest estate will be insufficiently competitive to produce for timber markets while non-timber benefits have not been adequately realised. In examining the first issue, of low planting rates, research has focussed on two potential causes. These are, that payments to forestry are inadequate relative to alternative income sources for farmers and that there are important non-financial issues – such as culture and lack of knowledge, which are inhibiting the growth of forestry in Ireland.

Work undertaken by Teagasc has examined the relative returns from forestry and other farm activities. The approach was based on the initial hypothesis that if returns from forestry exceed those from agriculture then there is an incentive to plant. Further work has extended this analysis to examine to what extent the potential return from forestry needs to exceed returns from existing land uses in order to induce change. This research has also made an initial examination of some features of the CAP reforms, although the underlying model has not been re-calibrated to project farm incomes under the new system. In advance of examining this work, it is worth looking briefly at the returns from Irish agriculture in recent years. An important issue that arises is that while comparisons must be undertaken at quite an aggregate level, it is necessary to disaggregate agriculture to some extent since averages are often misleading and forestry is not a viable alternative to some activities.

Teagasc research categorised farmers into a number of groups based on various viability criteria[83]. These categories are shown in Table 5.3, based on the Teagasc *National Farm Survey*, 2001.

Table 5.3: Categorisation of Farmers (2001)

Viable full-time farmers	41,300		
	of which:	Large farms*	30,400
		Small farms	10,900
Non-viable part-time farmers	36,400		
Non-viable transition farmers	42,600		
	of which:	Younger farmers	26,000
		Older farmers	16,600
Total farmers	120,300		

***Note:** Large farms require a minimum of 0.75 family labour unit input on a Standard Man Day basis
Source: Connolly (2003)

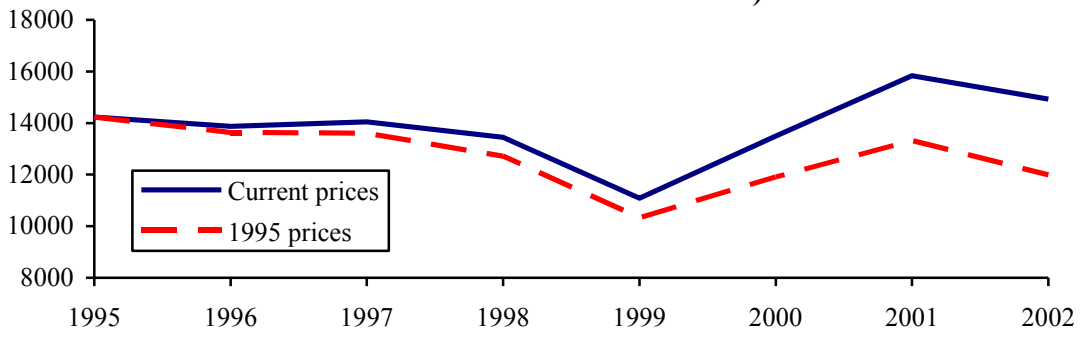
Out of a total population of 120,300 farmers, just over 34% were categorised as viable full-time farmers. These operations are mostly concerned with dairying and tillage, with some of the larger drystock farms included. Activity in the non-viable, part-time category is mainly dry-stock and with either the farmer or spouse having an off-farm income. It is expected that this category will grow as farm income declines relative to

[83] Connolly, L. (2003) *An Analysis of Farm Structures and Incomes*. Teagasc Research Paper

other income sources. The non-viable transitional category is composed of farmers who do not have viable farms but have not obtained off-farm employment. It is likely that a proportion of the 26,000 younger farmers in this category will acquire off-farm income in the future.

From this basis, it is projected that overall numbers will fall to 100,000 farmers in 2010, only 20,000 of whom will be viable full-time farmers. The part-time category is projected to rise to 60,000 by 2010. Data from the Teagasc National Farm Survey (NFS) shows that average family farm income (FFI) has shown a considerable decline in real terms since 1995[84]. This is shown in Figure 5.1. As a result of these trends, average family farm income in this period declined by 15.7% in real terms.

Figure 5.1: Average Family Farm Incomes 1995-2002 (Current Prices and Constant 1995 Prices)



The decline in average incomes in real terms will depend on the period chosen but a key issue for this project is that these averages hide a considerable dispersion of values. This is not unexpected given the categorisation above. Not only are incomes in dairying much higher than the average – at €28,100 in 2002 compared to the average of €14,900 – but they performed well also over the period. On the other hand, average FFI from cattle rearing was only €7,800 and was almost static over the period. Overall, approximately 66% of farmers are engaged in rearing cattle and sheep but receive only 36% of income generated in farming. As well as being related to the activities pursued, FFI is also closely related to farm size and farmers at the higher income end of the scale tend to be somewhat younger than the average age of 53 years.

In 2002, 40% of farms had an income of less than €6,500 while 20% had incomes greater than €25,000. Some 85% of farmers with income less than €6,500 were engaged in drystock. This amounted to just under 41,000 farmers, most of whom had off-farm incomes[85]. Income per hectare on farms is shown in Table 5.4 according to the farm type.

[84] Teagasc (2003) *National Farm Survey 2002*. The definition of farm income used is gross output less total net expenses incurred in running the farm business.

[85] Connolly (2003) provided estimates that showed that average income in 2001 where the farmer was engaged full-time amounted to €32,800. Farmers with average income of €6,800 who had an off-farm income source earned a further €18,900 bring total income to €25,700, somewhat less than full-time farmers.

Table 5.4: Family Farm Income per Hectare (2001 & 2002)

	€ per ha 2001	€ per ha 2002
Dairying	867	704
Dairying/Other	555	476
Cattle Rearing	267	269
Cattle other	266	304
Mainly sheep	316	322
Mainly tillage	428	351
All systems	444	406

Source: Teagasc *NFS 2002*

It is clear from these data that, at current levels averaging around €400 per ha, forestry premiums would not be competitive with dairying and only marginally greater than tillage in 2002, but that they would appear to be competitive with drystock farming.

An important finding of the NFS is that direct payments and subsidies to farming are a very important part of farm incomes. However, direct payment and subsidies greatly exceeded incomes in non-dairy sectors[86]. In 2002, direct payments and subsidies to 'cattle rearing' and 'cattle other' farmers amounted to 140% and 147% of farm incomes on these farms while the percentages for sheep and tillage were 119% and 111% respectively. This means that output on these farms was not sufficient to cover production costs. In other words, on farms engaged in cattle rearing, incomes would have been 40% higher if the payments could be received without having to engage in production. This is a major argument underlying the de-coupling arrangement in the CAP reforms.

The NFS was the source of data used by Teagasc to project farm forestry in Ireland[87]. A key variable used in the projection is the relative return from forestry and other land uses on farms. Returns from forestry were based on a 20% diverse conifer plantation with Yield Class 20. As such, the results may be slightly on the high side but not outside the potential range for the best sites. A 40-year rotation is used, with sales of thinnings from year 20. Revenues are discounted at 5% per annum. Revenues from agriculture over the 40-year period are based on income estimates from the NFS and the FAPRI model of farm incomes. In addition to production costs, the model includes an estimate for the opportunity cost of labour used in agriculture based on the excess labour input in agriculture over forestry valued at the minimum wage of €6.35 per hour. The returns ratio was specified as discounted returns per hectare from forestry, relative to discounted returns from agriculture per hectare. The estimates were produced for five regions of the country and for three dry-stock farming systems. The results are shown in Table 5.5[88].

[86] While the reverse is true in the case of dairying the comparison is not altogether correct since a proportion of incomes are accounted for by price supports for dairy products. This transfer is not included under the payments and subsidies heading.

[87] Behan, J. and K. McQuinn (2003) *Projecting Farm Forestry in Ireland*. Teagasc Working Paper

[88] Taken from Behan, J. (2002) 'Returns from farm forestry versus other agricultural enterprises'. Presentation to IFA Farm Forestry Conference, Limerick

Table 5.5: Returns Ratio, Forestry Relative to Agriculture

	Returns ratio
Cattle	
Mid-east	1.2
North-west	1.3
West	1.4
South-west	1.1
South-east	1.0
Suckler	
Mid-east	1.2
North-west	1.4
West	1.4
South-west	1.1
South-east	1.0
Sheep	
Mid-east	0.9
North-west	1.1
West	1.1
South-west	0.8
South-east	0.7

Source: Behan (2002)

These results indicate clearly that the estimated discounted returns from forestry exceed the returns from cattle and suckler farming in all regions of the country except the south east where they were similar. The work shows that this situation had existed since about 1996/97 and that while some decline in the ratios were projected up to 2005, the returns from forestry would grow relative to other land uses thereafter. On a no policy change scenario the projection indicates that forestry returns would exceed returns from drystock agriculture by 30% in most regions in 2010. However, this estimate excludes REPS. When REPS payments are included, the ratio falls and is less than 1 in the south east and in the range of approximately 1 to 1.1 for other regions in the period up to 2006. However, after this the ratio again rises. This supports the contention that REPS acts as a disincentive to forestry, but supports the indications from the NFS family farm income data that returns from forestry appear competitive with income from other land uses. Given the profile of relative returns, the clear question that arises is why afforestation has failed to reach the targets that have been set?

Attention has centred on the possible impact of factors that are not captured by this comparison of relative returns. One line has been to emphasise the impact of non-monetary factors. A set of these factors could be classed as a cultural objection to forestry. According to this it is considered inappropriate to forest good land and it is believed that forestry results in depopulation. It is contended also that there is a 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, some research has concluded that 'the pool [of landowners] that is willing to convert to forestry may now be drying up'[89].

[89] 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, page 41.

In general, landowners' attitudes to forestry are becoming more positive, with unfavourable responses to forestry increasingly based on pragmatic issues such as farm size, land quality and competition from other sources of EU payments. Acceptance is highest in communities and regions where forest resources are high, with long and strong forestry traditions, and few job alternatives outside of agriculture. However, it remains that forestry on good farmland is not favoured but is a definite competitor to agricultural enterprises on land marginal for farming and or situated some distance away from the main farmyard[90]. Farm forestry culture equals the total knowledge, beliefs, experience and skills throughout the community. This culture impacts, positively or negatively, on the advancement of farm forestry in Ireland. The lack of skills, and experience impedes adoption where opportunities exist. Thus, providing sound information to support policy for small-scale forestry remains important to counteract latent non-economic objections and to impart the knowledge required for good forest management. Improvements in small-scale forestry would be promoted through a bottom up approach based on the encouragement of private owners' associations. As a result, the implementation of policy must incorporate an assessment of the owner's knowledge resources as well as the biological capabilities of the land.

Other work suggests that there is a sufficient pool of land available to enable the targets set out in *The Strategic Plan* to be attained[91]. According to this work, there are 37,000 farmers with a land pool of 490,000 ha of land that can be afforested[92]. The research 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, the survey indicated that the premiums available were not sufficiently competitive to entice farmers to alter existing farming practices. In addition, where the land was needed for extensification payments there was an important disincentive to engage in forestry since afforested land is excluded from the calculation for extensification payments. This issue is returned to below.

This work suggests that a simple comparison of premiums and income streams may not be adequate to provide an understanding of the financial factors relevant to the decision to plant. Two features of the decision to afforest land appear very important. The first is that the value of land tends to fall once it has been planted. Research to incorporate this feature demonstrated that while the current premium of about €400 per hectare should be sufficient to trigger afforestation, where returns from agriculture are low – around €200 per hectare – the premium would need to increase to about €440 per hectare to encourage planting if agricultural returns are €350[93]. The key

[90] Reidy, J (2002) '*Farm forestry: land availability, take-up rates'*. Teagasc. Athenry.

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

[92] The identified total of 490,000 ha would be insufficient, in the absence of reform of the CAP, to achieve the afforestation programme set out in this report. However, the reforms will have a considerable impact on this estimate. In addition, in the future, land that could have been considered for afforestation previously may be unavailable for environmental reasons. The absence of a comprehensive land use strategy for Ireland means that a ready estimate of the land potentially available for forestry is not available.

[93] Weimars, E. and J. Behan (2004) 'Finding the Optimal Timing of Forestry Investment', in *Rural Futures: Proceeding of Rural Development Conference, Teagasc*. This estimation does not include

assumption driving these results is that the value of a hectare of land falls from €8,000 to €6,000 once it is planted. The higher premium required is a reflection of what may be considered to be a sunk cost associated with afforestation.

Second, the decision is irreversible. As a result, once a decision has been taken the option to engage in anything other than forestry is lost. However, this decision must be taken in the context of uncertainty regarding future income flows. The hypothesis is that this option has a value and thus there is an optimal timing of the investment. As a result, it is necessary for the relative returns from forestry to exceed those from agriculture by an amount that is sufficient to offset this loss. Initial examination of the impact of this uncertainty on the decision to plant suggests that it has important implications for conclusions regarding the competitiveness of the forestry payments[94]. The results obtained are based on models that aim to explain the observation that the rate of return that is required to trigger investment in a wide range of sectors – the hurdle rate – is often a multiple of the rate that would cover capital costs. In other words, the NPV of returns from investment in forestry might need to exceed the returns from not investing i.e. from continuing in agriculture, by a considerable amount in order to encourage planting. The work found that, the value of returns required for triggering investment rose to €971 per hectare, when the model incorporated the impact of uncertainty i.e. the fact that the decision cannot be reversed. This can be interpreted, as the payment required for encouraging a farmer to act now rather than wait. However, there is uncertainty also over what will happen land prices in the future and the differential between the value of land in agriculture and in forestry. If it is expected that the sunk costs associated with planting will increase in the future then the return required to trigger afforestation falls to about €607. Clearly, while these estimates are the result of exploratory work, they cast considerable doubt on the earlier conclusion that forestry premiums are competitive. This was based on a simple comparison of returns. However, there are other costs associated with engaging in forestry. The observed shortfall in the rate of afforestation suggests that an approach, which attempts to include the impact on land prices and the risks associated with undertaking an irreversible investment, may provide a better explanation of what has been observed. Finally, if this is correct, it indicates that farmers are undertaking rational assessments of the situation and that the possibility that cultural factors may be inhibiting afforestation should not be overstated.

5.2 Impact of CAP Reforms on Agricultural Incomes and Output

The mid-term review of the EU's Agenda 2000 resulted in proposals for a major reform of farm income supports under Pillar 1 of the CAP. These have now been agreed largely and, while detailed precise estimates of the impact of the reforms on farm incomes are not yet available, it is clear that the reforms will have a major impact on land uses on farms. The reforms are designed to simplify the system of farm supports and increase the incomes resulting from payments to farmers while

the impact of the CAP reforms which the paper calculated would tend to make afforestation more attractive as discussed further below.

[94] Weimars, E. and J. Behan (2004) *Farm Forestry Investment in Ireland under Uncertainty*. Teagasc Research Paper

reducing the costs of the farm budget and reducing distortions in product markets. In some respects they are a continuation of reforms begun in the early 1990s but they are important innovations that will impact on farm activity.

The main highlight of the reforms is the introduction of the Single Payment from 2005. Without going into the details, the scheme will greatly extend the de-coupling of payments from actual production going forward. In addition, since extensification payments are included in the Single Payment, land held in order to qualify for such payments will no longer necessarily be required. All livestock premia and arable aid schemes will be replaced by the Single Payment but REPS and the Disadvantaged Areas Compensatory Allowances schemes will continue to operate. The single payment entitlement will be based on the livestock premia and arable aid payments during the reference period of 2000-02. These entitlements will apply to the farmer, not to the land, and will be spread over the average area farmed in the reference period. Farmers will need to claim the entitlements and maintain the land associated with the entitlement in the reference period but entitlements can be leased or sold within guidelines. While it is not the case that farmers can totally disengage from farming, provisions in the scheme mean that the decision regarding land usage is greatly altered.

A key feature of the scheme is that farmers will be able to 'stack' payments on their land. Thus, having established an entitlement, a farmer can take part in REPS and can also be entitled to Area Compensatory Allowances (ACAs). In addition, farmers may consolidate their single payment entitlements onto part of their land. This procedure involves surrendering their entitlements to the National Reserve – a balancing mechanism created by holding back 3% of payments due – and receiving in return a smaller number of entitlements, but at a higher rate, so that the value is held constant. The potential gain is that the farmer is now free to afforest the land to which no entitlements are attached and receive forestry premiums, since forestry premiums are not included in the Single Payment scheme. It has been agreed that this can be done on 50% of the land. This provision also has an important implication for farmers who claim entitlements on land that was leased during the reference period. The farmer will only need to lease land up to 50% of the amount on which the entitlements are originally calculated and consolidate all entitlements onto this land.

This is a major reform and initial research suggests that there will be a considerable impact on land usage[95]. The main results predicted by the research are that the reforms will lead to:

- Movement of land use from crops to pasture;
- Significant extensification with fewer animals per hectare;
- An initial fall in cereal prices later recovering;
- Lower production of beef and fewer animals;
- Limited changes in dairy markets because of the impact of quotas; and
- Small increases in the world prices for crops and EU exports decline.

Research has been undertaken also in relation to the potential impact of the reforms, with specific reference to agriculture in Ireland[96]. This was done on the basis of the

[95] OECD (2004) *Analysis of the CAP Reform*

Luxembourg Agreement, which represented an interim stage in the reform process but this is sufficiently representative of the final agreement to provide meaningful indications of the potential impact on farm incomes and land use. The work produced a baseline projection of agriculture if no reforms are implemented and then compared this with the reforms proposed under the Luxembourg Agreement with a focus on the options for de-coupling that had been identified. De-coupling is treated under a maximum scenario – which approximates the final arrangement – and a minimum scenario.

In line with the OECD work, the Teagasc research identifies a decline in milk prices with de-coupling. The outcome in relation to beef is strongly influenced by the extent of the de-coupling that is achieved. Under the baseline scenario of no reform, cattle prices in 2012 remain close to 2002 levels and production is expected to remain steady once it has recovered from the low levels experienced in the wake of BSE and FMD. Cattle numbers in the EU are projected to decline by 10% with maximum de-coupling and prices are projected to rise by 9%. However, the declines in cattle numbers in Ireland are projected to be higher with an 18% fall overall in suckler numbers and a 7% fall in beef production by 2012. Prices are projected to rise by 10% relative to the baseline. Overall, the value of agricultural output declines by less than 1% compared with the baseline and income levels remaining close to current levels.

The single payment is maximised with the maximum de-coupling scenario. While complexities arise, it is generally the case that farmer incomes are higher with full de-coupling rather than the range of alternatives that were examined in the work. Farmer incomes are also higher as a result of the reforms identified when compared with the baseline case represented by a continuation of the existing policy. However, some potential for windfall gains and transfers within farming were also identified when partial de-coupling only is introduced. In general, de-coupling will result in more gainers than losers among farms although some transfer from the larger farms is possible. The model provided results in nominal values and inflation would reduce the real value of the incomes received. However, as it is expected that farmer numbers will fall by up to 3% per annum during this period if recent trends persist then it is expected that the real value of per farm income should be maintained at current levels with the reforms. This would be a major improvement compared with the trends identified in Figure 5.1 above.

5.3 Impact of Reforms on Land Available for Forestry

The overall conclusions from the available research on the impact of reform of the CAP suggests that there will generally be a reduction in beef production and potentially in the land that is used for dry livestock as a result of the reforms. The impact on incomes relative to current levels will be modest but will be positive when compared with the alternative of continuing with current policy. These results would appear to suggest on initial examination that the overall change in the structure of land

[96] Teagasc (2003) *The Luxembourg CAP Reform Agreement: Analysis of the Impact on EU and Irish Agriculture.* Teagasc Rural Economy Research Centre and FAPRI-Ireland Partnership

use in agriculture and agricultural incomes would have a modest impact on afforestation. However, this high-level analysis does not capture the potential impact of the reforms on land used in forestry as a result of the detailed provisions in relation to the stacking of payments. In addition, the impact of de-coupling, in removing the need to use land in agriculture in order to comply with requirements to access extensification payments, have to be taken into account. There are also reasons, given the existing age structure in farming and the likely levels of single payment entitlements, to believe that the relative attractiveness of forestry will be increased for certain groups of farmers in some areas of the country.

5.3.1 Relative Value of Payments under Alternative Land Uses

Under current policy, provided a farmer suffers no loss in extensification payments, the forestry premium would have a net benefit of €404 on average to the farmer assuming the farm was not in a disadvantaged area and not in REPS. However, since about 75% of farms qualify for the area-based compensatory allowance of just under €89 per hectare, it can be assumed that all forestry will be in areas where this is payable. This payment is lost after afforestation so that the net premium is reduced to €315. If a farmer is in REPS, and REPS offers an alternative income source to most farmers who might consider forestry, then the net value of the premium is reduced by a further €151 on average, implying a net gain from afforestation of €164 per hectare. To this would need to be added any change in payments related to production that might be lost following afforestation. This will vary greatly but the Teagasc work discussed in Section 5.1 above suggests that there would be a net financial benefit by engaging in forestry provided the extensification payments can be maintained.

The structure of agricultural support payments to farmers under the CAP will be altered considerably by the Fischler reforms. Assume that no profit is made on any production undertaken. Given the data from the NFS this appears reasonable for non-dairy farms, which provide the stock of land that potentially, can be transferred to forestry. It is estimated that the average single payment will be around €270 per ha for non-dairying[97]. Assume also that a farmer is entitled to REPS and to area-based compensation payments as this set of farmers provide those most likely to engage in forestry. On this basis, potential annual payments to a farmer with an eligible farm of 40 hectares who does not engage in afforestation will be as follows:

Scheme		Value €
Single Payment	40*€270	10,800
REPS	40*€200	8,000
Area based compensation	40*€88.80	3,552
Total		22,352

[97] There will be considerable variation around this level. Teagasc estimates indicate that just under 52% of farmers will receive entitlements for €250 per hectare or less while about 18% of mostly large cattle farmers will receive entitlements for over €400 per hectare.

In an alternative calculation, assume the farmer consolidates the entitlements to the maximum extent possible onto 50% of the farm and plants 20 ha in forestry. In this case, receipts – before accounting for tax – will be[98]:

Scheme		Value €
Single Payment	20*€540	10,800
REPS	20*€200	4,000
Area based compensation	20*€88.80	1,776
Forestry premium	20*€404	8,080
Total		24,656

The difference is an increase of €2,304 per annum or €115 for every hectare planted. The forestry element is tax free, while tax is liable on the remainder of the income although there would be offsetting costs. The ratio of returns from afforestation relative to non-afforestation for this farm is 1.1 to 1. After tax, it is likely that the ratio would rise somewhat. This does not indicate that there is any major impact likely when compared to the ratios report in Table 5.5 above. Thus, the income effect would not appear to be sufficient to change land use in a major fashion unless the fact that the decision is now made in the context of a lower level of uncertainty[99].

5.3.2 The Impact of Low Single Payment Entitlements

The previous calculation was done on the basis of an average single payment entitlement. However, Teagasc estimates identify that there will be a considerable range in entitlements. Based on 2002 data, it is estimated that in excess of 23,000 drystock farmers will have entitlements of less than €200 per hectare[100]. If the calculation is redone using an entitlement of €150 per hectare to represent these farmers then the ratio of returns increases to 1.21 i.e. a farmer would increase net income by 21% by availing of the ability to consolidate payments and afforesting the remaining land. This is a considerable difference given that these farmers are in the lower income categories by definition. If an average farm size of 33 ha is assumed – i.e. the average based on the DAF database from which Table 5.3 was drawn – then potentially 760,000 ha could benefit. It is not possible to estimate an elasticity value that could be used to estimate the actual amount of this land that might enter forestry but if even 25% of farmers decided to plant then this would provide sufficient land for

[98] Agricultural receipts will be liable for tax, although there may be some off-setting expenses, while receipts from forestry are tax free.

[99] The work by Weimars and Behan (2004) that was discussed above identified a potential negative impact of de-coupling on the decision to afforest. One factor that affects the ratio of returns from forestry relative to agriculture is the opportunity cost of lost income from alternative employment that reduces the net returns from agriculture i.e. forestry requires less labour per hectare. However, with de-coupling, the farmer no longer has to produce to receive payments so there is no gain from forestry, provided the farmer does not engage in production, on the assumption that the time input to keep the land in good condition will be equal to the time input required for forestry. This is why the opportunity cost of labour is not included in this calculation. Given that it can be assumed that, at best, there is no profit in production for many farmers in the absence of currently existing schemes, it can be assumed that many farmers will reduce production. This reduction in the opportunity cost of agriculture reduces the ratio of returns from forestry relative to agriculture.

[100] Reidy, J. and A. Kinsella (2004) *Forestry and the Single Payment Scheme*. Teagasc Briefing Paper

almost five years afforestation at 20,000 ha per annum[101]. Alternatively, it would amount to almost 3,000 ha per annum that was not previously available to forestry over the course of the afforestation programme used in the projections in this report. Furthermore, under the existing CAP rules, in the region of 40,000 drystock farmers were making losses on production activities, before direct payments. It would clearly make sense for these farmers to now disengage from production and plant forest.

Table 5.6: Impact of Low Single Payment Entitlement on Land for Forestry

	Assumed average SP €/ha	Area farmed (hectares)	Incomes ratio: Afforestation to no afforestation	Land made available
SP < €50/ha	40	446,293	1.30	55,787
SP = €50-€100/ha	75	518,435	1.26	64,804
SP = €100-€150/ha	125	523,651	1.23	65,456
SP = €150-€200/ha	175	542,638	1.20	67,830
		2,031,017		253,877

Note: The area of land that becomes available for forestry is calculated as in the previous paragraph assuming that 25% of the potential farmers consolidate their entitlements and plant 50% of their land. The dairy premium was not included in calculating the range of entitlements as forestry is not considered to be a substitute land use option for farmers engaged in dairying.
Source: Based on data from Department of Agriculture and Food

The incidence of low entitlements for single payments will not be confined to drystock farmers alone. In total about 44% of farmers are projected to fall into this category. This estimate implies that farmers working over 2 million hectares will have the potential to increase their incomes by 20% or more by consolidating entitlements and planting forest. This would equate to about 7,300 hectares per annum becoming available for afforestation over the course of the programme.

In conclusion, when account is taken of the differences that are likely to arise in payment entitlements under the Single Payment regime, the ability to consolidate entitlements and afforest 50% of land should have a considerable impact on the supply of land potentially available to plant. The calculations in this section have not included the impact of taxes. When included, this would strengthen this conclusion.

5.3.3 Afforestation and Extensification Payments

Research undertaken by COFORD has found that, among farmers who have considered forestry, the requirement to have land available to qualify for extensification payments had a major impact on the decision not to afforest. In a survey, 55.5% of those who had considered forestry cited this as a reason for not proceeding [102]. In contrast, only 33.7% said that planting would devalue the land. The proportion citing the need for land for extensification payments was exceeded as

[101] This is calculated as 760,000*0.25*0.5 equals 95,000 ha since the farmer can only consolidate on a maximum of 50% of the land.
[102] Collier, P. J. Dorgan and P. Bell (2002) *Factors Influencing Farmer Participation in Forestry*. Dublin: COFORD

a reason offered for not planting only by farmers taking what may be characterised as a wait and see approach arising from uncertainty about what might happen forestry premiums and other farm policy in the future. Notably, only 11% of farmers who had considered forestry said that a superior return available from REPS was a key consideration. This indicates that, along with the effect of uncertainty, the impact of the abolition of the need for land to qualify for extensification payments under the CAP reforms could have an important impact also, on the decision to afforest[103]. A key issue, therefore, is to identify the area of land, which will be affected by this change.

Extensification payments are payable according to calculated livestock units per hectare (Lu/ha) achieved on farms. In some cases, farmers have had to lease land, to ensure they can access these payments. Estimates by Teagasc indicate that there are approximately 26,000 livestock producers (20% of the total) with less than 0.8 Lu/ha on 980,000 ha (20% of land total). In addition, there is an estimated 15,000 producers with 0.8 to 1.0 Lu/ha on 484,300 ha. Average farm size for these producers is 35 ha[104]. A stocking rate of 0.8 would imply an average of 28 Lu on these farms and with a stocking rate of 1.0 the average would be 35 Lu. The minimum area required to qualify for the high extensification payment is 20 ha with 28 Lu (and with 35 Lu it is 25 ha). Allowing that farmers would build-in a safety margin of say 10% to ensure that they have sufficient land to achieve the stocking rates necessary for eligibility for the payments, increases these figures to 22 ha and 27.5 ha respectively. On average, this means that, there is an excess area of 13 ha (i.e. 35 ha. minus 22 ha.), on farms with the lower stocking rate, which could be afforested without affecting eligibility for extensification payments. There are 7.5 ha (i.e. 35 ha. minus 27.5 ha.) on farms with a rate of 1.0 Lu/ha. Multiplying this excess by the total area in these farms indicates that ***there is in the region of 400,000 ha. with low stocking rates that potentially could be afforested at present without affecting payments. Of course, not all this land might be suited to afforestation, due for example, to certain sites being inappropriate perhaps due to accessibility or potential adverse impacts of planting on the environment. Nevertheless, to date, it appears that farmers have not maximised their potential return, on a significant amount of land, presumably due to concerns that eligibility for the extensification payments could be affected.***

However, the abolition of intensification payments, with the introduction of the single payment regime, would remove any rational reason for continuing to withhold this land from forestry, where it is suitable.

5.3.4 Potential Impact of Good Farming Practice (GFP) Guidelines and Other Directives

The next couple of years will see implementation of a series of environmental protection directives and guidelines in Ireland. It has been suggested that this will

[103] It can also be argued that agreement of the Fischler reforms will soon remove a lot of the uncertainty in the factors affecting the decision. On balance, a reduction in uncertainty should promote investment against a neutral environment.

[104] This part of the analysis is based on Reidy, J. and Ni Fhlatharta (2002) *Forestry and Other Farm Schemes*. Teagasc Presentation

have a positive effect on farmers' willingness to invest in forestry by making agriculture less attractive, due to the potential costs involved in meeting these new regulations[105].

The Nitrates Directive has been a controversial issue in Irish farming but implementation is likely in the short-term. However, the Directive will not impact on all farmers equally. Analysis by the Department of Agriculture and Food concludes that fewer than 10,000 farmers are expected to be affected significantly by the provisions of the Directive. These farmers are likely to be working good quality high value land and to be disproportionately engaged in dairying. Forestry is unlikely to be a viable substitute and the single payment entitlements for such farmers are likely to be such that the ratio of incomes with consolidation of entitlements and afforestation to no afforestation will not be sufficiently attractive to encourage then to plant[106]. As a result, it is not considered that this development will have a significant impact on the decision to engage in forestry.

There is more potential for increased requirements for good farming practice (GFP) to affect the decision by some groups of farmers. These are likely to be concentrated in the younger age categories operating on less viable farms and in the older age groups. The argument in the case of the former is that these farmers could afforest and take other employment while for older age groups forestry may represent a way to retire from overly active participation in farming while still retaining some activity[107].

The Census of Agriculture 2000 identified just over 18,000 farmers under 35 years of age farming 630,000 ha. At the other end of the spectrum there were 28,000 farmers over 65 farming 840,000 ha. Clearly these two groups represent decisionmakers involving a considerable area of land.

While it is considered that the arguments that these farmers are likely to afforest are valid, it is also likely that they do not represent additional farmers, to those already identified in the sections above. The Teagasc NFS showed that a considerable proportion of farmers on low incomes is already earning incomes off the farm. These are likely to be already concentrated in the lower age groups. The CAP reforms will provide a further incentive for this to happen. These farmers are likely to avail of the opportunity to consolidate entitlements and plant forest. Similarly, older farmers are most likely to do so. Thus, the introduction of GFP will provide an increased incentive to follow this route rather than an additional group of farmers likely to plant.

5.3.5 Leased Land no Longer Required

[105] Interventions to achieve some environmental objectives will have the opposite effect. For example, it is proposed that up to 280,000 ha could be set aside for protection of the hen harrier in Ireland. It is not known to what extent these lands might coincide with the areas that have been identified as potentially available for forestry, but it is likely that there will be some overlap. However, even allowing for this requirement, it is considered that sufficient areas will continue to be available.

[106] The analysis by Weimars and Behan (2004) showed that forestry investment is only optimal where returns from agriculture are low and land values are low.

[107] The number of farmers retiring to take up forestry may be limited as participation in the farm retirement scheme precludes planting.

One possibility that may arise with the introduction of the single payment is that there will be a reduction in the willingness of farmers to lease land. This will arise because farmers no longer require as much land as previously to earn the same income as they need not produce and can consolidate entitlements on a smaller area. In addition, farmers will not need to lease land to achieve maximum stocking rates for extensification payments. (See Section 5.3.3 above) If this results in a lower demand for land, then owners, who by definition have not been working the land during the reference period, may wish to afforest the land in order to generate additional income. Given that they will not have single payment entitlements, this would represent the best option in many cases, even if they were willing to participate in REPS.

The quantity of land currently leased in Ireland is considerable, amounting to 19% of the farmed area in the Census of Agriculture 2000, comprising over 830,000 ha. Over 30% of all farmers leased some land, with the average being 18 hectares, although only 11% leased all their land. These data indicate that many farmers will be in a position to maximise their single payments without leasing and by consolidating their entitlements on land they own[108].

Specialist dairy and tillage farms accounted for 38% of leased land and this land, being of high quality, is less likely to be afforested. In addition, some factors will work to encourage farmers to continue to lease land. This includes profitable farmers who wish to grow their businesses but are not in a position to buy land. Also farmers who wish to participate in the early retirement scheme and avail of their pension for 10 years while placing their land on a long-term lease. The requirement for transferees under this scheme to expand their holding for the first 5 years, and the effect of the tax exemption scheme for income from land on a long term lease, mean that it is likely that there will be a land leasing market, into the future[109]. On the other hand, as participants in ERS leave the Scheme over the next number of years – it is estimated that in the region of 4,000 will leave up to end 2007 – a significant amount of land that had been leased will return to their control. Their options at that point will include renewing leases, selling the land or putting it to non-agricultural use such as forestry. However, they cannot engage in agriculture. The extent to which these land-owners will opt for forestry is difficult to predict. However, one third of the total land released under the Scheme was leased to non-family members and is most likely to return to the control of participants whose options include forestry.

If it is assumed that 38% of high value land continues to be leased and that the other factors cited above account for a further 38%, then there is 24% of leased land amounting to 200,000 ha., for which previous sources of demand no longer exist. A fall in lease values would encourage some further uptake of this land by farmers wishing to expand holding, but owners would clearly only be willing to reduce prices to a certain level before afforestation would become a more attractive proposition.

[108] In such cases, they would not be in a position to plant 50% of owned land with forestry but up to 50% of the total owned and leased in the reference period.

[109] From January 2004, farmers over 40 years of age who lease out land on a long-term basis are eligible for rental income tax exemptions of €10,000 for leases of 7 years or more and €7,500 for leases of 5 to 7 years. Under ERS2, the requirement to expand the holding by a minimum of 5 ha is limited to the first 5 years of participation in the scheme.

Thus, a high proportion of this area, say 150,000 ha, could become available potentially for afforestation, over the coming years[110].

5.3.6 Potential for Afforestation of Depleted Bord na Mona Lands

Bord na Mona owns extensive areas of bog-land, on a proportion of which the peat has been depleted and the land removed from production. Research undertaken by Bord na Mona indicates that in the long term there is potentially 25,000 to 40,000 ha suitable for afforestation. In the shorter term, 5,000 to 6,000 ha have been identified as being immediately available for afforestation and it has been proposed that this area could be planted at a rate of 2,000 ha per annum. Earlier experience with afforestation on cutaway bog was disappointing but research under the BOGFOR project in the wake of this experience has indicated that many of the problems could be addressed.

This is a considerable area of land in terms of the overall targeted levels of afforestation. The consultants are not in a position to provide a judgement in relation to the productive potential of this land or in relation to the potential environmental impacts. However, there are some potential benefits that should be noted in the context of the issues that have been raised in this report. The availability of large tracts of land in the effective ownership of the State provides an opportunity for afforestation of a character that emphasises the non-timber benefits of forestry, for example, through designing plantations to maximise recreational benefits. The afforestation would be taking place on a larger scale than the average for private sector planting. Furthermore, the land is located in close proximity to peat burning power stations, thereby providing a competitive reason for production of timber for use as bio-mass in these stations, as peat production declines in the future.

5.3.7 Conclusion

The analysis leads to the conclusion that, for a number of reasons, the reform of the CAP and the introduction of the single payment will have a significant positive impact on the attractiveness of forestry compared to agriculture. While recognising that there is uncertainty regarding the likely reactions of farmers and that there is the potential to double-count land, the data suggest that the following are reasonable conclusions:

- Farmer incomes under the single payment entitlements will be higher than if the existing arrangements were maintained. As a result, on average, no additional incentive to afforest will be created. However, the ability to consolidate entitlements on part of the farm and the fact that many farmers will receive entitlements below 75% of the average - €200 per ha per annum – will make forestry premiums attractive, with a potential 250,000 ha to be made available;
- There appears to be considerable over-provision of land for ensuring that requirements for extensification payments are met. This amount to in the region of 400,000 ha although not all of this is likely to be planted;

[110] This potential will not necessarily be realised as some of the land will be inaccessible, isolated, or unsuitable for other reasons.

- The introduction of the Nitrates Directive will have a negligible impact but the stricter implementation of GFP guidelines will provide an incentive for some groups to afforest; and
- The reduced need under de-coupling for farmers to lease land to achieve extensification requirements and to earn payments will make in the region of 150,000 ha of land potentially available.

While it is emphasised that these effects are not necessarily strictly additive, the analysis points to a major positive incentive for landowners and farmers to invest in forestry relative to the current situation. ***On this basis, there are strong reasons to conclude that a target of 20,000 ha per annum can be achieved.***

5.4 EU Forestry Policy into the Future

The treaties of the EU do not provide for the development of a common forestry policy in the community and it would appear unlikely that such a policy will be brought into being in the foreseeable future. This said, the EU has become increasingly important in this area and a strategy for the development of EU forestry has been developed and is currently under review. However, forestry remains an area of competency for member states.

EU support for forestry was provided as one of three accompanying measures for rural development that were introduced as part of the 1992 reform of the CAP[111]. The context of that reform, in which afforestation provided an alternative use of land removed from agricultural usage, provided an important rationale for support. Forestry was included also, as it was viewed as an integral part of rural development. Thus, forests are:

> *an important resource for rural development providing livelihoods for a diverse workforce, rural communities, millions of forest owners as well as forest-related enterprises*[112].

However, it was stressed that support should avoid distorting competition and should be market neutral[113]. Implementation of the forestry measure is based on forestry plans prepared by Member States. Support is available in the context of achieving a number of environmental objectives, with climate change identified as a specific problem to be addressed.

The Agenda 2000 process marked an important shift in the policy structure. Essentially, the CAP was divided into 2 pillars comprising market supports (1st pillar) and rural development (2nd pillar). The 1st pillar is primarily concerned with income support with the emphasis on food production. Rural development policy is concerned primarily with providing identified public goods with an emphasis placed on environmental and rural protection objectives. However, with agriculture and

[111] The 3 measures are agri-environment, early retirement and afforestation.

[112] European Commission (2003) *Extended Impact Assessment: Rural Development Policy Post 2006*; p. 13

[113] Council Regulation 1257/1999 on support for rural development from the EAGGF. OJ L 160/80, 26 June

forestry comprising 90% of land use in the EU-25 it is clear that supporting these activities will remain important for rural development.

The Fischler reforms – including the introduction of the single payment and de-coupling – represent a reform of Pillar 1 of the CAP. With agreement on this reform at an advanced stage, the EU is now engaging in reform of Pillar 2. This two-pillar structure is important in determining the types of reforms currently proposed in relation to supports for forestry as discussed below[114]. Three concerns are driving this latter reform. The first is to greatly simplify the funding structure. With funding for rural development currently being provided under both EAGGF Guidance and EAGGF Guarantee, a highly complex structure has emerged with a large number of programmes and different financial management and control systems[115]. It is proposed in this context that one financial instrument for funding rural development will be created and that a single monetary allocation will be provided to member states. Member states will then have discretion as to the proportions of the funding allocated to different sectors and programmes, although there will be guidelines in relation to the co-funding requirements. The total funding commitment for the years 2007 to 2013 has been identified as €88.8 billion, in 2004 prices[116].

The second concern is that economic activities in sectors other than agriculture need to be better integrated with rural development. As a result, the proposed reform foresees support for non-agricultural economic activities under this measure. Finally, the commission is concerned that a greater emphasis needs to be placed on the development and implementation of national rural development strategies by member states rather than deriving strategies that maximise the drawdown of EU funds. Therefore, funding will be provided in the context of National Rural Development Strategies. Environmental concerns are an important issue for forestry and here the reforms aim to ensure that forestry development takes place in the context of a comprehensive and fully integrated land use policy in member states.

The objectives of Pillar 2 are to be pursued under 3 axes: improved competitiveness of rural economic sectors (including forestry), enhancing the environment, and local and community development. In each case, funding will be provided to achieve identified objectives and not as income support. This is an important point, from the point of view of the funding that will be available for forestry. The payment of forestry premiums to farmers under the existing measure is designed to support incomes, so as to encourage alternative land uses. However, with the introduction of de-coupling, the need to promote alternative land usage in this way is removed, while the single premium takes care of income support. Thus, it is inevitable that the reforms will have an important impact on the type of supports that will be available in the future for forestry. In addition, as a result of the focus on competitiveness and the environment, the emphasis is likely to shift from rates of afforestation towards the

[114] The discussion in this section of the report is based on documents published by the EU to date and on consultations with personnel in DG Agriculture and DG Environment. Of particular importance is European Commission (2004) *Proposal for a Council Regulation on Support for Rural Development by the European Agricultural Fund for Rural Development (EAFRD)* COM 490 final. However, it is recognised that the proposed reforms represent a start to a process that will involve much discussion and likely revision before the final programme is agreed.
[115] European Commission (2003) *op. cit*
[116] European Commission (2004), COM 490 final, Annex 2

nature of the planting and its subsequent management. In part, this shift is prompted by concerns that an increasing proportion of the funds allocated to any new programme will be used in meeting commitments from previous funding periods[117]. This shift will have a particularly important impact on Ireland given that the emphasis here has been on increasing the land under forest. In addition, there has been a relative failure to create much of the supporting infrastructure in the private sector that would promote the competitiveness and environmental contribution of forestry. (See Section 2 above)**.**

Table 5.7 provides an indication of the proposed changes by comparing the funding available under the existing programme with proposed changes.

Table 5.7: Proposed Forestry Funding in the period after 2006 (per ha)

Subject	2000-06	2006-2013
Maximum annual premium to cover loss of income from afforestation		
- Farmers	€725 per annum (maximum 20 years)	€500 per annum (maximum 10 years)
- Others	€185 per annum (maximum 20 years)	€150 per annum (maximum 10 years)
Aid for establishment	100% of planting costs (within a set cost structure)	40% of costs but 50% of costs in handicapped areas and under *Natura 2000*, and 75% of costs in the outermost regions*
Aid for the improvement of the economic value of forests and for adding value to the primary forestry production		40% of costs but 50% of costs in handicapped areas and under *Natura 2000*, and 75% of costs in the outermost regions
Natura 2000 and forest-environment annual payments		€40 to €200 per annum

Note: Outermost regions, as defined in Article 299 of the Treaty, include French overseas departments, Azores, Madeira and the Canary Islands.
Source: European Commission (2004) COM 490 Annex 1 and OJ L 160/102 (1999) Annex

It is immediately clear that the proposed reforms would result in a considerable reduction of EU support for forestry, as it has been implemented in Ireland under the current programme. The cap on premiums is lower and for a shorter period and the supports for planting are reduced, so that the value of the EU contributions both to the grant and the premiums would be reduced. However, the final two measures are potentially very important if Irish afforestation can be reformed to comply with EU objectives and allow for this drawdown. The first source of payments relates to improving the competitiveness of forests and increasing the value of output. This

[117] Under the existing structure of EU funding, future commitments to pay premiums incurred at the time of planting are not counted within the existing budget, as they will not be paid within the timeframe of the existing budget. Instead, they are carried forward as funds already committed when the new budget is introduced. Thus, a proportion of the budget that is identified for the period after 2006 is already allocated.

would involve improvements in the management of forests and assistance with investment in forest infrastructure. A key issue is that assistance would be provided under this heading for investments to improve diversification and in the development of new market opportunities such as renewable energy. Under the heading of adding value, assistance will be provided to investments in processing technologies and in marketing as well as in developing new products. Payments would also be available to aid in training and in accessing advisory services and in overcoming and preventing natural disasters.

This report, in line with other work referenced in Section 2 above, has identified that there are considerable weaknesses in the Irish forestry sector in respect of management, marketing and supporting infrastructure. It is important that the approach taken is revised to ensure that these weaknesses are overcome with the assistance of these measures. However, the changes required in Ireland are probably much greater than in most EU countries. Analysis by the Commission shows that in being forecast to spend 14.9% of its EAGGF Rural Development budget in 2000-2006 on forestry, Ireland is well above the EU average of 9.7%, but is not out of line with a number of countries such as Portugal, Spain and the UK[118]. What marks Ireland as something of an outlier however is the fact that this expenditure is forecast to be heavily concentrated on afforestation. It is estimated that from total expenditure of €382.3 million, €350.8 (71.8%) million will be on afforestation with the remainder being accounted for by all other expenditure on forestry. This contrasts with an average for the EU-15 of 49.7% of funds being spent on afforestation with the remainder on supporting the sector through other programmes. Only in the case of the UK (77% on afforestation) and Denmark (84% on afforestation) is expenditure heavily weighted towards afforestation. It can be argued that this distribution of expenditure is warranted given the low level of forest cover in Ireland and the objectives of the 1996 *Strategy*. However, the fact remains that the proposed reforms of EU Rural Development spending after 2006 will require a much greater reform of Irish forestry strategy than is the case for other members states, if EU funding is to continue to play an important role in the sector. In effect, the new situation as proposed could be viewed as requiring a menu of schemes from which those engaged in planting could choose, so as to both maximise the assistance available while achieving the greatest value given the location and soils in question.

The final area of EU funding identified in Table 5.7 relates to investments compatible with EU environmental objectives. The approach that guides EU thinking in relation to payments in this area is not based primarily on an economic valuation of the objectives. Rather, the objectives are identified and the natural characteristics that are required to achieve the objective are set out. For example, species diversification may require that a proportion of trees of a certain age are not cut but are maintained even if they stop growing. Payments are then based on the economic value lost by the producer. This can be characterised as a private compensatory approach to valuation rather than a public good valuation approach. While the risk arises from the fact that it is difficult to assess value for money with this approach, it is seen in the EU as a having greater potential for effective implementation.

[118] European Commission (2004) *Draft Commission Staff Working Document in Support of the Communication of the Commission to the Council and the European Parliament on the EU Forestry Strategy*, Table 4

The *Natura 2000* programme provides the framework for EU environmental objectives. The EU has identified a particular role for forests in promoting progress under this programme as over 50% of the *Natura* sites that have been proposed for conservation have forest areas[119]. Under the scheme, Member States identify which sites they wish to have included and, following discussion with the Commission, these are designated as special areas of conservation. While traditional commercial agriculture and forestry will not be possible on these sites, economic activities such as leisure, tourism, hunting and sustainable forestry are possible. The approach taken by the EU is to try to ensure that the costs associated with the identification of a site under *Natura 2000* are shared by all rather than falling on the landowner. This is reflected in the inclusion of a funding mechanism in the rural development measure.

The aim is to achieve multi-functional forestry on *Natura 2000* sites. This means that the non-timber benefits of forestry are emphasised and landowners are compensated for the lost timber or other land use production. The range of criteria is far too great for discussion within this report but consultations with the EU Commission suggest that there is a perception that Ireland will not maximise the potential contribution from the EU under the sites that have currently been designated and more are required. In effect, the emphasis placed on supporting forestry in *Natura 2000* sites means that if Ireland were to increase the area identified for the scheme, forestry could be increased with considerable support from the EU. However, this approach appears incompatible with the focus on increased timber production that has driven policy implementation in this area in Ireland in recent years.

It appears at this stage, therefore, that there will be a considerable alteration in the funding available from the EU to promote afforestation and that an approach that places a much greater emphasis on the management of plantations and the environmental impact and non-market benefits of the planting will be required in Ireland. The funding will be provided as a single programme to Member States, which have discretion in terms of the strategic allocation of the funding. Programmes along the lines of the Native Woodland Scheme, Forest Road Scheme, High Pruning of Conifers Scheme and support for Shaping of Broadleaves are likely to become increasingly important in the development of Irish forestry under the new proposals. Identifying the specific reforms that are required in terms of the implementation of forestry strategy in Ireland is beyond the scope of this report. However, the implication would appear to be that a greater emphasis is required on realising the non-timber benefits of forestry and that the proportion of commercial forests grown to maximise timber output will be reduced.

5.5 Issues Arising

This section has been concerned with trying to understand the impact of the factors that influence the decision to invest in forestry given the range of incentives and alternative land uses with which the farmer is presented. This is a complex issue but the situation is made more difficult by the fact that many of the factors, which determine the decision, are undergoing considerable change as a result of the reform

[119] European Commission (2003) *Natura 2000 and Forests: Challenges and Opportunities*

of the CAP. This is an important issue as the ultimate purpose of this analysis is to shed light on afforestation in the future, in terms of the land that will be planted and the type of planting that may take place.

The outcome under the *Strategy* to date is known. Farmers have planted the most commercial species, as would be expected, but the targets for afforestation have not been met in any year and Teagasc forecasts to 2010, based on a continuation of existing incentives, indicate that planting would fall well short at 13,000 ha per annum. Explaining this outcome is a first requirement. A straightforward comparison of the NPV of returns from forestry and agriculture indicates that forestry payments appear to be competitive in all areas of the country and suggest that more land should have been available. However, further analysis that includes the prospect of a reduced land value and risk due to the irreversibility of the investment decision, suggests that farmers are acting in a rational manner and retaining the option to invest in the future. This would explain the failure to reach the targets. However, there is also evidence that perceptions of risk may be exaggerated, for example, the analysis indicates that farmers were not maximising potential payments on a large area of land due to an emphasis being placed on ensuring that they remained in a position to qualify for extensification payments.

The reforms of the CAP will change considerably the environment in which decisions are made. At an aggregate level, the Fischler reforms do not appear likely to greatly promote forestry with projections indicating that farmers' incomes are likely to be somewhat higher than otherwise and only a limited reallocation of land out of livestock farming. However, detailed analysis of the decision facing Irish farmers indicates that there is considerable potential for land to be made available. Of particular importance, is the fact that it will be no longer necessary for farmers to retain land for extensification payment, thereby removing one of the main factors that has been identified as an inhibitor to afforestation. In addition, the ability of farmers to consolidate entitlements on part of their land and stack payments, means that there will be a clear incentive for farmers on low incomes to plant part of their land. In addition, there are reasons to believe that some of the land previously leased to farmers will now be available for planting. While all the land that will be impacted by these factors will not be planted, there are reinforcing effects so that, on reasonable assumptions, there are strong reasons to conclude that sufficient land will become available for afforestation to reach the targeted 20,000 ha per annum. However, this analysis is done in the context of existing forestry support structure and this is likely to change.

Indications have emerged as to the structure of EU Rural Development policy in the period after 2006. Some conclusions can be drawn on the direction although it must be emphasised that the material currently available represents an early stage in the process towards finalising policy, particularly in relation to the level of payments that have been identified. This said, it is clear that there is to be a considerable shift in policy. This can be characterised as a move away from promoting more forestry as an alternative land use, towards promoting forestry to achieve specific aims, particularly in relation to environmental objectives. It is likely that this will have a much greater impact on Ireland's approach to forestry, than is the case in most EU countries, given the much greater emphasis that has been placed on afforestation here. While there will certainly be a changed EU environment within which Irish forestry strategy needs

to be implemented, it would be wrong at this stage to simple characterise this as a simple reduction in EU supports in the future. Rather, the emphasis in afforestation needs to shift to a considerably greater extent towards planting that aims to maximise the wider economic benefits of forestry. In addition, there needs to be a greater emphasis on the competitiveness of the sector in terms of the timber produced and its marketing. This will involve a greater emphasis on managing plantations as a crop rather than as a means of income support in the short-term.

The main implication of this work is that the targets set for forestry in terms of afforestation remain viable but that the structure of the planting that takes place will have to change. The potential exists for many farmers who previously considered and rejected the forestry option and for many who may not have considered forestry, to be encouraged to invest. However, the afforestation will have to be undertaken in a manner that is compatible with EU objectives in Rural Development policy. Primarily, this means creating a competitive industry and achieving environmental aims. In terms of Irish forestry strategy this will mean a greater emphasis on separately identifying forestry that is for timber production purposes and forestry that will achieve objectives in terms of the non-timber benefits. It is expected that the former will receive the lowest level of support from afforestation but greater support for management. The latter type of forestry is likely to be less commercial and therefore should receive a higher level of support and the outlook is that this will be the case in terms of EU funding. Furthermore, given that attention will shift from support provided to encourage afforestation, budgetary mechanisms will be required to allow the sector to access the value that is created in public goods.

6. A Renewed Strategy for Development: Key Issues to be Addressed

6.1 Identifying an Appropriate Target for Timber Output

The idea of critical mass, which underlies the targets in the 1996 *Strategy* is based on providing sufficient timber output to facilitate and promote the development of a sustainable timber processing industry in Ireland. The aim was to achieve a level of timber output that was identified as critical to enable a competitive industry to emerge in Ireland. This level of production was identified as 10 million m^3, per annum, (or 12 to 15 million m^3 preferably,) and was to be achieved on the basis of a productive forest estate of 1.2 million ha. by the year 2030. This level of production was considered necessary to generate true competition and the operation of market forces and to support a range of processing industries. The *Strategy* also identified losses that would arise if this level of output were not achieved.

The analysis underlying these targets is contained in an earlier consultant's report[120]. Critical mass was identified as an important criterion for success because:

- The scale effect in the industry was deemed to be important due to its capital intensive nature;
- Sawmills required raw material to enable them to move to 2-shift operation;
- The panel industry needed to be of international scale; and
- Mass would secure the future of the industry.

It is clear from this that the analysis was based very much on operating structures within the timber industry and, consequently, the analysis depended to a considerable extent on expectations regarding future timber and product markets, and on the direction of innovations in the industry. However, the intervening period has seen developments that were not foreseen. For example, the scale argument in relation to the pulpwood mills is no longer applicable to all products. Smaller scale facilities have been developed and operate competitively in some parts of the industry. Thus, the scale effect is not as important as it was thought to be, and the pulpwood sector can be developed on the basis of plants utilising the most modern technologies and processing operating on a smaller scale**.** Furthermore, Irish sawmills have moved already to the maximum number of shifts in many cases, or will have done so within a decade. This would suggest that the critical mass arguments, as they have been articulated to date, may provide a rationale for an afforestation programme of 20,000 ha per annum for a limited period only.

The approach taken in this report is somewhat different, with an emphasis placed on maximising the returns from forestry in terms of its wider potential contribution to the economy. There are two elements to this. The first argument, supporting the target of 20,000 ha. afforestation per annum, which is captured in Section 2.7 above and detailed in Sections 3 and 4, shows that investment in forestry provides a positive return to the economy when all economic impacts are included. The results indicate

[120] *Strategy for the Development of the Forest Sector in Ireland to the Year 2015*. Report prepared for the Department of Agriculture, Food and Forestry by Deloitte & Touch Management consultants and Jaakko Poyry Consulting (UK), April 1995

the importance of adopting this broad view. Furthermore, this will become more important if the proposals for the reform of EU Rural Development policy are introduced along the lines set out in Section 5.

The second argument is somewhat similar to the original rationale, in that it is based on projected timber output. However, while the 1996 *Strategy* was starting from a basis of growing the sector, Section 3 above shows that the projected output given a continuation of existing planting rates will lead to considerable contraction in value extracted from the sector after 2040. The core problem is that following a period of rapid and sustained growth in production, it is projected there will be a sharp decline. The difficulty is that considerable investment in processing capacity is required if the production in the period 2030-39 is to be handled. However, the prospects of this investment being forthcoming are diminished if the expectation is that the level of output is temporary.

The projections show that an afforestation programme that reached its targeted level of 20,000 per annum in the period 2008 to 2035 would greatly reduce this problem. While there would still be a decline after 2040, the extent and the persistence of the decline would be much less, to the extent that the problem could be overcome by staggered harvesting of crops. This provides a very strong case for maintaining the target that has been in existence, if the value of existing plantations is to be realised. This is the case irrespective of the innovations that might take place in the sector. Furthermore, the reforms of the CAP present an opportunity for this higher level of planting to be reached. ***Hence, a fundamental target of any renewed strategy for forestry development is a net annual rate of afforestation of 20,000 ha. Unless, adequate supports, initiatives and management control processes are put in place to achieve this target, then any future strategy is unlikely to meet with any higher levels of success, in terms of providing value for money, than has been the case to date.***

6.2 Ensuring Industry Development and Wealth Creation

6.2.1 Developing a Competitive Industry

The most obvious difference between experience to date and the objectives of the strategy has been a failure to achieve the targeted level of afforestation. However, the analysis of experience under the 1996 *Strategy* in Section 2 above, while acknowledging that there has been a big increase in private sector afforestation, identified a number of important deficiencies in terms of the sector as it has developed over the period. Thus, weaknesses exist in terms of the timber product, institutional weaknesses, and insufficient attention to the wider benefits of forestry. These will need to be addressed if the full potential of the sector is to be realised.

Many operators and representatives have identified weaknesses in the supporting infrastructure in areas such as marketing and management, and in the general level of knowledge among growers. The risk is that the product produced will be low value and that the non-realisation of forestry's potential will be compounded by a failure to

develop adequate marketing and logistics systems. One striking issue is that growers perceive that addressing this deficiency is a role for someone other then the industry to address. The sector is not creating the types of organisations that support agriculture in the form of co-operatives and single representative organisations. Instead, it remains disparate, of very uneven ability and lacking in a clear purpose. This outcome is a result of the way in which forestry has been promoted and the *Strategy* implemented primarily as a means of supporting farmer incomes.

The public sector has a role in providing the framework for such developments to occur but not in providing the services. This will require an approach increasingly determined by an enterprise development strategy focussed on forestry, rather than the administration of income supports. The proposed EU reform of Rural Development policy will require policy to move in this direction, as a result of the greater focus on supports for measures to underpin competitiveness, rather than income support. However, in advance of a move in this direction, and given that by 2010 some 30,000 ha. of privately owned forests will be age 18 and due for first thinning, the sector in Ireland needs to create the structures that will support the development of a framework to improve competitiveness. ***To achieve this, while allowing the responsibility to remain with the private sector, it will be necessary for the public sector to promote the required developments. This should also involve the creation of a Forum representing relevant interests to identify requirements and areas of responsibility.***

The 1996 Forestry *Strategy* identified a need to implement radical changes in the log sales system, including electronic auctions, open competitive bidding, transparent reserve pricing, standardised log measurement, provision for forward sales, and periodic independent audit. While progress has been made, the reserve price mechanism requires review to reflect the changing dynamics of the domestic market and to facilitate penetration of the UK market. In terms of timber quality, larger log sizes and a greater range of species are required, if timber from Irish forests is to achieve an increase in its share of the Irish market. This is particularly the case in relation to the construction sector.

The small average scale of plantation is a potentially important problem in terms of the competitive supply of timber. The evidence is that opportunities for economies of scale could be lost. The market is beginning to provide a range of services to farmers for the long-term management of the crop. However, economies of scale will mean that, ***in the absence of some form of group co-operation, sufficient returns are unlikely to be available and the services uncompetitive in areas of less than 10 ha.***

Under the *Strategy*, policy targeted the development of a comprehensive inventory and planning system for the forest resource. Progress on the development and implementation of information technology systems within the Forest Service was criticised for major cost and time overruns and functional shortcomings and the GPAS project was terminated, prematurely in 2000. The ground survey, planned to commence in 1998 was not undertaken nor was the inventory of private woodlands. A sample based national forest inventory is due to commence but it will need to be repeated at regular intervals and the lack of full time staff does not demonstrate commitment in this regard. There is no integrated database incorporating forest, environmental, ownership and administrative data. Furthermore, some considerable

work is still outstanding to update and clean existing data and place it in a format and database that is suitable to provide the information required. No county integrated forestry plans have been completed and the IFS project is effectively due to mapping resources being diverted elsewhere. Work on the preparation of a National Sustainable Forestry Plan has not started and there are no immediate plans to initiate this work. ***The current position means that a number of important issues in relation to planning and investment in the industry will be inhibited due to the absence of national forecasts. This situation should not be allowed to persist and good information should be made available to the sector. Overcoming these deficiencies must be prioritised and if the required human and IT resources cannot be allocated within the Forest Service then outsourcing should be considered.***

6.2.2 Ensuring Adequate Processing Capacity

While the arguments identified in this report in favour of retaining the afforestation target of 20,000 ha. per annum differ somewhat from those underpinning the 1996 *Strategy*, the capacity of the processing sector to handle the projected output remains an important issue. In summary, the baseline projections indicate that there would be a shortage of capacity in the sawmill sector early in the next decade and that panel mills are currently operating close to capacity. Sufficient material would be available requiring investment in additional processing capacity from about 2010. However, if output continues to fall below projections and if private sector thinning is lower than assumed in the baseline – in part because of the shortage of capacity in the pulpwood processing – then the requirement for investment would be pushed back to late in next decade.

Thus, there is some uncertainty as regards precisely when additional investment in processing capacity will be required. However, the extent of the increase in forest output over the next thirty years or so means that new investment in sawmills and in panel mills will be required under all reasonable assumptions, by the end of the next decade. In order for this to happen, there will need to be a high level of confidence that output levels being achieved at that time can be sustained into the medium term and beyond. As discussed in Section 3, this condition can be met only if an annual rate of afforestation of 20,000 ha. is achieved by 2008 and sustained out to about 2035, (see Section 3.2 above).

The possibility exists that there will be some incremental expansion of existing panel mills. However, any deficiency in terms of ensuring a market for pulpwood could cause private growers to avoid thinning crops. This would be damaging in the longer term, as it would lead to lower overall output growth, poorer quality and lower value being created. In addition, poor markets would provide a negative signal to potential growers that income couldn't be realised from thinning, thereby reducing the incentive to plant. ***It is important that this situation is not allowed to develop and that market opportunities are created for thinning. The two most important are likely to be the use of residues and pulpwood for energy production in Ireland or the production of pellets for export for use in energy abroad. Again, a requirement of any renewed strategy is that effective initiatives are included to deal with this issue in the short-term.***

6.2.3 Recognising and acknowledging the Environmental Dividend

Producing goods other than timber and contributing to objectives other than economic growth that have been identified with rural development is an increasingly important driver of EU policy. This is reflected in a number of recent policy statements[121].

> *Forests provide the raw material for renewable and environmentally friendly products and play an important role for the natural landscape, biological diversity, erosion control, the global carbon cycle and water balance. ...Forests are essential for providing environmental, protective, social and recreational services, especially in the light of an increasingly urbanised society.*
>
> European Commission (2003a) p. 13

Recognising the context of the evaluation in Section 4 in respect of non-monetary benefits of forestry is important. First, the forestry *Strategy*, as it has been implemented to date in Ireland, has emphasised timber production so that the contribution of forestry under other headings has not been maximised. Indeed, it may be the case that forestry has made a negative contribution in some instances. However, guidelines are in place to achieve these aims and EU policy in the future increasingly will support forestry that increases these values rather than the commercial production of timber. Second, it is often the case that achieving such benefits requires regulations and incentives, since increasing the contribution of forests in these areas may conflict with the maximisation of the commercial returns through timber production. On both counts, it is important that the non-timber benefits of forestry are fully recognised and reflected in policy to ensure that the industry is in a position to maximise total returns and that this can be achieved on the basis of reasonable evaluations of the relative importance of forestry, from the viewpoint of achieving commercial returns and non-timber benefits.

The non-timber benefits of forestry were assessed under a number of headings but data deficiencies limited formal evaluation to the three most important areas – leisure, carbon storage and bio-diversity. Most progress has been made in evaluating the carbon storage value of forestry and this is reflected further in the discussion in Section 6.7 below. The approach taken in relation to recreation and bio-diversity has been regulatory in nature and it is likely that this approach will have to be maintained into the future, as effective economic incentives for growers to provide recreation and bio-diversity benefits are unlikely to be devised. Within this, it is important that the incentive structure promotes, in as far as is possible, the type of forestry that will maximise the total benefits of forestry. One important issue is species diversity, which impacts also on non-timber benefits such as landscape. Considerable progress has been achieved in increasing species diversity in afforestation in Ireland, although the original target for broad-leaf species was never reached and has now been increased. The proportion of Sitka spruce now accounts for less than 60% of afforestation. However, the quality of land being afforested is a significant issue and there is concern regarding the quality and on-going management of planted broadleaf species that have been planted on marginal sites and are being neglected after year four.

[121] European Commission (2003a) *Extended Impact Assessment: Rural Development Policy Post 2006* and European Commission (2003b) *Natura 2000 and Forests: Challenges and Opportunities*

Although regulations have been implemented, there has been insufficient research undertaken into what mix of species is most suited to the land coming into forestry or what species offer potential for added value and a return to the grower. The Native Woodland Scheme was introduced to protect and expand Ireland's native woodland resource. Progress was inhibited by the withdrawal of funding in 2003. Regarding leisure, while policy has aimed to encourage provision of public access to forests, access to private forests is negligible and remains contentious. This requires resolution.

The debate on environmental issues in relation to forestry has become polarised and has come to be perceived as a threat to the viability of the sector, from a commercial point of view. An optimal policy would need to recognise and value non-timbers benefits and ensure that they are distributed to producers and the wider economy in an appropriate manner. This will not be possible as a complete solution and regulations will remain important. However, the regulatory approach that has been used to date in Ireland is that growers, who invest in trees, perceive that they are penalised by regulations. Against this, people who wish to avail of the non-timber benefits that forestry can deliver perceive that maximisation of commercial returns leads to inappropriate afforestation practices. Where there is inadequate appreciation of the value of NMBs – including the recreational value of forests, carbon sequestration from forests and the role of forests in sustaining bio-diversity – misuse or overuse of environmental resources will occur. This risks leading to an outcome where neither growers, nor those whose primary interest is in maximising the non-timber returns, are pleased and the creation of a difficult environment for policy making. As a result, it is important that research is undertaken to value the non-timber benefits and the results incorporated into policy implementation so that informed decisions can be taken, and seen to be taken, in a manner that maximises the total returns to the economy and society. In addition, ongoing review of what is being achieved is required, so as to ensure that the appropriate incentives are provided to investors so as to minimise the costs of achieving the desired outcome.

6.3. Ensuring Efficiency of the Incentive Structure

6.3.1 Integration of Agricultural and Forestry Payments

The 1996 *Strategy* identified a need for various programmes that impact on the relative returns from forestry and other land uses to be examined. The perception, however, is that the development of the REPS programme has made the problem that was identified more difficult to solve. In short, there is a perception that forestry funding is unable to compete with the returns that are available from REPS.

This is an overly simplistic view. The opportunity to use land for REPS does indeed form a clear alternative to forestry. However, research suggests that farmer concerns about eligibility for extensification payments and consideration of the risks involved in forestry provide a greater difficulty in encouraging forestry. Furthermore, the CAP reforms change the situation considerably and will remove a number of the inhibiting factors from the decision.

However, the changes do not mean that the potential for competition between payments to inhibit planting has been eliminated. Comparison of potential incomes indicates that farmers who qualify for a two single payment entitlement will have a clear incentive to plant trees, but the incentive is less clear for higher income farmers. An implication of this situation is that an increase of income possibilities from agricultural payments would progressively reduce the area of land available for forestry.

It has been suggested to the consultants that forestry payments should be index-linked to inflation. However, the consultants reject this approach as an inefficient way to determine payment levels, on the basis that it introduces a considerable potential for deadweight i.e. that payments would increase when there was sufficient land available in any case. In addition, it misses the point that the problem is not that the farmer cannot earn a positive return from forestry, but that the return would not be competitive with other payments if these increase. The solution to this problem is to link changes in forestry payments to changes in agricultural payments, including REPS payments, by means of an index of agricultural supports. The introduction of the single payment greatly simplifies the situation and the construction of such an index should be readily possible. This would have the effect of ensuring that forestry payments retain their position relative to other payments.

The perception of risk regarding future returns from forestry is an issue also and this indexation would reduce this problem. An important aspect here is that there would need to be a clear statement of commitment by the relevant authorities to this arrangement. A closely associated issue is the need to clarify the situation regarding forestry on farms that are in the REPS scheme. There is a perception currently that commercial forestry could in some manner affect eligibility for REPS on adjoining land. Even if there is no foundation to such views, it is obvious that in a situation where participation in forestry is susceptible to perceptions of risk, initiatives to clarify the situation would have a positive impact on planting.

6.3.2 Design of Incentive Schemes

The analysis in this report has identified that it is appropriate for public funds to be used to support private forestry. This is because of the difference in the value of timber when looked at from two points of view. The public benefits that are created are much larger than the value of timber and there is a need to address the distortions that exist in terms of the factors that influence the land use decision as a result of agricultural supports. It has also been identified that the EU is moving towards a policy that envisages the payment of premiums for a shorter time period (see Section 5.4). The rationale for supporting forestry needs to be reflected in the structure of premiums. In other words, it needs to be seen as payment for the production of public goods and the payment to farmers for compensation for income foregone from agriculture. In view of these factors, it is proposed that the premium payments for afforestation in the future should be reformed so as to reflect this underlying rationale

and that the compensation should be payable over a shorter period. On this basis, the following reform is proposed[122].

The premiums should be changed so that all growers receive the basic premium at the current levels of €171.41 per hectare for Sitka spruce and diverse conifers, and €184.11 per hectare for broadleaf species. All landowners (farmer and non-farmer) should be eligible to receive these payments for a period of 15 years. The farmers' compensatory payments – the extent to which farmers' premiums exceed the premiums payable to non-farmers – should be paid for the first 10 years of the plantation only. However, the rates should be adjusted so that the total present value when discounted at 4% per annum is equal to the existing value of the premiums, which are paid over 20 years. This payment should include also the supplementary payments and compensation for the shorter period over which the basic premium is paid to farmers i.e. the reduction from 20 to 15 years. The effect will be that the present value of payments, from the point of view of farmers, is unchanged.

The recommendation that the NPV of payments should be unchanged is based on an assumption that there will be no changes made to REPS and farm area payments. However, if the rates at which payments are made under these schemes should change, then a similar percentage change should be made to the farmers' forestry compensatory payments so as to maintain relative values from the point of view of recipients. This requires that ***premiums should be adjusted according to an index based on changes to total farm payments under the Single payments, REPS and Area Based Compensation payments[123].***

Comparing the data in Tables 6.1 and 6.2 shows the impact of this reform on annual premium rates. Table 6.1 shows the existing rates of premiums payable when the typical value of the supplement is included. This has been calculated on the basis of existing supplement rates and average plantations sizes in recent years. The total values are derived by multiplying the annual premium by the number of years over which it is payable. In calculating the present value of these payments to the exchequer, the risk free discount rate of 4% is used since it is assumed that this is a commitment by the exchequer.

Table 6.1: Existing Premiums Paid over 20 years (including average supplement)

	Current Value per ha		NPV Discounted @
	Per annum	Total	4% per annum
Sitka	356.92	€7,138.40	€4,850.66
Diverse	436.91	€8,738.20	€5,937.75
Broadleaf	478.18	€9,563.60	€6,498.62
Unenclosed	209.51	€4,190.20	€2,847.31

Table 6.2 shows the values of premiums that would be payable to farmers over 10 years – including the additional basic premium which is payable for 15 years – that would keep the present value of payments to farmers constant.

[122] This reform is analysed in the next section as Scenario C.
[123] This requirement has no implications for the calculations below as a no change policy is assumed.

Table 6.2: Revised Framers' Premiums (over 10 years) following Proposed Reform

	Current Value per ha		NPV Discounted @
	Per annum	Total	4% per annum
Sitka	534.48	€6,201.90	€4,850.66
Diverse	668.51	€7,542.17	€5,937.75
Broadleaf	732.95	€8,250.09	€6,498.62
Unenclosed	287.49	€3,731.94	€2,847.31

For a hectare with the targeted species mix, the total current value of premiums falls by 16.6% compared to existing situation as shown in Table 6.1 above and the present value of this to the State falls by 4.2% while keeping the value to the farmer constant. Finally, Table 6.3 shows values for farmers' compensatory premiums i.e. the difference between the premiums payable to farmers and non-farmers. This would now exist for 10 years only with both sets of growers continuing to receive the basic premium for a further 5 years.

Table 6.3: Farmers Compensatory Premiums following Proposed Reform

	Current Value per ha		NPV discounted @ 4% per
	Per annum	Total	annum
Sitka	363.07	€3,630.75	€2,944.86
Diverse	497.10	€4,971.02	€4,031.94
Broadleaf	548.84	€5,488.44	€4,451.62
Unenclosed	116.08	€1,160.79	€941.51

Note: The values in this table are those in the previous table with the basic premium, payable over 15 years, removed. These payments will be made for 10 years only to farmers.

One potential problem arising from this reform is that the 10 year premium is very short in the context of broadleaves. Indeed, consultations have identified that there is an issue in this regard even with the current 20 year period for the premium. As a result, further analysis was undertaken assuming that the broadleaf premium remains at its current level and is paid over 20 years as at present. The implications of this for the financing options discussed below are detailed in Appendix 6, Table A6.5.

6.4 Financing of Support Structures

6.4.1 Basis for Estimating Future Funding Requirements

Future payments for forestry will be composed of three elements: payment of premiums already committed covering the period up to 2023, payment of grants up to 2040, and payment of premiums committed in the future during the period 2005 to 2059. The establishment grant covers the cost of planting the land with forest. The cost must be matched by supporting invoices. The cost varies according to the species being planted, whether enclosed or unenclosed land is used and whether the forest is being planted by the individual landowner (e.g. farmer) or by a forestry company.

The establishment grant payment is made in Year 1. A further maintenance payment of approximately 33% of the initial payment is made 4 years after establishment.

Although the premium rates that were offered at the time of planting in the past were lower than currently, revisions in the rates have been backdated so that the current rates are relevant for assessing the value of outstanding commitments. In addition to these payments, farmers are also entitled to receive a supplement of €12.70 per hectare, for planting on enclosed land if the plantation is greater than 6 hectares and €25.40 if it exceeds 12 hectares. Examination of farmer planting in the past decade shows that the average supplement payable is €20.44 and the projection of future commitments assumes that this does not change. It is assumed that these per hectare payments will rise approximately in line with inflation, in other words, the values calculated can be read as real values in 2004 prices.

Table 6.4 sets out the annual expenditure by the State analysed by establishment grants and premia payments for the last three years to 31 December 2003.

Table 6.4: Total Funding Requirement 2001-03

	2001 €'000	**2002 €'000**	**2003 €'000**
Hectares Planted	15,464	15,054	9,097
Establishment Grant	35,553	35,850	23,479
Maintenance Grant	7,820	12,384	3,962
Premium Payments	42,474	48,099	49,326
Total Funding	85,847	96,333	76,767
EU Funding	47,900	49,000	50,100
State Funding	37,947	47,333	26,667
	85,847	96,333	76,767

EU funding for afforestation was agreed for a period of six years between 2000 and 2006 under the CAP Rural Development Plan 2000 - 2006. EU funds of €350.8m were allocated to the Irish afforestation programme in 2000. The funding allocation is to be reviewed in 2006 for the new development plan commencing in 2007.

The analysis in this report has concluded that forestry policy should aim to achieve net afforestation of 20,000 per annum into the medium term. This will provide the raw material for the development of a viable timber industry and will allow for the wealth creating potential of the sector to be maximised, (see Section 6.1). The projections earlier in the report adopted a cut-off point for afforestation of 2040 with a declining rate after 2035 (see Section 3). It should not be assumed, however, that this is a recommendation for zero afforestation beyond this date. Beyond this date, reforestation of clearfelled land will provide sufficient forest cover to maintain a steady amount of planting and timber output from conifers into the longer term. In other words, this represents the approximate time beyond which a steady state is achieved with a declining commitment to fund the industry. Thus, the period up to 2040 is when the commitment of funds is maximised, although these will continue to be paid beyond this date, for planting in years towards the end of the period.

The analysis also concludes that, although afforestation of only 13,000 ha per annum is projected under the existing regime, the change to the single premium will have an important impact and will make available sufficient land to achieve the 20,000 ha target, without additional premiums, (see Section 5). To consider future funding requirements, a number of scenarios based on the current grant and premium structure have been developed assuming 13,000 and 20,000 new afforestation each year, respectively. Options for amending the funding structures are considered later, (see Section 6.5).

Projections of funding requirements have been made based on three scenarios:

- Scenario A refers to a situation where the expected increase in afforestation does not take place. A continuation of afforestation at around recent rates of 13,000 ha per annum is assumed;
- Scenario B refers to a successful outcome in terms of achieving the target and the rate of afforestation rises to 20,000 ha per annum in the short-term and is maintained at that level up to 2035 then reducing to zero in 2040.
- Scenario C (see Section 6.3.2) in which it is assumed that the length of time over which the additional premium that is paid to farmers is reduced to 10 years and the annual premium is adjusted to keep the present value of the payments to farmers constant[124]. This Scenario is also used as the basis for identifying the potential impact of pre-selling timber at year 10 and alterations to the grant payments on the funding requirement.

The estimation of funding implied by these scenarios is based on similar assumptions regarding species composition, timing, rotation and productivity as in the production projections (see Section 3 and Appendix 2). The values derived for each year are the aggregate of grants payable, farmers' premium multiplied by the proportion of farm forestry in the total, and non-farmers' premiums multiplied by the proportion on non-farmers in the total. Payments have been adjusted for changes in the species mix over the years and the proportion of the land planted that is non-enclosed. The non-farmers premium is also adjusted to allow for the shorter time period over which it is paid. The cost of the farmer's supplement is also included in the premium values.

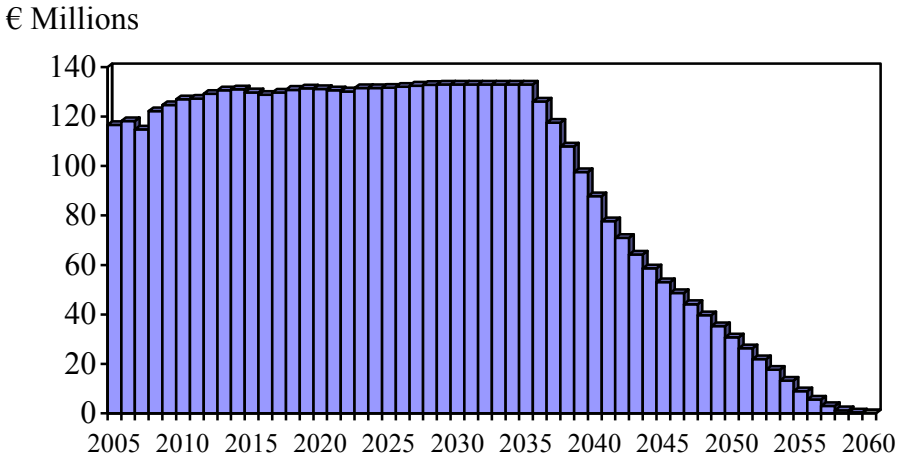
6.4.2 Funding Projections

Scenario A

The funding required for premiums and grants is shown in Figure 6.1 assuming that afforestation is along the lines of the Teagasc forecast to 2010 and 13,000 per annum thereafter, gradually declining after 2035.

[124] In practice, realising the full benefits of this scenario would require that a system for the forward selling of the timber would need to be put in place so that the farmers could earn income following year 10. Altering the premium structure would facilitate this development.

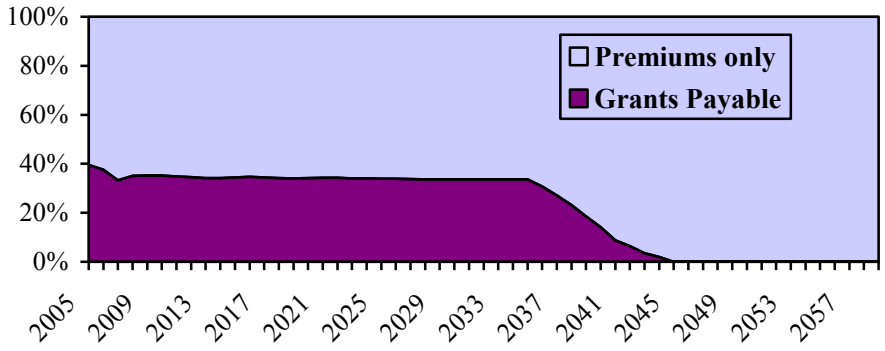
Figure 6.1: Funding Requirement, 13,000 ha per annum



Under this scenario, the annual funding requirement rises from a projected level of €116.5 million in 2005 to just under €133 million per annum in the period 2027 to 2035. It then declines and is eliminated in 2059. The total commitment under this scenario is €5.17 billion up to 2059. Applying the risk free real discount rate of 4% to this commitment by the public sector, the NPV of this stream is €2.5 billion.

Premiums, including the supplements, account for an increasing proportion of total payments and account for about 71% of the total payments in this projection. This is shown in Figure 6.2.

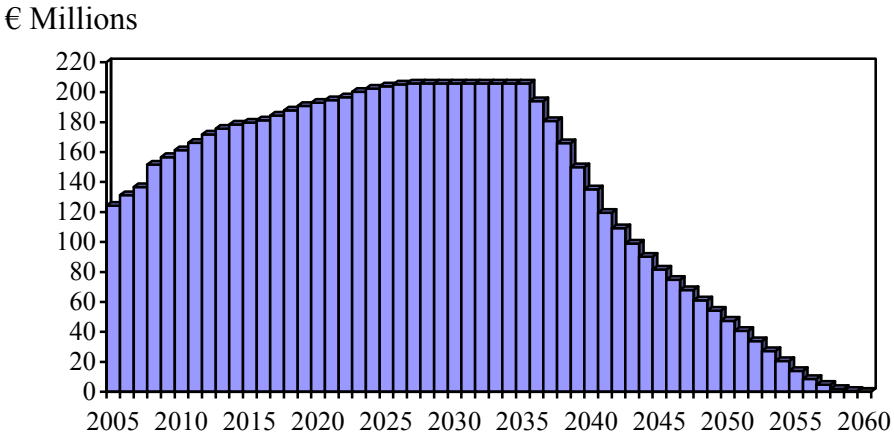
Figure 6.2: Premiums and Grants as a Proportion of Total Payments



Scenario B

In this case, the higher rate of afforestation means that the funding required rises from €124 million in 2005 to a peak of around €206 million per annum in the period 2027 to 2035 before declining. This profile is shown in Figure 6.3.

Figure 6.3: Funding Requirement, 20,000 ha per annum

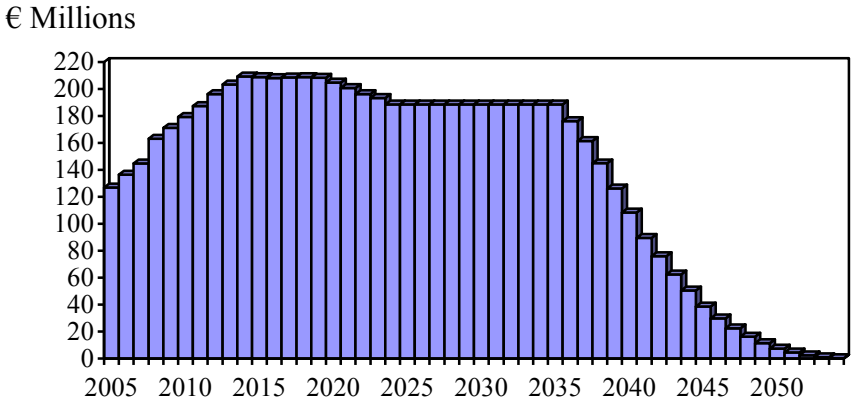


Increasing from 13,000 to 20,000 ha per annum means that the funding levels required for Scenario B far exceed Scenario A due to the 54% increase in annual volumes. This volume increase has an effect on both the grant and premium payments due. The total liability implied in this scenario is €7.5 billion, with a NPV of €3.5 billion. This is a 40% increase in present values over Scenario A. The profile of the split between grants and premiums would be similar to Scenario A and, in total, premiums account for 69% of the funding.

Scenario C

This scenario is devised within the parameters identified in Section 6.3.2 above. These are that afforestation will be 20,000 per annum for the period under review, the period for payment of the farmers compensatory premium is reduced to 10 years, and the rate of premium is adjusted so that the present value of payments to farmers is held constant. The value of the premiums per hectare per annum will be adjusted to the level shown in Section 6.3.2. Non-farmers premiums are unaffected under this scenario. The effect of this reform is to reduce the overall cost of the programme compared with Scenario B. The calculations show that it is possible to maintain the present value of the payments to farmers while reducing the total monetary commitment by the State. The funding profile under Scenario C is shown in Figure 6.4.

Figure 6.4: Funding Requirement, Scenario C



The total funding commitment under this scenario is €6.95 billion for the period under review, with the peak annual payment occurring somewhat earlier at just over €209 million in 2014. There is a reduction in the total value of the commitment of 7.5% compared to Scenario B while the present value of payments remains constant, at €3.52 billion. The proportion of premium payments in the total is also lower than under Scenario B, accounting for 66.5% of total funding over the period.

Table 6.5 below sets out the amounts payable under each scenario, the peak requirements and the net present value of cash-flows[125].

Table 6.5: Summary of Funding Requirements under Alternative Scenarios (€m)

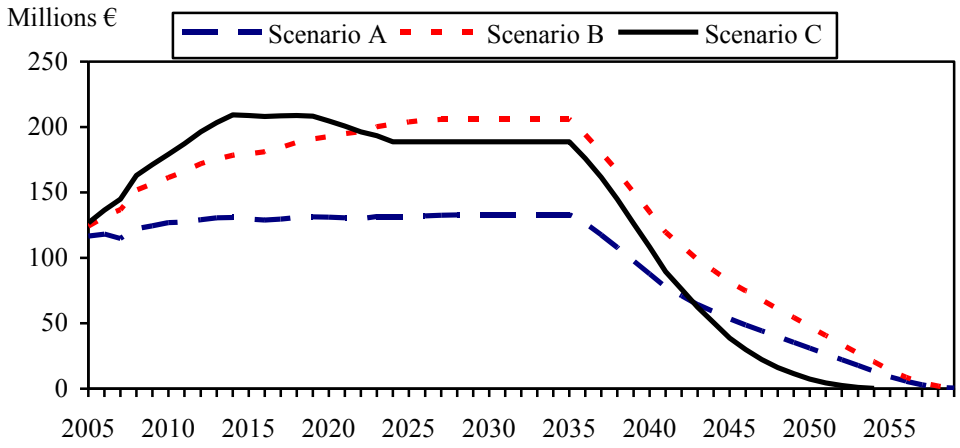
	Scenario A	**Scenario B**	**Scenario C**
Hectares per annum (2010-2035)	13,000	20.000	20,000
2005 Projected Payments			
Grant (Establishment and Maintenance)	46.12	52.72	52.72
Premium Payments	70.43	71.63	74.09
	116.55	124.35	126.81
Peak Requirement			
Year	2029 – 2035	2027 – 2035	2014
Grant (Establishment and Maintenance)	45.58	70.12	70.12
Premium Payments	88.27	135.80	139.21
	133.85	205.92	209.33
Total Payments (2005 – 2059)			
Grant Payments	1,537.91	2,328.33	2,328.33
Premia Payments	3,647.18	5,183.05	4,621.18
Total	5185.09	7,511.38	6,949.50
NPV (Discount Rate 4%)	2,520.29	3,515.43	3,515.43

The changes in premium payments between Scenario B and the shorter time period for Scenario C are significant. The total commitment of funds to pay premiums falls

[125] If the optional modification to Scenario C is included so that the premium structure in relation to broadleaves is not changed, then the saving relative to Scenario B is smaller when compared with the saving under Scenario C. See Table A6.5 for details.

by 10.8% while keeping the present value of growers' receipts constant. Figure 6.5 demonstrates the differences in the total funding profiles of the 3 Scenarios.

Figure 6.5: Comparison of Funding Requirements



When compared with the current provisions for 20,000 ha. afforestation, moving to the shorter period for farmers' compensatory payments, while keeping the present value of payments to farmers constant, would reduce the total commitment by 7.5%. ***In view of the significant saving that can be achieved, while maintaining the present value of these payments to farmers, it is recommended that any future strategy should incorporate a shortening of the premium payment period to 10 years. The rate of premium should be adjusted to preserve the present value of the income stream to growers, when compared with the existing regime.***

6.5 Future Funding Arrangements

A number of options for the funding of forestry plantations have been considered. These include:

- Current Structure - Exchequer and EU funding
- Change in Policy – Adoption of Scenario C
- Government Acquires Rights to Sale of Timber
- Revision of Grants

6.5.1 Current Structure

At present, exchequer funds are used to finance costs associated with preparing land for afforestation, fencing, planting, drainage and operating costs for year one through the establishment grant. Public funds are also used to provide maintenance grants to all growers four years after planting and an annual premium for 15/20 years (non-farmer and farmers respectively) to compensate for the loss of income from making the land available for afforestation.

Growers are provided also with an additional future revenue stream as they maintain the rights to sell the timber. This provides growers with access to returns available on the sale of timber, but the Government has no property rights or contractual obligations in relation to the timber. Table 6.6 shows the average sales receipts from a single hectare of forest over a 40-year period.

Table 6.6: Revenue from Timber Sales

	Age/Year	Volume per Ha (cu. m)	Price (Per cu. m)	Total Receipts €
First Thinning	21	38	7.37	280.06
Second Thinning	26	38	19.79	752.02
Third Thinning	31	38	30.44	1,156.72
Fourth Thinning	36	38	41.47	1,575.86
Clear Fell	40	245	50.02	12,254.90
				16,019.56
NPV (Discount rate 5.5% pa)				2,285.88

Table 6.7 shows the profit and loss account for a single hectare of forest planted including grants, premia, costs and timber sales revenues. The table sets out the calculations based on the status of the planter and covers a 40-year period from plantation to clear fell. The calculations are based on the proposed mix of species: Sitka 50%, Diverse 20% and Broadleaf 30%. For each option, a net present value of the total net profit has been calculated along with the NPV of the cost to the State[126].

Table 6.7: Forestry Profit and Loss Account per Hectare

	Farmer		Non-Farmer		Average	
	Gross €	NPV €	Gross €	NPV €	Gross €	NPV €
Income:						
Timber Revenues	16,020	2,286	16,020	2,286	16,020	2,286
Grants	3,506	3,380	3,506	3,380	3,506	3,380
Annual Premium	7,167	5,065	2,397	1,948	6,733	4,781
	26,693	10,731	21,923	7,614	26,259	10,447
Expenditure:						
Planting	3,506	3,380	3,506	3,380	3,506	3,380
Operating Costs	900	331	900	331	900	331
	4,406	3,711	4,406	3,711	4,406	3,711
Net Profit	**22,287**	**7,020**	**17,517**	**3,903**	**21,853**	**6,736**
State Payments	10,673	8,445	5,903	5,328	10,239	8,161

In NPV terms, the commitment of funds by the State on average is €8,190 per hectare over 20 years. Including the timber sales revenues, the net profit earned by farmers is, on average, €7,020 in NPV terms and €3,903 to non-farmers. This is equivalent to an average income of €6,736.35, on the basis that farmers undertake 90.9% of planting

[126] In this calculation, the operating costs and the returns from the timber are discounted at the risk adjusted rate of 5.5% per annum while the present value of State payments is calculated using the risk free rate of 4%.

Currently EU funding represents 75% of the co-financed public cost of the forestry programme or 51% of the total cost. This funding was agreed in 2000 in advance of commencement of the CAP Rural Development Plan and is agreed until 2006. This arrangement is to be reviewed in 2006 for the 2007-2013 period (see Section 5).

Internal Rate of Return of Investment in Forestry (IRR)
Internal rate of return (IRR) considers the rate of return on an investment derived from future cashflows. In the current situation, given that the State funds the planting and maintenance of the forests, while also providing annual premia to the land owner, the investment by the land owner relates to the provision of the land for planting. It is quite difficult to quantify the value of the land investment. However, it relates primarily to the difference in the value of agricultural land and planted forest land i.e. any reduction in land value as a result of planting forest on the land. For the purpose of this report, as per the current market, a value of €750 per hectare has been applied as the value of the farmer's investment[127]. This also assumes that the land will retain a value in the long term that is similar to the current value of planted land. Hence, the full value of land is not included in the returns calculation.

For the purposes of calculating a farmer's IRR, it has been assumed that any grant and premium payments do not represent returns and are treated as compensation for the loss of other income. The IRR is calculated by comparing the investment with future timber revenues. Table 6.8 below sets out the IRR calculation for the various types of grower over the lifetime of the forest (40 years). It can be seen that as premium income is not included in the calculations, there is no difference between types of growers in respect of returns available.

Table 6.8: Internal Rate of Return Calculation (per Hectare)

	Farmer	**Non-Farmer**	**Average**
	€	**€**	**€**
Value of land invested	(750)	(750)	(750)
Timber sales revenues	16,020	16,020	16,020
Net revenue	15,270	15,270	15,270
IRR	8.06%	8.06%	8.06%

It should be noted that while the revenues projected from the State are secure, the timber sales revenues will be subject to normal market conditions which may increase/decrease from the amounts included in the table above. Any variance will impact positively/negatively on the IRR calculation.

[127] This estimate of the fall in land values once planted is based on consultations with personnel in the sector

6.5.2 Change in Policy – Adoption of Scenario C

As can be seen from the current situation, the land owner provides the land for planting, receives a grant for planting the forest, premium income to compensate for any other income lost as a result of afforestation and all timber sales revenues. In this structure, there is limited scope (if any) for the State to reduce its financial exposure except by reducing the annual planting levels. Hence, to introduce any ability for the State to recoup funds will require changes in the current funding policies and mechanisms.

In Scenario C a change in current policy is required in relation to premium payments. In this scenario, all growers would receive a basic premium at the current levels for 15 years. Farmers would also receive compensatory (farmer's) premium for 10 years, at a level such that the present value of payments to farmers is unchanged from the current structure. Non-farmers would not be affected by the adoption of Scenario C as they would still receive the same amount over the same period length as in the original structure.

The effect of this revised structure is that less funds need to be provided to farmers in total terms but farmers maintain the current net present value of funds received as the monies are received earlier under the revised payment structure proposed. (See Section 6.3.2)

6.5.3 Change in Policy - Government Acquires the Rights to Sale of Timber

As stated previously, under the current funding structure, the State retains no rights to, nor receives any benefits from, the sale of timber even though the State has paid the initial planting costs, maintenance costs and annual income compensation (premium) payments to the farmer. The proposal here envisages a change to the present arrangement regarding the rights attaching to the timber sales. However, the proposal is designed to ensure that the grower maintains the levels of returns expected and even provides greater certainty regarding the eventual returns.

Under this proposal, the State would acquire an ability to pre-sell timber expected from planted forests after the ten-year premium payment period has passed. On selling the future timber revenues, a single payment would be made to the grower to compensate for the loss of the future revenues. This payment would be calculated to ensure the grower maintains the same rate of return – as measured by IRR – as would be expected were the grower to retain the forest and receive all timber revenues over the 40 year life of the forest.

It is estimated that the market value (in present value terms) in year 10 of a hectare of planted forests is €2,689. This estimate is based on current pricing models from which typical costs incurred by forest management companies have been deducted to calculate net cashflows. These costs include management fees, maintenance costs

(mark & measure, stumps), repairs (drain and road) and insurance. These cashflows are then discounted to present value terms at 5.5%.

To guarantee a farmer's IRR on his investment a payment of €1,684 in year 10 is required. The difference, of about €1,000 per hectare would be retained by the State to be reinvested into the forestry sector and assist in funding the annual financial exposure of the State.

This proposal provides a number of benefits to growers including:

- Certainty of return. Currently, the grower must ensure that the projected revenue levels are actually achieved in order to achieve the required levels of return. As the once off payment from the State in year ten will ensure the grower maintains a consistent level of return, this structure effectively provides a guaranteed rate of return.
- Elimination of timber market risk – as the rate of return is effectively guaranteed, the grower no longer has the risk of price variance in the marketplace. This will be affected by issues including the current demand, availability, quality of timber for sale, bargaining strength of seller and access to market. The individual grower is likely to have greater exposure to market variance than a large acquirer of forest estates.
- Advanced income payment – timber revenues are generally available from year 21 of the growing cycle however, the significant portion of the timber income is not receivable until clearfell in year 40. This revised structure provides access to timber revenue in a far shorter timescale (ten years).

The potential gains to the State created above arise primarily from reallocation of risks between individual farmer growers and institutional investment portfolios. In addition, institutional investors are likely to be prepared to place a higher value on semi-mature timber than the NPV of growers' future timber sales for the following reasons:

- Access to larger forest lots – the creation of a new market in semi-mature stands would enable access to larger lots across a number of growers from which economies of scale can be achieved, allowing a higher price to be paid for future timber.
- Active management – by actively managing forests, acquirers could increase the quality of forests thereby providing greater certainty on future timber income. This would allow a lower discount rate to be applied to future cashflows, hence increasing the estimate of present value, which can be paid.

Successful implementation of this option will require that an appropriate contract is devised and agreed with landowners at the time of planting. This will need to cover, *inter alia*, issues such as: access to the land; management of the crop following the purchase of the timber and the situation in relation to the need to ensure that the land will be reforested following clearfelling.

6.5.4 Change in Policy - Revision of Grant Payments

Grant payments account for in the region of 36% of the current value of the total funding commitment under Scenario C. As a result, there is considerable potential to reduce the overall cost of the programme if savings can be implemented in respect of this expenditure, while keeping intact the overall level of afforestation. The existing afforestation grant is paid in two stages. The first instalment, which is 75% of the total grant, is paid after all formation and planting work has been completed. The second instalment, amounting to 25% of the total, is paid four years later. This second instalment payment is dependent on maintenance work being undertaken on the plantation and approved by a forester. In this section of the report, the focus is on the initial payment and the conditions under which the level of payment is assessed.

The conditions for payment of the establishment grant are set out in the *Forestry Schemes Manual*. The applicant must comply with requirements in relation to a number of documents that are listed in Sections 2.1 and 2.2 of the *Manual*. The application must also include a statement of costs and invoices are required. The total costs must be broken down into direct costs incurred in the preparation and planting of the site, overhead costs and VAT. In general, the direct costs identified must be in line with a catalogue of costs provided by the Forest Service. Specific conditions also relate to the overhead costs. Overhead costs consist of salaries, miscellaneous costs and supervision/consultancy/management costs (including a profit element). The 'recommended' level of overheads depends on the entity that has carried out the work and the direct costs. For farmers and individuals, the recommended overhead is set at 25% of direct costs. For consultants and contractors with a turnover of less than €1.1 million per annum, it is set at 30% of the direct costs, and for self-assessment companies with turnover in excess of €1.1 it is set at 40% of direct costs.

This schema has been commented on during consultations undertaken in the preparation of this report and requires some examination. It is possible to identify a number of rational explanations for the payment of this overhead in terms of the situation when the 1996 *Strategy* was introduced. The objective was the creation of a forest estate and industry that would be far in excess of the existing situation. Planting would be taking place mostly on marginal land that had not been intensively managed in agriculture. This land to be planted would be rough and would need preparation that would require specialist machinery. In addition, the growth was to be based on planting by farmers who up to that time had not engaged in forestry to any large extent. As a result, it was deemed necessary to ensure that a service industry would be created that could supply the necessary planting services and expertise to facilitate the levels of planting targeted. The overhead would provide the finance to allow this sector to gear up with modern machinery and favour large contractors that would be able to achieve economies of scale and best practice.

This situation has now changed to a considerable extent. Forestry has begun to move more into the mainstream and the gearing up phase is completed. The land to be planted will increasingly become less marginal with average farmland undergoing afforestation. This will be boosted greatly by the CAP reforms as discussed in Section 5 above, where a farmer's afforestation decision will be determined increasingly by single payment entitlements rather than the productive value of the land under agriculture. Crucially, the introduction of a single payment removes from

the farmer the need to produce to earn income. As a result, there will be an increase in the labour available. Furthermore, this revision moves the grant payments structure in the direction envisaged by the EU proposals while still retaining the grant at 100% of the direct costs incurred.

The three levels for the calculation of the overhead also require examination. It is to be expected that there would be economies of scale available to the larger contractors. However, the higher level of overhead means that the supports are greater for these firms. In summary, if the planting can be done with a 25% overhead there is no gain to the State from paying 40% unless this is based on a lower level of direct costs. There is no evidence that there is a negative correlation between the level of overhead and the costs paid in grants.

In summary, these arguments mean that there is potential deadweight in the grant payments as a result of the way in which the overhead is calculated. Furthermore, the rationale that may have existed in the past for the structure of payments has been undermined by the imminent introduction of the single payment. The consultants are of the opinion that the level of costs is primarily a technical issue that is best addressed by the Forest Service. However, there is no rationale but considerable inefficiency in persisting with the current situation. Thus, it is proposed that the element of overhead provided in the grant should be abolished.

This proposal will have a considerable impact on the funding requirement. Currently, the total funding requirement for Scenario C – before inclusion of any revenues that might be earned from pre-selling the timber – is €6,950 million with a NPV of €3,515 million. Of this, future commitments for the payment of grants amount to €2,282 with a NPV of €1,193 million. (See Appendix 6, Table A6.3). The proposal relates only to future grant commitments and to the establishment grant only. If implemented, it is estimated that the saving would be €672 million with a NPV of €364 million. In terms of the overall funding requirement, the current value would be reduced to €6,278 million with a NPV of €3,151 (See Appendix 6, Table A6.6). The proposed revision provides a reduction in the overall commitment of 10.4% in present values.

6.6 Impact of Options on Funding

Comparison of Scenarios A and B – Increased Annual Afforestation.

Currently forestry policy of 20,000 hectares afforestation is not being reached. This is represented by Scenario A. If forestry policy is attained, afforestation increases to 20,000 hectares per annum, assuming no other changes are adopted, this is Scenario B. As shown in Table 6.9, moving from Scenario A to Scenario B results in an increase in costs to the Exchequer of €995.14m in NPV terms based on increases in grant and premium payments between 2005 and 2059.

Table 6.9: Summary Scenario A & B - Cost to Exchequer (€m)

	Scenario A	Scenario B
Past Commitments Grants 2005 – 2008	45.05	45.92
Grants 2005 – 2059	1,492.86	2,282.41
Past Commitments Premium 2005-2023	754.99	761.43
Premiums 2005 – 2059	2,892.19	4,421.62
Total Liability	5,185.09	7,511.38
Max Annual Payment	133.85	205.92
NPV @ 4%	2,520.29	3,515.43

See Appendix 6, Tables A6.1 and A6.2 for details

Summary Comparison of Scenarios B and C

For the purpose of evaluating an afforestation rate of 20,000 ha. per annum, Scenario B should be considered the base case. Moving from Scenario B to C maintains afforestation levels of 20,000 ha per annum but requires a change in policy regarding premium payments. All growers receive a basic premium at the current levels for 15 years but farmers would receive an additional compensatory premium for 10 years. This compensatory premium is at a level such that the present value of payments to farmers is unchanged from the current structure. The move to this Scenario results in higher premium payments in the short-term but lower payments in total terms as shown in Table 6.10. The summary impact of the pre-selling proposal also is shown.

Table 6.10: Summary Cost to Exchequer Scenario B & C and Pre-selling – (€m)

	Scenario B	Scenario C	Scenario C with pre-selling
Past Commitments Grants 2005 – 2008	45.92	45.91	
Grants 2005 – 2059	2,282.41	2,282.41	
Past Commitments Premium 2005-2023	761.43	761.43	
Premiums 2005 – 2059	4,421.62	3,859.75	
Total Liability	7,511.38	6,949.50	6,949.50
Pre-selling revenue			654.56
Max Annual Payment	205.92	209.33	203.38
NPV @ 4%	3,515.43	3,515.43	3,334.36

See Appendix 6, Tables A6.2, A6.3 and A6.4 for details

Table 6.11 shows the impact of revising the grant payments as discussed.

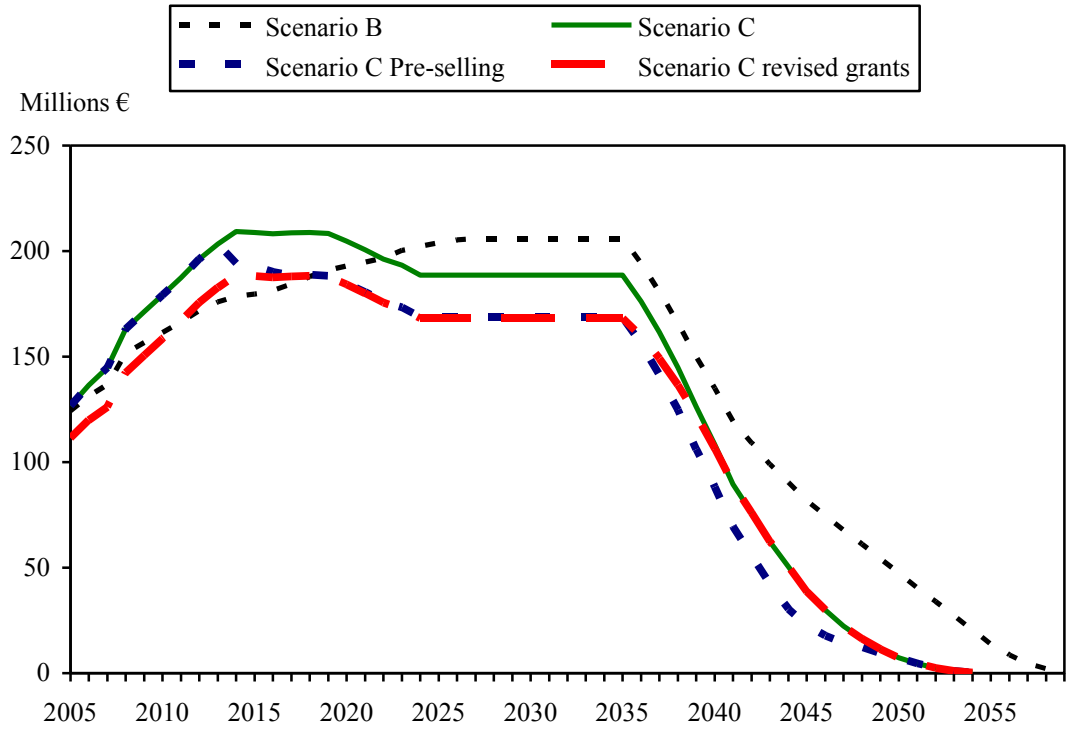
Table 6.11: Summary Cost to Exchequer Scenario C and Grant Revision (€m)

	Scenario C, existing grants	Scenario C, revised grants
Past Commitments Grants 2005 – 2008	45.91	45.91
Grants 2005 – 2059	2,282.41	1,610.90
Past Commitments Premium 2005-2023	761.43	761.43
Premiums 2005 – 2059	3,859.75	3,859.75
Total Liability	6,949.50	6,277.99
Max Annual Payment	209.33	188.70
NPV @ 4%	3,515.43	€3,151.36

See Appendix 6, Tables A6.3 and A6.6 for details

Figure 6.6 sets out the total liability to the State for Scenarios B and C. In addition, the diagram sets out the impact of introducing the funding proposal in relation to pre-selling of planted forests and the impact of revision the grant payments. The figure displays how the move from Scenario B to Scenario C reduces the total annual cash cost to the State in the long term and how the cost can be further reduced by the proposals. The impact of the pre-selling of timber reduces the funding costs to the State but the revised grant structure has a greater impact particularly in the year up to 2017. In addition, since the saving in relation to the grant payment occurs when the crop is planted, the present value of this saving is higher. Furthermore, introducing this revision with Scenario C means that the annual commitment is less than Scenario B in almost all years.

Figure 6.6: Comparison of Funding Requirements



6.7 The Value of Green Credits

The *Kyoto* agreement allows for carbon sequestration by new forests since 1990 to be included in the calculation of net emissions for the first reference period. However, there is considerable disagreement around this subject. A key point is that while forests do indeed store carbon, the storage is a once-off event up to the point where the equilibrium level is reached with no reduction in actual emissions. Thus, the impact of forests is not permanent in the sense of affecting the level of net emissions in the very long term. This argument has proven to be influential in the development of the European carbon trading mechanism to date.

It is not necessary to rehearse here the arguments around carbon trading in detail nor to explore the arrangements that have been put in place to facilitate trading. In summary, the current situation regarding the impact of forests is as follows. Sequestration is allowable in the calculation of the country's performance in meeting its commitments under *Kyoto.* However, the carbon sequestrated by forests cannot be converted into green credits to be traded by firms – or growers – to meet requirements under the EU's emissions reduction measures.

The EU formally adopted the *Kyoto Protocol* and identified national responsibilities in 2001[128]. While the EU is a full party to *Kyoto*, the principal of subsidiarity was invoked, meaning that responsibility for meeting the obligations was essentially a requirement of national governments. The approach taken means that firms in identified sectors in the EU must achieve reductions in emissions while States must also achieve overall targets under *Kyoto*. Under *Kyoto*, countries may meet part of their targets through flexible mechanisms, such as international emissions trading, joint implementation (JI), and the Clean Development Mechanism (CDM). Emissions trading can take place between countries with quantified limitation or reduction targets. This element of the protocol has given rise to the prospect of tradable 'green credits' whereby one country that is meeting its commitments can trade any spare capacity to another. In 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 addition to a proposal for a Council decision on ratification of the *Kyoto Protocol* and other measures, the package included a proposal for a directive on greenhouse gas trading in the European Community. This committed Member States to introducing a trading scheme for greenhouse gases by 1 January 2005 when the EU Emissions Trading Scheme Directive will come into operation.

The trading scheme works on a 'Cap and Trade' basis. All 25 EU governments are required to set an emission cap for all installations covered by the scheme. Each installation will then be allocated allowances for the particular commitment period in question. Installations that exceed their emissions limit could then purchase carbon credits from other companies with excess allowance or perhaps even purchase carbon credits from forests. As part of this process, fixed penalties for excess emissions by firms have been agreed. These have been set at €40/tonne in the period 2005 to end 2007 and at €100/tonne thereafter. Obviously, firms will wish to avoid these penalties by buying tradable credits. Because the EU did not wish to delay the development of

[128] COM (2001) 579 *The Kyoto Protocol to the United Nations Framework Convention on Climate Change and the Joint Fulfilment of Commitments Thereunder*.

green credits markets the Commission introduced a Directive, now endorsed by the European Parliament, to establish a mechanism for trading in the EU[129]. Generally known as the 'Linking Directive' as it aims to link EU mechanisms to the *Kyoto* provisions and commitments, this mechanism identifies the ways in which firms can meet their commitments through trading. Green credits created by afforestation i.e. sinks, which are allowable under *Kyoto*, cannot be used by firms for trading to meet commitments under this Directive.

A review of the Community emissions trading scheme will take place in 2006 and there is a possibility that this decision could be reversed. If this is so, carbon credits from the forest project could be traded to earn funds, which could be used to fund the project. The likelihood of this occurring, however, cannot be gauged at this point in time. As a result, no formal mechanism is emerging for the monetisation of the benefits of carbon storage in forests, although these benefits are recognised[130]. However, the fact remains that Ireland's performance in relation to its *Kyoto* commitment will allow for the carbon that is sequestered by forests to be offset against emissions.

Ireland has four options in relation to achieving its *Kyoto* commitment. These are:

- Reduce emissions sufficiently;
- Increase sequestration;
- Renege on its commitment;
- Trade sufficient green credits to meet its commitments.

As pointed out in the NCCS, Ireland will not achieve the necessary reduction in total emissions given the rate of economic growth since 1990. It should also be assumed that the country would not wish to renege on the agreement. Thus, the options are to increase the sinks as far as possible or to make up any shortfall through buying credits. This means that investment in the creation of green credits in forests is a direct substitute for buying credits. On this basis, it is argued that the money saved through increasing the value of the sinks i.e. forestry, should be offset against the cost of achieving this increase to provide a net cost of the forestry programme.

The analysis in Section 4, based on the technical values in Appendix 4, above showed that carbon sequestration with a mid-point value of €45.2 million per annum will arise from the afforestation programme identified. For the full afforestation programme, this provides a value of €659 million when discounted at the risk adjusted rate of 5.5%. Thus, the actual cost of the programme to the exchequer would be lower than the funding commitments identified in Section 6.4 by this amount.

[129] European Commission (2003) *Directive amending the Directive establishing a scheme for greenhouse gas emission allowance trading within the Community, in respect of the Kyoto Protocol's project mechanism*. COM (2003) 403 final. This was adopted by the European Parliament in April 2004.

[130] It is possible that a voluntary market could begin to emerge based on firms not covered by the EU regulations but who wish to meet CO_2 targets in an ethical accounting framework. This voluntary approach could give rise to payments to growers to encourage planting but this is unlikely to be widespread in the foreseeable future.

6.8 Concluding Remarks on Funding Options

This section of the report has analysed options for funding the afforestation programme. This has been done by estimating the funding requirement on the basis of a continuation of a rate of planting that provides afforestation of 13,000 ha per annum up to 2035, then declining to zero from 2040, with no change to current support structures. (Scenario A). Then the impact of four options to modify this programme, the support structures and the funding mechanisms were estimated. The options are:

- Moving to an afforestation programme based on 20,000 ha per annum up to 2035 then declining to zero from 2040 – Scenario B;
- Changing the support payments so that farmers compensatory payments are paid over a period of 10 years but the NPV of total payments to farmers is held constant – Scenario C;
- Introducing a contractual arrangement whereby in return for the support provided the State is provided with an option to purchase and resell timber from forests planted in year 10 and allocate any net funds earned to the programme;
- Revising the grant payment structure so that the changed circumstances arising from the CAP reforms are recognised and the efficiency of payments is improved;
- Recognising the savings that will accrue in complying with Ireland's *Kyoto* commitments as a result of the additional sinks created by afforestation and ring-fencing these funds to pay for afforestation.

The total NPV of funding Scenario A up to 2059 is estimated to be €2,520 million. However, there are strong arguments in favour of achieving Scenario B i.e. in this case, the funding requirement has a NPV of €3,515 million, on the basis of unchanged support structures.

There would be benefits from altering the support structure by moving to a structure where premium payments are paid over 10 years. Along with reducing the cost of the funding requirement by 7.5% in current terms, implementation of this option would create supports that would be more in line with the funding structure proposed in relation to the reform of EU Rural Development policy. This proposed change would facilitate also the forward selling arrangements, which are proposed in the third option[131]. This is Scenario C and the impact is to reduce the funding required by €561 million.

Payment of the establishment grants account for about 36% of total future commitments under Scenario C. The structure of these payments was devised in the context of a situation that has changed considerably due to the growth of the forestry sector in Ireland over the past decade and the reform of the CAP. As a result, there appears to be a rationale for persisting with the existing conditions and considerable

[131] The argument here is that forward selling at year 10 requires that the ultimate buyer of the timber can receive the same premium payment as the seller. Currently this would not be the case if the timber were to be sold by a farmer in year 10 to a non-farmer and the arrangement would not be viable. It is arguable that a system could be devised whereby the State would buy the timber in year 10 under the current rules and include in the price paid to the farmer the discounted value of future premium payments that would be due. However, there would be no further gain to the State in this case.

opportunity for deadweight payments that reduce the efficiency of the expenditure. It is proposed that the overhead payment element of the establishment grant should be eliminated. The effect of this would be to reduce the commitment by €672 million in current terms and by €364 million in terms of NPV. This gives a saving of 10.4% in the NPV of the total commitment.

The final option relates to the value of carbon stored in forests. While the proposals for the EU carbon trading mechanism will not provide a means to transfer this to growers directly, whereby it could be offset against the cost of the supports, this carbon has a real value to the Irish economy. As a result, it is possible to offset this value at national level against the costs of the programme. The analysis provides an estimate that this will be worth €38.8 million per annum for a carbon value of €15 per tonne, rising to €51.7 million at €20 per tonne, giving a mid-price estimate of €45.2 million per annum. Over the course of the afforestation programme, this provides a value of €659 million when discounted at the risk-adjusted rate of 5.5% that can be offset against the cost of the supports.

7. Recommendations for Achieving a Successful Outcome

7.1 Overview

The findings of this report can be summarised as follows. Policy as implemented under the 1996 *Strategy* has resulted in a larger forest estate than existed in 1995, with much greater private sector participation. However, there are weaknesses that will affect the returns from this estate. These arise from poor management of crops, failure to develop aspects of supporting infrastructure, lack of proper information to guide development, and an over-emphasis on timber value compared to non-timber benefits of forestry. These issues will be increasingly important given the proposed shift in EU policy away from supporting afforestation and towards aiding initiatives to improve the competitiveness of the sector and the achievement of environmental objectives through forestry. As a result, revisions are required to the *Strategy* and to specific measures.

The recommendations contained here fall, under three headings. The first relates to the appropriate targets for afforestation and to the incentives that should be provided to achieve these targets. The analysis leading to these recommendations is contained primarily in Sections 3, 4 and 5 above. The second category of recommendations relates to the development of the industry. While the environmental and non-timber benefits of forestry are important, deriving value from the timber produced remains the greatest source of benefits. However, the analysis in Sections 2 and 3 above identified that there are weaknesses in the sector that will need to be addressed. It is notable that a number of the issues that arise have already been identified in reports on the development of forestry in recent yeas but the required actions have not been implemented. The final category of recommendations relates to the financing of the sector and is based on the analysis in Section 6.

The recommendations in relation to the afforestation targets and incentives can be viewed as a restatement or revision as appropriate of forestry policy as laid out in the 1996 *Strategy*, and as revised in the intervening period. The 1996 *Strategy* placed a high emphasis on the importance of the timber produced. The recommendations here amount to a rebalancing of this to recognise the value of the non-timber benefits and also to shift the focus somewhat towards the need to promote competitive timber products to a greater extent. This latter theme is central to the recommendations in relation to the development of the timber industry. These can be placed broadly in two groups: issues in relation to implementation of the revised strategy and initiatives required to guide the development of a competitive sector. The public sector has a role in this regard, but the recommendations should not be interpreted as indicating that the State needs to undertake functions that should be the responsibility of what is increasingly a private industry. The final category of recommendations in relation to financing the expenditure required was absent altogether from the 1996 *Strategy*. The issue has a number of dimensions going forward, including that EU funding will remain an important source in the future but will be provided to achieve different objectives than in the past. In summary, future EU funding will place a greater emphasis on the competitiveness of the forest sector and on achieving environmental

objectives through forestry than in the past, with a reduced emphasis on afforestation to expand the area under trees or on income support.

The success of any revised strategy will depend on implementation of a cohesive programme to create a competitive forestry industry while extracting value in the form of non-timber benefits and allocating risks optimally. These objectives are important if maximum value for money from the expenditure of exchequer funds is to be achieved.

7.2 Afforestation Targets and Incentives

1. The 1996 *Strategy* identified an afforestation target of 20,000 per annum in order to achieve the critical mass of output that is required for the development of a competitive timber industry in Ireland. The analysis in this report is on a somewhat different basis but leads to the conclusion that failure to achieve this level of planting will lead to particular problems for the industry. The analysis is based on projections of output and a dramatic increase in output up to 2030. This will require considerable investment in processing capacity. However, the level of output falls sharply for a prolonged period after 2040 on the basis of current planting rates. The required investment would not be forthcoming if this situation was to be allowed to develop, thereby greatly undermining the rationale for the programme. In addition, there are positive returns from investment in afforestation. Afforestation of 20,000 ha per annum up to 2035, thereafter gradually reducing to zero by 2040, would give coverage of about 19% of Ireland's land area and a stable level of timber output from conifers in the long run. While the decline after 2040 would not be eliminated, the output projection is greatly smoothed and a much more stable production profile for investment would be achieved. ***As a result, it is recommended that the strategic target should be afforestation of 20,000 ha per annum up to 2035.***

It is recommended that forestry policy and the support structure should recognise that forestry is not a homogenous sector but includes both a commercial industry and a sector that produces public goods. If the returns from both activities are to be maximised then policy must be designed and implemented so as to achieve this outcome. Considering plantations and proposed afforestations in three categories provides a useful start. The categories suggested are:

- Production, where the main return is provided by the value of timber that can be produced. This is clearly a commercial operation;
- Protection, where non-timber benefits are important and while commercial timber will be produced, the forest is designed and managed in a manner that maximises returns in activities such as recreation;
- Protected forest, where the plantation is non-commercial and is grown and protected as a result of its non-timber benefits.

Irish policy has been designed to maximise the returns under the first heading. However, weaknesses in management and in marketing risk are reducing the returns under this heading. Furthermore, failure to adequately recognise and quantify the returns from non-timber benefits means that policy has not adequately

supported the protection of the potential environmental and recreational benefits of forestry. It is recommended that proposed plantations should be assessed and placed into these categories and that supports should be provided to achieve the aims appropriate to each category. Thus, any future strategy should recognise that there are two separate sectors: commercial timber production and planting to achieve environmental objectives and allocate funds to achieve objectives in each case; production, protection, protected.

2. Currently, planting proposals are assessed for support with an emphasis placed on achieving minimum stated yield classes. This is in line with the emphasis placed on timber output under the 1996 *Strategy*. While minimum yield class should remain a criterion, ***it is recommended that the decision to approve individual plantations from the point of view of their contribution to developing a competitive timber industry should also involve greater consideration of other factors.*** These should comprise the species to be planted, the availability of access to a public road, the size of the plantation and the size of individual plots, distance from sawmills, the amount and type of forest in the vicinity, and environmental constraints relevant to the site. A broadleaf target has been set at 30% of the area planted and the projections in this report, including the projections of returns, assume that this will be achieved from 2006. This may prove to be optimistic although there has been considerable progress made in recent years. An important issue is that not all sites are equally suitable for broadleaf planting and the incentive structure to date has favoured the planting of conifers, with broadleaves seen as a cost to the grower. This is compounded by the fact that poor maintenance of broadleaf plantations will result in poor trees ultimately. A conservative approach has been taken here by placing a zero value on broadleaf timber but it is clear that there are considerable non-timber benefits from broadleaf planting. Leisure and recreation benefits are important and these require that plantations are designed to maximise such benefits. This will not be achieved by poor planting of broadleafs in disparate locations. As a result***, it is recommended that greater attention should be paid to achieving the target in a manner that maximises the benefits of broadleaves rather than a planting structure that just meets the target in a numerical sense.*** There is considerable potential that inappropriate species might be planted on some sites, if the broadleaf target is implemented at an inappropriate geographical level. Research is required to identify the appropriate broadleaf target at a regional level, taking account of growing conditions and the potential non-timber benefits in each county, to achieve the national target. ***It is recommended that the broadleaf target should be achieved in the context of county forestry strategies and that the target should be achieved at the regional level.***

3. This study has placed values on the non-timber benefits of forestry as far as possible. However, in some cases, these values rely on research undertaken outside Ireland and there are considerable data deficiencies. This risks leading to a situation where decisions are sub-optimal from the point of view of maximising returns from forestry and the perception that regulations are being imposed on the sector that penalise growers to an unwarranted extent. There is a perception that environmental considerations conflict with commercial realities. It may not be possible to fully resolve this situation but better information on the returns would provide the basis for the best possible structure of incentives to maximise returns.

It is recommended that a much greater emphasis should be placed on undertaking research to identify and quantify the non-timber returns from forestry at national and regional levels, how these returns can be maximised within the existing estate and future planting, and the incentives that are appropriate. Returns from forestry have been accorded tax-free status. Effective mechanisms do not exist for allocating the non-timber benefits of forestry to growers. ***In recognition of this, it is recommended that this tax-free status should be maintained.*** EU policy in the future will place a much greater emphasis on achieving environmental objectives through forestry after 2006 and payments will reflect this. To maximise the drawdown of payments, afforestation will need to reflect this new situation. This will require considerable changes in the nature of Irish afforestation. Forestry in areas designated under *Natura 2000* has been identified as an important option. ***It is recommended that the authorities should re-examine the areas that have been submitted to date for designation under Nature 2000 so as to identify opportunities for extension of this list with a view to including areas on which future afforestation can be undertaken.***

Irish regulations require that afforested land must be 100% reforested following clearfell. It is recommended that this should be retained. However, the blunt application of this regulation risks making permanent, losses that have been incurred through inappropriate afforestation in the past. ***As a result, some limited flexibility is required. This should be introduced on the basis that decisions are applied to specific sites only and that reforestation is denied only on the basis that there would be identified and quantified losses, for example, through visual intrusion into the landscape or an impact on water quality. It is very important that this would not be done on more than a very restricted basis, and that commercial arguments or arguments that a relaxation of this regulation would reduce the risks associated with afforestation, should not be allowed to influence decisions in this regard.***

4. ***It is recommended that the non-farmer premium should be paid to all growers over 15 years. In addition, farmers should also receive the compensatory premium i.e. the value by which premiums paid to farmers exceed those paid to non-farmers, over the first 10 years. The annual value of the farmers' premium should be increased so as to keep constant the present value of the payments to farmers, when discounted at the risk free discount rate.*** Three distinct reasons are put forward for this reform:
    - It would be in line with the proposals for reform of forestry supports as currently proposed by the EU;
    - It would enable forward selling of timber on farmers plantations at year 10, thereby providing the potential to improve the management of these plantations in subsequent years; and
    - It would reduce both the total funding commitment and the present value of this commitment by the State while retaining the present value of receipts by farmers.

It is recommended that forestry premiums should be indexed to changes in payments under other agricultural supports that affect land usage including entitlements under the Single payment scheme and REPS. This is in order to maintain the attractiveness of forestry supports and reduce levels of uncertainty as

regards what the relative return from forestry will be in the future. This indexation should take account of any changes in the regulation governing the various programmes to ensure that the indexation reflects only changes in monetary values. The perception that REPS has a strongly negative impact on the decision to afforest has been overly emphasised. However, there is a perception that planting could affect the ability to access payments in the future. ***It is recommended that the position in relation to eligibility for agricultural payments following the CAP reform should be sufficiently clarified to ensure that uncertainty is reduced as far as possible***.

The average size of private plantations is small. The desire to promote afforestation of larger private sites is recognised by the existence of the supplement that provides an additional premium per hectare for plantations of 6 to 12 hectares and at a higher rate for plantations of 12 hectares and above. However, the evidence indicates that the rate at which the supplement is payable is inadequate to address the problem of small scale. This small scale will impact on the ability of service providers to achieve economies of scale. ***It is recommended that areas in excess of 12 hectares should attract a higher differential in terms of the supplement to premium payments that is provided than they currently do. In addition, the rate at which the supplement is payable should also be higher for plantations in excess of 25 hectares. These payments should be achieved by reallocation of resources within the current budget, i.e. there would be no net additional cost to the exchequer.***

5. The funding projections in Section 6 show that payments of the establishment and maintenance grants will amount to about 40% of total costs. Payment of the establishment grant alone will account for about 36% of total future commitments. Clearly, it is important that this expenditure is efficient in the sense of minimising costs while achieving aims. However, a number of issues have come to light that suggest that some examination of the regulations in relation to this expenditure is warranted. The establishment grant is currently paid upon confirmation of planting and receipt of claims that detail the expenses incurred. For growers who do not undertake planting themselves there is no net impact in the sense that the payment covers 100% of the expenses incurred. Allowable expenses are set out by the Forest Service and have been periodically revised. An issue relates to the allowable overheads. A 3-category approach is currently used. Farmers who plant their own lands can add 25% to costs to cover overheads. This rises to 30% for contracts and 40% for registered contractors who meet certain criteria. This is difficult to understand. The higher rates are applicable to larger firms. It would be expected that these might achieve some economies of scale but the reverse appears to be implied by this payment structure. In addition, there is a clear disincentive for farmers to undertake the work themselves or employ small local contractors. Furthermore, with the growth of the forestry sector over the past decade and the emergence of a servicing sector, and with the imminent introduction of the CAP reforms, the rationale for the identification of an overhead payment in addition to the direct costs has been removed. ***As a result, it is recommended that this payment structure should be revised and that the overhead element of the establishment grant should be eliminated.***

6. Poor management of plantations appears to be a problem in many parts of the private growing sector. The maintenance grant is paid four years after planting has been confirmed. Consultations have indicated that the impact of this structure is that maintenance is undertaken up to this point but that beyond this there is no incentive to manage the plantation correctly. ***It is recommended that the payment of this grant should be subject to a much greater extent than in the past to ongoing maintenance of the plantation to required standards. In addition, this should be monitored for a defined period beyond the current 4 years, and the grant should be subject to a claw-back if it is identified that the plantation is not being maintained.*** The recommendations in relation to the forward selling of conifers in Section 7.4 below will facilitate addressing this problem in conifer plantations. ***To overcome poor management in relation to broadleaf species, it is recommended that there should be more rigorous and consistent enforcement of regulations in relation to eligibility for premium payments, which depend on ongoing assessment of the management of the crop. Supports should be withheld to an extent that the threat of this sanction being applied provides an adequate incentive to improve standards.***

7. The direction of EU policy and the examination of forestry from the point of view of its wider benefits indicate the potential for targeted schemes to improve the planting of indigenous species and to protect forests. ***In the context of emerging proposals for the reform of EU policy it is recommended that an examination should be undertaken to identify appropriate targets for the Native Woodland Scheme, the NeighbourWood Scheme, the Reconstitution of Woodland Scheme and the Woodland Improvement Scheme. The required funding to achieve these targets should be provided.*** Specific problems are associated with establishing forests in areas with high populations of deer and grey squirrel. This is a technical issue and the specific measures required are outside the Terms of Reference of this report. ***It is recommended that appropriate measures should be identified and implemented.***

7.3 Development of the Industry

8. The understandable emphasis that has been placed on afforestation in the implementation of policy over the past decade must now be complimented by a new emphasis on the development of the infrastructure to support the viability of the industry. This infrastructure includes the development of markets, training and good management practices and structure along the lines of co-operative ventures that ensure that economies of scale are created. While the main production of the private sector is still well in the future, this development is required for three reasons:

- Markets will soon be required for thinnings;
- Afforestation must take place with due recognition of the need for the product to be marketable so the emphasis on the competitiveness of output will inform planting; and
- EU policy will increasingly demand that these developments to improve the competitiveness of forestry are undertaken.

It is recommended that attention be directed to a much greater extent to incentivising the creation of this infrastructure although it is not concluded that State expenditure should be increased in order to create markets for timber. The forestry sector is highly regulated with multiple stakeholders. Yet the success of the strategy depends crucially on the creation of a competitive and commercially viable private sector. The extent of regulation means that the perception has developed that there is excess intervention in a regulatory sense with insufficient attention paid to the needs of the growing industry. ***It is recommended that a Forestry Development Forum should be formed comprising diverse interests to drive the development of the enterprise approach that is required while ensuring that the industry matures as a sustainable forest sector that will maximise the wider benefits of forests.*** Among the areas to be examined by this Forum should be market trends at the European and wider international levels and ensuring that processing capacity and competence develops in line with productive capacity. Secretariat resourcing should incorporate the technical skills available in TEAGASC/COFORD. Optimum development of the forestry sector will depend, *inter alia*, on competition in the supply of roundwood. Such competition is necessary to drive efficiency improvements and consumer benefits. ***In order to identify how the State sector can foster sustainable roundwood prices and healthy competition, it is recommended that the Department of Agriculture and Food, should undertake an examination of current and projected future supplies of roundwood. This should extend to related market dynamics such as current cost structures in marketing and measurement of roundwood.***

9. Good information is essential for the development of a competitive industry and there are deficiencies in terms of the information currently available in relation to private forests. The required data are held by the Forest Service, but a comprehensive inventory of private forests that can be used to derive forecasts has not been developed, although it has recently been decided to undertake the necessary work to develop these data into an accessible format. To inform the development of the industry, ***it is recommended that priority should be given to this work. It should include the creation of a national forecasting model, and comprehensive spatial information on species, age and location of plantations and on the supply of thinnings should be available to the industry to inform decisions on product lines.*** The resources required to undertake this work have been identified within the Forest Service. It is important that there should be adequate resources assigned to undertake this work on an ongoing basis. ***It is recommended that consideration should be given to outsourcing the work involved in producing this information, should it be decided that adequate resources cannot be allocated within the Forest Service on an ongoing basis.***

10. ***It is recommended that the development of county forestry strategies should be promoted and these strategies should be used in the determination of plantation characteristics such as species mix, as discussed above.*** Ireland's afforestation programme has been implemented in the absence of a comprehensive and integrated land use strategy for the country. This is the case for all agricultural policy and is of growing importance given the growth in the REPS programme and the imminent introduction of the reforms to the CAP. In a strategic sense, afforestation can no longer be argued on the basis that it provides a more desirable

use of land than agriculture, given the need to reduce agricultural production. ***It is recommended that an examination should be undertaken in relation to improving integration among all those engaged in aspects of land use and decisions in relation to forestry should be compatible with this objective.*** The incorporation of the Forest Service in the Department of Agriculture and Food itself should facilitate the achievement of a more integrated approach to land use.

11. The Forest Service is organised around a dual structure, which is not unique in the Civil Service, and is deployed to undertake the administrative and technical functions of the Service. ***It is recommended that an efficiency audit of the Forest Service should be undertaken as part of the HR review, which would examine the extent to which this structure is optimally efficient. It is recommended that the Forest Service should commit to publishing a regular report e.g. every 1 or 2 years, on progress with implementation of the Forest Strategy and that this report should be used to inform ongoing adjustments to the strategy. Furthermore, it is recommended that the Department of Agriculture and Food should commit to ensuring that the Forest Strategy is fully reflected in the Department's business plan and its Annual Reports. It is also recommended that forestry legislation should be updated in areas such as the integration of EU Directives and felling procedures and should be reviewed regularly. In particular, issues such as the existing role of the Gardai in the granting of felling need to be assessed.***

12. It is essential that forest design and management should take account of future recreational needs. To this end, ***it is recommended that linkages should be formed between government and non-government organisations to agree a framework to deal with ensuring access to appropriate private forests for recreation. The provision of such access and basic requirements for recreational purposes should be linked to the provision of funding to the forests involved. This will become particularly important following the reform of the EU's Rural Development Strategy when access to EU funding will be increasingly linked to providing forests that maximise returns from non-timber outputs.***

7.4 Financing the Programme

13. ***It is recommended that the State should adopt a multi-annual budgeting policy in relation to forestry, so as to promote a consistent approach.*** This would reflect the fact that gearing up the sector for growth takes a number of years but considerable losses can occur if funding is reduced for even 1 year. This would also enhance the commitment of the State to the sector, thereby reducing perceived risk.

14. The afforestation programme requires considerable resources. At the same time, growers are not incentivised to manage the crops in a manner that maximises revenues and perceive that revenues are not earned until far into the future. However, while the state has supported the sector it has no contractual or property rights in relation to the timber. ***It is recommended that a contractual mechanism***

be devised that will apply to all applications for forestry support. The effect should be that the State would have an option, or right, to purchase from the farmer the timber in the plantation from year 10. The price should be designed to maintain the return on investment by the farmer – measured by IRR – that would be obtained if the farmer managed the crop to maturity and sold the timber. As a follow-on to this initiative, ***it is recommended that a mechanism should be devised to allow the State to sell timber that has been acquired to an agency either in the private or public sector that has an interest in owning and managing the forest to maturity***. ***It is further recommended that the funds thus raised be allocated to part fund the afforestation programme.***

15. The calculation of Ireland's liability under *Kyoto* will allow for the full equilibrium value of the potential storage of each hectare of afforestation to be allocated to the year of planting. Thus, the value at the time of planting that can be offset against the funding commitment is the total value of the future CO_2 that will be sequestered. ***It is recommended that when consideration is being given to the relative costs and returns of forestry that the potential saving in terms of green credits that will have to be purchased to enable Ireland to fulfil its commitments under Kyoto, should be fully included in the calculation. It is further recommended that the savings that arise as a result of the contribution of new forestry to meeting Ireland's committments should be ring-fenced and allocated to forestry in advance of estimating the budgetary impact of the forestry strategy.***

Appendix 1: Submissions Received

A1.1 Alphabetical List of Submissions

Barry, Joe
Bord na Mona

Carey, Dr Michael, Forestry and Management Consultant
Carew, Michael
Chavasse, H.K.P.
COFORD
Coillte Teoranta
Consultant Foresters Regional Group

Dept. Crop Science, Horticulture and Forestry, UCD
Doyle, Michael, Consultant

Fleming, Jerry
Forest Friends Ireland
Forestry Assessment Companies
Forestry Development Association Co-Op
Forestry Inspectorate Group, IMPACT
Forestry Services Ltd
Friends of the Irish Environment

Gallagher, Dr Gerhardt

IFA Kildare Forestry Section,
Irish Farmers' Association
Irish Forest Industry Chain
Irish Forest Unit Trust
Irish Forestry Contractors Association
Irish Timber Council
Irish Timber Growers Association

Just Forests

Kelleher, Colin

Lehane, Patrick
Leonard, A.

Maher, William J.
Mulloy, Fergal

North Western Regional Fisheries Board

O'Brien, Tim
O'Callaghan, Pat

Quigley, Brendan

Society of Irish Foresters
Society of Irish Foresters Consultant Foresters Regional Group
South Western Services
Spillane, Dr. Charlie
Sustainable Energy Ireland
Sweeney, Michael

Taffe, Emer
Tree Council
Trihy, Patrick

Vin Du Longueville

Walsh, Patrick J.
Western Forestry Co-Operative Society
Wood Technology Centre, University of Limerick
Woodlands of Ireland

A1.2 Examination of Submissions

The consultation process was launched officially at an open information meeting organised by the Forest Service for stakeholders and interested parties in Tullamore in April. A total of 42 submissions were subsequently received from a wide cross section of the forestry and stakeholder sectors, although very few submissions were from environmental and non-governmental organisations. In general, submissions tended to focus on five or six issues and were limited to fewer than four pages.

The scope of topics covered in the submissions was extensive, varying from highly technical issues to general comments on the multiple benefits of forestry. However, the issues most regularly raised in the submissions were:

- The need for a ***Forest Inventory and Management Planning System***: Currently, there is no national forest inventory. Sound, reliable and up-to-date information is required as the basis for future planning and development of the sector. The inventory should be linked to a requirement for forest management plans which would provide information necessary to forecast future volumes.

- The importance of ***Continuity in Funding***: The long term nature of forestry investment, together with competition from other land uses requires a continued commitment in funding to ensure that there is a degree of confidence in the sector going forward. A Government commitment to multi-year funding would provide the confidence.

- Concerns regarding the availability of ***Markets for Small Roundwood*** i.e. thinnings from the private sector: If markets are not developed, then crops will go unthinned. If this happens it will act as a disincentive to others to plant and the afforestation will fall. In the longer term this will impact on supply.

- A need for ***Institutional Reform***: The main thrust of the submissions centred on the need for a Forestry Advisory Body, a Forest Development Agency, and the outsourcing of many of the services being provided. The Forest Service has focused on afforestation to date but now a more developmental and commercial market focus is required. It was suggested that the role of the Forest Service should be limited to regulatory and supervisory functions.

- ***Realising Non-timber Benefits***: Growers see the environmental values of forestry as potentially important sources of revenue going forward against a background of increasing regulations. Carbon sequestration is the main issue and the expectation was expressed that carbon credits will belong to the landowner and provide a source of income.

Appendix 2: Model for Production Projections

A2.1. Variables Included in the Model

Production projections have been calculated for the period 2004 to 2075 and are detailed in Section 3 of the report. The projections are based on separate calculations for production by the private sector and Coillte and for coniferous and broadleaf species. It is assumed that planting is undertaken in compliance with the Afforestation Scheme as set out in the Forestry Schemes Manual and in compliance with the suite of environmental guidelines in force[132]. A large number of variables are involved in constructing the projections. Benchmark values are used that are in line with experience in Ireland and internationally and, where appropriate, sensitivity is undertaken with reference to key variables such as Yield Class, Stocking ratios and thinning practices. It should be noted that as this model produces projections for the potential production in future years, actual production may vary for a number of reasons, such as responses to market signals or difficulties in accessing mature timber.

Overall Planting

Actual levels of planting for the period 1982 to 2003 are used for projecting production by the private sector. Earlier planting rates by the private sector were very low and production in the medium term will mostly arise from thinnings. The best estimate based on sawmills is that the private sector is currently supplying just less than 100,000m^3 excluding IFUT sales. The production projections in the model are in line with this and with work undertaken by COFORD[133]. The production projection for the Coillte estate is based on actual plantings and growth and is taken from the Coillte 10 year forecast for the period up to 2010 and thereafter from Coillte's 100 year forecast[134]. It is assumed that land that is clearfelled will be replanted in the following year in both the private sector and Coillte estates. Net afforestation in the public sector will be very small and is placed at 200 ha per annum.

Afforestation by the private sector is based on actual planting up to 2003, the Teagasc projections up to 2010 and, initially, at 13,000 from 2010 to 2035, thereafter declining to zero in 2040. This assumption is then amended to show afforestation rising from 14,000 in 2004 to 20,000 in 2008 and remaining at this level to 2035 before declining to zero in 2040. The total area under forest in Ireland will then be just over 1 million ha, approximately 15% of the total land area of the country, under the assumption of 13,000 ha per annum and 1.4 million ha (19.5% of the land area) if the target rate of 20,000 ha per annum is achieved.

[132] Government of Ireland (2003) *Forestry Schemes Manual*

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

[134] The estimates included for Coillte are the actual forecast output from the Coillte model. As a result, the values assumed in this note relate to the private sector. These are not necessarily out of line with those used in the Coillte assumptions but some differ, for example, thinning practices. The consultants adopt the Coillte estimates on the basis that there is no additional information that would suggest that these projections are inaccurate.

Reforestation of private forests will begin in 2022 i.e. 40 years after the first plantings in 1982. Planting in this and subsequent years will depend on the area clearfelled, regulations in relation to planning, plus net afforestation up to 2040.

Period and Rotation

Production projections cover the period 2004 to 2075. A rotation period of 40 years is assumed for Sitka spruce and diverse conifer species. This is in line with normal expectations and would not be expected to diverge much. The rotation period for broadleaf species is subject to much greater variability and will be relatively low for species such as Ash but perhaps as high as 150 years or more for Oak. On the basis of the species mix that has been planted to date, an average rotation period of 60 years is used for the broadleaf species.

Yield Class

A Yield Class of 18 is assumed for Sitka spruce with a drop of one Yield Class for diverse species. However, it is arguable that the Yield Class might reach 20 and projected production is sensitive to this variable. Yield Class 8 is assumed for broadleaf species. Again, this varies by species but this is an appropriate average given the species mix planted in recent years.

Species Mix

In line with the guidelines, it is assumed that future planting is 70% conifers and 30% broadleaf. Diverse conifer species account for 20% of the total so that Sitka Spruce accounts for 50% overall[135]. This applies to afforestation and reforestation. The diverse percentage has changed in recent years. To allow for this, the model is based on 10% diverse species up to 1990, with gradual growth to 25% in 2001. This is maintained to 2006 and reduces to 20% thereafter. Sensitivity analysis is also undertaken on the basis of a species mix that is designed to achieve an estate that is 50% broadleaf in the longer term.

Stocking

Maximum stocking rates for land are set at 90% of the area available i.e. 10% is to allow for small losses throughout the crop and for roads and ridelines. This, while being less than the conventional allowance of 15%, is considered realistic in the light of the quality of land being planted and the stocking requirement at second grant stage.

The area planted is also affected by the requirement for areas for biodiversity enhancement (ABE). This was not an issue up to 1994 so the value is set at zero. Thereafter, the requirement grew gradually reaching the required level of 13% in 2002. This is based on analysis of previous planting plot sizes and estimates going

[135] The underlying data on species mix that are used in the projections are based on planting under the afforestation programme only. The proportions of broadleaves in existing planting for amenity and environmental purposes are higher. It is estimated by the Forest Service that including these areas, which are not considered to form part of commercial plantations, would increase the proportion of broadleaves in the total by between 5.3 and 6% in the years 2001-03.

forward. Together, these requirements mean that 23% of the land is non-productive from a timber perspective.

Depletion and Stability

Some of the land planted will not survive to production as attrition will take place due to natural forces, wind, disease and fire. While this can take place at any time, the model assumes that the impact is felt at the time of clearfelling. To allow for this, it is assumed – based on international experience – that 9% of the land that is planted does not produce timber. Thus, production will be 91% of the area planted i.e. area*0.77*0.91. As a result, about 70% of the available land will produce timber.

The stability of trees is an important issue that will affect attrition. The model assumes rotations that are just less than a top height of 24 metres. While the rotation can be lengthened in sensitivity analysis, increasing the top height will mean an increase in losses due to windblow, especially on the wetter soils.

Thinnings

Standard intermediate thinning is assumed in line with Forestry Commission Booklet 48[136]. The first thinning of conifers takes place in year 18 and thereafter on a five year cycle. However, not all private sector planting is likely to be thinned. Based on an analysis of Coillte's thinning and rotation classification (TRC) system, about 40% of crops are unlikely to be thinned to standard for a variety of reasons, including access, stability, proximity to markets, quality etc. As a result it is assumed that only 60% of the private forests are thinned. This impacts on the timing of production, the quality of the timber produced and the volume of the final clearfell. Sensitivity is also undertaken on the assumption that only 40% of private crops are thinned.

Broadleaf Base Harvest

Production of Broadleaf timber is not a fully commercial operation and its development in the private sector has not been in line with conifers. Current production to the sawmills amounts to about 12,000 m^3 and there is additional production that does not enter the normal production chains being used as firewood and fencing, for example. An estimate is included for this so that a base harvest is included in the production projections of 20,000 m^3.

Yields

The timber yield is affected by growing rates, species and forest management. Yield table data for Irish growing rates are available so that the model requires information relating to how these translate into yields for different species under different conditions. The key condition is whether the forest has been thinned. The following yields in volume of timber in m^3 per ha – net of attrition – are used in the model:

	Diverse	Sitka	Broadleaf
Clearfell/ha when Thinning undertaken	258	369	218
Clearfell/ha when no Thinning undertaken	416	551	218

[136] Forestry Commission *Yield Models for Forest Management*. Booklet 48

It is noted that the volume of conifer timber at clearfell in thinned forest is lower than where no thinning has taken place. However, this is not reflected in the value since the quality of the timber will be lower. In the case of broadleaves, this is an issue as there are no yield models for unthinned crops. Furthermore, the quality of some broadleafs is questionable and as the likelihood is that the poorer quality crops will remain unthinned it is assumed that clearfell volumes are similar to thinned crops.

Uses of Timber

The model provides projections for the total volume of timber and also of the availability of timber for various uses. The 3 potential markets are identified as pulp, pallet and sawlog. The key property of the timber determining its usage will be the diameter of the trees. Timber below 14cm top diameter is suitable for pulpwood and to a limited extent for stakewood, timber in the range of 14 to 20 cm will supply the pallet market while timber greater than 20 cm in diameter will be sold as sawlog. The total volume produced is allocated between these categories according to the following proportionate distribution:

Production	Pulp <14cm	Pallet 14-20 cm	Sawlog
First thinning	0.9	0.1	0
Second	0.6	0.4	0
Third	0.3	0.6	0.1
Fourth	0.15	0.45	0.4
Clearfell	0.1	0.25	0.65

It is important to note that there is no downgrade due to quality considerations. A certain level of downgrade is normal based on tree form, species and other quality considerations

A2.2 Construction of the Model

Projections for the volume of thinnings each year is done separately for Coillte and the private sector and by species. These are then aggregated. Using Sitka spruce as an example, output (1Y) from the first thinning in Year t will be:

$$1Y_t = P_{t-17} * ss_{t-17} * k * T$$

where $1Y_t$ represents the output from the first thinning in year t;
P_{t-17} is the area planted in total – including afforestation and reforestation – 17 years earlier (i.e. thinning is taking place in the 18^{th} year of the plantation);
ss_{t-17} is the proportion of Sitka Spruce in the total area planted 17 years earlier;
k is the stocking ratio i.e. 90%; and
T is the proportion of plantations that are thinned i.e. 60% in the private sector.

This is then repeated for each year of the forecast to give the total output from thinnings of Sitka Spruce (TY_{ss}) plantations in each year i.e. $TY_{ss} = 1Y+2Y+3Y+4Y$. This is then converted to volume of roundwood (W_{ss}) produced in year t from Sitka Spruce thinnings by the formula:

$$W_{ss} = TY_{ss}*YC*5*0.7$$

where YC is the appropriate yield class i.e. 18 in the case of Sitka;
5 is the thinning cycle (years) or the interval between thinnings; and
0.7 is the percentage increment removed, the standard being 70%.

A similar calculation for diverse species provides an estimate of the total volume of conifer timber available from thinnings in the private sector in any year. This is then converted to timber assortments for particular markets according to the proportions shown above.

The approach taken in relation to clearfell is similar. In this case, the relevant planting year is t-39 i.e. clearfell in year 40. The total volume of timber onto each market from conifers will then be the aggregate of thinnings from Sitka and diverse species plus clearfell from Sitka and diverse species based on plantings 39 years earlier. The results produced are then smoothed by using a 8 year moving average. This is done to remove the volatility in the output estimates that can arise due to sharp differences in planting from year to year. This reflects the fact that harvesting will be a function in part of market conditions and capacity in both the harvesting and processing sectors. Since these do not change much from year to year, harvesting will be smoothed to maintain a fairly constant level of capacity utilisation. In addition, producers will wish to avoid sharp swings in supply onto the market that could adversely affect overall returns.

The model for the projection of the supply of broadleaf timber follows a similar structure but with some different values attached to the variables. A total of 7 thinnings are assumed with the first taking place in year 21. Clearfelling takes place in year 60. The estimated production is added to the 20,000 m^3 of the base output projection to give projected output for each year. Only total production figures are given for broadleaves as it is not possible on the information available to provide any reliable breakdown by product use category.

This provides estimates for production by the private sector. Projections from the Coillte 10 year and 100 year forecasts are used to provide estimates for output from this source. These are aggregate production figures and do not distinguish between thinnings and clearfell. These are allocated to the various markets according to data from the past decade. These data show that 20% of output has gone to the pulpwood market, 31% to the pallet market and the remaining 49% to produce sawlogs. This provides the product classification.

Appendix 3: Crop Value Projection Model

A3.1 Background

The crop value projection model is designed to provide a value in the year of planting for the timber that will be produced from a hectare of forest with characteristics typical of forest currently being planted. The value that can be assigned to a typical hectare of forest in Ireland will depend on:

- The time period to harvesting and marketing;
- Timber prices;
- The characteristics of the timber and output per hectare; and
- The costs associated with growing, harvesting and bringing the timber to market.

There are a number of methods for the valuation of forests including (a) transaction based, (b) costs based, (c) liquidation based and (d) expectation based (discounted cash flow). The preferred valuation approach is the transaction-based methodology provided the transaction evidence is suitable in terms of reliability, comparability and number of transactions. Where transaction evidence is not available, then the next best approximation of market value is the expectation value approach methodology. Using the expectation approach, future timber revenues are calculated based on forecasted volumes and timber prices. Costs are subtracted to give future net cash flows, which are discounted to give forest value. Variations of the expectation approach arise depending on whether (a) a single or perpetual series of rotations is assumed, (b) land value is included and (c) the reforestation cost is charged to the current or next rotation. This has given rise to a number of definitions of value:

- Forest Expectation Value (FEV): The present value of cash flows arising from both the land and the tree crop in perpetuity. The Victorian Plantations Corporation has used this method[137].
- Land Expectation Value (LEV): The present value of a perpetual series of crop rotations on the land, the land being bare of the crop at the commencement of the series.
- Crop Expectation Value (CEV): The present value of cash flows arising from the tree crop, the cost of the land being included by a notional rent calculated at the discount rate applied to the LEV, alternatively calculated as Crop Expectation Value = Forest Expectation Value - Land Expectation Value
- Terminating Forest Expectation Value[138] (TFEV): The present value of cash flows arising from both the land and the crop for one rotation only, with the land sold after harvest at land market value (LMV). There are a number of variations of this method relating to the time period used.

[137] Ferguson, I. :1997) *Valuation of forest assets*. Report commissioned by Auditor – General, Australia. http://www.audit.sa.gov.au/95-96/forest

[138] In general terms, terminating values are used where forestry is not considered to be the highest and best land use. The calculation of LEV and FEV under Irish conditions is dubious, given the impact of grant aid on the resulting values.

- Terminating Crop Expectation Value (TCEV): The present value of cash flows, for the current rotation only, arising from the crop, the cost of the land being included by a notional rent calculated as the discount rate applied to the LMV, alternatively calculated as TCEV = TFEV – LMV.

The expectation approach is sensitive to a number of factors such as price, discount rate, taxation status, etc. so careful assumptions are required to provide a reliable as well as comparable estimate of value.

Discount Rate

Forest valuations are extremely sensitive to the discount rate used and the subject has generated considerable comment and discussion for over 100 years. The literature provides a wide range of discount rates and the basis for their determination, as discussed further in Appendix 5. At the outset, it is important to distinguish between discount rates applying to investment appraisal (hurdle rates) in forestry and those applying to forest valuation. Due to the history of State investment in plantation forestry, threshold rates have typically reflected the State's own discount rate for capital investment. This is usually placed at 5% in Ireland although the low interest rate environment of recent years suggests that a lower rate is arguable. In addition, it is necessary to distinguish between instances where the use of a social discount rate is required and instances where a private discount rate is appropriate. In using this model to value timber planted by private growers, the real private discount rate is used giving a rate of 5.5% per annum. However, a lower rate could be used if valuing the social value of the timber since the risk relating to price would be less important. Sensitivity analysis around this rate was undertaken.

Yield Growth Models and Forecasting

Growth models are pivotal to predicting future timber production and by implication future timber revenues. In Ireland, the Forestry Commission Yield Tables, supplemented by a small number of Irish models have been used to forecast timber volumes up to and including the present by both the private and state sector[139]. These models predict stand parameters (volume, height, basal area etc.) over time based on assumed management interventions (thinnings). In more recent times, significant progress has been made in the development of dynamic stand models[140]. Dynamic models show greater flexibility in terms of modelling different crop treatments. However, the first prototype of the Sitka model was found to be unreliable when thinning treatments varied significantly from marginal thinning intensity[141].

Forecasting Volume

Normally, when yield models are used to predict future volumes, a general volume reduction of 15% is applied to cater for roads, ridelines and unproductive areas[142]. The Forest Service tested this 15% in 1984 on a random sample of four forests and the

[139] Coillte (1993) *Inventory and Harvest Forecasting System*, Version 1.1

[140] Broad, L. (1998) 'Growth and Yield Models: An Overview'. Paper presented to workshop on Decision Support Tools in Forest Planning, COFORD.

[141] Phillips, H. (1998) *Resource Management: Modelling Management Interventions*. Report on Rotation Length, Thinning Intensity and Felling Decisions for Blue Areas. Coillte (Unpublished)

[142] Forestry Commission *Yield Models for Forest Management*. Booklet 48 HMSO, London

results showed that when all unproductive areas were mapped and netted, they accounted for 12% of the gross area.

Attrition

To allow for creeping windblow and disease, (areas which are too small to map separately during routine inventory) forecast volumes can be adjusted by what is called an "attrition factor". Coillte uses an attrition factor of 7.5%. The 7.5% was arrived at based on a comparison of forecast versus actual volume outturn[143]. The attrition factor is converted to an annual attrition rate based on the number of years between time of first thinning and age of maximum mean annual increment (MMAI).

A3.2 Model and Assumptions Used

Growth Models

Sitka was assumed to be YC 18. Diverse species was assumed to be equivalent to YC 14 Sitka. The 20% Diverse category uses Japanese Larch YC 8 as the minor species. Broadleaf was assumed to be YC 8 and to be revenue neutral i.e. the revenue earned equals the cost of growing broadleaves. In effect, broadleaves are being grown for environmental value and not timber value. Thus, there is no addition to monetary value from broadleaves. A rotation of 40 years for conifers and 60 years for broadleafs was assumed.

Management Regime

Conventional standard thinning was assumed on 60% of the plantation with a balance of 40% not thinned. This is based on a combination of the small scale of private forests, difficulties with access, the behaviour of private owners who are unlikely to maximise volume availability and topographic factors. Financial rotation was assumed (rotation of maximum net present value).

Timber Prices

Long term price forecasts for timber are rarely produced and projections are generally based on an observed correlation between the price of timber and the consumer price index (CPI). The implication is that the price of timber rises in line with general inflation. However, prices can diverge from inflation over limited period for various reasons. For example, the price of timber in the UK fell by over 50% in real terms i.e. in excess of the CPI, in the 5 years from 1996 to 2001. Two factors in particular have led to this short run divergence: much greater imports from Scandinavian countries that are targeting the UK market and that have created a situation of oversupply and the strong performance of the UK currency in this period. This had the effect of reducing the price of imports when measured in UK prices so that timber prices in the UK fell faster than on world markets. The implication is that it is important to use a smoothed average price as a base rather than individual years in examining price changes over time.

[143] Clinch (2002) Personal communication

To account for these factors, a fifteen-year average of standing conifer prices was used as the base price. The underlying prices were updated to 2004 using the CPI. No price deflation was assumed. Sensitivity was undertaken using a 10 year price average.

Stocking and Attrition

A stocking of 90% was assumed. In addition, allowance was made for 12% for areas of biodiversity enhancement (ABE) as required under current regulations and a 6% allowance for attrition and other factors.

Operating Cost

The cost of establishment and all costs to end of year four were equated to the first and second instalment of the grant. This means that both the grant and the costs that arise at establishment are basically excluded from the calculation. The main costs arising after this period relate to harvesting. Timber prices were reduced by 10% to cover the costs of measurement, marketing etc. This is a good approximation of the cost that can be expected in a standard plantation.

Appendix 4: Estimating the Value of Non-marketed Goods

A4.1 Methodologies

As the environmental impacts of forestry are marketed they have no direct price. The values therefore have to be derived by indirect methods, focusing on attempts to reveal demand and preferences. Conceptually, the same measure of benefit applies to market and non-market goods, that is, the maximum amount an individual would pay to avoid losing, or gaining, access to the good. Thus, measures of non-market benefits are concerned with estimates of consumer demand and consumer surplus[144].

Non-market valuation techniques attempt to value un-priced assets to ensure that all costs and benefits of a strategy are identified and allocated. However, these value assessments do not command universal support, with some critics arguing that the environment is beyond monetary valuation and the use of the environment is anthropocentric, and hence deny the validity of these exercises[145]. However, if there is no benefit assessment conducted of the benefit realised, then some other criterion is needed to rank projects, for example, a value for ecology. Other criticisms focus on the practical difficulties of measuring people's preferences, focusing on the lack of information, the sample selection, the use of values transferred from one area to another, the way the future is discounted[146], and how to incorporate uncertainty into the calculations. Issues of scale, aggregation, risk and uncertainty, and benefit transfer also pose challenges to environmental economists in this arena. Therefore, it is also important to take account of how well the assessment is done.

Nevertheless, environmental economists have developed a formidable economic toolbox of techniques to address these valuation questions[147]. These are continuously being redefined and innovated with limitations being reduced via empirical application. As a result, valuation of environmental assets is an increasingly useful tools for decisionmakers, especially with the existing correlation between the value of the asset and the related investment and policies required to maintain or improve the asset. These include production function approaches that quantify environmental impacts in relation to indirect economic impacts on related market sectors. There are also revealed preference measures such as hedonic pricing and stated preference techniques such as contingent valuation or choice modelling.

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[144] Lipton, D. (1995) *Economic Valuation of Natural Resources: A Handbook for Coastal Resource Policymaker*s, National Oceanic and Atmospheric Administration, Coastal Ocean Program Decision Analysis Series No. 5.

[145] Anthropocentrism refers to a world-view that considers everything in terms of human wants and needs.

[146] See Sumalia, U. and R. Walters (2003). 'Intergenerational Discounting' in U.R. Sumalia, '*3 Essays on the Economics of Fishing*. Fisheries Centre Research Reports, 2003, Volume 11 No. 3. University of British Columbia. The authors develop an equation for use in calculating net discounted benefits, which provides a 'middle' position whereby the reality of 'personal' discounting and that of 'social' discounting are included in a social welfare function.

[147] The EU's Agenda 21 calls for refining of valuation methods such as contingent valuation to make them more inclusionary in nature, with the use of focus groups and other devices to engage with relevant stakeholders, with the aim of reducing problems of potential bias.

Key techniques using information to indirectly determine what a market might reveal in value if it did exist include indirect measures based on observable behaviour. The two main types of approaches are:

- Travel Cost Method & Random Utility Methods: These approaches are based on obtaining expenditure and travel behaviour for recreational opportunities. Economists tend to prefer techniques of this sort because they are based on actual behaviour rather than verbal responses to hypothetical scenarios. The greatest disadvantage is that they cannot be employed unless there is some easily observable behaviour that can be used to reveal values; and
- Hedonic Pricing: This is a methodology for decomposing prices of market goods to extract embedded values for related environmental attributes, for example, the increase in value of a property adjacent to or overlooking a river or lake[148]. Again, economists tend to prefer techniques of this sort because they are based on observable data resulting from the actual behaviour of individuals. The disadvantage is that most environmental incidents will only have a small, if any, effect on housing prices.

An additional and commonly used technique is contingent valuation or stated preferences. This technique attempts to measure the change in value directly by using methods to elicit preferences, either by using hypothetical settings, called contingent valuation, or by constructing a market where none existed. This experimental method is based on direct surveys of individuals[149]. Within this approach, a number of concepts for valuing damage have been developed including:

- Willingness to pay to secure a benefit (WTPsb);
- Willingness to pay to avoid a deterioration (WTPad);
- Willingness to accept compensation to tolerate a deterioration (WTAtc); and
- Willingness to accept compensation to forego a benefit (WTAfb).

Since the first published contingent valuation study in 1963, more than 2,000 related papers, reports and books have been published in the area. Under this method a sample of people are asked to make choices between alternative future resource management options. Although theoretically the WTP must equal to willingness to accept WTA, empirical evidence suggests contrary; the WTA has been found significantly greater than the corresponding WTP[150]. Two problems encountered with this approach are that the results of the survey may not be representative, and, that the responses may be affected by an individual's beliefs. Research has found that

[148] See for example Lake, I., I. Bateman, A. Lovett (1997), 'Visual Impact, Environmental Valuation and House Prices', Paper presented at GIS Research UK: 5th National Conference, Leeds. Brief discussions with auctioneers in Ireland indicate that they concur with the conclusion that properties are worth more when they are adjacent to, or in view of, rivers, lakes, or the sea. Also see, Willis and Garrod (1993) *The value of waterside properties: estimating the impact of waterways and canals on property values*, ERM.

[149] See Mitchell & Carson (1989), *Using Surveys to Value Public Goods*. Baltimore. Johns Hopkins University for Resources for the Future (Washington D.C.) and Horowitz and McConnell (2000). *A Review of WTA/WTP Studies*. Department of Agricultural and Resource Economics, University of Maryland.

[150] Fisher, A., G. McClelland, and W. Schulze, (1998), 'Measures of Willingness to Pay versus Willingness to Accept: Evidence, Explanation, and Potential Reconciliation', In: G. Peterson, D. Driver, and R. Gregory, *Amenity Resource Valuation: Integrating Economics with Other Disciplines*, pp. 127-134. Pennsylvania: Venture Publishing.

contingent valuation methods work better if people have more and better information on which to base their decisions[151]. Furthermore, individuals' expressions of willingness to pay or willingness to accept compensation are conditioned by their own endowments of wealth. Therefore, care should be taken in interpreting any aggregation of these individual measures, due to the possible distributional implications[152].

Other valuation techniques include: Damage Cost Avoided, Defensive Expenditure, Replacement/Substitute Costs and Restoration Costs, as advocated by UN guidelines.

Without the assistance of proper value assessment, prejudice and short-term considerations about the impact of prices can easily outweigh more diffuse and longer-term environmental/social interests. Moreover, public valuation of environmental and social benefits rises over time as incomes increase and concern for the environment heightens, and as the remaining stock of environmental assets dwindles with growing pressures. The use of appropriate methodologies would permit full valuation of all the goods and services produced by forests. Thus, it would promote investment in the forestry sector and sustainable forest management practices, as reflected in the Forest Principles of Agenda 21, the *Natura 2000*, Rio Summit, 1991 (United Nations Conference on Environment and Development) and the United Nations Convention on Climate Change. The forest principles developed at Rio were issued as non-legally binding authoritative statements of principle for a global consensus on the management, conservation and sustainable development of all types of forests. In Europe, Ministerial Conferences were held reaching their conclusions in the Third Ministerial Conference on the Protection of Forests in Europe held in Lisbon in 1998. The last ministerial conference was held in Vienna in 2003. However, value assessment exercises are inevitably quite crude. The crudeness can be significantly reduced if appropriate budgets and realistic time-scales are allocated especially when primary data needs to be gathered. As a result, an appropriate target must be to observe that an initiation of these techniques would lay the foundation for developing a continuous analytical process within the sector.

A4.2 Using the Models

In the 1990s, following a recommendation of the House of Commons Committee of Public Accounts that the non-market benefits of forestry should be quantified in monetary terms, the UK Forestry Commission became actively engaged in valuation research. The Commission has estimated that the non-market benefits of woodland to contribute some £1.02 billion annually[153]. This work found that the non-market benefits of woodland are dominated by recreational and bio-diversity values followed by landscape benefits, with carbon sequestration also contributing significantly to the social and environmental benefits of forests. The Southwest of England Woodland

[151] Diamond, P. A. and J. A. Hausman (1994), 'Contingent Valuation: Is Some Number Better than No Number?', *Journal of Economic Perspective*, 8: 45-64. Hanley, N., Clive S., and L. Walker (1995), 'Problems in Valuing the Benefits of Biodiversity Protection', *Environmental and Resource Economics*, Vol. 5, pp. 249-272.
[152] Bockstael, N., et al (1998), *On Valuing Nature*. University of Maryland.
[153] Willis et al (2003). *The Social and Environmental Benefits of Forests in Great Britain*. Report to the Forestry Commission.

and Forestry Strategic Economic study valued the recreation, tourism and sporting activities at a gross value of circa £300-375 million per year[154]. They reviewed the other environmental values attributable to woodlands and forest for the region at £313 million, equivalent to £1,470 per ha of woodland cover. Significant resources are allocated under the Commission's 1999 corporate plan and the Rural Development Plan on improving landscapes, habitats, and wildlife of amenity farmland through planting new woodlands and improving existing ones. Further contributions are made via the Farmland Wood Premium Scheme and the Woodland Grant Scheme.

Some assessments of non-market outputs from forestry have been undertaken in Ireland[155]. Research has identified models to provide values in Ireland but the results provided are limited in terms of their practical applicability and are not sufficient in number to comprehensively inform policy and strategy[156]. It is not uncommon internationally for values from one context to be transferred to other schemes/locations – termed 'off the shelf values' or 'benefit transfers' – although it is known that this can give rise to problems. Although significant work has been undertaken outside of Ireland, it is not necessarily appropriate to use the 'benefit transfers' method, as the nuances and applicability (such as distributional aspects mentioned above) of the model are lost. A key related issue concerns the definition of the relevant aggregation population: i.e. the group of people who hold WTP values, and across whom total values should be calculated. Who holds the values and whether these values vary across the population affects decision-making. For example, some NMBs of forestry exhibit severe diminishing marginal WTP. The prime example of this is recreation benefits. Here, the relevant aggregation population is largely clustered around the site. If the site is subject to severe congestion, the provision of additional woodland might only result in a modest decline in marginal WTP. However, in areas where substitutes exist, or where demand is low, the provision of additional woodland might lead to a very significantly declining marginal WTP. It is therefore vital that the impact of substitutes and other factors that impinge upon marginal WTP are incorporated within the aggregation procedures. The experience with valuations to-date has shown that contingent valuation/stated preferences studies and related proxies are specific to the resource, the change and the population studied.[157] Nevertheless, for the purpose of informing the policy, examples of NMB valuations undertaken outside of Ireland can be examined. It is worth noting that

[154] Forestry Commission (un-dated), *South West England Woodland and Forestry Strategic Economic Study*.

[155] See Clinch (1999): *Valuing Forestry* (COFORD) and Hutchinson W G and Chilton S M (1995) *The use of CVM to explore the trade-offs between the positive and negative externalities of afforestation programmes on marginal farmland and peatland in Ireland* in Hofreiter M F and Vogel S (eds. 1995) *The role of agricultural externalities in high income countries* EAAE Seminar. Hutchinson W G and Chilton S M (1995) *Integrating cognitive psychology into the CVM to explore the trade-offs between non market costs and benefits of alternative afforestation programmes in Ireland* in Adamowicz W L et al (eds.) *Forest Economics and the Environment* London: CABI. Also Scarpa, R., W.G. Hutchinson, J. Buongiorno and S. Chilton (1999) 'Stated willingness-to-pay for forest recreation: Do forest attributes matter?' Paper Presented at the 9th annual conference of the EAERE.

[156] See Hutchinson, G., Scarpa, R., Chilton S., and T. Mc Callion. (2001). 'Parametric and non-parametric estimates of willingness to pay for forest recreation in Northern Ireland: a multi-site analysis using discrete choice contingent valuation with follow-ups'. *Journal of Agricultural Economics*, 52(1) pp. 104-122, for application of a contingent valuation technique for forest recreation.

[157] CSIRO (2002), *Value of Returns to Land and Water and Costs of Degradation.* Final Report to the National Land and Water Resources Audit. Volume 1.

practicing environmental economists are ready to undertake NMB valuations when their value as an integral part of sustainable development policies is fully appreciated.

A4.3 Review of Relevant Research and Data

A4.3.1 Recreation and Leisure

The recreation value of forestry in Northern Ireland has been estimated at in excess of £2 million per year at 1992 prices, according to conservative estimates[158]. These values are consistent with those reported in earlier UK studies and are shown to be relatively stable across alternative methods of estimation. Additional empirical work by Hutchinson et al (2003)[159] indicates that managing a regional recreational resource equitably and efficiently may also involve simultaneous changes introducing recreational improvements at some sites while restricting recreation at others. They argue that this information may be combined with knowledge of the different socio-economic characteristics of the affected districts to identify the extent of regressive and progressive equity effects of policies for management of these recreational resources.

More recent work suggests that individual demand for forest visits in Northern Ireland, for visitors who set out with the main purpose of conducting a recreation visit to a forest, enjoy substantially higher economic benefits than previously estimated. This is estimated at €6 (UK£4) but there is quite a variation across forests sites (£1.15 to £7)[160]. Furthermore, to maximize the sporting benefits of forested land, research suggests that forest developments should involve small scale, high value added production rather than mass production timber[161]. It has also been noted that costs related to recreation are tending to increase due to public liability insurance costs[162].

The recreational value of woodland in the UK was estimated using the EU CAMAR data set.[163] The benefit transfer estimates were compared to the actual willingness to pay (WTP) amounts derived from the 2002 on-site surveys at each of the 7 forests surveyed. The recreation demand benefit transfer function from the EU CAMAR data derived conditional mean WTP values per visit based on woodland attributes. These attributes covered total forest area in hectares, percentage coverage of broadleaf species, larch and presence of nature reserves, all of which were beneficial for the

[158] Hutchinson, G., Scarpa, R., Chilton, S., McCallion, T (2001). 'Parametric and Non-Parametric Estimates of Willingness to Pay for Forest Recreation in Northern Ireland: A Discrete Choice Contingent Valuation Study with Follow-ups'. *Journal of Agricultural Economics* Vol. 52.
[159] Hutchinson, G., Scarpa, R., Chilton, S., McCallion T., (2003), 'Spatial Distribution versus efficiency effects of forest recreation policies using a regional travel cost method', in Hanley, N., D. Shaw, and R. Wright (eds.) *The New Economics of Outdoor Recreation*, Edward Elgar.
[160] Scarpa, R. (1999). *Assessing the amenity value of forests, with applications to Wisconsin and Ireland*. PhD dissertation, University of Wisconsin – Madison.
[161] McGilvray and Perman (1991) *Sporting Recreational Use of Land*. Forestry Expansion, Paper Number 10. Forestry Commission, Edinburgh.
[162] Clinch, P., (1999). *The Economics of Irish Forestry*. COFORD.
[163] Ni Dhubhain et al (1994). *The socio-economic impact of afforestation on rural development*. Final Report EU CAMAR. Contract No. 8001-CT90-0008.

user. Conifers, and a measure of congestion (yearly visits over car park capacity) both had negative impacts on the user. Applying this benefit transfer function to the attributes of the 7 forests produced a mean WTP per visit values that ranged from €1.65 (UK£1.10) per visit to Epping to €4.50 (UK£3.00) per visit to Delamere. The benefit transfer function can be used to compute the recreational value of any combination of forest attributes. For example, an English woodland of 900 hectares, with 60% of the area conifers, 20% broadleaf species, 12% larch, 5% of tree planted before 1940, with a nature reserve, and a congestion index of 20, would have a mean WTP value of per visit of £1.48[164]. This is a significant value so that including recreational values will positively alter the NPV of forest land. However, while these values can be assumed to apply to the marginal visitor, it is not necessarily the case that they are appropriate for a marginal hectare of afforestation. Further research has indicated that there is the equivalent of a downward sloping demand curve from the current price of free entry[165]. This study revealed that if a price for entry to a forest area were charged, 34% of respondents would reduce the number of visits they made to the forests. This indicates that people would change their visit behaviour to forests substantially if an entry fee were charged. While 20% of respondents would reduce their visits by less than half, the other 80% would reduce their visits by one-half or more. In addition, the willingness to pay for each visit declined with frequency of visit, on average by half. This suggests that it is important that supply of the resource is available to users at a low private cost. This also illustrates the difficulties of willingness to pay studies: the suggestion here is that the willingness to live without the visit would give a lower estimate of value.

The value estimates reported in the model show that the total forest area in hectares has a positive effect on welfare. Positive effects were also found for the percent coverage of broadleaf species, the percentage of larch in the plantations and the presence of nature reserves. On the other hand, the marginal effect of conifers and a measure of congestion – defined as yearly visits as a proportion of car park capacity – are negative. This shows that, in the UK, both species composition and forest recreational management are factors affecting the overall value of the plantation. It also suggests that, for tree species, there are positive values arising from diversity. These results are all consistent with expectations, but the model somewhat surprisingly produced a significant negative effect from the presence of older trees planted pre 1940. When the model was run independently for the various regions of the UK it identified only one significant difference between the values in these regions.

This analysis indicates that an ideal site that will contribute the greatest recreational value has the following attributes.

- The larger the forest site the better: as increasing the size of the forest leads to a higher measure of value;
- Variety is very important, so a mixture of larch and broadleaf species is ideal with few conifers;

[164] Willis et al (2003). *The Social and Environmental Benefits of Forests in Great Britain*. Report to the Forestry Commission.
[165] Scarpa, R (2003). 'The recreation value of woodlands' in *Social and Environmental Benefits of Forestry: Phase 2*, Report to the Forestry Commission.

- It is important to manage the relationship between visitor numbers and availability of car parking spaces at peak times as congestion in this regard shows a high negative utility;
- An ideal forest has a nature reserve or equivalent protected area. This attribute adds greatly to value.

Further research is required in relation to valuing edible forest products, foliage, and to a lesser extent, on forest-based tourism[166].

A4.3.2 Carbon Sequestration and Storage

The reference point for the development of interest in valuing the carbon storage action of forest is the *Kyoto* agreement where forests were recognised as legitimate carbon sinks for inclusion in calculating net emissions. Ireland's emissions of CO_2 in the base year of 1990 were 31.575 Mt with total emissions of greenhouse gases equivalent to 53.752 Mt of CO_2. If recent trends continue, the *National Climate Change Strategy* projects that by 2010, Ireland's net greenhouse gas emissions, calculated in accordance with the *Kyoto Protocol*, will be in the range of 71.9 – 73.8 Mt CO_2 equivalent, with 51.373 Mt of CO_2[167]. 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.

Under *Kyoto*, the impact of new forests that have been planted since 1990 in sequestering CO_2 may be counted in assessing a country's total emissions[168]. Although the vegetation transfers the carbon from the atmosphere into storage in timber, more carbon stored in forests is in soils than above ground. It has been estimated that the average rate of carbon storage in Irish forests of pure Sitka spruce is in the region of 3.36 tonnes per ha per year[169]. This estimate means that, 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.

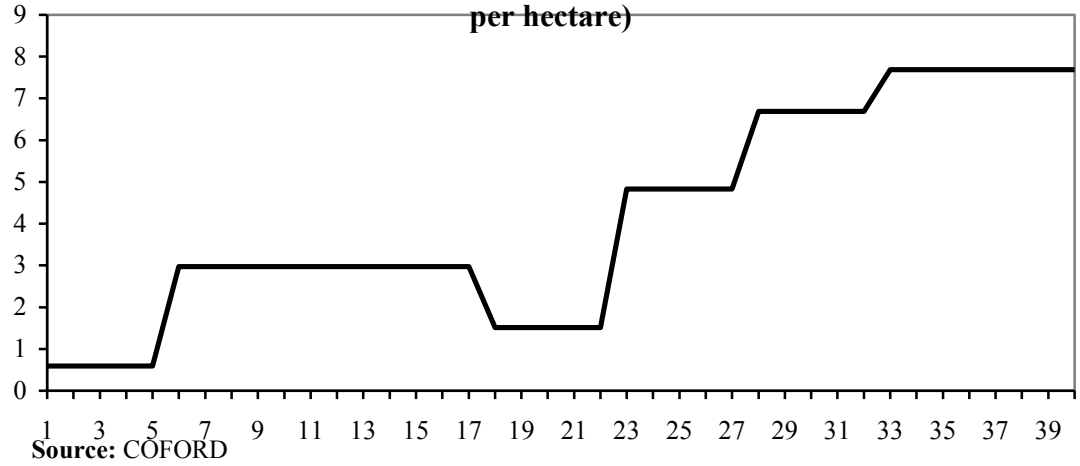
More recent research undertaken by COFORD has been accessed to provide estimates of the annual CO_2 sequestration of a typical hectare of new forest as it grows. The analysis is based on assumptions in relation to species composition, yield class etc.

[166] COFORD (2004), *Markets for Non-Wood Forest Products*.
[167] 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. The NCCS estimates are based on 2 scenarios, the first where the targeted rate of afforestation is achieved and the second where 50% of the rate is achieved. Thus a mid-point would equate to annual afforestation of 15,000 ha.
[168] *NCCS*, Appendix 2.
[169] Kilbride, C., K. Byrne and J. Gardiner (1999) *Carbon Sequestration & Irish Forests*. Dublin: COFORD. This estimation was done using an average Yield Class of 16. This is considered to be somewhat on the low side as a result of growth rates being achieved in private forests over the past decade.

that are deemed to be appropriate to Irish conditions and the existing forest estate and differ slightly from the assumptions used in the production projections in Section 3 of this report. However, they are sufficiently close to provide an assessment. The COFORD work assumes that the hectare in question is composed of 80% Sitka spruce and 20% beech. The conifers were deemed to have a Yield Class 16 and undergo intermediate thinning (equal to 56 m^3 per ha at 20, 25 and 30 years.) For the beech plantation a yield class 4 was assumed and no thinning was undertaken. Average growth rates were used from the Coillte estate for Sitka spruce and beech throughout[170]. Four growth periods were identified for the Sitka. The cumulative volume at age 32 was 382 m^3 with the annual increment peaking in the years 28 to 32 at 120 m^3 per ha. After thinning, the volume was estimated at 150 m^3 per ha[171].

Figure A4.1 shows the rate of annual incremental CO_2 sequestration in tonnes per hectare under these growth assumptions. This storage estimate is net of emissions from soils, vegetation and thinning. This shows annual storage reaching a level of 7.7 tonnes of CO_2 per ha in the period from 33 to 40 years with cumulative storage of CO_2 over the full growing period amounting to 165 tonnes of CO_2.

Figure A4.1: Annual Incremental CO_2 Sequestration (tonnes per hectare)



Source: COFORD

However, while indicating carbon sequestration activity, this approach is inadequate in providing a basis for estimating the value of sequestration by forests under the *Kyoto* provision. This approach provides what can be considered to be an estimate of gross sequestration by the forest. However, at clearfell, much of the carbon is removed and returned to the atmosphere. Thus, this is not an estimate of the amount of CO_2 that is locked into the forest. A crude estimate of the CO_2 stored at any stage during the first rotation after planting could be obtained by assuming that reforestation takes place soon after clearfell. Then the equilibrium level of carbon in the forest will be an average, weighted to reflect sequestration at different stages of growth, of the

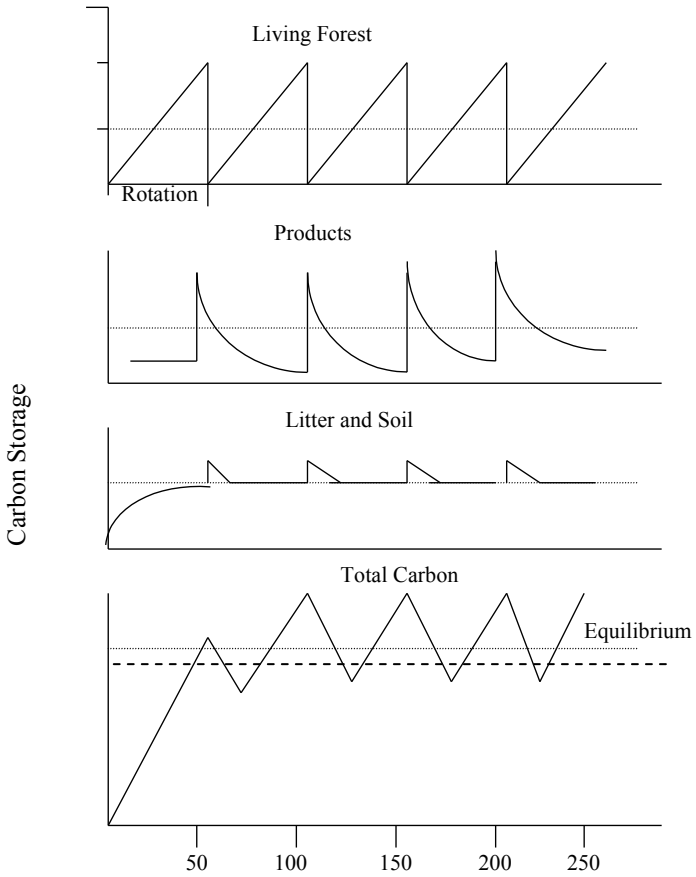
[170] The estimates were derived using the International Panel on Climate Change approach (draft Good Practice Guidance). It is thought that average growth rates in the private sector in Ireland may exceed the levels achieved on average in the Coillte estate. As a result, the growth estimates may be conservative.

[171] These figures are for a fully stocked hectare. The calculations on which sequestration is estimated below reduce projected yields by 15% to allow for non-planted areas. This is in line with parameters in the CARBWARE model for estimating carbon storage in Irish forests.

carbon accumulated in the timber. This calculation indicates an average level of around 60 tonnes stored per hectare during the first rotation. However, the amount of carbon stored will build up during subsequent rotations until an equilibrium level of storage is reached.

Figure A4.2 shows a stylised representation of the concept of equilibrium carbon storage in a forest over successive rotations[172]. Storage takes place in three ways. The top part of this figure is somewhat similar to Figure A4.1 above and shows carbon accumulating during the growing period and then removed at the end of each rotation. However, in Figure A4.2, carbon stored in the roots, which is not removed at clearfell, is included under litter and soils. This is why the amount stored reverts back to zero in the first diagram in Figure A4.2.

Figure A4.2: Equilibrium Carbon Storage in Forests



The middle two diagrams in Figure A4.2 show two potential additional sources of carbon storage in forests. The first is in wood products. This shows that this peaks at clearfell i.e. the carbon is simply transferred from the living forest to the wood, and then declines over time as the wood is gradually broken down. The rate at which this decline occurs depends on the use to which the wood is put. For example, wood used in construction can be expected to continue to store the carbon for perhaps 75 to 100 years while wood used for energy production will release the carbon within a short period of perhaps a couple of months. This diagram shows that some of the carbon

[172] Figure is sourced from Cannell, M. (1995) *Forests and the Global Carbon Cycle in the Past, Present and Future*. European Forest Research Institute Report No. 2

remains in products and that the minimum level rises slowly over time. While this is clearly a source of storage, there are no reliable estimates of this impact for Ireland and no estimate of the carbon thus stored is included in the analysis.

Finally, carbon is stored in soils. This has a number of aspects including roots, litter and other material in the soil. The level soon reaches the equilibrium as carbon is stored in the root system and is not removed at clearfell. Root material was captured in Figure A4.1 but the carbon in litter and other carbon in the forest soil has not been included. Reliable estimates of this carbon are not available for Ireland but the experience with forestry since 1990 suggests that it may not be very important in the overall context. Clearly litter breaks down over time thereby releasing the carbon but more importantly in the Irish context, the planting of some forest on peat soils means that there may be a net release of carbon from such soils[173]. Thus, the assumption in the estimates below is that Irish forestry has had an overall zero impact on soil carbon.

Both the rate at which carbon is sequestered and the equilibrium level varies according to the species type. Furthermore, there is no correlation between the rate of sequestration and equilibrium storage levels. As a result, the number of rotations required for the equilibrium level to be reached will vary. Estimates of storage and equilibrium levels for the main species based on growing conditions in the UK have been published in the past[174]. These indicated an equilibrium level of 192 tonnes CO_2 per hectare for Sitka, 200 tonnes for Beech and 154 for Oak in the UK. For all these species, the equilibrium level is exceeded during the first rotation although much of this is then removed when the timber is harvested and eventually returned to the atmosphere. A shorter rotation period than was assumed in the UK studies would be appropriate in Ireland, implying that the rate of storage per annum would be higher and, while this does not imply a higher equilibrium level, it does mean that the equilibrium level would be reached in a shorter time period.

A model of CO_2 storage constructed by COFORD personnel in the course of this project has provided estimates of equilibrium CO_2 storage under Irish conditions[175]. The results differed from the earlier estimates for a number of reasons. First, the estimates were produced for a hectare planted using 70% conifer and 30% broadleaf i.e. the recommended planting species proportions for the future. Second, the model assumed that 15% of the land is not planted due to the need for areas for biodiversity enhancement. Finally, the model netted out CO_2 that would be stored on the land from its use in agriculture i.e. storage in pasture and hedgerows.

This model identified an equilibrium level of 129.2 tonnes of CO_2 per hectare. This means that an additional hectare of afforestation will lock up in perpetuity 129.2 tonnes of CO_2 assuming reforestation over and above the CO_2 that would be stored on

[173] This statement in relation to the impact of afforestation of peat soils on carbon in the soil should not be interpreted as a conclusion that there is no sequestration by such forests. The statement relates to carbon in soils only and is not a reference to storage in timber or roots which proceeds as on other soils when adjusted appropriately to reflect the expected yield class.

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

[175] The results provided by this work should be considered to be preliminary and further refinement of the underlying model in the future may lead to some adjustment in the results. However, the underlying assumptions are more representative of typical growing conditions in Ireland than assumptions underlying estimates that have appeared in the literature to date.

this hectare if used in agriculture. This does not include the carbon that remains locked into timber products as discussed above – it assumes that all carbon in timber taken from the forest is returned to the atmosphere within the period before reforestation. As a result, there is additional carbon locked in as a result of the afforestation but no estimate of this is available. Furthermore, it does not include the carbon avoided through not engaging in agriculture[176].

A4.3.3 Biodiversity

Generally, wildlife diversity or protection value is associated with the type of forest management system – intensive and extensive[177]. Again, it is difficult to measure value as bio-diversity benefits are difficult to capture. The problems arise principally due to the fact that people have widely different preferences for wildlife and that bio-diversity is a difficult concept for people to grasp. Nevertheless, various proxies can be used. For example, the commercial value of wildlife is reflected in the prices that can be charged for hunting i.e. the license fee. Where this is not possible, the contingent valuation technique provides one option to put value on bio-diversity[178]. This implies the creation of fictitious markets with an implied demand function for bio-diversity.

So far there have been no economic estimates of the value of wildlife habitats in Ireland. Nevertheless, bio-diversity may have a high economic value based on potential future uses and people's concerns for leaving a diverse natural capital to future generations and their concerns for the well-being of non-human species[179]. The cost of wildlife conservation in forests could possibly also be inferred from the opportunity costs of timber production foregone by regulations to promote bio-diversity. This approach is instrumental in determining EU policy in this area. Such an approach is applicable only in cases where there is an established relationship between the timber production and environmental damage. In such cases, the cost of foregoing timber production in the interests of wildlife might quantify the cost of conservation in monetary terms. However, there is an implied assumption in using such an approach that the initial regulation is optimal. For example, if the regulation is insufficient it is clearly undervaluing bio-diversity. As a result, this approach provides an *ex post* valuation and would only be appropriate to use as an input to the decision process if a range of values from different areas could be adopted or if an objective measure of bio-diversity change could be used in conjunction. Within

[176] Agriculture is known to be a major source of emissions in Ireland. However, it is arguable that, following the reform of the CAP and decoupling as described in Section 5 below, a proportion of the land going into forestry would not have been used in agriculture so there is a reduced saving. However, as the CO_2 impact of forestry is being calculated on a net basis here there is some additional impact not included in the calculation.

[177] Bunnel, F. (1976), 'Forestry-Wildlife: Whither the Future?', *Forestry Chronicle*, Vol. 52 (3).

[178] Pearce, D. and D. Moran (1994) *The Economic Value of Biodiversity*, EarthScan Publications, London,.

[179] See Ozdemiroglu & Bullock (2000) *Environmental Impacts and Parameters for Inclusion in the Economic Valuation of Road Schemes*. Dublin: EPA

Ireland, the key issue in this regard is the perception that a number of alternative land uses would have a greater bio-diversity value than blanket Sitka spruce planting[180].

Even if individuals do not visit forests, they are still likely to value the preservation for other potential uses and for future generations. Benefits of species preservation or non-use values can be substantial and the contingent valuation method is a popular technique to elicit values in this regard. An important option value of forests comes from the pollination of crops, maintenance of species and a vast genetic library, commonly visited by bio-prospecting pharmaceutical firms, commonly referred to as quasi-option values. These are often cited as a reason for promoting preservation of forest areas, and indeed, other natural resource assets. Research indicates that people are willing to pay for the preservation of forests to ensure that future generations could enjoy forest recreation[181]. Almost similar results were reported in the UK on a small sample study of six forests in England and Wales[182]. Some estimates of opportunity costs or existence values could also be made. Proxies for this could include cash offer from an international conservation group, the market value of flora and fauna in use and the cost of replacement.

A4.3.4 Landscape

Valuations investigating public preferences and willingness to pay for forested landscapes, seen either from home or during regular journeys to and from home have been undertaken in the UK[183]. Of the preferences investigated, the strongest were for plantings that mixed trees and open space and where spacing of trees was random rather than regular. If these preferences were translated to forest structures, it might be expected that respondents would prefer the forest to look more natural and that there would be a preference for small scale rather than large plantations and a high species variety. If preferences for these attributes are separable and additive, then those configurations that offer all of the favoured factors should attract the highest values.

Furthermore, hedonic pricing studies in the UK have shown that proximity to trees can positively influence property values by 3.5% to 7%[184]. Broadleaf species and, to a lesser extent, mature conifers tended to exert a positive influence on house prices, although Sitka spruce was found to depress house prices[185]. Research has also shown

[180] This is in keeping with the findings of research such as by Hanley & Craig (1991). 'Wilderness development decisions and the Krutilla-Fisher model: the case of Scotland's 'flow country'. *Ecological Economics*, 4.

[181] Walsh, R., R. Bjonback, R. Aitken and D. Rosenthal (1990), "Estimating the Public Benefits of Protecting Forest Quality", *Journal of Environmental Management*, Vol. 30 pp. 175-189.

[182] Willis, K. and J. Benson (1988), 'A Comparison of User Benefits and Costs of Nature Conservation at Three Nature Reserves', *Regional Studies*, 22: 417- 428. Kramer, R. A. and D. E. Mercer (1997), "Valuing a Global Environmental Good: US Residents' Willingness to Pay to Protect Tropical Rain Forests", *Land Economics*, 73(2): 196-210 used the contingent valuation technique to estimate U.S. residents' willingness to pay to protect tropical rain forests at US$1.9 billion

[183] Willis et al (2003). *The Social and Environmental Benefits of Forests in Great Britain*. Report to the Forestry Commission.

[184] Countryside Agency (2000). *Economic Benefits of Community Forestry, Phase 1 Study*.

[185] Garrod & Willis (1992) 'Amenity Value of Forest in Great Britain and its Impact on the Internal Rate of Return from Forestry'. *Forestry*, Vol 65, No 3. 1992.

that substantial values are associated with afforestation projects near to cities[186]. Overall, there would appear to be consensus that that broadleaf species are of greater value than conifers, in respect to their impact of landscape[187]. However, clear preferences for forested landscapes compared with non-forested alternatives were found only for broad-leaved woodland in a peri-urban setting. For views from home, WTP ranged from between £200 and £500 per household per year depending on the model used and the forest configuration, while travelling WTP was in the range of £155 to £330 per household per year[188]. These values excluded recreational benefits.

These findings suggest that there are positive values associated with forestry under certain conditions. A study of 28 Irish forests, found that, compared with a non-forested landscape, an increase in broadleaf cover is worth 10 pence per visit, around 12 pence per visit for larch and 5 pence per visit for evergreen conifers[189]. This agrees with the UK work and indicates that when compared with the alternative of no afforestation that commercial forests can have a positive impact.

A4.3.5 Water supply, Quality and Flood control

Significant increases in levels of nitrates, potassium, bromides and iodine in local watercourses following tree removal have been found in the UK[190]. On the other hand, forests, via increasing seepage of rainwater, and inducing precipitation, benefit water production/quality. While hydrologists have pointed to the theoretically large impact of forestry on water availability, UK water companies perceive little impact of existing forestry on water supply costs[191]. Nonetheless, the impact on water company costs may increase if large areas were afforested with coniferous species.

One approach to valuing the impact of forestry on water supply is to estimate the soil protection value of forest land over the second best use of soil, e.g. grassland[192]. An alternative is to look at replacement values. The impacts of forestry on water quality can generally be considered to be positive if they are less damaging than the next most likely land use. Any negative effects on water quality through sediment run-off will be exacerbated by the use of chemicals during the rotation.

[186] Anthon (2002), 'The value of urban afforestation: A hedonic pricing case'. Paper presented at the Biennial meeting of the Scandinavian Society of Forest Economics, May. Denmark.
[187] O'Leary et al (1999), *Afforestation in Ireland – Regional Differences in Attitudes to Forestry*. ESRS 99/10. University College Dublin.
[188] Garrod, G (2003). *Landscape Values of Forests. Social & Environmental Benefits of Forestry Phase 2*, Report to the Forestry Commission, Edinburgh.
[189] Scarpa, R., Chilton, S., Hutchinson, G and G. Buongiorno (2000). 'Valuing the Recreational Benefits form the Creation of Nature Reserves in Irish Forests'. *Ecological Economics*, Vol. 33 (2).
[190] Neal, C., C. Smith and S. Hill (1992). *Forestry impact on water quality*. Institute for Hydrology Report No. 114/5/W/. Prepared for the National Rivers Authority.
[191] Forestry Commission (2003). *The Social and Environmental Benefits of Forests in Great Britain (Phase 2)*
[192] Rezende, A., (1978) *Evaluating Forestry Projects*, Ph. D. Thesis, Faculty of Forestry, University of Toronto

In the UK (any assessment in the UK is easier due to the existence of water companies) a study by Willis[193] used 1997 data on annual levels of rainfall in millimetres and evaporation and the percentage of forest cover in England and Wales in an application of the Calder-Newson (1999) model to estimate decreases in water availability from forestry. This information was used to calculate the cubic meter loss of water per hectare of forest for each county in England and Wales. The costs of these decreases in available water were expressed in monetary terms by using the estimated replacement costs in terms of the costs to water companies of increasing water supply, for example through bore-hole abstraction, treatment etc. These costs were represented as the average Long-Run Marginal Costs of providing potable water. The study also reviewed a number of previous studies that looked at costs of reduced water availability due to forestry on land used for agriculture, hydro-electric production, wildlife and recreation (for example the costs of low-flows to anglers). External benefits of forestry on water quality identified in the study were human and animal health benefits, for example from reducing risks of Cryptosporidium, E.coli and Eutrophication by reducing the amount of land in agricultural use.

The replacement costs of water lost to forests were estimated for all counties in England and Wales. These were calculated as capitalised costs. The total possible maximum costs of replacing potable water was approximately £52.5m for England and £35.4m for Wales, thus a total of approximately £88m for both countries (2002 British Pounds.) The Present Value of these costs was estimated to be £5.3m per annum using a 6% discount rate over a 25-year period.

The costs and benefits of forestry on water supply and quality have not been measured in Ireland, although Clinch (1999)[194] suggested that the costs of the effects on water afforestation planted under the current Forestry *Strategy* would amount to circa IR£10 million. This figure assumes an acidification cost of zero. However, this was based on the early years of the Forest Strategy and implementation has changed in the meantime. Acidification of watercourses may occur in upland forests (above 300-400m) where sulphur and nitrogen is scavenged from the atmosphere. In Ireland, permission to plant is not granted above circa 300 metres and, nationally, there is very little forest planted above the 1,000 ft contour. This effect is more significant in mature forests, and the concern relates principally to sulphur, which has an established role in surface water acidification[195].

A4.3.6 Health

Research on the impact of woodland on air quality, and thus health, in the UK found that net pollution absorption by woodland was found to have reduced the number of deaths brought forward by air pollution by between 59-88 deaths and between 40-62 hospital omissions. Given the nature of attempting to determine the epidemiological

[193] Willis, K. G. (2002), *Benefits and Costs of Forests to Water Supply and Water Quality*, Report to the Forestry Commission, CREAM, University of Newcastle
[194] Clinch, P., (1999). *The Economics of Irish Forestry*. COFORD.
[195] RSPB (2001) *Assessing the Economic Benefits of Forestry in the UK*.

impacts of woodland on health, many simplified assumptions were made[196]. Other research in the UK concluded that the existing 20% woodland cover should reduce pollutants such as ozone, sulphur dioxide and nitrogen oxides by 4-5%, with a similar additional up-take if the area of forest were to be doubled[197]. In Norway, research found that natural landscape had qualities to meet children's needs for stimulating motor development, with a positive relationship between landscape structures (shrubs, trees, slope and roughness of terrain) and play activities[198]. No equivalent research is available in Ireland.

[196] Powe, N and K. Willis (2002). 'Mortality and Morbidity Benefits of Air Pollution Absorption by Woodland' in *Social and Environmental Benefits of Forestry Phase 2*. Report to the Forestry Commission.

[197] Broadmeadow, M and Freer-Smith, P (1996). *Urban Woodlands and the Benefits for Local Air Quality*. Report for the Department of the Environment, prepared by the Environment Research Branch of the Forestry Commission.

[198] Fjortoft, I and Sageie (2000). 'The natural environment as playground for children: landscape description and analyses of a natural playscape'. *Landscape and Urban Planning* Vol. 48.

Appendix 5: Identifying the Appropriate Discount Rate

The purpose of discounting is to allow a single number to provide a summary value for a future stream of income or payments. This may then be used to compare one stream with another in which the timing of the payments may differ. The procedure requires that a common base year is adopted and that future payments are discounted by a percentage each year. Where the entity in respect of which the discounting is being undertaken is a private person or firm, the underlying rationale of the exercise is simply the observed preference to have money today rather than to have to wait. Money received today is valued more highly than the same amount of money at some future time. This is true even if there is no risk regarding the possibility of future payment. If there is risk, then the preference for money today will be stronger. The rationale for discounting in the public sector is more complex but it is generally accepted that it is appropriate that a similar discounting approach should be adopted, although it is often argued that the appropriate 'social' discount rate should be lower, than for a private individual or firm.

The main decision is to identify an appropriate discount rate. It is generally accepted that the interest rate is a reflection of individual time preferences and perceived risks. Care must be taken as to whether the rate identified is a real or a nominal rate. The nominal rate is simply the rate quoted in the market. Subtracting the expected rate of inflation from the nominal rate gives the real rate. In this report, it is assumed that future inflation will be, on average, equal the target rate of inflation of the ECB, i.e. 2% per annum. In forestry economics, it is usually assumed that both costs and revenues increase at the same rate over the life of the investment i.e. that there is a single rate of inflation that covers all costs and, particularly, the value of the timber. In doing this, the inflation rate is removed from the calculation and everything is expressed in terms of present value, i.e. in today's money. Since all future flows are expressed in real terms, i.e. they are not inflated annually to reflect the rate of inflation, the appropriate discount rate must recognise this by excluding the element that relates to inflation. This means that a real discount rate is used throughout.

Table A5.1 contains examples of discount rates used in forest valuations in the literature and shows that there has been significant variation. Traditionally, discount rates of between 3% and 5% have been used in relation to State forestry valuation in Ireland.[199] Various justifications have been provided for these discount rates. As a result of this variation, this report proceeds on the basis that a risk free discount rate that would be appropriate to all sectors of the economy should be used in the first instance. However, where it is observed that here is considerable risk associated with the future stream of payments then a risk-adjusted rate is used.

[199] Phillips, H. (1999) 'Harvesting the Forestry Investment'. Paper presented to IFIC Conference *Investing in Growth*, Dublin

Table A5.1: Discount Rates (%) Used In Forest Valuation

Country / Location	Rate	Reference
Ireland	5.0%	Valuation of forest assets prior to formation of Coillte in 1988
Finland	2.5 – 5%	Muukkonen (1999)
Austria	0% - 1.2%	Eurostat (2000)
Great Britain – FC	3.0%	Rutherford (1987)
Carter Holt Harvey	8.0%	Carter Holt Harvey (1994)
Fletcher Challenge – NZ	7.5%	Ferguson (1997)
Fletcher Challenge – Chile	8.0%	
Forestry Corporation	9.0%	Shirley (1994)
Forestry Commission	4.0%	Ferguson (1997)
Tasmania		
Waimate District, Australia	8.0%	Waimate (1999)
Timberlands Ltd NZ	8.0%	Timberlands (2001)
New Zealand	8-10%	Manley (1998)
New Zealand	8-12%	Keating (1990)
Evergreen Forests	9.0%	Evergreen Forests Ltd. (2001)
Nuhaka Farm Forest	9.0%	Perpetual Trust (2001a)
Opio Forests	9.0%	Perpetual Trust (2001b)
Europe	0-3.5%	Eurostat (2000)
UK	3.5%	HM Treasury (2003)

A problem with basing the discount rate on interest rates is that there are many interest rates quoted in the market and it is necessary to identify the most appropriate one. The starting point is to identify a risk free rate of return that can be earned on funds. This is usually taken to mean the rate of return on government bonds. The most recent issues from the Irish Government through the NTMA are the 4.6% Treasury Bond 2016 and the 4.5% Treasury Bond 2020. As the name implies, these pay 4.6% and 4.5% per annum respectively on the face value and are currently trading close to this value. Thus, 4.5% is a starting point. This is a nominal rate and with a 2% rate of inflation implies a real rate of 2.5% for a government backed risk-free rate on this investment.

However, this is not necessarily the appropriate rate to use in the case of forestry for a number of reasons. Forestry is highly illiquid as an investment compared with bonds. As a result, it is appropriate that this feature is incorporated. Furthermore, even where risk is not identified as an issue and the report talks of the risk-free rate there will be some underlying risk at all times in the case of forestry relative to investment in government bonds. Thus, it is appropriate to include some risk premium in all cases. To reflect these factors, a 1.5% premium is added to the base rate giving a real 'risk free' discount rate of 4%.

This is the rate used in most cases of discounting in the report. However, in some cases, particularly in relation to incomes derived from future timber sales where there is uncertainty about future timber prices and in the calculation of non-timber benefits, it was deemed that there is a substantially higher level of risk involved. As a result, a risk-adjusted discount rate of 5.5% per annum was used in these cases.

It is generally the case in the report that the lower discount rate is appropriate in providing NPV values for flows from the point of view of the exchequer. This primarily involves the calculation of future funding requirements. The exception is where non-market benefits are being calculated and the higher rate is used. On the other hand, the higher rate is generally appropriate in calculating future flows from the point of view of the private grower. However, where the flows involve State payments where commitments have been given the lower rate is used. One impact of this practice is that, in the main, public expenditure requirements – and the equivalent income to private growers – are discounted at 4% while the value of public goods is discounted at 5.5%.

It can be seen therefore that the discount rates adopted broadly amount, in effect, to a social discount rate of 4% and a private discount rate of 5.5% although it is emphasised that this is not the basis on which the values are derived. However, this differential with a lower social rate is in line with accepted practice. In addition, this social discount rate appears appropriate to the Irish economy. Over the years, a 5% real rate had been recommended[200] but in the lower interest rate environment in EMU a reduction in this rate now appears to be appropriate.

One final point relates to the discounting of income in the distant future. It has been claimed over the years that investments in environmental improvements have suffered since many of the benefits arise in the distant future and discounting even at low rates beyond 50 years soon reduces the values to very low levels. One possible solution is to allow the risk free discount rate to decline with time[201]. This view has influenced thinking in the UK Treasury and the current recommendation is that a discount rate of 3.5% should be used for the first 30 years into the future but that this should be reduced to 3% for years 31 to 75 and further reduced by 0.5% every 50 years thereafter[202]. This is potentially important in the case of forestry given that the returns from broadleaf plantations are very long-term. However, there is also great risk associated with valuing incomes far in the future and no good dataset on which to base prices.

The report adopts a more cautious approach in terms of long-term benefits. In the case of broadleaves it is assumed that there is no net income, so discounting is not required. For non-timber benefits, such as the recreational and biodiversity benefits which arise in perpetuity assuming reforestation, the evaluation is only done over the period of the afforestation programme i.e. up to 2040, and discounting is confined to this period.

[200] Department of Finance (1994) *Guidelines for the Appraisal and Management Capital Expenditure Proposals in the Public Sector*

[201] Spackman, M. (2002) *Observations on Discounting and the Very Long Term*. UK Treasury Paper

[202] HM Treasury (2003) *The Green Book: Appraisal and Evaluation in Central Government*. London: HM Treasury. The recommended 3.5% rate excludes risk and also excludes an allowance for 'optimism bias' i.e. a confirmed tendency for researchers undertaking appraisals to be systematically optimistic in relation to future flows. Including this would increase the recommended rate somewhat.

Appendix 6: Detailed Financial Tables

Table A6.1: Forestry Funding under Scenario A

	Grants		Premiums		
	Past Commitments	Afforestation Programme	Past Commitments	Afforestation Programme	Total Liability
2005	13,158,199	32,966,406	66,132,833	4,294,129	116,551,567
2006	12,800,295	31,647,750	65,306,001	8,436,407	118,190,452
2007	7,791,370	30,329,094	64,299,105	12,374,943	114,794,512
2008	11,293,100	31,647,750	62,791,848	16,484,720	122,217,417
2009	-	43,825,156	60,038,117	20,765,737	124,629,010
2010	-	44,709,463	56,997,546	25,217,995	126,925,004
2011	-	44,275,113	53,300,576	29,670,253	127,245,942
2012	-	44,709,463	50,327,762	34,122,511	129,159,735
2013	-	45,143,813	47,366,044	38,574,769	131,084,625
2014	-	45,578,163	43,208,250	43,027,027	131,813,440
2015	-	45,578,163	37,582,486	47,479,285	130,639,934
2016	-	45,578,163	32,180,538	51,931,543	129,690,244
2017	-	45,578,163	28,552,488	56,383,801	130,514,452
2018	-	45,578,163	25,253,832	60,836,059	131,668,053
2019	-	45,578,163	21,351,732	65,288,317	132,218,211
2020	-	45,578,163	16,807,050	69,592,303	131,977,516
2021	-	45,578,163	11,982,282	73,902,012	131,462,457
2022	-	45,578,163	7,228,248	78,217,661	131,024,072
2023	-	45,578,163	4,290,339	82,527,371	132,395,873
2024	-	45,578,163	-	86,831,141	132,409,303
2025	-	45,578,163	-	86,983,116	132,561,278
2026	-	45,578,163	-	87,281,216	132,859,379
2027	-	45,578,163	-	87,777,120	133,355,282
2028	-	45,578,163	-	88,107,722	133,685,885
2029	-	45,578,163	-	88,273,023	133,851,186
2030	-	45,578,163	-	88,273,023	133,851,186
2031	-	45,578,163	-	88,273,023	133,851,186
2032	-	45,578,163	-	88,273,023	133,851,186
2033	-	45,578,163	-	88,273,023	133,851,186
2034	-	45,578,163	-	88,273,023	133,851,186
2035	-	45,578,163	-	88,273,023	133,851,186
2036	-	38,721,150	-	87,382,572	126,103,722
2037	-	31,864,138	-	85,601,668	117,465,806
2038	-	25,007,125	-	82,930,314	107,937,439
2039	-	18,150,113	-	79,368,507	97,518,620
2040	-	12,462,986	-	75,361,475	87,824,461
2041	-	6,775,860	-	70,909,217	77,685,077
2042	-	4,517,240	-	66,456,959	70,974,199
2043	-	2,258,620	-	62,004,701	64,263,321
2044	-	1,129,310	-	57,552,443	58,681,753
2045	-	-	-	53,100,185	53,100,185
2046	-	-	-	48,647,927	48,647,927
2047	-	-	-	44,195,669	44,195,669
2048	-	-	-	39,743,411	39,743,411
2049	-	-	-	35,291,153	35,291,153

2050	-	-	-	30,838,894	30,838,894
2051	-	-	-	26,417,522	26,417,522
2052	-	-	-	22,027,035	22,027,035
2053	-	-	-	17,667,433	17,667,433
2054	-	-	-	13,338,717	13,338,717
2055	-	-	-	9,025,444	9,025,444
2056	-	-	-	5,587,180	5,587,180
2057	-	-	-	3,008,481	3,008,481
2058	-	-	-	1,289,349	1,289,349
2059	-	-	-	429,783	429,783
Total	45,042,964	1,492,860,123	754,997,078	2,892,194,358	5,185,094,523

Note: Cashflows are calculated on a weighted average basis across type of species, farmer/non-farmer and enclosed/non-enclosed land.

Table A6.2: Forestry Funding under Scenario B

	Grants		Premiums		
	Past Commitments	Afforestation Programme	Past Commitments	Afforestation Programme	Total Liability
2005	13,158,199	39,559,688	66,474,704	5,152,954	124,345,545
2006	12,800,295	42,197,000	65,647,871	10,675,992	131,321,158
2007	7,791,370	47,471,625	64,640,976	16,840,657	136,744,628
2008	12,161,800	52,746,250	63,133,719	23,690,285	151,732,054
2009	-	65,776,750	60,379,988	30,539,913	156,696,650
2010	-	66,645,450	57,339,417	37,389,541	161,374,408
2011	-	68,382,850	53,642,447	44,239,168	166,264,465
2012	-	70,120,250	50,669,633	51,088,796	171,878,679
2013	-	70,120,250	47,707,914	57,938,424	175,766,588
2014	-	70,120,250	43,550,121	64,788,052	178,458,422
2015	-	70,120,250	37,924,357	71,637,679	179,682,286
2016	-	70,120,250	32,522,409	78,487,307	181,129,966
2017	-	70,120,250	28,894,359	85,336,935	184,351,544
2018	-	70,120,250	25,595,702	92,186,563	187,902,515
2019	-	70,120,250	21,681,758	99,036,190	190,838,198
2020	-	70,120,250	17,137,077	105,707,891	192,965,217
2021	-	70,120,250	12,312,309	112,367,454	194,800,012
2022	-	70,120,250	7,558,274	119,003,259	196,681,783
2023	-	70,120,250	4,620,366	125,615,306	200,355,921
2024	-	70,120,250	-	132,227,353	202,347,603
2025	-	70,120,250	-	133,864,373	203,984,623
2026	-	70,120,250	-	135,143,446	205,263,696
2027	-	70,120,250	-	135,804,651	205,924,901
2028	-	70,120,250	-	135,804,651	205,924,901
2029	-	70,120,250	-	135,804,651	205,924,901
2030	-	70,120,250	-	135,804,651	205,924,901
2031	-	70,120,250	-	135,804,651	205,924,901
2032	-	70,120,250	-	135,804,651	205,924,901
2033	-	70,120,250	-	135,804,651	205,924,901
2034	-	70,120,250	-	135,804,651	205,924,901
2035	-	70,120,250	-	135,804,651	205,924,901
2036	-	59,571,000	-	134,434,725	194,005,725
2037	-	49,021,750	-	131,694,874	180,716,624

2038	-	38,472,500	-	127,585,098	166,057,598
2039	-	27,923,250	-	122,105,396	150,028,646
2040	-	19,173,825	-	115,940,731	135,114,556
2041	-	10,424,400	-	109,091,103	119,515,503
2042	-	6,949,600	-	102,241,475	109,191,075
2043	-	3,474,800	-	95,391,847	98,866,647
2044	-	1,737,400	-	88,542,220	90,279,620
2045	-	-	-	81,692,592	81,692,592
2046	-	-	-	74,842,964	74,842,964
2047	-	-	-	67,993,336	67,993,336
2048	-	-	-	61,143,709	61,143,709
2049	-	-	-	54,294,081	54,294,081
2050	-	-	-	47,444,453	47,444,453
2051	-	-	-	40,642,341	40,642,341
2052	-	-	-	33,887,746	33,887,746
2053	-	-	-	27,180,667	27,180,667
2054	-	-	-	20,521,104	20,521,104
2055	-	-	-	13,885,299	13,885,299
2056	-	-	-	8,595,661	8,595,661
2057	-	-	-	4,628,433	4,628,433
2058	-	-	-	1,983,614	1,983,614
2059	-	-	-	661,205	661,205
Total	45,911,664	2,282,414,138	761,433,399	4,421,624,071	7,511,383,269

Table A6.3: Forestry Funding under Scenario C

	Grants		Premiums		
	Past Commitments	**Afforestation Programme**	**Past Commitments**	**Afforestation Programme**	**Total Liability**
2005	13,158,199	39,559,688	66,474,704	7,610,720	126,803,311
2006	12,800,295	42,197,000	65,647,871	15,773,225	136,418,391
2007	7,791,370	47,471,625	64,640,976	24,874,359	144,778,330
2008	12,161,800	52,746,250	63,133,719	34,986,729	163,028,498
2009	-	65,776,750	60,379,988	45,099,099	171,255,837
2010	-	66,645,450	57,339,417	55,211,469	179,196,336
2011	-	68,382,850	53,642,447	65,323,840	187,349,137
2012	-	70,120,250	50,669,633	75,436,210	196,226,093
2013	-	70,120,250	47,707,914	85,548,580	203,376,744
2014	-	70,120,250	43,550,121	95,660,951	209,331,322
2015	-	70,120,250	37,924,357	100,776,328	208,820,935
2016	-	70,120,250	32,522,409	105,514,168	208,156,827
2017	-	70,120,250	28,894,359	109,661,877	208,676,486
2018	-	70,120,250	25,595,702	113,146,846	208,862,798
2019	-	70,120,250	21,681,758	116,631,815	208,433,823
2020	-	70,120,250	17,137,077	117,503,058	204,760,385
2021	-	70,120,250	12,312,309	118,200,051	200,632,610
2022	-	70,120,250	7,558,274	118,548,548	196,227,072
2023	-	70,120,250	4,620,366	118,548,548	193,289,164
2024	-	70,120,250	-	118,548,548	188,668,798
2025	-	70,120,250	-	118,548,548	188,668,798
2026	-	70,120,250	-	118,548,548	188,668,798
2027	-	70,120,250	-	118,548,548	188,668,798

2028	-	70,120,250	-	118,548,548	188,668,798
2029	-	70,120,250	-	118,548,548	188,668,798
2030	-	70,120,250	-	118,548,548	188,668,798
2031	-	70,120,250	-	118,548,548	188,668,798
2032	-	70,120,250	-	118,548,548	188,668,798
2033	-	70,120,250	-	118,548,548	188,668,798
2034	-	70,120,250	-	118,548,548	188,668,798
2035	-	70,120,250	-	118,548,548	188,668,798
2036	-	59,571,000	-	116,526,074	176,097,074
2037	-	49,021,750	-	112,481,126	161,502,876
2038	-	38,472,500	-	106,413,704	144,886,204
2039	-	27,923,250	-	98,323,808	126,247,058
2040	-	19,173,825	-	89,222,674	108,396,499
2041	-	10,424,400	-	79,110,304	89,534,704
2042	-	6,949,600	-	68,997,934	75,947,534
2043	-	3,474,800	-	58,885,563	62,360,363
2044	-	1,737,400	-	48,773,193	50,510,593
2045	-	-	-	38,660,823	38,660,823
2046	-	-	-	29,873,933	29,873,933
2047	-	-	-	22,412,523	22,412,523
2048	-	-	-	16,276,593	16,276,593
2049	-	-	-	11,466,144	11,466,144
2050	-	-	-	7,318,435	7,318,435
2051	-	-	-	4,530,460	4,530,460
2052	-	-	-	2,439,478	2,439,478
2053	-	-	-	1,045,491	1,045,491
2054	-	-	-	348,497	348,497
Total	45,911,664	2,282,414,138	761,433,399	3,859,745,757	6,949,504,957

Table A6.4: Forestry Funding under Scenario C with Pre-Selling of Timber

	Total Liability	Revenues	Net Total Liability
2005	126,803,311	-	126,803,311
2006	136,418,391	-	136,418,391
2007	144,778,330	-	144,778,330
2008	163,028,498	-	163,028,498
2009	171,255,837	-	171,255,837
2010	179,196,336	-	179,196,336
2011	187,349,137	-	187,349,137
2012	196,226,093	-	196,226,093
2013	203,376,744	-	203,376,744
2014	209,331,322	(15,082,012)	194,249,310
2015	208,820,935	(16,087,480)	192,733,455
2016	208,156,827	(18,098,415)	190,058,412
2017	208,676,486	(20,109,350)	188,567,136
2018	208,862,798	(20,109,350)	188,753,448
2019	208,433,823	(20,109,350)	188,324,473
2020	204,760,385	(20,109,350)	184,651,035
2021	200,632,610	(20,109,350)	180,523,260
2022	196,227,072	(20,109,350)	176,117,722
2023	193,289,164	(20,109,350)	173,179,814

2024	188,668,798	(20,109,350)	168,559,448
2025	188,668,798	(20,109,350)	168,559,448
2026	188,668,798	(20,109,350)	168,559,448
2027	188,668,798	(20,109,350)	168,559,448
2028	188,668,798	(20,109,350)	168,559,448
2029	188,668,798	(20,109,350)	168,559,448
2030	188,668,798	(20,109,350)	168,559,448
2031	188,668,798	(20,109,350)	168,559,448
2032	188,668,798	(20,109,350)	168,559,448
2033	188,668,798	(20,109,350)	168,559,448
2034	188,668,798	(20,109,350)	168,559,448
2035	188,668,798	(20,109,350)	168,559,448
2036	176,097,074	(20,109,350)	155,987,724
2037	161,502,876	(20,109,350)	141,393,526
2038	144,886,204	(20,109,350)	124,776,854
2039	126,247,058	(20,109,350)	106,137,708
2040	108,396,499	(20,109,350)	88,287,149
2041	89,534,704	(20,109,350)	69,425,354
2042	75,947,534	(20,109,350)	55,838,184
2043	62,360,363	(20,109,350)	42,251,013
2044	50,510,593	(20,109,350)	30,401,243
2045	38,660,823	(16,087,480)	22,573,343
2046	29,873,933	(12,065,610)	17,808,323
2047	22,412,523	(8,043,740)	14,368,783
2048	16,276,593	(4,021,870)	12,254,723
2049	11,466,144	(2,010,935)	9,455,209
2050	7,318,435	-	7,318,435
2051	4,530,460	-	4,530,460
2052	2,439,478	-	2,439,478
2053	1,045,491	-	1,045,491
2054	348,497	-	348,497
Total	6,949,504,957	(654,559,329)	6,294,945,628

Table A6.5: Forestry Funding under Scenario C, Retaining the Broadleaf Premium over 20 Years, with Pre- Selling of Timber

	Grants		Premiums			
	Past Commitments	Afforestation Programme	Past Commitments	Afforestation Programme	Pre-selling of Timber	Net Total Liability
2005	13,158,199	39,559,688	66,474,704	7,763,406	-	126,955,997
2006	12,800,295	42,197,000	65,780,088	16,091,474	-	136,868,857
2007	7,791,370	47,471,625	64,880,135	25,373,903	-	145,517,033
2008	12,161,800	52,746,250	63,480,241	35,687,713	-	164,076,004
2009	-	65,776,750	60,877,012	46,001,523	-	172,655,285
2010	-	66,645,450	58,040,070	56,315,332	-	181,000,852
2011	-	68,382,850	54,405,403	66,629,142	-	189,417,395
2012	-	70,120,250	51,453,180	76,942,952	-	198,516,382
2013	-	70,120,250	48,501,742	87,256,762	-	205,878,754
2014	-	70,120,250	44,331,813	97,570,572	(15,082,012)	196,940,623
2015	-	70,120,250	38,669,388	103,210,549	(16,087,480)	195,912,707
2016	-	70,120,250	33,250,505	108,491,836	(18,098,415)	193,764,176
2017	-	70,120,250	29,668,310	113,230,705	(20,109,350)	192,909,915

2018	-	70,120,250	26,358,012	117,350,137	(20,109,350)	193,719,049
2019	-	70,120,250	22,471,525	121,469,568	(20,109,350)	193,951,993
2020	-	70,120,250	17,759,876	124,144,227	(20,109,350)	191,915,003
2021	-	70,120,250	12,757,524	126,283,955	(20,109,350)	189,052,379
2022	-	70,120,250	7,830,101	128,176,219	(20,109,350)	186,017,220
2023	-	70,120,250	4,786,190	129,821,020	(20,109,350)	184,618,110
2024	-	70,120,250	-	131,465,821	(20,109,350)	181,476,721
2025	-	70,120,250	-	131,465,821	(20,109,350)	181,476,721
2026	-	70,120,250	-	131,794,781	(20,109,350)	181,805,681
2027	-	70,120,250	-	131,959,261	(20,109,350)	181,970,161
2028	-	70,120,250	-	131,959,261	(20,109,350)	181,970,161
2029	-	70,120,250	-	131,959,261	(20,109,350)	181,970,161
2030	-	70,120,250	-	131,959,261	(20,109,350)	181,970,161
2031	-	70,120,250	-	131,959,261	(20,109,350)	181,970,161
2032	-	70,120,250	-	131,959,261	(20,109,350)	181,970,161
2033	-	70,120,250	-	131,959,261	(20,109,350)	181,970,161
2034	-	70,120,250	-	131,959,261	(20,109,350)	181,970,161
2035	-	70,120,250	-	131,959,261	(20,109,350)	181,970,161
2036	-	59,571,000	-	129,896,499	(20,109,350)	169,358,149
2037	-	49,021,750	-	125,770,976	(20,109,350)	154,683,376
2038	-	38,472,500	-	119,582,690	(20,109,350)	137,945,840
2039	-	27,923,250	-	111,331,642	(20,109,350)	119,145,542
2040	-	19,173,825	-	102,049,213	(20,109,350)	101,113,688
2041	-	10,424,400	-	91,735,403	(20,109,350)	82,050,453
2042	-	6,949,600	-	81,421,593	(20,109,350)	68,261,843
2043	-	3,474,800	-	71,107,784	(20,109,350)	54,473,234
2044	-	1,737,400	-	60,793,974	(20,109,350)	42,422,024
2045	-	-	-	50,480,164	(16,087,480)	34,392,684
2046	-	-	-	41,405,230	(12,065,610)	29,339,620
2047	-	-	-	33,569,171	(8,043,740)	25,525,431
2048	-	-	-	26,971,989	(4,021,870)	22,950,119
2049	-	-	-	21,613,681	(2,010,935)	19,602,746
2050	-	-	-	16,874,812	-	16,874,812
2051	-	-	-	13,250,307	-	13,250,307
2052	-	-	-	10,120,727	-	10,120,727
2053	-	-	-	7,486,074	-	7,486,074
2054	-	-	-	5,346,347	-	5,346,347
2055	-	-	-	3,454,082	-	3,454,082
2056	-	-	-	2,138,241	-	2,138,241
2057	-	-	-	1,151,361	-	1,151,361
2058	-	-	-	493,440	-	493,440
2059	-	-	-	164,480	-	164,480
Total	45,911,664	2,282,414,138	771,775,818	4,298,380,651	(654,559,329)	6,743,922,942

Table A6.6: Forestry Funding under Scenario C with Grant Revision

	Grants		Premiums		
	Past Commitments	Afforestation Programme	Past Commitments	Afforestation Programme	Total Liability
2005	13,158,199	24,087,048	66,474,704	7,610,720	111,331,652
2006	12,800,295	25,692,851	65,647,871	15,773,225	119,915,230
2007	7,791,370	28,904,458	64,640,976	24,874,359	126,212,180

2008	12,161,800	32,116,064	63,133,719	34,986,729	142,399,307
2009	-	45,146,493	60,379,988	45,099,099	150,626,644
2010	-	46,015,188	57,339,417	55,211,469	158,567,142
2011	-	47,752,579	53,642,447	65,323,840	166,719,935
2012	-	49,489,969	50,669,633	75,436,210	175,596,884
2013	-	49,489,969	47,707,914	85,548,580	182,747,538
2014	-	49,489,969	43,550,121	95,660,951	188,702,117
2015	-	49,489,969	37,924,357	100,776,328	188,187,842
2016	-	49,489,969	32,522,409	105,514,168	187,523,732
2017	-	49,489,969	28,894,359	109,661,877	188,043,391
2018	-	49,489,969	25,595,702	113,146,846	188,229,704
2019	-	49,489,969	21,681,758	116,631,815	187,800,728
2020	-	49,489,969	17,137,077	117,503,058	184,130,128
2021	-	49,489,969	12,312,309	118,200,051	180,002,353
2022	-	49,489,969	7,558,274	118,548,548	175,596,816
2023	-	49,489,969	4,620,366	118,548,548	172,658,907
2024	-	49,489,969	-	118,548,548	168,038,542
2025	-	49,489,969	-	118,548,548	168,038,542
2026	-	49,489,969	-	118,548,548	168,038,542
2027	-	49,489,969	-	118,548,548	168,038,542
2028	-	49,489,969	-	118,548,548	168,038,542
2029	-	49,489,969	-	118,548,548	168,038,542
2030	-	49,489,969	-	118,548,548	168,038,542
2031	-	49,489,969	-	118,548,548	168,038,542
2032	-	49,489,969	-	118,548,548	168,038,542
2033	-	49,489,969	-	118,548,548	168,038,542
2034	-	49,489,969	-	118,548,548	168,038,542
2035	-	49,489,969	-	118,548,548	168,038,542
2036	-	43,066,756	-	116,526,074	159,592,854
2037	-	36,643,544	-	112,481,126	149,124,692
2038	-	30,220,331	-	106,413,704	136,634,056
2039	-	23,797,118	-	98,323,808	122,120,945
2040	-	17,110,730	-	89,222,674	106,333,422
2041	-	10,424,343	-	79,110,304	89,534,662
2042	-	6,949,562	-	68,997,934	75,947,508
2043	-	3,474,781	-	58,885,563	62,360,354
2044	-	1,737,391	-	48,773,193	50,510,591
2045	-	-	-	38,660,823	38,660,828
2046	-	-	-	29,873,933	29,873,936
2047	-	-	-	22,412,523	22,412,525
2048	-	-	-	16,276,593	16,276,594
2049	-	-	-	11,466,144	11,466,144
2050	-	-	-	7,318,435	7,318,435
2051	-	-	-	4,530,460	4,530,460
2052	-	-	-	2,439,478	2,439,478
2053	-	-	-	1,045,491	1,045,491
2054	-	-	-	348,497	348,497
Total	45,911,664	1,610,898,493	761,433,399	3,859,745,757	6,277,986,206

Glossary of Terms and Acronyms

ABE	Area for biodiversity enhancement
ACAs	Area Compensatory Allowances – payments scheme operating within the CAP
BMW	Border, Midlands and West regions of Ireland
Bord na Mona	Government owned company with responsibility for publicly owned bogs in Ireland
BSE	Bovine Spongiform Encephalopathy
CAP	Common Agricultural Policy of the European Union
CDM	Clean development mechanism under the *Kyoto* agreement
CIP	The Census of Industrial Production produced annually by the Irish Central Statistics Office
CIS	Commonwealth of Independent States
CO_2	Carbon Dioxide
CO_2 equivalent	Emissions of greenhouse gases expressed in terms of the equivalent quantity of CO_2 taking the relative impact on global warming into account
COFORD	Irish Government agency that undertakes forestry-related research
Coillte	Irish state company that manages forests in public ownership
CSF	Community Support Framework
EFTA	European Free Trade Area
EIA	Environmental Impact Assessment
ERS	Early Retirement Scheme
EU	European Union
FACs	Forestry Assessment Companies
FAPRI model	Farm income forecasting model developed in collaboration by Teagasc
FFI	Family farm income
FIPS	Forest Information Planning System
FMD	Foot and mouth disease
Forest Service	Agency within the Department of Agriculture and Food with responsibility for Irish forestry policy
FSC	Forest Stewardship Council
FTEs	Full time equivalents – a measure of employment
GFP	Good farming practice
GPAS	Grants and premium administration system
Ha	Hectare
IFA	Irish Farmers Association
IFCA	Irish Forestry Contractors Association
IFCI	Irish Forest Certification Initiative
IForIS	Integrated forest inventory system
IFS	Indicative Forest Strategies
IRR	Internal rate of return
ITGA	Irish Timber Growers Association
JI	Joint implementation of the *Kyoto* agreement

Kyoto	Legally binding targets agreed by governments at Kyoto in 1997 to reduce emissions of greenhouse gasses under the United Nations Framework Convention on Climate Change
LPIS	Land parcel identification system
Lu/ha	Livestock units per hectare
m^3	Metres cubed, a commonly used measure of timber
MDF	Medium density fibreboard
MMAI	Maximum Mean Annual Increment – the rotation age at which volume production is maximised
NACE codes	Commonly used classification of industrial activities for statistical purposes
NCCS	Ireland's National Climate Change Strategy
NFI	National Forest Inventory
NFS	National Farm Survey published annually by Teagasc
NMB	Non-monetary benefit
NPV	Net Present Value
OSB	Oriented strand board
R&D	Research and development
RD	Rural development in the context of the EU's Rural Development Strategy
REPS	Rural Environment Protection Scheme
RFPs	Regional Forest Plans
S&E	South and East regions of Ireland
SFM	Sustainable forest management
SP	Single payment – farmer payments scheme introduced under the reform of the CAP
Teagasc	Irish Government agency that undertakes agriculture-related research
TIDG	Timber Industry Development Group
WFD	Water Framework Directive of the EU
WTP	Willingness to pay
YC	Yield Class – a measure of the growing rate of timber in terms of the annual increment of timber produced

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