Review of Evidence for the Formulation of Forestry Policy in England

Final report for the Department for Environment, Food and Rural Affairs

CJC CONSULTING
economics environment countryside

October 2005

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CJC Consulting

with

Prof. Ken Willis	University of Newcastle upon Tyne
Prof. Paul Selman	University of Sheffield
Dr Graham Tucker	Ecological Solutions

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CJCCONSULTING

45 Southmoor Road Oxford. OX2 6RF

T/F 01865310088

M 07884436514

Email: r.crabtree@zetnet.co.uk

www.cjcconsulting.co.uk

Contents

Executive Summary……i

1 Introduction 1
1.1 Remit 1
1.2 Methodology 1
1.3 England Forestry Strategy (EFS) 2
1.4 Intervention in relation to forestry 2
1.4.1 International agreements 3
1.4.2 Market failure and cost-benefit analysis 3
1.4.3 Contributions to other policy agendas 4
1.4.4 Sustainability in forest management 5
1.5 Structure of the study 6
2 Forestry situation in England 7
2.1 Introduction 7
2.2 Forest estate 7
2.2.1 Area 7
2.2.2 Woodland creation and restocking 7
2.2.3 Woodland management 8
2.3 Timber production and prices 8
2.4 Timber processing 9
2.5 Returns to investment 10
2.6 Employment 10
2.7 Non-market outputs from forestry 10
2.8 Cost of policy intervention in forestry 11
2.9 Summary 13
3 Strategic policy relating to forestry 14
3.1 Introduction 14
3.2 Rural White Paper 2000 14
3.3 Devolution review 14
3.4 Sustaining England's woodlands 15
3.5 Defra Rural Strategy 2004 15
3.6 Sustainable Communities 2003 15
3.7 Regional Forestry Frameworks 2003 15
3.8 Defra's Five Year Strategy 2004 16
3.9 Sustainable Development Strategy 2005 16
3.10 Strategic implications of changes in delivery 17
4 Social benefits 18
4.1 Introduction 18
4.2 Access and recreation 18
4.2.1 Policy background and developments since the EFS 18
4.2.2 Visitor numbers 18
4.2.3 Benefits from 'open-access' forests: generalist visitors 20
4.2.4 Benefits from forests: specialist recreational visitors 21
4.2.5 Implications for the policy agenda 21
4.3 Health 22

4.3.1 Policy background and developments since the EFS 22
4.3.2 Impacts of trees and woodlands on health 22
4.3.3 Health benefits from air pollution absorption 23
4.3.4 Health benefits from physical activity 24
4.3.5 Health programmes using woodlands 25
4.3.6 Autonomous use of greenspace 26
4.3.7 Implications for the policy agenda 27
4.4 Other social benefits 27
4.4.1 Policy background and developments since the EFS 27
4.4.2 Current investment 27
4.4.3 Community woodlands 27
4.4.4 Targeting social groups 28
4.4.5 Implications for the policy agenda 28
5 Environmental and resource protection benefits 30
5.1 Introduction 30
5.2 Climate change 30
5.2.1 Policy background and developments since the EFS 30
5.2.2 Contribution to GHG emission reduction 30
5.2.3 Value of sequestered carbon: damage estimates 31
5.2.4 Value of sequestered carbon: market cap and trade estimates 32
5.2.5 Benefits from carbon sequestration in trees 33
5.2.6 Carbon trading 33
5.2.7 Implications for the policy agenda 34
5.3 Biodiversity 34
5.3.1 Policy background and developments since the EFS 34
5.3.2 Forest biodiversity status and forestry pressures 41
5.3.3 Minimum-intervention forests and new wild woods 45
5.3.4 Climate change 46
5.3.5 Biodiversity impacts from forestry on non-forest habitats 47
5.3.6 Economic valuation of biodiversity benefits 48
5.3.7 Value of marginal changes in forest biodiversity 48
5.3.8 Implications for the policy agenda 49
5.4 Landscape and amenity 51
5.4.1 Policy background and developments since the EFS 51
5.4.2 Valuation of landscape 52
5.4.3 Benefit estimates 53
5.4.4 Implications for the policy agenda 54
5.5 Soils, water protection and flood control 55
5.5.1 Policy background and developments since the EFS 55
5.5.2 Impact of forestry on water supply 56
5.5.3 Cost of forestry to the water industry 57
5.5.4 Impact of forests on wetlands and flood management 57
5.5.5 Policy on flood control 58
5.5.6 Impact of forestry on soils and water quality 59
5.5.7 Implications for the policy agenda 60
5.6 Renewable energy 60

5.6.1 Policy background and developments since the EFS 60
5.6.2 Cost of energy production from renewables 61
5.6.3 Biomass 62
5.6.4 Carbon emissions 63
5.6.5 Implications for the policy agenda 63
6 Rural development and economic regeneration 64
6.1 Policy background and developments since the EFS 64
6.1.1 Rural development in policy 64
6.1.2 Defra Rural Strategy 64
6.1.3 Economic regeneration 64
6.2 Roles for forestry 65
6.3 Forestry for rural development 66
6.3.1 Rural economy 66
6.3.2 Linkages and knock-on impacts 66
6.3.3 Rural employment 68
6.3.4 Forestry as a mechanism for rural development 68
6.3.5 Timber products and other economic impacts 70
6.3.6 Tourism 71
6.4 Forestry for economic regeneration 72
6.4.1 Re-location and retention of businesses 72
6.4.2 Regeneration benefits 73
6.5 Recent experience from forestry/woodland partnership projects 74
6.5.1 Economic regeneration 74
6.5.2 Rural development 75
6.5.3 Importance of location 76
6.5.4 Conclusions from case studies 76
6.6 Implications for the policy agenda 77
7 Cross cutting issues 79
7.1 Introduction 79
7.2 Sustainable forest management 79
7.3 Enhancing benefits - new planting or existing woodlands? 79
7.4 Adjustment to market conditions 79
7.5 Locational and regional aspects 80
7.6 Costs of forest creation on farmland 80
8 Conclusions for strategic policy 82
9 References 87
10 Annex I Regional forestry frameworks – position at October 2005 97
11 Annex II Priority Habitat targets, and biological trend and progress towards targets in England 100

Acknowledgements

We wish to thank the members of the steering group (Alastair Johnston, Iain Southall, Sandra Shattock, Pat Snowdon, Rod Leslie, Keith Kirby and David Crichton) for their advice during the project. We also wish to express our appreciation to Paul Hill-Tout and his staff for providing information on numerous aspects of the brief. Several Defra staff provided assistance on more specialised aspects of the remit (Roger Smith, Patrice Mongelard, Jo Halliday, Sarah Webster, Ann Davies, Nia Wyn Jones, David Richardson). Ian Dickie gave an RSPB view on the biodiversity element of the study.

Within the research team, Ken Willis contributed the review of environmental and social benefit values. Paul Selman wrote much of the text dealing with rural development and economic regeneration. Finally, Graham Tucker took the lead on the section dealing with the contribution of forestry to biodiversity.

Bob Crabtree

CJC Consulting Limited

October, 2005

Abbreviations

AIA	Additional Impact Assessment
AMG	Annual Management Grant
AONB	Area of Outstanding Natural Beauty
AWB	Artificial Water Body
BRIG	UK Biodiversity Reporting and Information Group
C	Carbon
CAP	Common Agricultural Policy
CB	Cost-Benefit
CBA	Cost-Benefit Analysis
CCL	Climate Change Levy
CDM	Clean Development Mechanism
CE	Choice Experiment
CEA	Cost-Effectiveness Analysis
CHD	Coronary Heart Disease
CHP	Combined heat and power
CO_2	Carbon Dioxide
CROW	Countryside and Rights of Way Act
CV	Contingent Valuation
CWHP	Chopwell Wood Health Project
CWS	Community Woodland Supplement
DCMS	Department for Culture. Media and Sport
DEFRA	Department for Environment, Food & Rural Affairs
DETR	Department for Environment, Transport & the Regions
EA	Environment Agency
EBG	England Biodiversity Group
EBS	England Biodiversity Strategy
EFIP	England Forestry Industries Partnership
EFS	England Forestry Strategy
EH	English Heritage
EN	English Nature
ERDP	England Rural Development Programme
ERU	Emission Reduction Unit
ETS	European Union Emissions Trading Scheme
EU	European Union
EWGS	English Woodland Grant Scheme
FAO	Food and Agriculture Organisation fot he United Nations
FC	Forestry Commission
FCE	Forestry Commission England
FC RAC	Forestry Commission Regional Advisory Committee
FCS	Forestry Commission Scotland
FE	Forest Enterprise
FTA	Forestry and Timber Association
FWPS	Farm Woodland Premium Scheme
GB	Great Britain
GDP	Gross Domestic Product
GHG	Greenhouse Gases
GIS	Geographic Information System
GO	Government Office
HAP	Habitat Action Plan
HMWB	Heavily Modified Water Bodies

HPM	Hedonic Pricing Model
IMD	Index of Multiple Deprivation
IRR	Internal Rate of Return
K	Potassium
LEAP	Livestock Exclusion Annual Premium
LRMC	Long-run Marginal Cost
LUPG	Land Use Policy Group
MAI	Mean annual increment
MC	Marginal Cost
MPA	Most Preferred Alternative
MWI	Marches Woodland Initiative
NCEES	Northumberland Coalfield Environmental Enhancement Strategy
NFFO	Non-Fossil Fuel Obligation
NGO	Non-governmental Organisation
NPA	National Park Authority
NPV	Net present value
NT	National Trust
NWDA	North West Development Agency
O_3	Ozone
ODPM	Office of the Deputy Prime Minister
PACEC	Public and Corporate Economic Consultants
PAF	Population Attributable Fraction
PAWS	Planting on ancient woodland sites
PBRS	Public Benefit Recording System
PEC	Pan European Criteria
POST	Parliamentary Office of Science and Technology
PM	Particulate Matter
PPS	Planning Policy Statement
PSA	Public Service Agreement
PV	Present Value
RBMP	River Basin Management Plan
RDA	Regional Development Agency
RDS	Rural Development Service
RFF	Regional Forestry Framework
RO	Renewables Obligation
ROC	Renewable Obligation Certificates
RR	Relative Risk
RSPB	Royal Society for the Protection of Birds
RSS	Regional Spatial Strategies
SAP	Species Action Plan
SD	Sustainable Development
SFM	Sustainable Forest Management
SO_2	Sulphur Dioxide
SPS	Single Payment Scheme
SRC	Short rotation coppice
SRMC	Short-run Marginal Cost
SSSI	Site of Special Scientific Interest
tC	tonne of carbon
TCM	Travel-Cost Model
UKBAP	United Kingdom Biodiversity Action Plan
UKBG	United Kingdom Biodiversity Group
UKCIP	UK Climate Impacts Programme

UKFS	United Kingdom Forestry Standard
UKWAS	United Kingdom Woodland Assurance Standard
UNFCC	United Nations Framework Convention on Climate Change
VOSL	Value of a Statistical Life
VPF	Value of a Preventable Fatality
WFD	Water Framework Directive
WGS	Woodland Grant Scheme
WHI	Walking the Way to Health Initiative
WIG	Woodland Improvement Grant
WT	Woodland Trust
WTP	Willingness to Pay
YC	Yield Class

Executive Summary

1. Remit

The purpose of the research was 'to review developments in policy and the evidence base relevant to forestry since the launch of the England Forestry Policy (in 1998) so as to ensure that forestry policy in England is based on the best available evidence'.

The study was to undertake the following:

- Identify the key policy issues within the England Forestry Strategy and identify the rationale for government intervention. This involves building on the Economic Analysis of Forestry Policy in England (CJC Consulting, 2003) study.
- Identify key policy areas relevant to forestry policy and assess the reviews, strategies and research since the launch of the EFS.
- For each of the above identify the evidence used and assess whether it is the best available. The assessment would include examinations of the methodologies used.
- Identify relevant evidence which has not been used but which could be used to underpin existing forestry policy.
- Identify any gaps in the evidence.
- Identify the implications for forestry policy in England.

The study was to concentrate on policy analysis and exclude consideration of the institutional aspects of policy delivery. The study does not cover in detail the timber processing sector or the prospects for timber prices. In addition, it does not draw detailed comparisons with agriculture as a land use but does explore the public expenditure costs of converting agricultural land to forestry.

2. Method

This review builds on the previous cost-benefit analysis (CBA) for Defra and H. M. Treasury (CJC Consulting, 2003). The aim has been to avoid undue repetition and concentrate on new evidence. The approach follows the guidelines for the public policy analysis given by H. M Treasury (2003). This indicates the procedures that should be used to appraise policy options including the analysis of risk. Where forestry is relevant to other government policy agendas, such as health or renewable energy, we analyse the contribution that forestry may make.

3. Intervention

Government intervention in forestry occurs for three main reasons. These are:

1. International and EU obligations.
2. When a market failure results in the market mechanism alone not being able to achieve economic efficiency (for example through the market having difficulty supplying public goods or an externality occurring when a particular activity produces benefits or costs for other activities that are not directly priced into the market).
3. The requirements of other government policy agendas.

4. Market situation and profitability

Timber prices have fallen markedly in the last decade. Real prices are now only 20-25% of the levels recorded in the 1980's and early 1990's. Eastern Europe and the CIS countries are very competitive in terms of wood supply although the UK is competitive in

technology. Some improvement in prices has been observed in recent months although prices remain very depressed. Much of the timber production and harvesting in England is commercially unviable at such prices.

5. Public benefits and costs

Forests produce a diverse range of social and environmental benefits (including recreation, health, biodiversity, and landscape improvement). They may also be used as instruments of rural development and economic regeneration. Virtually all forests and woodlands produce multiple benefits; the size and mix of these benefits is highly variable and depends on species, forest design, management, location and use.

The net cost of intervention by government in English forestry is around £60m per year. Around 40% of this total is spent on supporting the delivery of benefits from the public estate.

6. Developments in policy since 1998

Since the publication of the England Forestry Strategy in 1998 forestry has been partially devolved to national administrations and there have been a number of policy reviews. The Rural White Paper (2000) set an expansionary tone for forestry whereas the priorities relevant to forestry in the Rural Strategy (2004) were economic and social regeneration, and enhancing the value of the countryside. Defra's Five Year strategy (2004) was concerned to set targets for sustainable development, with forestry having a role though sustainable forest management, resource protection and delivering on the woodland bird indicator. The 2005 UK Sustainable Development Strategy set a framework within which forestry can deliver on climate change, renewable energy, natural resource protection and environmental enhancement, and sustainable communities. Regional Forest Frameworks (RFF) have been developed to give regional visions and priorities for forestry.

7. Evidence

The study reviewed the evidence that may support intervention in forestry. This was in the context of:

- Access and recreation
- Health
- Other social benefits
- Climate change
- Biodiversity
- Landscape and amenity
- Soils, water protection and flood control
- Renewable energy
- Rural development
- Economic regeneration

8. Cross cutting issues from the review

- There is a need to re-examine the interpretation of sustainable forest management because of the economic unsustainability of much 'commercial' forestry. It is an important issue facing the whole European forest sector (FAO, 2005).
- Public investment in forestry expansion can be justified but only if it delivers cost-effective public benefits or where new planting is needed to deliver on wider policy

agendas. The evidence supports the case for directing a higher proportion of the public investment in forestry at the existing woodland estate than occurs at present. But this may need to be reassessed if the carbon sequestration gains from new planting were given a higher profile in policy.

- The creation of RFFs injects a regional perspective into national strategy. The review supports most of the published RRF regional priorities. National policy will need to define what are acceptable areas for intervention in forestry and establish national requirements. Delivery mechanisms can then take account of regional priorities within the overall framework. RFFs raise some critical issues for the development of Defra forestry strategy:
  - There appears to be no formal way in which national requirements, such as that of delivering on SSSI and UKBAP targets, are linked to RFF expressions of regional priorities. Defra strategy has to address the issue of how regional and national interests are to be integrated.
  - It is not clear what the regional priorities imply for the distribution of forestry expenditure.

9. Prioritisation

The issue for policy is one of setting priorities for intervention and public expenditure. This review has identified several 'new' policy areas, not forming part of the EFS, where forestry has the capacity to contribute. These are:

- The health agenda
- Equity, community and other social agendas
- The climate change agenda
- Landscape and amenity
- Soils and water, including delivery on the Water Framework Directive
- Renewable energy

The fabric against which forestry policy is developing has thus become more diverse and complex. We consider that the main *raison d'etre* for most intervention in forestry is to deliver public benefits that fall within government policy agendas. It is therefore important to assess how forestry compares in cost-effectiveness terms with other mechanisms for delivering on each agenda. Since forests typically produce multiple benefits the full range of impacts should be taken into account in any assessment.

10. Summary of conclusions for strategic policy

Commercial timber production: There is no direct economic argument for supporting commercial production and harvesting unless carbon sequestration and/or renewable energy production is highly valued, or the output of other public goods (e.g. biodiversity) is at risk. What is needed is a policy of assisting the industry to adjust to a changing market situation in which the UK is less competitive as a timber producer.

Access and recreation: The forest estate is a major source of recreation benefit and there is a strong case for maintaining the facility and expanding it where this can be justified by additional visits. Benefits from increasing the total recreation stock (through woodland creation or conversion of use) will depend on location and woodland characteristics. The emphasis should be on sites that are accessible to people. Conversion of existing woods for recreation is likely to be more cost effective than woodland creation and offers much higher benefits in the short term.

Health: Forests located near to where people live are an important health resource and the evidence suggests a higher profile for health issues in forestry policy. The main health benefits derive from increased physical activity. This indicates an emphasis on providing greenspace suitable for walking and other non-specialised activities easily accessible to people on a regular basis.

The limited evidence on health impacts of autonomous use of greenspace supports the conclusion that a clean, green, accessible local environment will deliver increased health benefits. New woodlands will contribute most where they are widely used and part of larger greenspace area/path networks etc., and where there is a local deficit in supply.

The cost-effectiveness of programmes designed to encourage physical activity in greenspace is unclear but there is considerable potential for benefits. The success of programmes depends on converting sedentary people to more active lifestyles over the longer term.

Contributions to other social agendas: Woodlands contribute to a range of education and social agendas and services (including probationary and community services). Detailed information is not available on the cost or extent of these services but they are clearly widespread and form an increasing aspect of policy delivery. It would be useful to have more information on the benefits delivered to these social agendas. This would better enable priorities to be established for the types of contribution for which woodland are cost cost-effective.

Government wishes the benefits from intervention in forests to be available to all. This would strengthen the case for a more urban focus in forestry together with targeted measures to facilitate use by under-represented social groups.

Climate change: Carbon sequestration reduces net emissions of greenhouse gases. This is accounted for in the national emissions inventory as are the impacts of deforestation and changes in soils and other carbon pools. Forestry can also contribute via renewable energy and provision of sustainable materials. Impacts of sequestration on overall net emissions are, however, quite small. A case can be made for including woodland sequestration within carbon trading, and supporting measures that facilitate trading by forest owners. Owners would then have an additional income stream and an incentive to manage trees to sequester carbon.

Without trading, government should factor in the sequestration benefits in decisions on intervention in forestry, and especially as regards incentives for forestry expansion. At the government's central value of £70 per tC the social benefit is of the order of £200-£400 per ha per year. This would provide a strong case for forest expansion. However, it would be more logical to price C sequestration at the marginal cost of emissions control. Based on experience in the South West forest, an expansion of forestry by say 20,000 ha per year for 5 years in order to increase the carbon sink would cost possibly £400-500m in grant aid payments.

Renewable energy: Forestry's role as a source of renewable energy will depend on its competitive position alongside other biomass and non-biomass sources. The Renewables Obligation already creates demand for biomass, although this also stimulates biomass imports. The Biomass Taskforce found varying opinions about the cost-effectiveness and environmental implications of short rotation coppice (SRC).

Biomass from wood should form part of the emerging policy agenda for renewables. There is a significant resource of underutilised woods in England. The report from the Biomass Taskforce report will assist in formulating policy as will Defra's current review of

energy crop costs. Clarification is required on the cost of SRC production and processing, its competitiveness with other energy corps, and the levels of subsidy required to expand production. Biomass production may represent a considerable opportunity for forestry if government were to provide the required incentives.

Biodiversity: Evidence from benefit valuation studies on biodiversity is very limited but reveals a preference for restoring PAWS and creating new areas of semi-natural broadleaved forest adjacent to existing sites. There are strong drivers for forestry policy from other agendas (e.g. SSSI PSA target, woodland bird indicator, UKBAP, England Biodiversity Strategy), and policy needs to respond to these. The evidence indicates that a particular priority for protecting SACs and achieving favourable condition on these and other SSSIs. A high priority is also indicated for the restoration of former non-wooded habitats of high conservation value that have been detrimentally impacted by afforestation.

Biodiversity priorities are in the main best served by concentrating on the improvement and maintenance of ecological quality in existing woodland, especially ancient woodland, rather than an expansion of woodland. The scope for large-scale recreation of 'wildwood' landscapes that are dominated by natural processes should also be investigated and acknowledged in future strategies.

Not withstanding the need to meet current biodiversity conservation policy objectives, it is necessary to take account of, and prepare for, climate change by developing a more dynamic and adaptive strategy towards forest biodiversity conservation. In the short-term there needs to be a commitment to more research and debate amongst stakeholders on likely impacts and adaptation strategies.

Landscape and amenity: The evidence indicates that the use value of wooded landscapes can be substantial. They have been identified for urban areas and travel routes where large numbers of people obtain benefits from seeing trees in the landscape. One strand in woodland policy should be to enhance landscape and provide amenity close to where people live (urban and peri-urban locations). But planting in highly-visited areas may also be justified where the enhanced landscape is appreciated by the public.

There is no economic evidence to support planting to strengthen landscape 'character' in remote locations with a low population where aggregated visual benefits to the public would be minimal. However, it is not clear whether some wooded landscapes may have non-use or cultural values because no valuation research has been undertaken on this aspect. There is a need for more research to quantify the value of woodlands in cultural landscapes in order to better inform the development of forestry strategy.

Soils, water protection and flood control: More research is required on the economic efficiency of woodland in reducing the risk of flood. On current evidence it would be difficult to include flood control as an element in forestry strategy.

In catchments sensitive to N, P and sediment loading new woodlands can improve water quality if planted in appropriate locations, mainly by reducing pollution from agriculture. It is doubtful if woodlands are a cost-effective mechanism for reducing N losses when assessed solely in terms of Water Framework Directive (WFD) benefits. However, woodlands and buffer strips have a role in reducing P and sediment transport.

The adaptation of agriculture to the SPS introduces uncertainty into the measures that will be needed to deliver WFD objectives. The role of woodlands will be clarified when Defra has examined the full range of available options for intervention.

Rural development: Forestry has been used to stimulate local economic activity in rural areas and so create employment and income directly and through knock-on effects. However, much timber production and harvesting is now unprofitable as a commercial activity.

As a rural development activity woodland creation is not ideal because of its protracted timescale, uneven labour profile and long-term dependency on subsidy. Direct public benefits in remoter rural areas from landscape and additional provision of recreation are usually small. However, land-based activities typically require costly incentives and forestry is not unusual in this respect. Current evaluations of the South West Forest (Devon) and Forest Futures (Cumbria) should assist in better understanding the benefits from large scale planting and intervention to support woodland improvement.

The case for forestry in rural development is stronger where it stimulates innovation in business development including nature-based and special activity tourism which use existing woodlands. There may also be a case for facilitating the formation of forest clusters in regions where commercial production is important in the local economy and where this is specified by the RFF.

Regeneration and urban development: The case for intervention to facilitate woodland creation and improvement within and near urban areas in need of regeneration is very strong. Not only are there potential benefits to quality of life in terms of recreation, amenity, health and social inclusion but there are almost certainly impacts on business attraction and retention. This role of trees and woods to deliver on a range of community, environmental and development agendas should feature in policy.

Tree planting as a framework for new development and as an after-use for terminated development is already encouraged by the planning system. This is often achieved at little cost to the public, especially where developers contribute, through legal agreements, to creation and maintenance.

1 Introduction

1.1 Remit

The purpose of the research as defined in the remit was 'to review developments in policy and the evidence base relevant to forestry since the launch of the England Forestry Policy so as to ensure that forestry policy in England is based on the best available evidence'.

The study was to undertake the following:

- Identify the key policy issues within the England Forestry Strategy and identify the rationale for government intervention. This involves building on the Economic Analysis of Forestry Policy in England (CJC Consulting, 2003) study.
- Identify key policy areas relevant to forestry policy and assess the reviews, strategies and research since the launch of the EFS.
- For each of the above identify the evidence used and assess whether it is the best available. The assessment would include examinations of the methodologies used.
- Identify relevant evidence which has not been used but which could be used to underpin existing forestry policy.
- Identify any gaps in the evidence.
- Identify the implications for forestry policy in England.

The study was to concentrate on policy analysis and exclude consideration of the institutional aspects of policy delivery. We have included some discussion of the costs of delivering policy and the cost-effectiveness of alternative mechanisms when this is relevant to the development of policy itself.

1.2 Methodology

This review builds on the previous cost-benefit analysis (CBA) for Defra and H. M. Treasury (CJC Consulting, 2003). The aim has been to avoid undue repetition and concentrate on new evidence.

We use CBA as the underpinning methodology following the guidelines for the analysis of government policy given by H. M Treasury (2003). The remit does not require an aggregate CBA of English forestry. An aggregate assessment would in any case not be very informative since policy development requires an assessment of different possible directions for intervention. Where government has already developed policy agendas of relevance to forestry we also analyse the cost effectiveness of forestry in delivering on these agendas.

We have included a technical review of biodiversity to supplement the limited economic evidence on that topic. The study does not cover in any detail the timber processing sector nor the prospects for timber prices or markets. It does not draw comparisons with the benefits derived from government investment in other land-based sectors such as agriculture.

Detailed reviews at a regional scale were considered to be beyond the scope of the study. We have, however, highlighted where location is likely to be a critical element in the development of policy, and included a discussion on the regional priorities indicated under Regional Forestry Frameworks (see Section 3.8).

1.3 England Forestry Strategy (EFS)

The EFS (Forestry Commission, 1998) set out a national programme for forestry over the period to 2003/2008. The EFS was set within the main aims of UK forestry policy at that time which were:

- The sustainable management of our existing woods and forests; and
- A continued steady expansion of our woodland area to provide more benefits for society and the environment.

The EFS itself has four strategic priorities:

- **Forestry for rural development** which covers forestry's contribution in the wider countryside including the contribution of both new and existing woodlands to the rural economy, timber and marketing opportunities and to contribute through upstream and downstream job creation.
- **Forestry for economic regeneration** which refers to forestry's role in strategic land use planning including the restoration of former industrial land and creating a green setting for future urban and urban fringe development.
- **Forestry for recreation, access and tourism** which focuses on providing more and better public access to woodlands, ensuring that woodland and forests continue to be used for a wide range of recreational pursuits as well as complementing and supporting the tourist industry.
- **Forestry for the environment and conservation** which embraces the role that woodlands can play in conserving and enhancing the character of our environment and in delivering the government's objectives for nature conservation, biodiversity and climate change.

The strategy set new directions for forestry intervention in England and in particular shifted the focus away from timber production towards the delivery of public goods. The strategy does not give delivery targets or indicate the balance of outputs to be achieved. Performance targets are set in the spending reviews agreed with H. M. Treasury.

1.4 Intervention in relation to forestry

Government intervention in forestry occurs for three main reasons. These are:

1. International and EU obligations which require intervention by the UK government.
2. When a market failure results in the market mechanism alone not being able to achieve economic efficiency (for example through the market having difficulty supplying public goods or an externality occurring when a particular activity produces benefits or costs for other activities that are not directly priced into the market).
3. Intervention in relation to other government policy agendas. Forestry could either be a *mechanism* to assist in agenda delivery (e.g. sustainable development, rural development) or itself a *target* within another agenda (e.g. the favourable condition target for SSSIs). These agendas may be derived from international or EU obligations, or from domestic policy goals.

A further economic argument for intervention could be to displace other negative externality-creating activities such as (a) imported timber that is harvested non-sustainably, and (b) other economic activities associated with external social costs (mainly from pollution of soils, water and air). We do not deal with (a) which is a complex issue beyond the scope of this study. (b) is considered in the appropriate sections of the report.

1.4.1 International agreements

The UK Government is a signatory to a number of post-Rio international agreements relating to the sustainable management of forests and the role of forests as carbon sinks. At the 1993 Ministerial Conference on the Protection of European Forests in Helsinki the Government agreed to the guidelines for sustainable management of forests in Europe. Pan-European Criteria (PEC) on sustainable forest management (SFM) were agreed in 1994. Government also signed the declaration of the Pan European Ministerial Conference on the protection of forests in Europe in Lisbon in 1998. The UK has responsibilities under the United Nations Framework Convention on Climate Change to protect and enhance carbon sinks such as forests (DETR, 2000a).

The implications of the agreements relating to SFM are discussed in Section 1.4.4 and those relating to climate change in Chapter 5.

1.4.2 Market failure and cost-benefit analysis

The recent CBA of forestry in England (CJC Consulting, 2003) assessed the evidence for market failure in the forestry sector and the case for intervention. The study listed the situations where some degree of market failure may exist. These are:

- Recreation;
- Carbon sequestration;
- Watershed regulation;
- Biodiversity conservation;
- Economic security;
- Landscape and amenity;
- Air pollution;
- Distortion of agricultural land prices;
- Employment creation;
- Economic regeneration;
- Social stability and human health;
- Displacing imported timber that is harvested non-sustainably, and
- Displacing domestic agricultural production to reduce negative externalities.

A common first cut approach to appraisal is to apply the test of whether the value of benefits exceeds the costs incurred, using the Treasury discount rate of 3.5% to convert all the costs and benefits to 'present values' so that they can be compared (H. M. Treasury, 2003). Calculating the present value (PV) of the difference between the streams of costs and benefits provides the net present value (NPV) of an option and this is the primary criterion for deciding whether government action can be justified.

Conclusions from the previous study are given in Table 1.1. On the basis of that review intervention has the potential to deliver net benefits from procurement of urban amenity, local woodland access, recreational provision and biodiversity. The cost-benefit from intervention is usually highly dependent on the location and accessibility of the woodlands because this will determine the level of public use. The case for intervention in timber production *per se* was weak. This is market activity. However, if public goods (e.g. biodiversity, recreation) were at risk from limited management this could provide a case for intervention. With other woodland outputs the case for intervention was less clear, either because there was a lack of evidence or because the evidence did not provide convincing support for government action.

Table 1.1 Net benefits from intervention to procure different woodland outputs (as identified in the 2003 cost benefit analysis)

	Main woodland output	Net benefit	Factors determining marginal cost-benefit
1	New urban and peri-urban visible amenity	Potential for high benefits depending on context	Highly context-dependent (population size, existing visible woodland cover)
2	Additional local access (e.g. CWS)	Marginal net benefit substantially positive	Highly context-dependent (user population, existing local recreation stock)
3	Recreation in existing FE woodlands	Average net benefit substantially positive	Potential for positive marginal benefits from recreation expansion but depends on local recreation stock in relation to demand
4	New biodiversity and conservation (new broadleaved native forest)	Positive net benefits but should be treated as indicative only	Highest benefits when new woods buffer and link existing woods of high conservation value. Doubts exist about the effectiveness of WGS in creating biodiversity value but more information is needed
5	Carbon sequestration	Intervention appropriate for market creation not procurement.	
6	Timber	Intervention inappropriate unless public good output is at risk.	
7	Water and air pollution reduction	Minimal benefits	
8	Urban regeneration	Likely to be strongly positive but more information needed	Depends on size of population benefiting from visual amenity and recreational access. Impact on local economy uncertain.
9	Rural amenity and landscape	Insufficient evidence to support intervention except where justified by 1 and 2 above	Dependent on local population size and visual impact on landscape
10	Rural development	The case for intervention depends on the benefits procured under 2 and 4 above.	

Note: see CJC Consulting (2003) for an expanded explanation of these conclusions.

1.4.3 Contributions to other policy agendas

This study investigates the links between forestry and other agendas that might lead to a case for intervention through forest management. The principal agendas that are relevant are:

1. The EU Water Framework Directive.
2. Climate change policy.
3. Renewable energy policy.
4. Rural and regional development.
5. Sustainable development.
6. Biodiversity policy (UKBAP, England Biodiversity Strategy, PSA targets, sustainability indicators).

In the first four, forestry is a delivery mechanism (to be assessed alongside other possible mechanisms). With sustainable development (5), forestry is expected to play a role in contributing to UK policy, and in (6) forestry is largely a target element for the policy. The use of forestry as a mechanism for the delivery of other policy objectives can only be justified if it is *cost-effective* as compared with alternative types of intervention.

The role of forestry in sustainable development is discussed below because it is a central tenet of the EFS. Contributions to other policy agendas are considered in subsequent chapters.

1.4.4 Sustainability in forest management

International agreements relating to SFM require participating governments to establish national programmes for sustainable forestry. SFM was defined at the Helsinki conference as 'the stewardship and the use of forests and forest land in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfil, now and in the future, relevant ecological, economic and social functions, at local, national and global levels, and that does not cause damage to other ecosystems'. SFM forms an element in the wider agenda for sustainable development within the UK government described in 'Securing the Future' (UK Government, 2005) (see Section 3.7).

The national programme for England consists of four elements:

- The England Forestry Strategy.
- The UK Forestry Standard (UKFS) (Forestry Commission, 2004c).
- Compilation of a set of indicators of sustainable forestry (Forestry Commission, 2002a).
- Independent verification under the UK Woodland Assurance Standard (UKWAS).

The UKFS 'sets out criteria and standards for the sustainable management of all forests and woodlands in the UK'. It forms the basis on which UKWAS has been developed. There are 40 UK indicators of sustainable forestry. Of the key UK framework indicators only one relates directly to forestry and that is the indicator of woodland bird populations (see Section 5.3).

There appears to be growing flexibility in the definition of SFM because the interpretation of what is binding on management in UKFS and UKWAS has changed considerably in recent years. In part this reflects the changing commercial environment for timber and the undesirability of perpetuating forests that are unprofitable. But opportunities to increase environmental benefits have also been important. Substantial areas of forests have been converted to non-forest habitats including open ground habitats. In England the new English Woodland Grant Scheme EWGS (Forestry Commission England, 2005) is designed in part to facilitate conversion of conifer plantations into native woodland or non-woodland habitats[1].

Conversion of forest from conifers to other habitats such as native woodland, heathland and wetland could be interpreted as a sustainability measure in that valued natural capital is being restored. However, it could also be explained in terms of a policy response to a change in the relative value to society of market (timber) and non-market (biodiversity) outputs from current forests.

[1] *Conifer trees get the chop*. Guardian, June 28th 2005.

1.5 Structure of the study

Chapter 2 provides background information on forests and woodlands, timber prices and markets, and non-market output. It also discusses the size and direction of public expenditure associated with forestry. Chapter 3 considers the changes in the institutional arrangements for forestry since 1998 and briefly reviews the main policy agendas to which forestry may be expected to contribute.

Chapters 4-6 consider the main outputs from forestry their benefits to the public and the contribution made by forestry to other policy areas within government. In each case the policy context is described, the contributions of forestry assessed primarily in economic terms and the implications for policy summarised together with an assessment of the evidence base. Chapter 7 deals with a number of cross-cutting issues and Chapter 8 draws conclusions for the development of strategic policy.

2 Forestry situation in England

2.1 Introduction

This chapter provides a brief account of the forest resource, its outputs and the nature and cost of government intervention in the sector. The chapter concentrates on market outputs and returns because they can be a driver for forest expansion and management by private investors. This can have implications for external effects (e.g. landscape impacts). Non-market outputs are considered in greater detail in subsequent chapters.

2.2 Forest estate

2.2.1 Area

The woodland stock in England is 1.11m ha, 82% of which is in the private estate (Table 2.1). It is 66% broadleaved and new planting is almost entirely in the private sector.

Table 2.1 Area of forestry in England

	Conifers ('000 ha)	Broadleaves ('000 ha)	Total ('000 ha)
Public forest estate	154	52	205
Private	217	693	919
Total	**370**	**745**	**1,115**

Source Forestry Commission (2004b).

Within the total of 1.1m ha, there are 200 kha of ancient and semi-natural woodlands, 200 kha of other semi-natural woodland and 140 kha of forest planted on ancient woodland sites (PAWS)[2]. 50 kha of the PAWS has been restored giving a total ancient and native woodland area of 450 kha.

The UKWAS standard is applied by Forest Enterprise (FE) to the public estate, and the UKFS good practice guidelines are applied as conditions on woodlands managed or created with WGS incentives. 340,000 ha of woodland (30.5% of the total area) is under UKWAS certification which delivers SFM as defined by UKWAS. This has increased from the 26% noted in the 2003 CBA study. The actual area that meets UKFS standards is not known because much of the estate is not subject to grant aid conditions at any one time. The FC estimate that only 30% of the private woodlands in England are under 'active' management.

2.2.2 Woodland creation and restocking

New planting in 2004-2005 was 5,300 ha, all by the private sector and virtually all in broadleaves (Table 2.2). Hence new coniferous planting has all but ceased in England. This rate of planting is similar to the average over the last five years. Rates of restocking have fallen to very low levels especially in private woodlands (900 ha). The current rate contrasts with rates of 3,500-4,000 ha per year in the early 1990s[3]. The implications is that very little private woodland harvesting is taking place, which in turn would appear to be a result of low timber prices (see below) and the costs of re-planting which is normally a condition attached to the felling licence. This marked fall in conifer harvesting on private woodlands has been confirmed by the Forestry Commission.

[2] Simon Pryor personal communication.
[3] Although there was a distorting effect of the 1987 hurricane.

Table 2.2 Areas of new planting and restocking (England, '000 ha)

Year ending 31 Mar	New planting			Restocking			Total		
	FE	Non-FE	Total	FE	Non-FE	Total	FE	Non-FE	Total
2000-01	0.1	5.7	5.9	2.1	1.8	4.0	2.3	7.6	9.9
2001-02	0.6	4.7	5.4	2.3	1.1	3.4	2.9	5.8	8.7
2002-03	0.7	5.2	5.9	2.3	1.1	3.4	3.0	6.3	9.2
2003-04	0.1	4.6	4.6	2.2	0.9	3.2	2.3	5.5	7.8
2004-05	0.0	5.3	5.3	1.6	0.9	2.5	1.7	6.2	7.9

Source: Forestry Commission, Forest Service and the Woodland Grant Scheme
Note: Figures for England in 2003-04 have been revised from Forestry Statistics 2004.

2.2.3 Woodland management

In 2004/5 The FC grant aided 171,000 ha with management grants. This consisted of 156,000 ha subject to annual management grants (AMG), 12,000 ha of woodland improvement grants (WIG) and 3,000 ha in Livestock Exclusion Annual Premiums (LEAP).

2.3 Timber production and prices

Timber prices have fallen substantially in the last ten years. The nominal price for GB standing timber was £6.13 per cu m overbark in the 6 months to March 2005 compared with £11-17 in the period 1986-1998 (Forestry Commission, 2005a). Real prices (adjusted for inflation) are now only 25% of the levels recorded in the same period and 18% of the peak 1987 peak (Figure 1.1). The fall in prices has mainly been triggered by increases in supply from the Baltic States and Eastern Europe. There has been a slight recovery in prices in the last two years which IPD (2005) attributes to weaker sterling, higher freight costs for imported timber, increase demand, and reduced supply from the Baltic states and FC Wales.

FAO (2005) has reviewed the forestry situation in Europe. It concluded that Eastern Europe and the CIS countries and now very competitive in terms of wood supply. Their production of forest products is expected to increase dramatically in the next 20 years whereas forestry in Western Europe will expand to meet 'broader social objectives'. A significant expansion of sawn timber exports in expected from the Russian Federation which has a major competitive advantage in timber production. Economic conditions will therefore remain challenging in the future and the economic viability of European forest management will remain under threat.

We can infer from the FAO analysis that a return to prices observed a decade ago is highly unlikely. But there does appear to have been some return of confidence in the market and IPD (2005) suggest 'cautious optimism' following the slight recovery in timber prices.

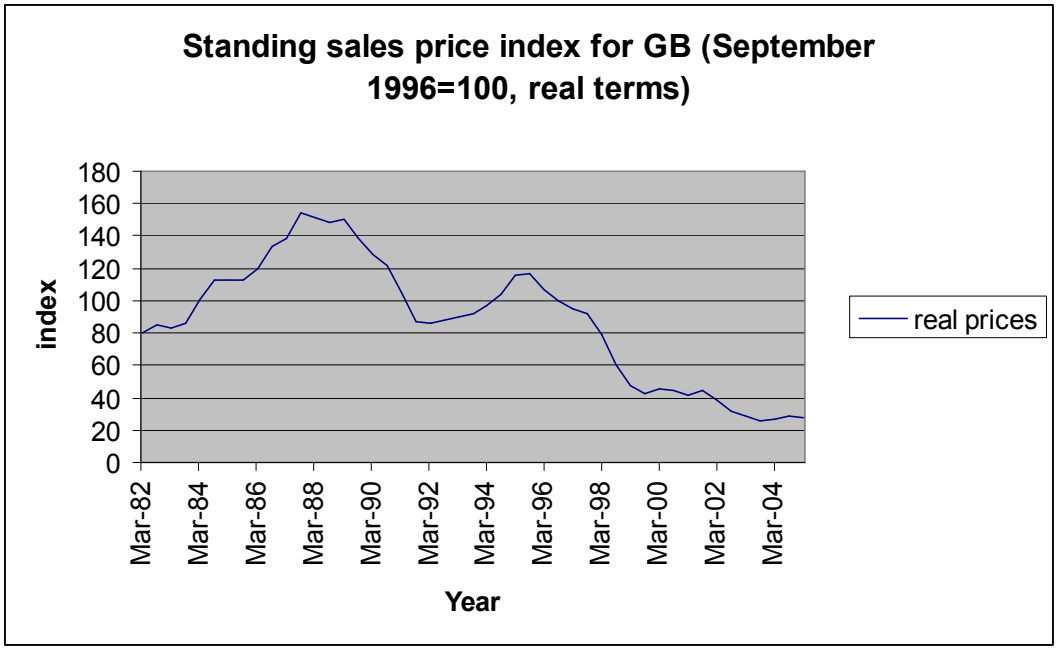

Figure 1.1 Coniferous Standing Sales Prices for Great Britain (real terms) (source: Forestry Commission, 2005a)

2.4 Timber processing

Supplies of GB timber for the timber processing industry appear reasonably assured despite the depressed situation in commercial timber production. Timber output is forecast to increase by 42% over the next 15 years (from 2202/2006 to 2017/2021) (Table 2.3). With this significant increase in output and expected continued growth in the UK economy an expansion in processing capacity is to be expected. However, private woodland harvesting in England has been declining (see above). It is not clear whether this is simply a delay in the hope of an improvement in timber prices, a relaxation in restocking conditions or increased grant aid under the EWGS. In some cases it could be that crops are not worth harvesting if they must subsequently be re-stocked. The FC forecasts are best interpreted as potential output, part of which may not be realised.

Table 2.3 Forecast output of timber in GB (thousand cu m overbark standing)

	Softwood			Hardwood	Total
Annual average in the five years	FC woodland	Non-FC woodland	Total		
2002–2006	5,130	5,750	10,870	1,000	11.870
2007–2011	5,980	7,080	13,060	1,000	14,060
2012–2016	6,240	8,200	14,440	1,000	15,440
2017–2021	6,850	8,630	15,480	1,000	16,480

Source: Forestry Facts and Figures (Forestry Commission 2004b)
Note: FC indicate that the hardwood forecasts are unreliable.

2.5 Returns to investment

IPD (2005) calculates 3-year rolling annualised returns from private Sitka spruce forests in Britain, and these show that returns have improved from a low of –5.4% in 1998-2001 to +1.9% in 2001-2004. This reflects some recovery in timber and plantation prices but may also reflect changes in residential and amenity values. The return includes the WGS subsidies available to owners.

In the 2003 CB study we applied 2003 timber prices to FE planting models for Kielder and Thetford forests managed by Forest Enterprise. At 2003 prices (£11.92 per m^3 for timber over 1.00m^3) the internal rates of return (IRR) were around 1.7% for Sitka spruce Yield class (YC) 14 and negative at YCs less than 10. YC 14 Scots Pine gave a return of 1.65%. These results would still be broadly applicable now.

These low returns from restocking are confirmed by detailed investment models used to assess the returns from Sitka spruce producing timber without subsidy in Scotland (CJC Consulting, 2004). This used typical establishment and management costs together with current standing crop prices of 7.0-13.0 £/m^3 for trees sizes of 0.3-0.78m respectively. The rates of return were around 2% for Sitka YC 14 and zero for YC 10. Yields would have to exceed YC 18 to give a 3.5% rate of return[4] on capital from timber alone. These results were not greatly improved by a doubling in timber prices. They are broadly applicable to the public Sitka estate in England.

It should be made clear that the IRRs discussed above are based on timber as the sole output and are derived for the public estate. They can also be applied to restocking private woodlands in a no-subsidy situation. The calculations take no account of any value (opportunity cost) attributed to the land. For new planting without subsidy the returns would be negative in many contexts.

The FAO (2005) review indicates that this situation is not expected to radically improve. The outlook for forest product prices is stable but costs will continue to rise. Margins will be squeezed further, and new unsubsidised planting or restocking is only likely to be viable on highly productive sites or where investors receive other benefits[5]. The low restocking rates in England support this conclusion (see Table 1.3). Of course, many forests owners have other outputs from their woodlands that they value (sport, landscape, amenity) and they may also receive WGS payments.

2.6 Employment

The most recent (1998-99) Forest Employment Survey (Forestry Commission, 2001) indicated 6,166 full-time equivalent (FTE) jobs in domestic forestry in England with a further 8,573 in haulage, primary wood processing and related non-forest jobs. This total employment in forestry has decreased over time, mainly due to productivity increases associated with the use of newer technology.

2.7 Non-market outputs from forestry

Non-market economic benefits are very important in forest policy. Since the 1980s English forests have been increasingly managed for multi-purpose objectives. The non-market social and environmental benefits principally comprise recreation, the landscape value of woodland, biodiversity benefits in supporting species that would otherwise not

[4] H. M. Treasury discount rate (see Section 1.4.2).
[5] Forestry is no different in this respect to much of English agriculture in a fully decoupled context (see, for example, ADAS, 2003).

exist without a forest habitat, carbon sequestration, air pollution absorption benefits, and natural resource protection. These non-market benefits accrue to non-forest economic agents, such as visitors (recreation values), homeowners (landscape values and increased house prices), and society as a whole (carbon sequestration values and biodiversity values): they are, because of their 'public good' nature and market imperfections, benefits for which the FC or a private woodland owner cannot charge.

Willis *et al*. (2003) recently provided new estimates of the annual value of the social and environmental benefits from forests in England. The value of £885m per year is substantial and relates mainly to recreation (£354m) and biodiversity (£302m) benefits, with smaller contributions from carbon sequestration and landscape. However, what is more important for policy is the marginal value of changes in the outputs of these goods.

2.8 Cost of policy intervention in forestry

Current intervention by government in forestry is by four principal mechanisms:

- Management of public forests and associated land by Forest Enterprise;
- Grant aid primarily for woodland creation and changes to forest management aimed at supporting the delivery of public goods;
- Regulation of forests and forest health; and
- Forest research and training.

The main costs of government intervention in forestry are given in Table 2.4. Payments, in the form of grant aid and partnerships, account for £32.8m of the £108m expenditure for 2005/06. Regulation and administration accounts for a further £11.7m and the management of the public estate by Forest Enterprise accounts for a net expenditure of £23.5m. Overall, the net accounting cost to the exchequer of intervention in forestry is currently around £61.0m per year. CJC Consulting (2003) concluded that, for both arable and grazing land, woodland creation would produce no saving in CAP support costs. We also expect this to be the case under the Single Payment Scheme (SPS) (see Section 7.6).

These accounts are partial in that they do not include the value to the public of the non-market outputs from forestry. Willis *et al.* (2003) estimated the value of these benefits at £885m annually for all forestry in England. The implication is that public expenditure on forestry, in aggregate, generates good value and should therefore be maintained at current levels. Whilst this is suggested by the high benefit-cost ratio (14.5) it is not a strictly valid conclusion. The Willis estimates are of benefits to the total estate and not those to policy intervention in the estate. Even so, it does seem likely that intervention by government does produce substantial net benefits, at least from the public estate (see CJC Consulting, 2004 for evidence from Scotland).

Table 2.5 gives further detail on grant aid payments. The major part of the expenditure is made to support new planting. Sixty-one per cent of the WGS payments were on woodland creation. If FWPS/FWS payments are included this rises to 76% of the total. Management grants are 34% of the WGS total and 20% of the overall total.

Table 2.4 Forestry intervention income and expenditure, England (£m)

	2003-04 Actual	2004-05 Forecast	2005-06 Plan
EXPENDITURE			
FCE woodland grants and partnerships	21.9	21.2	20.4
FWPS/FWS	10.2	10.2	12.4
FCE policy, regulation and administration	11.2	12.4	11.7
Forest Enterprise England operating costs	35.0	35.8	35.7
Forest Enterprise England recreation, conservation and heritage	18.5	21.5	22.3
Forest Enterprise England purchase of assets	4.7	2.2	5.5
Total expenditure	**101.5**	**103.3**	**108.0**
INCOME			
FCE EU co-financing	5.1	4.9	6.5
FCE other income	1.8	1.6	0.5
Forest Enterprise England operating income	25.0	26.6	28.5
Forest Enterprise England recreation, conservation and heritage income	8.8	9.9	9.4
Forest Enterprise England sale of assets	1.8	6.0	2.1
Total income	**42.5**	**49.0**	**47.0**
Net expenditure	**59.0**	**54.3**	**61.0**

Source: Forestry Commission and Defra
Note: these accounts do not include a return on the capital tied up in the public estate. Nor do the accounts include the expenditures of Forestry Commission GB, any savings in other CAP support from displaced agriculture, Defra FWPS/FWS administrative costs, or costs to local authorities in tree management and insurance.

Figure 2.5 Grant aid paid in year ending 31 March 2005 (£ million)

Total grants by type of grant	
New planting: WGS	6.1
New planting: supplements	3.9
New woodland from natural regeneration: WGS	0.1
New woodland from natural regeneration: supplements	0.2
Restocking: planting	0.6
Existing natural regeneration	0.1
Restocking: natural regeneration	0.1
Management grants	5.7
FWPS/FWS	12.5
Total WGS	**16.8**
Total FWPS/FWS	**12.5**

Source: Forestry Commission

Hence, most of the expenditure on incentives for private woodlands is directed at woodland creation. Net expenditure on the public estate is almost entirely on management (including re-stocking) since little or no new planting is taking place.

2.9 Summary

There are 1.11m ha of woodlands in England, with 66% in broadleaves. The public estate only accounts for 18% of the total area but is a key element in timber production accounting for 42% of the conifer area. New planting was 5,300 ha in 2004/05 but restocking was limited (2,500 ha). The commercial sector is facing much lower timber prices than those recorded a decade earlier although there has been a slight price recovery in 2004/5. FAO (2005) offers little prospect of a sustained price recovery. Rates of return from timber are very low at current prices except on very productive land.

The net exchequer cost of intervention in forestry, through grant aid, management of the public estate and regulation, is currently £61m per year of which £23.5m relates to management of the public forest estate. Whilst data are not available to estimate the return on this expenditure it is expected to be substantial at least in relation to expenditure on the public estate. The majority of the grant aid to the private sector is spent on woodland creation and restocking.

3 Strategic policy relating to forestry

3.1 Introduction

The 1998 EFS remains the government's principal statement on forestry strategy in England.

A number of policy statements and initiatives since 1998 have modified the context for forestry or its interpretation in practice. The principal ones are:

- Rural White Paper 2000.
- Devolution review 2002.
- Sustaining England's Woodlands 2002.
- Sustainable Communities: building for the future 2003.
- Regional Forestry Frameworks 2003.
- Defra 5 year Strategy 2004.
- Sustainable Development Strategy 2005.

These are reviewed below.

3.2 Rural White Paper 2000

The Rural White Paper (DETR, 2000) closely followed the EFS but set a clear expansionary tone for forestry, supporting a significant increase in woodland cover across England. It stated that trees, woods and forests would have a more prominent place in the countryside. This would include an increase in the role of forestry in the rural economy, more woodlands on derelict and former industrial land, more woodlands available for people to visit and enjoy as well as an increase in the extent of semi-natural and native woodlands.

3.3 Devolution review

The Devolution Review (Interdepartmental Group, 2002) proposed new structural arrangements relating to forestry. These included:

- Much greater integration of policy development and delivery between the Forestry Commission's National Offices and the rural affairs departments in England, Scotland and Wales. These were to be underpinned by concordats worked up individually between each rural affairs department and the relevant National Office.
- Devolving the Forestry Commission's Forest Enterprise agency into three bodies, charged with managing separately the public forests in England, Scotland and Wales. In England this resulted in the establishment of Forestry Commission England (FCE) as a devolved management body and Forest Enterprise England as the body responsible for management of the English public forestry estate.

The strategic relevance of the devolution arrangements with the formation of FCE is that forestry policy and delivery can more readily be shaped to meet perceived needs and priorities in England than may have been the case before. It allows not only the public estate to be managed with reference to an English context but intervention in private woodlands to be geared to English needs. Key consequences of devolution are the transfer of strategic policy to Defra, closure of the WGS and the development of the

EWGS, and the further development of differentiated intervention by region within the Regional Forestry Frameworks (RFFs) (see below).

3.4 Sustaining England's woodlands

This report (Forestry Commission, 2002b) is a review of how the Commission supports the sustainable management of woodlands in England. It is primarily about delivery of SFM rather than strategic issues, since SFM is already a strategic objective of the FC. It is therefore not strictly relevant to this study.

3.5 Defra Rural Strategy 2004

The Defra Rural Strategy (Defra, 2004a) gives the most recent statement of government strategic policy for rural areas in England. In part it is a government response to the Haskins (2003) review of the delivery of government policies in rural England.

The government's three priorities for rural areas are:

1. Economic and social regeneration: supporting enterprise and targeting resources to area of greatest need.
2. Social justice for all: tackling social exclusion.
3. Enhancing the value of our countryside: protecting and enhancing the rural and urban environments and enhancing the value and natural beauty of the countryside for rural communities and the benefit of society in general.

The strategy states that forestry has a particularly important part to play in enhancing the value of the countryside and refers to the EFS for strategic content. Priority areas of action to protect the environment are: climate change, biodiversity, water, flood risk, soils and air quality.

Forestry is thus both a potential delivery mechanism for the strategic priorities (mainly 1 and 2) or as a target (with associated delivery mechanisms) since it forms part of the natural capital stock (3). The only specific reference to forestry is to 'encourage woodland owners to consider diversifying into recreation and tourism under the Regional Forestry Frameworks'. This would suggest that the case has to be made for forestry's role as a component or delivery mechanism for the higher level strategic priorities of the strategy.

3.6 Sustainable Communities 2003

Building on the Urban White Paper, *Sustainable Communities: building for the future* (ODPM, 2003) sets out strategies to create more liveable cities and sustainable communities. Much of the strategy is about housing and new growth areas but it includes plans for regeneration of deprived areas and improvement of local environments (parks and public spaces). The White Paper sets out measures to improve the green infrastructure of urban areas in order to increase the attraction of our living and working spaces. Cabe Space (2004) has promoted the value of good urban space design. Trees and woodlands can contribute in the delivery of these plans.

3.7 Regional Forestry Frameworks 2003

Regional Forestry Frameworks (RFFs) (Forestry Commission, 2005) have been developed to take account of the government's regional agenda and to deliver EFS more effectively, taking account of regional interests and perceived priorities. The Forestry

Commission does not lead in the development of the RFFs but informs the process on national priorities and delivery mechanisms. Each RFF will provide the Commission with the overarching policy and funding priorities for forestry and woodlands in a region. The Forestry Commission vision for RFFs is that they will operate by:

- presenting the individual regional vision for woodlands and forestry on a 5–10 year timescale;
- setting the regional priorities within the context of national forestry policy;
- describing the actual and potential contribution of forestry to sustainable economic development, local strategic partnership strategies and community plans, and regional biodiversity action plans; and
- identifying partnerships for investing in forestry projects that help to deliver regional targets.

The current situation on RFF development is described in Annex I. In the majority of cases the Government Office (GO) for the regions chairs the steering group that consists of the GO, the Regional Assembly, the Regional Development Agency, The Forestry Commission and the Countryside agency. The RFFs that have been developed are extremely diverse in their structure, presentation and action plans. In most regions, social and environmental gains from forestry are the priorities. This is most notable in regions with marked population concentrations where the environment in which people live and work is paramount (e.g. London). In more rural regions such as southwest England, where environment is not a constraint on the well-being of the population, the contribution of forestry to the economy has a higher priority.

RFFs raise some critical issues for the development of Defra forestry strategy:

- Regional differences exist in priorities for government action in forestry.
- There appears to be no formal way in which national requirements, such as that of delivering on SSSI and UKBAP targets, are linked to RFF expressions of regional priorities. Defra strategy has to address the issue of how regional and national interests are to be integrated.
- It is not clear what the regional priorities imply for the distribution of forestry expenditure.

3.8 Defra's Five Year Strategy 2004

Delivering the Essentials of Life (Defra, 2004b) is a Departmental Strategy and is mainly concerned with environmental issues. A key aspect of the strategy is the setting and delivery of sustainable development (SD) objectives. Aspects where forestry could play a significant role are:

- Sustainable forest management as one element in Defra's aim of embedding SD across all key areas of government.
- The UK Framework indicator on woodland bird populations.
- Protecting natural resources – improvements in river water quality, protection of the variety and diversity of wildlife under the England Biodiversity Strategy; and improvement in the condition of SSSIs.

3.9 Sustainable Development Strategy 2005

'Securing the Future' (UK Government, 2005) builds on the 1999 strategy and indicates four priorities for UK action. These are

- Sustainable consumption and production.
- Climate change and energy.
- Natural resource protection and environmental enhancement.
- Sustainable communities.

It is possible to see a contribution from forestry to all of these prioirites. A specific role for forestry is identified in addressing climate change. Forestry practices are stated to make a significant contribution to reducing greenhouse gas emissions through carbon sequestration, burning wood as fuel and by using wood as a substitute for energy intensive materials such as concrete and steel. Specific mention is made of the taskforce established to make recommendations on the contribution of biomass. In addition forestry clearly has a role in delivering on the agendas for natural resource protection and environmental enhancement. Whilst the action plan for sustainable communities does not specifically identify roles for forests an woodlands, these are implicit in action to create attractive and welcoming parks and public spaces to improve health by encouraging and supporting health lifestyles.

3.10 Strategic implications of changes in delivery

Implied shifts in strategy since the EFS was launched can be detected from changes in the direction and balance of policy delivery. We examine the two sources of evidence – the changes to grant aid, and the management of the public estate by Forest Enterprise.

The new EWGS has six payment streams – planning, assessment, felling permission and regeneration, improvement, and creation. The main differences from WGS are:

- The shift towards greater support for planning and management of existing woodlands rather than woodland creation.
- Grant aid for restocking with native species and for conversion to non-forest habitats.
- The absence of direct support for 'commercial' forestry which does not contribute public good benefits.

Forest Enterprise, which manages the public estate, has been changing its priorities to concentrate more on public benefit delivery (Forestry Commission, 2004a), and specifically to:

- Manage FE woodlands with an increasing emphasis on people and the environment.
- Develop and promote woodland recreation to support government targets for activity and health. This includes the promotion of public access to the estate and the dedication of FC woodlands under CROW.
- Promote sustainable tourism to benefit the wider economy in rural areas.
- Support government targets for the England Biodiversity Strategy through the restoration of priority habitats and the improvement of SSSIs.

4 Social benefits

4.1 Introduction

This chapter considers access, recreation, and health benefits of forests, including benefits from reduced air pollution.

4.2 Access and recreation

4.2.1 Policy background and developments since the EFS

Forestry for recreation, access and tourism is one of the four objectives of the EFS. The aim is to enhance the stock of access, facilitate a wide range of uses and support the tourist industry.

The importance of the countryside as a recreational resource especially for urban people is highlighted in the Rural White Paper and the Defra Rural Strategy. Specifics relating to recreation include CROW, rights of way and encouragement of active recreation. The White Paper proposes a review of how to provide for all groups of people to enjoy countryside recreation. Health issues dominate the current recreation agenda and these are addressed in Section 4.3.

4.2.2 Visitor numbers

Benefits from access to forests are determined by the number of visitors and the welfare gains derived from the visits (measured, for example, by their willingness to pay).

It is not feasible to permanently record all visits to woodlands. Visits to forests and woodland are estimated in two ways: through surveys at sample dates and times at forest entry points, and through a random sample survey of general public households enquiring whether the respondent (or any household member) had visited a forest or wood over a preceding time period.

Where an entrance charge is levied (e.g. at Westonbirt) then an accurate record of the number of visits can be compiled. Otherwise the non-priced open access nature of most woodland renders accurate estimates of the number of visits and visitors problematic.

Surveys of visitors have recently been undertaken at some FC forests, mainly in Wales and at three sites in northern England. Estimates based upon such surveys of visitors at woodland entry points tend to produce a lower aggregate estimate of visits to woodland in England than omnibus surveys of the general population. The TNS Travel and Tourism (2004) omnibus survey estimated 222 million visits to woodland in England, of which it was estimated that 21% or 46.62 million were to FC woods and forests; 33% to local authority woods; 23% to private woods; and 7% to woods of voluntary organisations.

This TNS estimate of visit numbers is higher than the estimate of Benson and Willis (1992) in which all forest district managers in GB were requested to estimate [on the basis of a range of indicators (car park occupancy, trail use, and visitor centre use, etc.)] the numbers of visits to their respective forests over the preceding 12 months. This produced an estimate of 28 million visits to FC woodland in Great Britain, of which 21.5 million visits were to FC woodlands in England (Willis, 1991). Visit numbers may have grown since 1988 when the original estimates were made.

Visits to forests based upon sample surveys of visitors entering at principal access points, and from car park information, probably underestimate the actual number of visits

to forests, since they under-record visitors entering the forest through minor access points. On the other hand, general household surveys are known to over-estimate the number of visitors to forests, because of memory bias, and lack of a definition of woodland. However, it seems clear that the number of visits to FC forests and woods in England lies somewhere between 20 million and 47 million per year.

Locational effects

More recently Jones *et al.* (2002) attempted to predict the number of visitors interviewed at a variety of forests in GB. Controlling for population in zones of origin, they found that the dominant factor determining visits was the negative effect of increasing travel time. Visits were also significantly related to increases in travel time to substitute sites: many potential woodland visitors appeared to consider similar natural and manmade environmental outdoor attractions (inland water, heathland, coast, and National Trust sites) as substitutes for woodland recreation. Areas with higher levels of young children, retired, and higher social classes, were all associated with increased numbers of visitors.

Converting predictions of numbers of visitors interviewed at forest sites to predicting annual visitor numbers at these sites was more difficult. The Jones *et al.* (2002) model was able to predict party numbers to 5 sites, for which reasonably accurate FC visitor data were available, only to within one order of magnitude (see Table 3.1).

Table 3.1 FC estimates of number of 'parties' visiting five woods.

Site	Forestry Commission estimate of number of party visits per year	Predicted number of party visits per year
Beechenhurst	72,845	22,024
Blidworth woods	63,849	78,532
Chopwell	33,708	17,854
Mabie	51,704	21,204
Symonds Yat	77,525	16,267
Total	299,631	155,881

Source: Jones *et al.* (2002).

Nevertheless, it is clear that recreation visits to 'ordinary woodland' exhibit a distance decay function. Visits are drawn mainly from the population in areas surrounding the woodland. This is clearly illustrated by Jones *et al.* (2002) in relation to Salcey wood. Any expansion to woodland will create fairly 'ordinary woodland' as distinct from nationally recognised woodland areas such as the New Forest, or Forest of Dean. The latter attract holiday visitors from greater distances. Indeed, if the marginal increase in woodland area is attached to an existing non-peri-urban forest, such as Thetford, it is doubtful whether such an increase will attract any additional visits (unless existing forest trails are congested, which is unlikely to be the case).

Increasing road congestion and travel time may in the long run moderate potential increases in the number of visits to forests in England; particularly longer distance trips to forests. Conversely, increasing road congestion might increase local trips to forests. However, the marginal value of longer distance trips to forests is often higher than for shorter distance trips to woodland, reflecting the fact that some visitors are willing to

spend greater amounts of money to experience recreation in different types and often more remote forests (e.g. less congested, more rugged, etc).

The marginal benefits of woodland recreation are higher where substitute recreational experiences are limited. It is difficult to generalise how the marginal recreational benefits of woodland vary in space: often consumer surplus on visits to more remote sites is higher than local sites because fewer substitutes are available in those areas; whilst for sites fringing urban areas, woodland is used for low marginal value visits and activities such as dog walking (where substitutes sites e.g. other public footpaths, parks, etc, are readily available). Of course the reverse is often true for aggregate benefits of woodland, since remote areas attract relatively few visits compared to more numerous visits to urban fringe woodland. Thus, the aggregate value of fewer trips at a higher value per trip may be much less than the aggregate value of more trips to local forests at a lower value per trip.

Long run demand for forest recreation is likely to increase as incomes grow. However, unlike luxury recreation trips (e.g. wildlife safaris, yachting and eco-tourism in rainforests) which are relatively income elastic, day recreation trips to boreal forests are relatively income inelastic; perhaps less than 0.5 (Loomis and Walsh, 1997).

Activities

The TNS survey found that walking was the main activity in 62% of forest trips, followed by cycling (8%), and horse riding (2%). The Forestry Commission (2004e) visitor survey data reveals that dog walking was one of the most popular activities in woodland, accounting for between 30% and 40% of all trips (Christie *et al.*, 2004) depending upon the forest. The TNS survey found for woods and forests, that a high proportion of trips to woods were described as 'regular' (81%) (a feature consistent with dog-walking as an activity) compared to day trips overall where 'regular' visits only accounted for 69% of trips. Also consistent with dog-walking as an activity was the fact that more wood/forest trips (50%) were taken unaccompanied by other people (TNS, 2004).

4.2.3 Benefits from 'open-access' forests: generalist visitors

The recreation value of the Forestry Commission (FC) estate was established in the late 1980's through a series of travel-cost models (TCMs) covering 15 forests; which represented the entire range of forest types in the FC estate. The TCMs estimated a consumer surplus of around £2 per person per visit (in 1988 prices), although this varied between individual forests from £1.34 to £3.31 per person per visit, depending upon the characteristics and location of each forest, with an enormous variation in the numbers visiting different forests (see Willis, 1991).

In 1992 H. M. Treasury halved the consumer surplus of £2 per person per visit to £1, and permitted the FC to use it in estimating the social value of its investments. Since 1992 this recreational value of £1 has been indexed to account for inflation, standing at £1.42 in 1999-2000, and currently at circa £1.60 per person per visit.

A later analysis of individual demand for forest visits from the EU-CAMAR dataset in Ireland, for visitors whose main purpose was a recreational visit to a forest, revealed that these visitors had a substantially higher economic surplus than previously estimated, with quite a variation across forest sites (£1.15-£7) (Scarpa, 1999). Once forest attributes were accounted for in the demand system of the Northern Ireland portion of the EU-CAMAR data, the TCM fitted better and the expected benefit of each forest visit varied between £2.25 to £3.70.

A subsequent survey of visitors to 7 English and Welsh forests [Brenin (in Wales), Dartmoor, Delamere, Epping, New Forest, and Thetford] by Scarpa (2003) estimated both open-ended and discrete choice estimates of willingness to pay (WTP) for access to these forests for recreational purposes. The pooled visitor data for the 7 forests indicated a mean maximum WTP amount that varied between £1.66 to £2.75 depending upon the analytical model adopted.

All these studies have sampled purposeful trips to forests, usually at car parks where longer distance visitors would arrive. Casual visitors, such as local dog walkers, etc., are under-represented in these surveys. Moreover, a local dog walker who may make two trips to a woodland every day is unlikely to pay £2 per visit. Other studies have shown that dog walkers have a low consumer surplus on the marginal walk (around 4p to 30p), principally because of the number that they make and the availability of substitute sites (Willis and Garrod, 1991).

The lower marginal benefit per visit attached to local walks in woodland is also evident from a study of the Community Woodland Supplement (CWS) (woodland within five miles of the edge of a village, town or city where there are few other woodlands available for recreation) (Crabtree *et al.*, 2001). The distance decay function for visits to this woodland was steep: while 69% of respondents living within ¼ mile of a CWS woodland had visited the woodland, this declined to 6% for those living >5 miles away. However, only 6% to 19% of respondents (depending upon distance from the site) indicated a positive willingness to contribute financially towards continued procurement of access. The mean WTP for CWS woodland was £15.38. However, only a small part of this public benefit derived from physical (recreational) access to the woodland. Most residents are more interested in trees in their locality for other reasons than access. Indeed, Crabtree *et al.* (2001) estimated that the mean use value per household (for households within 4 miles) of CWS woodland, varied from a lower bound estimate of £0.13 to an upper bound estimate of £0.56 per household per year.

4.2.4 Benefits from forests: specialist recreational visitors

People engaging in specialist recreational activities are usually willing to pay more than general users (e.g. casual walkers) to enjoy their sport. The two main issues for specialist recreation are (1) whether additional forests and/or additional tracks and improved facilities in existing forests will lead to increased participation and greater visitor numbers; and (2) the amount such visitors are willing to pay (including consumer surplus) on existing and new visits.

The FC has commissioned a study by Christie *et al*. (2005) into people's willingness to pay to undertake specialist recreational activities in forests: cycling (mountain bikes), horse riding, and nature watching, plus comparator group of 'general' forest users. This study is due to report later this year. It will provide more accurate and reliable information on the value of specialist recreation in forests and woods. The assessment of FC investment in mountain bike facilities suggests that benefits to users have the potential to be very high in relation to costs (CJC Consulting, 2004).

4.2.5 Implications for the policy agenda

Little new evidence on recreation benefits from the English estate has come on stream since 2003. The evidence on benefits aggregated across all users of the English forest estate is reasonably good, but evidence on marginal benefits from woodland expansion or improvement is much more limited. There is a need for better data on visitor numbers and their type (generalist, specialist users) and the willingness to pay for facilities by

specialised users (mountain bikers, horse riders etc.). Research and monitoring are in hand to fill some of these gaps especially on FC sites.

As indicated in Section 4.2.1, there is no overall agenda for recreation as such. Provision in woodlands produces substantial public benefits, estimated by Willis *et al*. (2003) at £354m per year. This is likely to have increased slightly with inflation and a small income effect; it may need to be revised upwards when new data on visitor numbers and the value of specialised recreational activities become available.

The Rural Strategy encourages woodland owners to consider diversifying into recreation and tourism under the Regional Forestry Frameworks. However, it is likely that market opportunities will be quite limited because of the amount of free accessible greenspace that is available to the public. They are likely to be restricted to the provision of specialised activities for which a charge could be set. Any expansion of the basic access resource will require intervention on the part of government and EWGS takes this forward with payments for long–term access to woodlands.

A strategy for woodland recreation provision has to take account of the locational distribution of both the supply of access and the demand by people for its use. This requires a carefully targeted approach. Woodlands can be substituted for other greenspace, which implies that integration between woods and other greenspace in local networks is needed. There is thus a strong case for extending the GIS-based approach to deficit identification (e.g. Woodland Trust, 2004 in their 'Space for People' publication) to cover all recreational greenspace.

4.3 Health

4.3.1 Policy background and developments since the EFS

The EFS did not specifically aim to deliver health benefits except possibly in association with recreation.

The Department of Health (Department of Health, 2004a) has reported on the evidence relating to physical activity and its impact on health. It estimates the cost of physical inactivity in England at £8.2bn per year with an additional £2.5bn cost for the inactivity element in obesity. The Public Health White Paper (Department of Health, 2004b) has 'increasing exercise' and improving mental health' as two of its priorities, and an action plan for physical activity (Department of Health, 2005) has been launched. As part of this delivery plan, a health concordat has been agreed between a number of bodies including FCE. This aims to encourage active use of the outdoors to improve people's health and well-being. 'Healthy life expectancy' and 'Mortality rates' are two supporting indicators in the Sustainable Development Strategy.

4.3.2 Impacts of trees and woodlands on health

Trees can improve the health of the general population by providing areas for physical activity and mental relaxation, and by improving air quality. The study for the Forestry Commission by CJC Consulting (2005) provides a detailed economic analysis of the health benefits from greenspace. Whilst there is increasing evidence that relates to health benefits from air pollution reduction and physical activity, the data on contributions to psychological well-being and mental health were found to be too limited to allow quantitative analysis.

Improved health benefits of woodland will be partly captured in the recreational value of woodland for those visitors engaging in walks and other physical activities for health benefit reasons (as measured by visitors' WTP for recreation benefits). It is important to

avoid double counting in this situation. However, the value of a preventable fatality (VPF) or the value of a statistical life (VOSL) is considerably higher than any payments made to participate in physical exercise schemes to reduce the probability of mortality or morbidity from coronary heart disease (CHD), stroke, or colon cancer, from lack of physical exercise. Hence, it is important to estimate the health benefits of forests in a separate analysis to that of the benefits of recreation in forests.

4.3.3 Health benefits from air pollution absorption

Trees absorb pollutants through the stomata, and by capture on their leaf/needle and bark surfaces. Taylor and Constable (1994) estimated for sulphur dioxide (SO_2) and ozone (O_3) that 70% and 80% of the pollution absorbed is internal to the leaf. For particulate matter (e.g. PM_{10}), the main dry absorption route is through deposition on leaf and bark surfaces. Conifer trees have a higher pollution capturing effect for PM_{10} and SO_2 than broadleaves, since over winter months the latter have no leaves; whilst the pollution capturing of broadleaves themselves is some five times greater than that of grassland. The layered canopy structure of trees, which has evolved to maximise photosynthesis and the uptake of carbon dioxide, provides a surface area of between 2 and 12 times greater than the land areas they cover.

The air pollution absorption effect of forests and woodland can be estimated using the UK National Air Quality Information Archive, which provides air quality information in terms of daily average gravimetric units ($\mu g/m^3$) for both sulphur dioxide (1996) and $PM_{10.}$ This can be matched with data on the type and spatial distribution of woodland on a $1km^2$ basis, from the Woodland Inventory (Wright, 1998), which identifies all FC and private woodland of 2 hectares or more. Average rainfall, which affects pollution absorption, information can also be integrated from the Met Office.

There are also established epidemiological relationships relating mortality and morbidity (hospital admissions) to PM_{10} and SO_2 levels. These relationships, with the number of people living in each 1 km grid square, can then be used to estimate reductions in mortality and morbidity due to the presence of trees compared with an alternative grassland land-use.

Increases in air pollution essentially reduce the length of life of a person rather than resulting in an immediate death. Unfortunately, there is no reliable information on the time by which a life is shortened: i.e. whether reductions in the levels of PM_{10} and other air pollutants extend life by 1 week, 1 month, 1 year, etc. Hence it is difficult to estimate the value of a reduction in PM_{10} and other air pollutants. The general consensus appears to be that further reductions in air pollution, which are already low compared with the 19^{th} and early 20^{th} century when bronchial and lung diseases were major problems, extend life by weeks and months rather than years. However, a recent longitudinal study by Rabl (2002) estimated that the mortality of adults > 30 years old was 330 per million persons for a 1 $\mu g/m^3$ increase in PM_{10} per annum over expected lifetime. Thus Rabl (2002) estimated that a permanent reduction in PM_{10} by 15 $\mu g/m^3$, would increase life expectancy by about 4.5 months. To put this in perspective, typical concentrations of PM_{10} in urban areas in England are around 20 to 30 $\mu g/m^3$, and the average reduction in PM_{10} attributable to trees in 1 km grid squares with trees in England is 0.049 $\mu g/m^3$. Hence the impact of woodland on health from reduced air pollution in rural areas with small populations is limited.

Trees, woodland, and shrubs in urban areas, for example along roads, can act as a buffer, especially for airborne particulates and NO_x,. However, little is known about the aggregate health effect of this type of woodland. It may be significant in terms of health

effects; and research is required to document its impact on population at risk. Linear belts of trees and woodland along roads also offer some protection for sensitive habitats such as heathland from impacts of pollution from roads (Bignal *et al.*, 2004); and noise attenuation by woodland could offer benefits for birds near areas such as roads or industrial areas (Reijnen *et al*., 1994a, 1994b, 1995).

For England, net pollution absorption by trees was found to reduce the number of deaths brought forward by air pollution by, on average, 5 deaths per year and to reduce hospital admissions by about 4 per year. With a discounted value of life and cost of hospital admission, this provided an upper bound estimate of benefit of £583,570 per year.

Aggregating the data on a county basis indicated that Hampshire and Surrey benefited the most from woodland, with the net effect also being important within Greater Manchester and Outer London.

The health benefits from air pollution absorption by trees may be much greater than the £583,570 per year estimated above. There may also be health benefits from reductions in other pollutants, such as $PM_{2.5}$, O_3, and NO_x, not considered in the study by Powe and Willis (2004). Moreover, there are many small woods of less than 2 hectares located close to urban populations, and close to sources of pollution (e.g. road traffic emissions) and the health benefits of these need to be included. Small woodlands have greater edge effects, where most pollution is captured; and deposition of pollution is also strongly influenced by exposure (proximity to source). Woodland creation around and within urban areas will hence lead to larger health benefits from pollution absorption than woods and forests in rural areas.

4.3.4 Health benefits from physical activity

Context

There is no doubt that regular physical activity is highly efficacious as a preventer of illness and as a therapeutic intervention for existing illness. Physical activity is beneficial (*preventative and therapeutic*) for cardiovascular disease, musculo-skeletal diseases, stroke and cancer. Physical activity has not been shown to be *preventive* for all types of mental illness, but there is good evidence that it is *therapeutic* for clinical depression, and for general mental well-being (Department of Health, 2004a).

A substantial proportion of the English population is now considered to be overweight or obese, and/or fails to undertake sufficient physical exercise. Both lead to an increased chance of illness and/or premature death. Department of Health (2004a) concludes that 'for general health, a total of at least 30 minutes a day of at least moderate intensity physical activity on five or more days of the week reduces the risk of premature death from cardiovascular disease and some cancers, significantly reduces the risk of type 2 diabetes and it can also improve psychological well-being'. It is estimated that only around 37% of men and 25% of women currently achieve this level of activity (Joint Health Survey Unit, 1999); and that 23% of men and 26% of women are sedentary (took less than one 30 minute period of moderate activity per week) (POST, 2001).

Research suggests that approximately 40% of deaths from coronary heart disease (CHD) are associated with inadequate physical activity, and that persuading sedentary people to take regular light exercise (e.g. walking) could reduce deaths from CHD by 14%; increased physical activity could reduce the number of strokes by around 25%; and that physical exercise decreases risk of colon cancer, which is much higher for sedentary people than it is amongst the most active members of the population.

Relative risk analysis

There are potentially significant health benefits to sedentary and overweight people using green spaces, such as urban fringe woodland, for physical exercise. The impact of increased physical activity on prevented deaths and morbidity is calculated through the population attributable fraction (PAF)

$$PAF = p(RR - 1) / [1 + p(RR - 1)]$$

using the prevalence of the risk (*p*) i.e. the proportion of the population exhibiting the risk, and relative risk[6] (RR) of those at risk compared to those without the risk. RR due to lack of adequate physical exercise is in the region of 2.0 for CHD, 1.4 for stroke, and 1.6 for colon cancer.

Unlike the effects of air pollution which reduce life expectancy by a few weeks or months at the end of an individual's life, CHD, stroke, and colon cancer are conceptually similar to road accident deaths: inducing death now and shortening an individual's life by many years. CJC Consulting (2005) calculated that a 1% unit reduction in the sedentary percentage of the UK population would save 1,063 lives per year that would otherwise have been lost. If people over 75 are excluded the figure falls to 343 lives. On the same basis, morbidity would be reduced by almost 15,000 per year (9,200, if older people are excluded). It was not possible to quantify the benefits to psychological health from changes in greenspace and its use.

Benefits from reduced mortality and morbidity were valued using government estimates of the value of a preventable fatality (VPF) combined with estimates of medical costs, productivity loss and savings in informal health care costs. The annual value of decreased morbidity and mortality from a 1% unit reduction in the percentage of sedentary people in the UK was estimated at £1.44bn (£479m if older people are excluded). The £1.44bn translates into a mean of £2,423 per additional active person per year.

The net benefit from additional greenspace provision or programmes to increase physical activity on existing greenspace depends on provision costs and success in changing sedentary behaviour over the long term.

4.3.5 Health programmes using woodlands

Numerous promotion campaigns have been run by public sector organisations and NGOs to encourage physical activity (mainly walking) and some use woodlands as part of the resource. The largest project is the joint Countryside Agency/ British Heart Foundation "Walking the Way to Health Initiative" (WHI). The WHI (2005) was established in 2000 with the aim of supporting 200 'walking for health' schemes across England for two years. 557,170 people took part in organised walks in the 2003/2004 year. No evaluation of costs and health benefits the WHI has been published as yet.

Very little evaluation information is available from which one can assess the health outcomes of such programmes. More detailed programme monitoring and evaluation is required to provide evidence on long-term health gains using medically recognised measures, drop out rates, displacement effects and programme costs (CJC Consulting, 2005).

[6] Relative risk is a measure of how much a particular risk factor (e.g. inactive lifestyle) influences the risk of an outcome (e.g. death by age 70). For example, if RR=0.5 for a factor this means that there is half the risk of the specified outcome for persons exhibiting that factor.

In the Forestry Commission study we assessed the possible benefits from the Chopwell Wood Health Project (CWHP) near Gateshead (CJC Consulting, 2005). This programme aims to improve health, by providing a range of physical, and stress relieving, activities within a woodland setting. Participants in the programme are recruited from people attending local GP surgeries with health problems (overweight, obesity, high blood pressure, and diabetes; all of which benefit from physical exercise). GPs can refer such patients to the CWHP following a medical consultation with the GP. The referral period lasts for 13 weeks, within which the client can attend prescribed activities at a reduced price (£1.35 per visit), after which the client pays the full public fee of £3.25 per visit (Powell, 2005). Although health outcomes were uncertain the programme had the potential to be cost-effective when assessed using reasonable assumptions about health benefits. A more accurate evaluation of the CWHP would require information from the medical records of individual referrals on the illness for which they were referred, the seriousness of the illness (i.e. the probability of the individual's death without the exercise), and monitoring of participants after they have completed the CWHP course to ascertain whether they continue to exercise.

What is clear is that activity has to be built into people's lives on a regular basis and programmes need to increase the activity levels of sub-active people rather than displace existing activity. Woodland-based physical exercise projects using existing green space can potentially be cost effective if benefits are significant. They obviate the need for the large capital expenditure and running costs that gym and leisure complexes incur.

4.3.6 Autonomous use of greenspace

Rather little is known about autonomous use of 'new' greenspace (e.g. new or existing woodlands opened up for access). Health benefits will depend primarily on the numbers of previously sedentary users and how the local environment is improved in terms of provision, accessibility and quality.

A correlation has been observed in a number of studies between physical activity and the physical environment. Both Craig *et al.* (2002) and Frank *et al.* (2005) observed a positive relationship between environmental indicators and physical activity such as walking to work. The effect of attractiveness and accessibility of public open green space on use for physical activity has also been investigated by Giles-Corti *et al.* (2004) in two studies within the 408 km^2 of metropolitan Perth, Western Australia. Interviews were conducted with 1,803 adults, aged 18 to 59, on access to public open space and physical activity, specifically investigating the effect of distance, attractiveness, and size of public open space. 28.2% of respondents reported using public open space for physical activity: the likelihood of using the open green space increased with increasing levels of access. Those with good access to large, attractive open green spaces, were 50% more likely to achieve high levels of walking.

In a recent European cross sectional study Ellaway *et al*. (2005) found that higher levels of greenery and lower levels of graffiti and litter in residential environments are associated with being physically active and not overweight and obese. Residents in high 'greenery' environments were 3.3 times as likely to take frequent physical exercise as those in the lowest greenery category. They concluded that efforts to promote activity should take into account these environmental facilitators and barriers.

The limited evidence that exists does support the view that the quality of the local environment and the accessibly of its greenspace are important generators of autonomous use and that this has health benefits. This supports the view of Cabe Space

(2004) that 'access to good-quality, well-maintained public spaces can help to improve physical health'.

4.3.7 Implications for the policy agenda

The evidence base on air pollution benefits is incomplete and health benefits may be substantially underestimated. There is a need for more evidence about the absorption effects of trees, woodland and shrubs in urban areas and along roads.

In relation to physical activity the evidence is also limited, but sufficient to suggest a substantial public benefit if increased activity levels amongst the more sedentary element of the population could be achieved. There are gaps in evidence on the psychological benefits from woodlands, which may be substantial. There is also a dearth of good evaluation data on both the costs and benefits of activity programmes and on the pay-off from improved greenspace provision or promotion. More information is also needed on the relative cost-effectiveness of different types of intervention using greenspace to improve health.

The available evidence supports the case for the inclusion of health objectives in forestry policy. The main health benefits derive from increased and frequent physical activity. This indicates an emphasis on providing greenspace suitable for walking and other non-specialised activities easily accessible to people on a regular basis.

The limited evidence on health impacts of autonomous use of greenspace supports the conclusion that a clean, green accessible local environment will deliver increased health benefits. Woodlands will contribute most where they are part of larger greenspace area/path networks etc., and where there is a local deficit in supply. This again indicates an urban/peri-urban focus on intervention. Woodlands form part of the greenspace resource; this indicates the need for policy coordination with other policy measures that relate to greenspace.

The cost-effectiveness of programmes designed to encourage physical activity in greenspace is unclear but there is considerable potential for benefits. Nor is it clear which social groups should be targeted to maximise effectiveness. A need for coordination with health and community policy objectives is indicated.

4.4 Other social benefits

4.4.1 Policy background and developments since the EFS

The 'social' element in the EFS was confined to recreation, access and the social benefits derived from rural development and regeneration. Since then forestry interests have sought to deliver on a wider range of social agendas. Apart from health (see above) these include community policy, education, disability, social inclusion, crime and disorder, and social equity.

4.4.2 Current investment

The Forestry Commission does not have data on the current level of staff time or expenditure associated with delivering on these social agendas. It is probably quite small because the area of activity is being developed. Expenditure on partnership activities designed to further the social agenda is stated to be c£250,000 per year.

4.4.3 Community woodlands

Much of the benefit to communities from trees and woodlands has been measured in terms of access, recreation, health, landscape and amenity, all of which are assessed

elsewhere in this study. These reviews taken together show the potential for large social and environmental benefits from trees and woodlands near where people live and travel.

It is possible that the aggregate benefits from trees and woods near where people live and work is not fully captured in this analysis. For example, local community woodlands provide a meeting place and focus for joint activity especially if the community is involved in ownership and/or management of the wood. There may therefore be benefits over and above those measured elsewhere in this report. However, in a study that included community benefits in Moray it proved difficult to identify any significant benefits other than those from recreation and amenity (CJC Consulting, 2005a). Previous research on the benefits of community forests in England came to similar conclusions (CJC Consulting, 2000). We therefore consider that any additional aggregate social benefits from community woods over those reported elsewhere in this study are small.

4.4.4 Targeting social groups

Woodlands are mainly used by a limited range of social groups. Government wishes to increase the extent to which excluded, minority and disadvantaged groups benefit from its interventions in forestry. It follows that measures that widen accessibility to the woodland resource need to be explored, although this may present problems given the largely fixed location of the public estate. In general, woodlands provide most benefit where they are near communities so that travel is less of an issue. The provision of facilities for the disabled, and action to remove other barriers to use, is important. This should clearly form part of forestry policy.

There is a regional element here in that communities in specific locations may be disadvantaged by job opportunities and a poor quality environment, e.g. coalfield communities (ODPM, 2005a). In this case woodland policy can contribute, mainly through environmental improvement.

Forests (and especially the public estate) are also a resource that can be used to further a variety of other social objectives. These include:

- Education.
- Activities in relation to probationary services.
- Activities in relation to social services including youth, children and adults with emotional and behavioural difficulties, women's groups (women's refuges) and asylum seekers.

The FC work with a range of social services and RDAs in order to facilitate visits, working parties etc. Again, it is not possible to estimate the benefit from such investment in cost-benefit terms because of difficulties in valuing the effects in monetary terms. However, we presume that government would wish to use its forest resources to further its social agendas where it is feasible and cost-effective to do this. Strong integration between resource providers and users (e.g. social services) is clearly important. The resource costs may be substantial where forestry staff are needed to plan and supervise activities.

4.4.5 Implications for the policy agenda

Detailed information is not available on the contribution that woodlands make to education, probationary and other social services. It would be useful to have more information on the costs of providing services from forestry. This would better enable priorities to be established in relation to cost-effectiveness.

There is a strong case for the public forests to deliver on the wider social agendas and this should form a part of policy. But without more evidence it is difficult to prioritise action as between different social polices or compare it with other policy areas.

5 Environmental and resource protection benefits

5.1 Introduction

This chapter reviews recent evidence on the value of the environmental benefits from forests, and their contribution to a range of environmental policy agendas. The aspects considered are climate change; biodiversity; landscape and amenity; soil, water protection and flood control; and renewable energy.

5.2 Climate change

5.2.1 Policy background and developments since the EFS

Increasing carbon fixing through forestry expansion was not included as a specific aim of the EFS. However, the 1992 United Nations Convention on Climate Change (UNFCCC), and Kyoto Protocol recognise the role that forests can play in greenhouse gas reduction, and there is a general requirement under UNFCCC for all countries to protect and enhance sinks. The UK Sustainable Development Strategy (UK Government, 2005) indicates that both new grant aided planting and changes in forestry practices can help to reduce carbon emissions.

Under the Kyoto Protocol, and subsequent agreement amongst EU countries, the UK has a commitment to reduce greenhouse gas emissions by 12.5% below the base year [7] level, on average over the first commitment period, 2008-2012. There is also a manifesto commitment aiming to reduce CO_2 net emissions by 20% by 2010; and following the publication of the Energy White Paper in February 2003, the UK has a longer term goal to put the UK on a path to reduce carbon dioxide emissions by 60% by 2050 with real progress by 2020.

Carbon sequestration in forests is accounted for in the UK Greenhouse Gas Inventory which reports greenhouse gas emissions by source and removals by sinks (NAEI, 2005). The 2004 review of the Climate Change Programme (UK Government, 2004) indicated that the UK was comfortably on track to meet the Kyoto commitment, but without additional measures would fall short of the domestic 20% target. There is, however, evidence of an increase in CO_2 emissions (Vidal, 2005). The UK Climate Change Programme is currently being reviewed to determine the action needed to put the UK back on track to meet its domestic 20% target.

5.2.2 Contribution to GHG emission reduction

Greenhouse gas emissions into the atmosphere are now acknowledged to contribute to climate change; and although the global warming potential of methane and nitrous oxide emissions are 21 and 310 times greater than that of carbon dioxide, the amounts emitted of these gases are much lower so that CO_2 contributes some 85% of the global warming effect of UK emissions.

Forestry reduces the amount of carbon in the atmosphere compared to what it otherwise would have contained by locking it into tree production. The significance of the carbon reduction attributable to forestry in England depends upon the size and structure of the forestry sector. Carbon sequestration is maximised by forests producing high timber

[7] 1990 is the base year for emissions of CO_2, CH_4 , and N_20 and 1995 is the base year for emissions of HFCs, PFCs and SF_6.

yields on short rotations, on soils of low organic content where products have long-lived end uses. All of these conditions cannot necessarily be met in a forest strategy for England.

Where forest products are used as a renewable energy source the sequestered carbon is released on combustion. Compared with non-renewable energy sources, wood grown for combustion creates no net emission over it life.

Carbon sequestration depends upon timber yield and carbon density, which varies between species occurring in the UK. The Edinburgh Centre for Carbon Management (2002) estimates that one hectare of mature oak (yield class 4, planted at an initial spacing of 1.2 metres, stocking density of 4,200 plants per hectare, intermediate thinning, excluding soil) will offset 75 tC over a 100 year period. This corresponds to 275 tCO_2. A mixed species planning of lowland native woodland type, containing approximately 50% oak, or other main tree species (of average yield class 4, planted at variable spacing, stocking density of 1,200 plants per hectare, minimal thinning, excluding soil) will offset between 30-60 tC per ha (110-220 tCO_2). This estimate assumes that open space is not included and woody shrubs account for 10% or less of the planting mix. Broadmeadow and Matthews (2003) suggested higher carbon sequestration values, with commercially managed stands assumed to accumulate approximately 100 tC per ha averaged over a number of rotations (around 3 tC ha^{-1} yr^{-1}).

The carbon content of the soil can change under trees compared to an alternative land-use. Planting trees on peat soil can lower the carbon content of the soil and thus lower the net amount of carbon sequestrated from timber production. However, on other soils trees contribute to woodland soils as a carbon sink. Broadmeadow and Matthews (2003) point out that forest soils can contain more carbon than the trees comprising the forest. Land under arable cultivation has on average 153 tC ha^{-1} in England and 93 tC ha^{-1} in Wales. Under woodland the carbon content of soil increases to 217 tC ha^{-1} in England and 228 tC ha^{-1} in Wales.

The end product of the timber (paper, furniture, etc.) determines how long carbon remains 'locked-up' beyond the end of the rotation, or whether it is released back into the atmosphere shortly after the end of the rotation. Wood products can replace more energy intensive materials such as steel, concrete, aluminium and plastics in a variety of activities, most noticeably construction. There are considerable carbon benefits to be gained from such substitution (Reid *et al.*, 2004) The Building Research Establishment's (2004) own EcoHomes standard (upon which the Government's new code for sustainable building will be based) recognises that in virtually every construction situation wood is the most environmentally friendly material to use.

5.2.3 Value of sequestered carbon: damage estimates

The social cost of carbon is the monetary value of worldwide damage from the anthropogenic emission of carbon dioxide into the atmosphere. There is considerable variation in estimates of the social cost of carbon emissions. This stems from uncertainty in the relationships between the variables involved, and the assumptions built into models. The models relate emissions to atmospheric changes; atmospheric change to temperature change; and temperature change to damage. Damage includes sea level rise, floods and storm events, the impact of climate change on agricultural production, and effects on population health and disease. This damage is estimated sector by sector, and region by region, and aggregated to provide a global total in relation to the increase in CO_2 emissions. Damage will rise in the future with increased

population and income growth. Catastrophic and extreme events account for nearly all of the damages, in some models. All of these variables are subject to uncertainty.

Variations in the value of carbon also arise from assumptions about the income elasticity of willingness to pay to avoid the damage, the discount rate to adopt, the weight to be given to equity considerations, and dynamic adaptation in production by producers in response to climate damage. The latter allows for benefit gains from global warming, and some models with adaptive reaction have estimated net gains to the global economy. It has been argued that in terms of per capita income, damage from global warming is higher in the developing world, because poorer countries are more dependent upon climate sensitive economic activity than richer countries. Thus, equity weighting (what weight should be given to $1 damage to a poor person compared to $1 damage to a rich person) can affect outcomes and values. There is no consensus on what the elasticity of the marginal utility of income (ε) or 'measure of inequality aversion' should be between rich and poor nations. More detailed discussion on the various factors and uncertainties surrounding estimates of the damage cost of climate change are outlined in Tol (2002,a,b).

In a review of these issues, and adopting a range of assumptions about various factors such as the discount rate and ε, Pearce (2005) concludes that the social cost of carbon in the UK is likely to lie between £2.4/tC and £15/tC. This conforms to a subsequent meta analysis by Tol (2005) of 103 estimates of marginal damage costs of carbon dioxide emissions; producing a mode of $2/tC, a median of $14/tC, and a mean of $93/tC because of the skewed nature of the value estimates. Studies with lower discount rates and equity weighting had higher estimates and much greater uncertainties; whilst peer reviewed studies had lower estimates and smaller uncertainties. Tol concludes that climate change impacts are very uncertain, but that using standard assumptions about discounting and aggregation, a marginal damage cost of carbon dioxide emissions of $15 /tC seems justified and that marginal damage costs are unlikely to exceed $50/tC (i.e. £27/tC).

The study by Brainard *et al.* (2003), and the review of forest policy by CJC Consulting (2003), adopted a marginal social cost of £6.67 per tC. However, a range of social cost of carbon values can be derived from damage estimate models. A study by Clarkson and Deyes (2002) for H. M. Treasury estimated the social cost of carbon at £70/C (with a range of £35 to £140 /tC), and this is the value that DEFRA and other government departments currently use in appraising policies that lead to changes in carbon emissions. Defra is currently undertaking a review of values of the social cost of carbon. There is a rationale for adopting the same value for carbon in appraising policies in all sectors of government.

5.2.4 Value of sequestered carbon: market cap and trade estimates

Alternative estimates of the marginal social cost of carbon can be derived from market cap and trade prices. The Kyoto Protocol created a global market for the trading of greenhouse gas (GHG) emission reductions or 'carbon credits'. Since CO_2 is the most prevalent of the GHG emissions, this has become the carbon market. Guidelines for trading were established under the Marrakech Accord as (1) cap and trade, which caps emissions of each participating country, with trading in excess emissions; (2) projects implemented to reduce emissions, creating emission reduction units (ERUs); and (3) creating of emission reductions in countries (i.e. developing countries) not subject to emission reduction requirements: the clean development mechanism (CDM).

The EU Emissions Trading Scheme (ETS) started in January 2005. Each EU ETS member state set a cap on CO_2 emissions and allowed their industrial sectors to trade carbon credits to meet their obligations. The price of carbon dioxide allowances reached €34 per t in July 2005 but was since fallen back. However, the trading prices do not necessarily reflect the benefit per tonne of reduced carbon emissions, or the value of damage avoided. The EU ETS price is affected by the price of abating emissions, and is currently subject to market influences that may have little to do with the value of carbon reduction. Rather it is a price determined in the political market place. Indeed, the inconsistency in the implicit price of carbon in different government policies has been documented by Pearce (2005) who calculates that the Climate Change Levy (CCL) implies a carbon tax of £16/tC on coal, £30/tC on gas, and £31/tC on electricity. To achieve consistency in decision making in government there would be some merit in adopting a shadow price for carbon of £16/tC or £30/tC for the benefit of carbon sequestration in forests in England.

5.2.5 Benefits from carbon sequestration in trees

Willis *et al*. (2003) estimated the annual value of sequestered carbon in England's' forests and associated soils at £43.11m per year. This study used a C value of £6.7 per t. Using a £ 70 per t figure would value the C sequestration at £450m per year, making it the largest single benefit from forestry. On average across the whole estate, this is equivalent to around £400 per ha per year. Other reports reviewed above suggest sequestration rates of £2.75-3.0 tC per ha per year (excluding soil effects) depending on species and design. At the government's central; value of £70 per tC the benefit range is thus of the order of £200-£400 per ha per year. However it is arguable that within the context of the current policy agenda of emission reductions the correct price for valuing carbon sequestration in woodland policy is the marginal cost of emission control. The evidence summarized by Pearce (2005) suggests that this is lower than £70 per tC.

5.2.6 Carbon trading

Carbon sequestration is excluded from the EU ETS. It is understood that sequestration is regarded as having only a temporary impact and trading may be associated both with accounting difficulties and high organizational costs. Direct trading would probably only be feasible for FE and major landowners but it might be possible for smaller areas to be included through an intermediary body that also had a regulatory function.

The World Bank has introduced in 2004 a bio-carbon fund to sequester carbon in forests and agro-ecosystems. Bio-carbon projects within the fund include reforestation around reservoirs in Brazil, agro-forestry in Columbia, biodiversity in Madagascar, small group tree planting in Tanzania, reforestation in the upper Nile basin in Uganda, reforestation around Chernobyl in Ukraine, and sea-water agro-forestry in Mexico. The BioCarbon Fund does not itself mean that the units can be used against emission reduction commitments, but afforestation and reforestation projects are in fact eligible under the Clean Development Mechanism of the Kyoto Protocol. It seems slightly illogical that carbon sequestration in developing countries is eligible for carbon off-sets, but that English woodland carbon sequestration is not included within the EU ETS. This issue is likely to be considered by the European Commission in its review of the EU scheme, to be completed by June 2006.

If sequestration becomes tradable, then sequestration becomes a market good and Pearce (2003) has argued that the main role for government is to facilitate efficient trading. However, most new planting in England is in very small parcels and these are

probably untradable because of high transaction costs. Without trading there is a case for intervention to reflect the social value of sequestered carbon.

5.2.7 Implications for the policy agenda

The evidence base on carbon sequestration is good especially at an aggregate level. There is less agreement on the social value of carbon.

Carbon sequestration in woodlands reduces net emissions of greenhouse gases and this is accounted for in the national emissions inventory. Impacts on overall net emissions are, however, quite small. Forestry may also contribute via renewable biomass energy and provision of sustainable materials. Government should seek to optimize the overall contribution of the sector.

A case can be made for including woodland sequestration within carbon trading and supporting measures that facilitate trading by forest owners. Owners would then have an additional income stream and an incentive to manage trees to sequester carbon. But there may be practical problems in taking this forward.

If trading proves infeasible government could factor in the sequestration benefits in decisions on intervention in forestry, and especially as regards incentives for forestry expansion. At the government's valuation of £70 per tC the social benefit is of the order of £200-£400 per ha per year. If C fixing is valued at £200 per ha this converts to a PV of £4,271 over 40 years at 3.5%. This approximately justifies the grant aid cost per ha typical of large scale planting programmes such as the South West forest where the mean grant aid payment from government has been around £4,000-£5,000 per ha in PV terms. It provides a case for forestry expansion especially if other private and public benefits are also delivered. However, there could be negative landscape and biodiversity impacts depending on species, location and the land use displaced. An expansion of forestry by 20,000 ha per year for 5 years would cost possibly £400-500m in grant aid payments.

Nevertheless, there is no economic logic at present in factoring a price of £70 per tC into incentives for planting if other emission-reducing measures can be introduced at lower cost. In addition, there is some inconsistency in UK policy at present in that decisions that reduce the afforested area (and its C fixing) are being taken without accounting for the loss of C fixing benefits (CJC Consulting, 2004). It almost certainly reflects the limits on public expenditure for forestry and the fact that C benefits are not accounted for in the forestry accounts.

5.3 Biodiversity

5.3.1 Policy background and developments since the EFS

EFS biodiversity policy drivers

The EFS took into account biodiversity legislation and conservation policies existing in 1998 including:

- The Wildlife and Countryside Act and designation of Sites of Special Scientific Interest (SSSIs).
- EU Council Directive on the conservation of wild birds (79/409/EEC), usually referred to as the Birds Directive.
- EU Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora, known as the Habitats Directive.
- Biodiversity: the UK Action Plan (UKBAP) (Anonymous, 1994), which implements

requirements under the Convention on Biological Diversity (ratified by the UK in 1994) has the following overall goal: "To conserve and enhance biodiversity within the UK and to contribute to the conservation of global biodiversity through all appropriate mechanisms".

- Biodiversity: the UK Steering Group Report (UKSG, 1995a, b) which outlined a programme of action to meet the UKBAP objectives, and contained the following key components:
  - The development of 130 costed Habitat Action Plan (HAPs) and Species Actions Plans (SAPs) with targets for some of the most threatened and declining species and habitats. These national action plans form the basis for long-term strategic biodiversity conservation in the UK;
  - The establishment of an effective system for handling the necessary biological data at the local and national levels so that the status of biodiversity can be assessed and progress can be monitored;
  - The promotion of increased public awareness of the importance of biodiversity, and the broadening of public involvement; and
  - The promotion of Local Biodiversity Action Plans as a means of implementing the national plan.
- The Government Response to the UK Steering Group Report (Anonymous, 1996) which largely endorsed the Report and established the UK Biodiversity Group (UKBG), chaired by Defra, and a framework of others groups to drive the process forward.

The UKBAP

Since the preparation of the EFS there has been an intensive and wide ranging programme of activities to implement the UKBAP, such that by October 1999, the UKBG completed the publication of six tranches of SAPs and HAPs (UKBG, 1998a, b, c, 1999a, b, c, 2000). These include HAPs for 5 forest Priority Habitats[8] found in England (see Annex II). Lead partner organisations or agencies were also appointed for each plan and English Nature took on the responsibility for wood pasture and parkland, whilst FC took on other woodland habitats. UKBAP targets were revised in 2001 and these and progress towards them as reported in 2002 is summarised in Table 5.2. A new HAP for lowland mixed deciduous woodland has also recently been produced and is awaiting Ministerial approval.

A significant proportion of UKBAP Priority Species[9], and therefore SAPs, are associated with forest habitats (Table 5.2). However, it is important to note that several non-woodland habitats have higher numbers of Priority Species associations, and particularly species that are primarily associated with them. For example, whilst lowland woodpasture and parkland habitat is fourth in terms of the number of Priority species primarily associated with it, the top three habitats hold significantly more of such species. Several other forest habitats are relatively low in the ranking of habitats with respect to the number of primary associations with Priority Species. However it should be noted that the number of priority species supported by a habitat is not an appropriate means of

[8] Identified under the UKBAP because they are habitats that the UK has international obligations for, are at risk, functionally critical or important for BAP Priority Species.

[9] Species identified as being a priority in the UK BAP because they are globally threatened and/or rapidly declining in the UK.

valuing the habitat, since even one Priority Species is of value by default, and it is the assemblage of a range of species and their interactions that make the habitat of value.

The number of species associated with each habitat will of course depend on how the habitats are defined and split. Notwithstanding this limitation the analysis nevertheless underlines the requirement to carefully consider the location of new woodland planting and the necessity for removing inappropriate new planting on previously non-wooded habitats of high conservation value. Assessment of progress with implementation of the BAP takes place every three years and two reports have been completed so far, in 1999 and 2002. As indicated in Annex II, progress with many HAP objectives has been mixed, with no or insufficient progress to meet targets occurring for many habitats, especially where habitat restoration is involved. For many targets it has not been possible to assess progress, often because monitoring systems are being set up or because current assessments are baselines, and trends have yet to be observed.

Table 5.2 Priority habitats ranked by number of associated Priority Species: the top three habitats and forest habitats

Rank*	Habitat	Number of Priority Species primarily associated with Priority Habitat, including joint associations	Total number of Priority Species recorded using the habitat
1	Lowland heathland	57	79
2	Lowland calcareous grassland	46	66
3	Maritime cliffs and grassland	36	59
4	Lowland wood-pastures and parkland	27	56
8	Native pine wood (not found in England)	17	25
12	Wet woodlands	12	26
13	Upland oakwood	11	35
20	Lowland beech and yew wood	7	21
27	Upland mixed ash woodland	2	15

Source: Simonson and Thomas (1999).
Note: * Out of 32 habitats

The Biodiversity Strategy for England

The 1999 UKBAP progress assessment formed a major contribution to the UKBG's follow-up report on progress 'Sustaining the Variety of Life: 5 years of the UK Biodiversity Action Plan' (UKBG, 2001). The UK Government favourably received the report, and supported the guiding principles of the UKBAP, recognised the enthusiastic work of the wide range of partners involved and accepted its recommendations for establishing a new structure at the UK level. As a result, a new UK Biodiversity Partnership replaced the UKBG to enable devolution of responsibilities for implementation to the country level, whilst recognising that there are issues that need to be addressed at the UK level. The new partnership also aims to involve a wider range of participants and to be open to the full range of organisations in the biodiversity partnership.

As a result, the England Biodiversity Group (EBG) was formed to implement the UKBAP within England and 'Working with the Grain of Nature – a Biodiversity Strategy for England' was published in 2002 (Defra 2002). As regards woodland and forestry the strategy's aims are:

- "To conserve the biodiversity of all woodland types, particularly ancient semi-natural woodland, veteran trees and wood pasture.
- To protect biodiversity-rich woodland from external threats from industry and surrounding land uses to ensure its role is fully recognised in development proposals.
- To ensure that forestry and woodland management and creation enhances non-woodland habitats and species, and contributes to the conservation of biodiversity at a wider, landscape scale.
- To fulfil the potential of forestry as one of the best examples of sustainable development and to increase woodland's role in enhancing people's quality of life".

The Strategy includes a programme of action for the forestry sector that aims to:

- Protect native woodland from further damage, i.e.
  - Take measures to prevent loss or damage to ancient woodland and trees, and their uniquely rich biodiversity, from development and mineral extraction.
  - Tackle the adverse impacts from agricultural activities on land adjoining woodland and in wood pasture, including intensification, over-grazing and drift of agro-chemicals.
  - Arrest undesirable change in woodland due to the impact of certain species (especially rhododendron, deer and grey squirrels).
- Enhance, extend and restore the existing native woodland resource, i.e.
  - Seek better evidence about the ecological condition and threats to native woodland, wood pasture and ancient trees and better understanding and awareness of the implications of climate change.
  - Encourage woodland management which conserves and enhances the rich biodiversity of our native woodland – including promoting the restoration of ancient woodland sites and parkland adversely affected by past conifer plantation.
  - Create new native woodland where it will complement, enhance and protect both existing woodland and open ground habitats.
- Manage non-native woodland to improve biodiversity in the wider landscape, i.e.
  - Diversify and restructure commercial plantations to provide a range of habitats and structures, to suit both woodland and non-woodland species.
  - Take appropriate opportunities to re-create or restore open-ground habitats, such as heath and moorland, by removal of the largely coniferous plantations that were established on them in previous decades.
- Realise the broader quality of life benefits of woodland biodiversity, i.e.
  - Improve the evidence on the contribution of woodland, and its associated biodiversity, to people's quality of life and on the value of the environmental services it provides.
  - Secure more high quality public access to woodland with rich biodiversity. This will enhance people's enjoyment, provide health benefits and increase public understanding of woodland and the sustainability of wood products.

Defra and FCE have taken forward the EBG programme for ancient and native woodlands through the 'Keepers of Time' statement of policy objectives (Defra, 2005b).

The EBG has selected the following biodiversity indicators as a means of assessing performance with respect to woodlands and forestry:

- H1: Populations of woodland birds (a subset of the UK Sustainability Headline Indicators – see below).
- F1: Progress towards woodland HAP/SAP targets in England.
- F2: Condition of woodland SSSIs in England (see below).
- F3: Trends in woodland plant diversity.
- F4: Area of ancient/broadleaved woodland under an approved management regime.
- F5: Area of ancient woodland open for public access and number of leisure day visits to woodland.

A baseline assessment of the status of these indicators was published in December 2003 (Defra, 2003a), see Table 5.3. Annual stock takes on progress with each of the sectors addressed by the Strategy were produced by the EBG for 2002-03 and 2003-04[10].

Table 5.3 2003 Baseline assessment of Biodiversity Strategy for England woodland and forestry indicators

	Indicator	Trend
H1	Populations of woodland birds	No change / uncertain trend
F1	Progress towards woodland HAP/SAP targets in England	No trend data
F2	Condition of woodland SSSIs in England	Positive trend
F3	Trends in woodland plant diversity	Negative trend
F4	Area of ancient/broadleaved woodland under an approved management regime	No trend data
F5	Area of ancient woodland open for public access and number of leisure day visits to woodland	Positive trend

Source: Defra (2003)

For 2002-03 the EBG concluded that "Woodlands will benefit from better protection and management as a result of closer links with agri-environment schemes and the major reviews of native woodland policy and woodland grants. The challenges remain to reverse the impacts of previous afforestation programmes, secure better protection of woodland from development and understand the causes of decline in woodland birds."

In 2003-04 they concluded that "Ancient woodland policy development has progressed well, but the work on restoration of open habitats is slightly behind schedule; work aligning delivery mechanisms continues, particularly via the new England Woodland Grant Scheme and PPS-9."

A review of UK HAPs and SAPs including targets is currently taking place under the coordination of the UK Biodiversity Reporting and Information Group (BRIG). As a

[10] Unpublished reports available at http://www.defra.gov.uk/wildlife-countryside/biodiversity/biostrat/index.htm

contribution to this revised targets for forest habitat have been provided by the England Woodland Biodiversity Group[11] (Table 5.4).

Table 5.4 Proposed indicative HAP targets for all native woodland in England

Target type	Target text, with 2010 values	2005 baseline	2010 target	2015 target	2020 target	Target description
Maintain extent	No loss of native ancient woodland No net loss of native woodland	200,000 ha of ASNW 50,000 ha of bdlvd PAWS 200,000 of OSNW 60,000 of Other bdlvs	250 kha of AW 285 kha of other NW	250 kha of AW 285 kha of other NW		
Achieve condition	350 kha (65%) in favourable or recovering condition* by 2010	c. 60%	350 kha (65%)	375 kha (70%)	400 kha (75%)	Broadly equates to initiating improvement on 1% of the resource p.a. Figures may need revision once better baselines established.
Restoration	Area of PAWS restored to native woodland	56 kha 40%	63 kha 45%	71 kha 51%	84 kha 60%	Area of PAWS fully restored (i.e. achieved 80% broadleaves)
	Area of PAWS being restored or improved	14 kha 10%	21 kha 15%	28 kha 20%	35 kha 25%	
	Proportion of the PAWS canopy occupied by broadleaves	55%	58%	62%	65%	Applies to the whole PAWS resource.
Expansion	Expand the area of native woodland by 5300 ha (1%) per annum	?	26 kha (5% increase)	53 kha (10% increase)	80 kha (15% increase)	Achieved through a combination of converting (restocking) existing plantations and creating native woodland on ex-agricultural land.

Note: All figures are kha. Baseline figures are approximate.
Source: England Woodland Biodiversity Group (unpublished)
*See below

These targets reflect recent socio-economic changes affecting forestry in the UK which have reduced the rate of conifer planting. They also take into account CAP reform that will reduce the margins from farm production over much of the UK, which may in turn favour native woodland expansion.

Thus the new targets are ambitious regarding the restoration of PAWS, largely because it is envisaged that little new conifer planting will now be undertaken for commercial reasons. Thus much of the regeneration may be achieved by broadleaved replanting on clear-felled or thinned plantations.

The targets also include expansion of native woodland cover by 5,300 ha (1%) per annum. However, it is not clear how this increase in expansion rate is to be achieved. The England Woodland Biodiversity Group note that although historic and current rates of broadleaved woodland creation under WGS have been about 3-4,000 ha p.a. it looks likely that under the 2007–2012 Rural Development Regulation support for and emphasis on 'afforestation' may be reduced and this could lead to a reduction in

[11] The England Woodland Biodiversity Group co-ordinates implementation of the woodland sector of the England Biodiversity Strategy and the HAPs for Native Woodland in England. Membership includes all key stakeholders, with secretariat support provided by FC England.

woodland creation funded under EWGS. A significant rise in small woodland creation is likely under agri-environment schemes, and through colonisation of field margins and 'abandoned' land. However, most of this new woodland will probably be under the 2-ha threshold for contributions to the HAP targets. They will, none the less, be an important contribution to woodland expansion.

The England Woodland Biodiversity Group proposes as a long-term aspiration a target to "Improve the landscape context of 'most' ancient woodlands". They also strongly recommend that "indicators and SMART targets of connectivity and landscape resilience should be used for semi-natural habitats as a whole rather than specifically for woodland", with targets perhaps based on total or cumulative area of semi-natural habitat, landscape connectivity and permeability of the matrix between semi-natural habitats.

They propose that the landscape improvements could be achieved by:

- Creating adjoining or connected woodland, including 'scrub';
- Buffering woodland margins with set aside or headlands;
- Creating other habitats adjacent to or connected to the woodland;
- Enhancing existing adjoining or connected habitats, including hedges; and
- Reducing the intensity of land use in the matrix between habitat fragments.

The CROW Act and SSSI Public Service Agreement target

Conservation legislation in England and Wales has been revised and strengthened under the Countryside and Rights of Way Act 2000 (CROW Act). One of the key aims of the Government's revisions has been to emphasise the importance of positive management of SSSIs. Defra has a Public Service Agreement (PSA) with H. M. Treasury to have at least 95% by area of England's SSSIs in 'favourable' or 'unfavourable recovering' condition by 2010.

FC has responded positively to the Section 28G obligations and the PSA target and has produced a delivery plan that aims to "Bring into favourable condition by 2010, 95% of all SSSIs where the Forestry Commission has statutory responsibilities". FC also recognises that its Section 28G responsibilities apply to the FC's statutory functions to other woodland owners as well as its own land holdings. This commitment, if achieved, will make a major contribution to the attainment of Defra's target for woodland habitats because approximately two-thirds of woodland SSSIs are on the FC estate or are in the FC administered WGS.

UK Sustainability Strategy - Wild Bird Indicator

Defra (2005) has a framework indicator for woodland birds within its SD programme. As noted above, the Biodiversity Strategy for England (Defra, 2002) has selected a subset of woodland birds as a measure of forest biodiversity conservation performance.

In response to the development of this indicator FC has set itself a target to reverse the long-term decline in the number of woodland birds by 2020 as measured annually against underlying trends.

Council Directive 92/43/EEC (the Habitats Directive)

Although the Habitats Directive was in force at the time of the publication of the EFS it was not explicitly referred to. The main aim of the Habitats Directive is: "...to contribute towards ensuring biodiversity through the conservation of natural habitats and of wild

fauna and flora in the European territory of the member states to which the Treaty applies" (Article 2).

One of the most stringent obligations (under Article 3) is to select, designate and protect a series of sites, called Special Areas of Conservation (SACs), for 189 habitat types and 788 species identified in Annexes I and II of the Directive (as amended). The listed habitat types and species are those considered to be most in need of conservation at a European level (excluding birds, which are covered by the Birds Directive). A selection of these habitats and species are given priority status in the Directive because they are considered to be particularly vulnerable and are mainly, or exclusively, found within the European Union. Of the Annex I habitat types, 76 are believed to occur in the UK, of which 22 have priority status. Of these 76, nine are forest habitats that occur in England and four have priority status (see Table 5.5). Of the Annex II species, 43 are native to, and normally resident in, the UK, but only one is a priority species. Few Annex II species are closely associated with forest habitats.

Table 5.5 Forest habitats that occur in England that are listed on Annex I of the Habitats Directive

Name (as in Directive)	English name	Priority habitat
Atlantic acidophilous beech forests with *Ilex* and sometimes also *Taxus* in the shrublayer (*Quercion robori-petraeae* or *Ilici-Fagenion*)	Beech forests on acid soils	
Asperulo-Fagetum beech forests 41	Beech forests on neutral to rich soils	
Sub-Atlantic and medio-European oak or oak-hornbeam forests of the *Carpinion betuli*	Oak-Hornbean forests	
Tilio-Acerion forests of slopes, screes and ravines	Mixed woodland on base-rich soils associated with rocky slopes	Yes
Old acidophilous oak woods with *Quercus robur* on sandy plains	Dry oak-dominated woodland	
Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles	Western acidic oak woodland	
Bog woodland	Bog woodland	Yes
Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)	Alder woodland on floodplains	Yes
Taxus baccata woods of the British Isles	Yew-dominated woodland	Yes

Water Framework Directive

An important development regarding freshwater and coastal biodiversity has been the development of the EU Water Framework Directive. The implications of this for forestry strategy are described in detail in Section 5.5 below.

5.3.2 Forest biodiversity status and forestry pressures

Forest policy has two key impacts on biodiversity conservation:

- Impacts on forest habitats and species of biodiversity conservation value (i.e.

targets).

- Impacts of forestry practices on non-forest habitats and species.

These are therefore discussed separately: impacts on forest habitats and species immediately below, and impacts on other habitats in Section 5.3.5.

Forest habitats

It is relatively clear that forest biodiversity is not greatly threatened by forest loss (i.e. conversion to non-wooded habitats). Indeed, the broadleaved forest area expanded across Britain by 5% between 1990 and 2000 (Haines-Young *et al*., 2000). However, there was significant turnover of forest during this period and some ancient woodlands and other sites of particularly high biodiversity value may have been lost. Nevertheless, such threats are probably small compared to other factors. For example, the England Woodland Biodiversity Group note in their proposed targets document that "up to 2,000 hectares have been listed as 'threatened' by development at any one time by the Woodland Trust". Although such losses would be highly undesirable, this is a small proportion of the 200,000 ha of ancient semi-natural woodland in England (Defra, 2005b).

There is good evidence that a significant proportion of England's forest habitats are ecologically degraded. In particular, site condition monitoring by English Nature indicates that, as of September 2004, 30.6% by area of lowland broadleaved, mixed and yew woodlands UK BAP Broad Habitat category[12], is in adverse condition (i.e. unfavourable stabilised or declining condition), and 28.6% in the uplands (unpublished English Nature ENSIS data 2005). This level of adverse condition is relatively moderate compared to some other habitats (e.g. rivers and streams, which has 69.7% in adverse condition, the highest proportion of any habitat) and is slightly lower than the average across all habitats (36.1%). In contrast only 8.1% of coniferous woodland is in adverse condition.

The condition of woodlands outside the SSSI system is not systematically monitored. However, if we assume that SSSIs are generally better managed for biodiversity than other woodland sites, we can predict that a significantly larger proportion of such woodlands will be in unfavourable condition.

English Nature identifies reasons for adverse condition as part of its site condition monitoring, and in 2003 data indicated that the principal threats to broadleaved forest in England were forestry and woodland management (mainly absence of), overgrazing (in upland woods), deer grazing and browsing (Table 5.6). The main issue regarding forest management is its absence in many forests as a result of declining markets for wood products. Consequently, many woods are now under-managed resulting in shading of rides, loss of open space, loss of early successional stages, lack of regeneration, lack of dead wood, disease build-up (e.g. *Ustulina* spp), invasion of non-native species and encroachment of urban impacts such as dumping. In particular, coppicing, which is a traditional woodland management practice that provides many biodiversity benefits has declined considerably.

In recent decades there has also been a considerable increase in deer numbers in lowland England, especially of non-native species such as the Muntjac . Overgrazing by deer in the lowlands causes long-term damage to the woodland structure, limits natural regeneration of the woodland and ultimately may lead to the loss of these woods. Deer in woodlands also have a severe effect on the ground flora and bird populations (Fuller,

[12] It is not currently possible to report condition according to BAP Priority Habitats.

2001; Fuller & Gill, 2001; Fuller *et al*., 2005). Overgrazing by livestock is mainly a problem that is confined to upland woods, many of which are so overgrazed that tree regeneration no longer takes place.

Table 5.6 Reasons for adverse condition in broadleaved and yew woodland SSSIs in England in 2003 (% of area in adverse condition)

Adverse reason	Upland	Lowland
Agriculture overgrazing	52.1	1.2
Forestry and woodland management	33.2	65.7
Forestry deer grazing/browsing	19.1	15.5
Lack of corrective works weed control	5.9	4.1
Agriculture inappropriate CS/ESA prescription	4.8	0.2
Lack of corrective works scrub control	3.5	13.0
Game management pheasant rearing	1.0	1.9
Agriculture undergrazing	0.3	6.9
Freshwater quality direct pollution	0.3	1.2
Freshwater drainage	0.0	14.8
Air pollution (no/so)	0.0	2.0
Public access/disturbance	0.0	1.9

Note Reasons listed on less than 1% of SSSIs are excluded.
Source: English Nature ENSIS data September 2003.

Although only listed as a reason for adverse condition on a small number of SSSIs air pollution is likely to be a major factor affecting woodland habitats. Despite general improvements in air quality in the UK over recent decades air pollution from nitrogen remains a widespread problem (NEGTAP, 2001). Nitrogen oxides and ammonia (NH_3) are directly toxic to vegetation, but indirect effects through acidification and eutrophication (i.e. nutrient enrichment) are likely to have the most significant ecosystem impacts.

Critical loads have been identified for pollutants (i.e. thresholds below which, according to current knowledge, there will be no harmful effects on an ecosystem) and pollutant deposition levels mapped in relation to these. These comparisons indicate that critical loads for acidification were exceeded in 71% of UK ecosystems in 1999 (NEGTAP, 2001). More recently Sutton *et al.* (2004, cited in Kirby *et al*., 2005) have estimated that 90% of woodland received nitrogen deposition in excess of the estimates for critical loads. However, careful interpretation of critical load predictions is required. Exceedance of critical loads only indicates that there is a risk to the ecosystem, it does not indicate that impacts have occurred or will occur.

Evidence from national vegetation and plant species mapping indicates that there has been a general widespread detectable shift in vegetation types towards those of nutrient enriched conditions (Haines-Young *et al*., 2000; Preston *et al*., 2002). In an examination of long-term change across a sample of British woodlands Kirby *et al.* (2005) also found signs of eutrophication in the ground flora that were correlated with models of diffuse pollution and the management of adjacent land.

Overall there is good evidence to suggest that air borne nitrogen pollution is likely to be at least a contributing reason for adverse condition in a high proportion of woodland SSSIs that are exhibiting vegetation change in line with nutrient enriched conditions.

Data from UKBAP progress reporting also indicate that the main factors causing woodland habitat degradation are the decline of traditional practices (e.g. coppicing and pollarding), loss of ancient trees, replanting with inappropriate tree species, scrub encroachment, inappropriate grazing and overgrazing (Defra, 2003a). Atmospheric pollution, invasive species and disease are also recognised as significant factors causing loss or decline.

Forest species

There is also good evidence that undesirable changes are occurring in some key forest species groups. For example, as reported in Table 5.4 above (England Biodiversity Strategy Indicator F3) there has been a decline in woodland plant diversity. CEH resurveys of Countryside Survey squares found that species richness of all plants in the woodland ground flora declined by 12% between 1990 and 1998, including species that are indicative of ancient woodlands (Defra, 2003a). Similar results were obtained from a longer term survey of ecological change in 103 woods across Britain (Kirby *et al*., 2005). Although there was considerable variation in species richness between sites, overall species richness per plot and per site declined markedly by 36% and 12% respectively. Reasons for these vegetation changes are complex and not fully understood but are thought to relate to increased shade (resulting from reduced management), eutrophication (from nitrogen pollution), soil changes, disturbance events (e.g. the 1987 storms in south-east England), deer grazing and climate change.

Forest population trends are not known for most animal groups. However, there are good long-term representative data on woodland bird populations from the British Trust for Ornithology's (BTO) Common Bird Census and more recent Breeding Bird Survey (which form the basis for the UK Wild Bird Sustainability Indicator and one of the England Biodiversity Strategy Indicators – see Table 5.4). The 2003 assessment of the woodland bird indicator showed that woodland bird populations have fluctuated on a gradually declining trend since the mid-1970s to 81% of the 1970 baseline in 2002 (Defra 2003a).

Ten out of 32 woodland species declined by more than 50% between 1966 and 1999, while five species increased by more than 50% over the same period. Woodland specialists have declined markedly in comparison to generalists, but the declining species differ substantially in their ecology and life-history patterns. Consequently it is difficult to identify the cause of these declines and it is likely that multiple factors have exerted a combined effect on several of the species. Nevertheless Fuller *et al*. (2005) identified seven possible causal factors that are worthy of further study:

- Pressures on migrants during migration or in winter;
- Climate change on the breeding grounds;
- General reduction in invertebrate food supplies;
- Impacts of land use on woodland edges, habitats adjacent to woodland and hedgerows;
- Reduced management of lowland woodland;
- Intensified habitat modification by deer; and
- Increased predation pressure from Grey Squirrels, Great Spotted Woodpeckers (and corvids.

A Defra/English Nature/FC funded research project by the BTO and RSPB is currently investigating the potential causes of woodland bird declines, and is expected to report in December 2005.

Most of the woodland indicator species are associated with broadleaved woodland and therefore would benefit from broadleaf replanting of conifer plantations. Coal Tit and Goldcrest are the only species that have clear preferences for conifer dominated habitats. Thus there is unlikely to be any significant implications from PSA woodland bird target on forest planting policy objectives. However, two UK BAP Priority Species, Nightjar and Woodlark, use early stage conifer plantations for nesting (in the absence of other semi-natural habitats). Achievement of the SAP targets for these species could therefore be hindered if the area of new conifer planting declined significantly.

5.3.3 Minimum-intervention forests and new wild woods

The UKBAP HAP for broadleaved woodland proposes that a series of minimum intervention forest sites be established across the ecological and geographic range of UK woods. These would probably constitute a limited core of about 30 woodland reserves where the management objective would be to limit the impacts of people (Peterken, 2000). Thus their future composition, structure and associated species would be largely determined by natural processes. However, limited management interventions might be taken, if for example, the establishment of invasive alien species threatened the sites' conservation objectives.

The principal purpose of developing such reserves is scientific research and monitoring. Nevertheless, it is likely that, in the longer term especially, such reserves would develop high biodiversity and cultural values. The likely composition of most minimum intervention reserves would be inherited-natural, but a few might be restored to original-natural, whilst others would be allowed to develop freely towards a future-natural composition (Peterken, 2000). Most reserves would be 'high-forest' woodlands, but some wood-pasture sites would also be included. It is envisaged that the reserves would also be current SSSIs and a provisional list of sites have been identified by English Nature (Mountford, 2000).

There is also growing interest in the recreation of large areas of near-natural forest landscapes or 'wildwoods' (Garforth & Dudley 2003; Worrell *et al*. 2002). This is in part the result of new opportunities arising from socio-economic changes affecting agriculture and forestry, especially in the uplands. Such wildwoods would be extensive landscape mosaics dominated by native woodland (30-70%) but with other habitats, including agricultural land. The inspiration for such wildwoods comes from large, near-natural reserves re-created in continental Europe, in particular the Oostvaardersplassen (Wigbels, 2001). It also reflects in part an increasing recognition of the role that grazing and browsing animals may have played in influencing previous woodland structure (Hodder *et al*., 2005; Kirby, 2004a; Kirby, 2003, 2004b; Vera, 2000).

According to Worrell *et al.* (2002) the rationale for the wildwoods concept is to:

- Augment current activity in native woodland creation, which tends to be small scale and dispersed;
- Complement forest habitat network and woodland "defragmentation" projects by providing future "core forest areas"; and
- Create new mixes of land uses and rural enterprises in these areas.

New wildwoods would be a contribution towards the development of new areas of wild land, referred to as "rewilding" or "wildlands" by some groups within the nature

conservation movement (Taylor, 2005). The key biodiversity benefit would be the creation of landscapes where natural ecological processes could regain importance.

The creation of large-scale wildlands would also be in accordance with requirements for biodiversity conservation in response to predicted climate changes (irrespective of what they might be), especially if such areas formed interlinked areas of habitat (see below). To be effective each wildwood would have to be fairly compact in shape and cover thousands of hectares to allow natural dynamic processes to dominate and to provide sufficient range for viable populations of large-territory wildlife species. Thus, there are significant constraints on where wildwoods can be developed.

Initially it is likely that new wildwoods would be restricted to the uplands where such conditions are likely to be found. Indeed English Nature has stated that there is scope for increasing native forest cover in the uplands, which could contribute to wildwood visions (Brown *et al*. 2001). In Scotland a number of small privately funded wildwood type projects have been initiated (e.g. Ashmole, 2004; Watson Featherstone, 2004) , but progress in England has been slow and mainly restricted to within the National Parks (Worrell *et al*. 2002).

No economics research has been undertaken to determine the public benefits or disbenefit from the creation of wildwoods. Much might depend on whether they were accessible to the public or treated as restricted areas. Although decoupling is likely to 'release' sizeable areas of land from productive agriculture it is expected that this will retain value under the SPS (see Section 7.6). The opportunity to convert large area of land at minimal exchequer cost therefore appears highly unlikely.

5.3.4 Climate change

Since the publication of the EFS the Inter-governmental Panel on Climate Change has stated that there is no significant doubt that the world's climate is changing as a result of human activities, and in particular the release of carbon dioxide and other 'greenhouse gases' into the atmosphere (IPCC, 2001). Although the future impacts of climate change on the world's ecosystems and habitats, and associated species are much less certain there is good evidence to suggest that forests and their associated species will be significantly affected in the UK.

The latest UKCIP (Hulme *et al,* 2002) predicted climate changes are summarised as follows:

- Average annual temperatures across the UK may rise by between 2ºC and 3.5ºC by the 2080s, with greater warming in the south east than in the northwest of the UK, and there may be more warming in summer and autumn than in winter and spring. According to the UKCIP High Emissions scenario, the southeast may be up to 5ºC warmer in summer by the 2080s.
- Annual average precipitation across the UK may decrease slightly, by between 0 and 15 per cent by the 2080s, although there are likely to be large regional and seasonal differences.
- By the 2050s, typical spring temperatures may occur between one and three weeks earlier than at present and the onset of present winter temperatures may be delayed by between one and three weeks. This is likely to lead to a lengthening of the thermal growing season for plants.
- The seasonal rainfall distribution will change, with winters becoming wetter and summers perhaps drier across the UK and with the biggest relative changes in the south and east. Precipitation in the High Emissions scenario may decrease in

summer by 50 per cent by the 2080s in the southeast and increase in winter by up to 30 per cent.

- Extreme weather events will also become more frequent. High summer temperatures will become more frequent. Very cold winters will become increasingly rare, but extreme winter precipitation will become more frequent.

Modelling studies, such as the MONARCH project, (Harrison et al., 2001) have attempted to predict the likely impacts of such changes on biodiversity. However, the issues are complex and impacts on woodlands are difficult to predict with certainty (not least because climate impacts will interact with other future human induced habitat changes). It is therefore beyond the scope of this study to examine these in detail; the predicted impacts of climate change on British forests have been summarised by the FC (Broadmeadow, 2002; Broadmeadow and Ray, 2005).

The key, and widely accepted conclusion, that is relevant to this study is that the range of many species will shift significantly over time as the climate changes are registered within ecosystems. For example, results from the MONARCH project indicate probable shifts in the range of Beech (*Fagus sylvatica*) over the next 50 years towards northwest England and away from the southeast where current conservation efforts are focused (Harrison *et al*., 2001). Such predictions suggest that new planting of Beech in southern England may no longer be appropriate, future Beech conservation efforts may need to be beyond its current native range. Clearly this has major implications for the future conservation of natural and semi-natural habitat types in the UK and any future EFS. In particular current protected site approaches, which focus on fixed designated features of interest are unlikely to remain appropriate.

Instead a more dynamic, flexible and adaptive approach to conservation is needed with a greater emphasis on maintaining ecosystems and ecosystem processes rather than specific species populations or community types. The creation and maintenance of interconnected networks of habitat is also likely to be an important adaptation measure. Such networks may enable mobile species to disperse to new climatologically suitable areas. However, as noted by Wesche (2003) “responses should be cautious and based on good science; thus, there is a need for further research at local levels to evaluate individual species responses to changing conditions”.

With respect to woodland, Broadmeadow and Ray (2005) recommend the following adaptation measures, which require little change from best practice and have few costs:

- Climate change predictions must be considered in the choice of planting stock;
- Tree species and woodland types should be well matched to site; if currently at the dry end of their suitable range, they should not be planted;
- Mixtures of species and/or provenance will provide some insurance against climate change since not all will be affected to the same extent; and
- At a landscape level, larger, better connected woodland should be an objective.

5.3.5 Biodiversity impacts from forestry on non-forest habitats

Forests and forestry management practices can have a number of significant impacts on non-forested habitats. Some of these impacts can be beneficial such as the provision of cover for breeding or roosting for species that predominantly inhabit open habitats. Forests can also provide sources of prey for such species. There are also indirect biodiversity benefits from improved water quality following conversion of agricultural land to broadleaved forest. Woodland shelterbelts and scrub can act as a buffer or barrier to

pollution and noise disturbance. For example woodlands may offer some protection to sensitive habitats such as heathland from pollution from roads (Wilson, 2004).

However, the most important biodiversity conservation impact of forestry is the detrimental impact of afforestation on open habitats. This leads to direct habitat loss and habitat fragmentation. Although such impacts can be partially reversed, this is expensive and in some habitats technically very difficult. Afforestation was a major problem in the past when government policies favoured the creation of new plantations (mainly conifers) on economically low-value land such as upland moorland and low heaths, which unfortunately are of high biodiversity conservation value. Such policies are no longer promoted. However, many plantations remain on such sites. Although FC has undertaken removal of conifers on some important sites the amount of habitat restored is relatively low. Furthermore, as EN note, there is little return from the removal of softwood timber from such sites and there are currently few other incentives or grants available to private owners to aid this work (English Nature, 2003).

5.3.6 Economic valuation of biodiversity benefits

The use value of biodiversity or wildlife in forests is measured through people's WTP (in terms of distance and time costs) to visit forests. Forest are important habitats for a number of endangered and protected species. The TNS (2004) tourism and recreation survey estimated that about 2% of all visits to forests were to observe wildlife, and this increases to 7% in some forests (Christie *et al.*, 2004). A more precise estimate of the recreational value of nature watching in forests should be available from the report into the value of specialist recreation from the Institute of Rural Sciences, Aberystwyth University, in October 2005.

The biodiversity value of forests extends beyond use value: some people are willing to pay to preserve wildlife and biodiversity that they will not see. This may be for an existence motive (they want wildlife or a certain quantity and diversity of wildlife to exist even if they have no intention of visiting forests to see it); or for a bequest motive (to ensure that the wildlife is available to future generations). Values for these motives, termed non-use biodiversity values, are more difficult to capture, and are subject to greater error than biodiversity use values.

Woodland, trees and shrubs can also act as a buffer, especially for airborne particulates and NOx, and offer some protection for sensitive habitats such as heathland from impacts of pollution from roads (Bignal *et al.*, 2004); and noise attenuation by woodland can also offer benefits for birds near areas such as roads or industrial areas.

5.3.7 Value of marginal changes in forest biodiversity

The study by Hanley *et al.* (2002), which adopted the Garrod and Willis (1997) study as a basis to estimate the biodiversity value of marginal changes in forests across all woodland types, still remains the most comprehensive and inclusive assessment of the non-use value of biodiversity in the UK upon which to evaluate forest strategy.

The Garrod-Willis (1997) study assessed the value of improving biodiversity in 300,000 ha of remote upland coniferous forest, which was largely unvisited by the general public. Results were expressed as WTP for a 1% (3000 ha increase) in biodiversity improvement in these forests.

The Hanley *et al.* (2002) study asked people to estimate the biodiversity value of additional increments of different types of forest. It used focus groups in which participants had tokens and a simple open-ended CV to elicit values and WTP for forest biodiversity. The token results are probably the more accurate and reliable because

respondents spent more time considering the relative merits of different types of forest for biodiversity in the token experiment, and because some respondents were reluctant to engage in the valuation exercise, and may not have understood the CV part of the exercise so well.

The relative values as revealed by the "tokens" exercise, are summarised in Table 5.7 can be taken to represent the relative merits and values for marginal increases in biodiversity in different types of woodland. Lowland conifer forest is perceived by the public to have a relatively low biodiversity value. A strategy of new planting and restructuring with lowland new broadleaved native forest type has, by contrast, a relatively high biodiversity value for the public.

Table 5.7 Relative biodiversity preferences for different types of forest, and actual mean WPT per household per year (£s).

Biodiversity forest type	Relative preference for existing area	Relative preference for an increase[+] of 12,000 ha.	Absolute WTP values per household for an increase of 12,000 ha.
Upland Conifer Forest (control)	1.00	1.00	0.39
Lowland Conifer Forest	1.21	1.15	0.37
Lowland Ancient Semi-Natural Broadleaved Forest	2.11	2.31	1.26
Lowland New Broadleaved Native Forest	1.95	4.23	0.93
Upland Native Broadleaved Woods	2.32	3.31	1.00
Upland New Native Broadleaved Woods	1.95	3.15	0.68

[+] Or in the case of ancient lowland and upland native broadleaved woodland to protect and regenerate these woodland types.
In columns 2 and 3 the base value is the individual mean for upland conifer, with other types of forest scaled to that token unit, for existing area and increase in area, respectively.
Column 4 documents the actual WTP amounts per household in £'s per year; updated to 2005 prices using HM Treasury GDP deflator.
Source: Hanley et al. (2002).

There are approximately 21.109 million households in England (ODPM, 2004). Thus the aggregate biodiversity benefit to all households in England for a strategy of expanding lowland new broadleaved native forest is (21.109 million * £0.93 =) £19.631 million for each 12,000 ha increase in this type of forest.

However, in appraising planting and restructuring schemes consideration must be given to the time taken for new plantings to mature, which can take 20-30 years. The full biodiversity benefits of new planting will therefore only appear at some time in the future. This issue can be avoided with selective and sensitive re-structuring of forests, if old woodland is interspersed with new planting, providing a diversity of forest habitats.

5.3.8 Implications for the policy agenda

Evidence

The impacts of forestry (management and planting) on UK habitats are relatively well understood and the UK BAP HAPs are underpinned by a good scientific evidence base. However, the impacts of forest management and natural forest processes are less well understood in relation to the conservation requirements of some species, including several common woodland birds. For example, although the woodland bird indicator has

shown recent declines this is likely to be due to multiple and as yet uncertain causes. It is thus difficult to formulate forest policy objectives for such species.

A further area of particular uncertainty is in relation to climate change. Although it is now widely accepted that the global and UK climate is changing and the broad directions of change are known, the magnitude, timing and regional variation in future climate change is much less certain. Consequently impacts on biodiversity are difficult to predict. This is partly due to scientific and data limitations, but also uncertainty over future greenhouse gas emissions and the synergistic impacts of future land-use changes. As Broadmeadow and Ray (2005) note "it would be premature to develop prescriptive guidance on climate change adaptation strategies for woodland until firmer predictions of both climate change and how woodland is likely to respond are available. Nevertheless it is possible to identify some strategic principles that would help to mitigate the predicted impacts of climate change on forest biodiversity (such as a reduction in forest fragmentation).

The evidence on the economic valuation of biodiversity is quite limited. It is inadequate as a basis for policy formulation although it does indicate that the public attach a high value to biodiversity conservation in forests and a general preference for broadleaved woodland.

Implications

On the basis of the evidence reviewed here, there is a strong case for the inclusion of biodiversity conservation objectives in forest policy, especially in relation to the management of existing forest resources. There is less evidence that an expansion of typical semi-natural forest habitat would deliver significant biodiversity conservation policy targets. However, it is likely that targeted semi-natural broadleaved forest would provide significant benefits to existing forest, by buffering existing forests from external detrimental impacts and reducing fragmentation, which would facilitate adaptation to climate change. Carefully selected and extensive new planting / regeneration may also enable the creation of large 'wildwood' landscapes where natural processes are able to predominate – which are currently lacking in England.

To deliver biodiversity conservation policy targets it is suggested that future forestry strategies should:

- Develop a broader landscape approach where forests are seen as one of many inter-related ecosystem components. In particular, reconsider the implied principle that forest expansion *per se* is desirable, and instead focus on the potential ecosystem services and other biodiversity benefits that forests can provide, whilst recognising that other habitats may be of equal or greater value.
- Take a longer-term vision and set clearer medium-term (e.g. 10-20 years) and long-term (e.g. 50 years plus) objectives for forests, whilst taking into account the need for flexibility to deal with climate change (see below).
- Enhance the linkage between forestry strategy and the delivery of UK and England biodiversity policies and targets, the achievement of the Defra PSA target for SSSIs, UKBAP HAPs and SAPs and the Biodiversity Strategy for England. In particular:
    - Consider giving greater emphasis to existing woodlands at least until 2010, rather than expansion, unless expansion has specific high priority biodiversity benefits e.g. reducing fragmentation of woodlands thereby contributing to FC;
    - Renew its commitment to the UKBAP but give a greater commitment to the implementation of HAPs and SAPs, through the development of a forest BAP

delivery plan. To date progress on most HAPs has been slow and inadequate to meet targets, and therefore new measures are required to rectify this;
    - Align biodiversity policies and actions to the aims and programme identified in the England Biodiversity Strategy (see above); and
    - Use the England Biodiversity Strategy forest indicators as performance measures and set SMART targets for these, over the short, medium and long-term.
- Refer explicitly to the Wild Birds and Habitats Directives and note the high priority that should be given to protecting SACs and achieving favourable condition of the habitat and species features of community importance for which they were designated. Conservation objectives for SACs will be largely achieved through measures for SSSIs (as all Natura 2000 site designations are underpinned by SSSI designations). However, many SACs and SPAs will be of particularly high national and international conservation importance and therefore the EFS should consider preferentially targeting resources to such sites.
- Give a greater priority and a clearer commitment to the removal of forest plantations on former non-wooded habitats of high conservation value (especially SACs, SSSIs and UKBAP Priority Habitats) and to the restoration of the pre-forestation habitat or transformation to enhance the habitat in accordance with the interest of a designated area.
- Not withstanding the need to meet current biodiversity conservation policy objectives, take account of, and prepare for, climate change by developing a more dynamic and adaptive strategy towards forest biodiversity conservation. In the short-term there needs to be a commitment to more research and debate amongst stakeholders on likely impacts and adaptation strategies.
- Work towards the creation of integrated forest networks to counter the past impacts of forest losses, fragmentation and isolation. George Peterken (in CJC Consulting 2004) has suggested the following strategy for forest networks in Scotland, that may equally well apply to England:
    - Enlarge small woods until they reach a size at which their wildlife is self-sustaining;
    - Link separate woods and plantations so that forest-based species can move from one site to another
    - Create well-forested districts ('Core Forest Areas') that can function as centres of population for forest-based species; and
    - Create links of native vegetation within large plantation forests so that native wildlife can move easily around predominantly coniferous plantation forests.
- Assemble more information on the feasibility, and cost-benefit from creating large expanses of forest (as 'wild wood') incorporating significant areas of minimum-intervention habitat within them.

5.4 Landscape and amenity

5.4.1 Policy background and developments since the EFS

Forests and woodlands have a profound impact on landscape and visual amenity. The main impact is through the size, design and location of new planting. In addition to providing benefits to residents woodlands can impact on tourism by enhancing the visual quality of the countryside. Tourism effects are considered in Chapter 6.

Landscape is not specifically mentioned in the Rural Strategy 2004 although the importance of protecting and enhancing the countryside and urban environment is clearly indicated. Improving landscape in the form of urban greenspace is a major element in ODPM policies for communities. ODPM (2002, 2003) and its champion Cabe Space (2004, 2005) have raised the policy profile of quality greenspace as part of public space. It is seen as a key element in improving the quality of urban life and especially so in deprived areas where environmental quality is often poor.

Government planning policy on landscape is set out in its planning policy guidelines. PPS1 (ODPM, 2005) gives the Government's overarching planning policies on the delivery of sustainable development through the planning system. It states that planning should facilitate and promote sustainable urban and rural development by protecting and enhancing the natural and historic environment and the quality and character of the countryside (Para 5). In its key principles, PPS1 states that "a spatial planning approach should be at the heart of planning for sustainable development" (Para 13.iii) and "design which fails to take the opportunities for improving the character and quality of an area should not be accepted" (Para 13.iv). When preparing development plans, "planning authorities should seek to enhance as well as protect biodiversity, natural habitats, the historic environment and landscape and townscape character" (Para 27). The Forestry Commission consults with local authorities and other interests in relation to new planting.

In planning policy for sustainable development in rural areas (PPS7) government recommends Landscape Character Assessment, along with Village or Town Design Statements and Village or Parish Plans, as a tool to assist Local Authorities in the preparation of policies and guidance that encourage good quality design throughout rural areas (Para 13). PPS22 gives specific guidelines in relation to landscape effects of crops for renewable energy.

Landscape Character Assessment is recommended as a tool for creating carefully drafted, criteria-based policies in Local Development Documents to protect valued landscapes outside nationally designated areas without the need for rigid local designations, which may restrict sustainable development and the economic vitality of rural areas. Local landscape designations should only be maintained or, exceptionally, extended where it can be clearly shown that criteria-based policies cannot provide the necessary protection (Paras 24 and 25).

The main contribution of forestry policy to wider landscape policy is to contribute to landscape character and to enhance greenspace and amenity especially in urban and peri-urban areas. Landscape character assessment includes consideration of historic and cultural landscapes and protected areas.

5.4.2 Valuation of landscape

The landscape value of forestry is difficult to quantify. The problem is that landscape comprises many attributes (topographic relief, changes in relief, shape, valleys and hills, agricultural land, field boundaries, broadleaved woodland, coniferous woodland, rivers, lakes, and settlements), each of which can have different levels (e.g. grassland, arable) or quantities (e.g. hectares of coniferous woodland), and each of which can have varying geometric configurations (e.g. square block of forest, irregular blocks, etc.). Each attribute can also be in different relationships and degrees of proximity to any other. This creates literally millions of permutations of landscape configurations.

Nevertheless, academic environmental economists and the Forestry Commission have since the 1990s actively engaged in attempts to derive a monetary value for forest landscapes. The FC commissioned studies from Entec and Hanley (1997) and Garrod

(2003), and independent researchers have also attempted to value the landscape benefits of forests and woodland. These have been undertaken with varying degrees of sophistication, from studies estimating how house prices are affected by varying proportions of trees in the landscape, to the landscape benefit effects of different types of trees and forest shapes and structures.

5.4.3 Benefit estimates

Forest valuation studies have usually used differentials in property prices or WTP estimates to drive the benefits from trees or woodlands in a landscape.

Hedonic pricing

The value of woodland, in a wider landscape context, either agricultural or urban, has been investigated in a number of studies. In a study of landscape characteristics in Gloucestershire, a hedonic price model (HPM) indicated that the proximity of a house to at least 20% woodland cover (i.e. the 1 km square in which the house was located comprised 20% woodland) raised the property price by 7.1%. However, there was no statistically significant impact on property prices when woodland cover extended to between 20% and 60% of the area, or when woodland cover exceeded 60%. Whilst there were relatively few observations in the latter category, the results suggest that high levels of woodland may have no impact or may have a negative impact on house prices (Garrod and Willis, 1992). Indeed Le Goffe (2000) noted that woodland in Brittany appeared to have a negative impact on the rental value of gïtes in the area.

In another study covering the whole of Great Britain, Willis and Garrod (1992), using an HPM found that a 1% increase in the relative proportion of broadleaved woodland in a forested area in a given 1 km square, with all other independent variables held at their mean values, increased the expected selling price of a property by £42.81 (in 1988 prices); whilst a similar increase in the relative proportion of mature (mainly sitka spruce) conifer (excluding larch, Scots pine and Corsican pine) reduced the expected selling price of a house by £141.

A number of HPM studies have shown that woodland in an urban setting adds significantly to house prices. Powe *et al.* (1995) found that properties in an urban area increased in value by £3,441, *ceteris paribus,* within 500 metres of deciduous trees. This amounted to about 8% of the house price.

WTP estimates per household

Garrod (2003) attempted to value woodland in six landscape configurations of forest based on four attributes: shape, scale, structural variety and species variety. A series of 37 computer generated images of the six generic landscapes were produced. The results suggested that a 'typical' respondent preferred small woodlands comprising of stands of randomly spaced broadleaves of varying heights, interspersed with areas of open space. Clear preferences for forested landscapes compared with the non-forested alternatives were only found for broadleaved woodland in a peri-urban setting. Using a most preferred alternative (MPA) model give annual household WTPs of between £199 and £265 per ha.

In the study by Garrod (2003) no systematic links between magnitude of WTP and incidence of the forest design factors most favoured by respondents were found for both broadleaved and conifer forests. However, an earlier study by Entec and Hanley (1997) did find such a relationship. This CE study assessed WTP per household per year for forest shape; felling method; species mix in autumn, and winter, and spring. This produced WTP values for (selective) felling: £12.89; (organic) shape: £13.90; and (diverse mix of evergreen, broadleaf, and larch) species: £11.36. WTP for the ideal

forest landscape was inferred by summing these variables, and produced a value of £38.15 per household per year. The separate CV study indicated households would be willing to pay £29.16 per year to see enhancements in the appearance of British forests that resulted in the perception of an "ideal" forest emerging. So there is evidence to suggest that shape, structure and design of forest matter in landscape values.

There has been no research on the non-use value of trees in cultural landscapes. However, it is clear that people are willing to pay for the preservation of cultural goods (e.g. in museums that they never see or visit) and that people also have non-use values for the outputs of agri-environmental schemes in areas of England they do not visit. Research is needed to properly and accurately value woodlands in the cultural landscape in order to inform public policy on this aspect of forestry strategy.

Location and benefits

The marginal impact of forested landscapes depends not only on WTP per household, but also on the number of households having views over the woodland. Unless the woodland is located in a peri-urban setting, the number of households with a woodland view is likely to be quite small. Applying the Garrod estimates to challenge funded schemes in sparsely populated Grampian and the more densely populated Central Belt produced landscape values of £200-400 (PV per ha new planting) in Grampian but £1,500-2,000 (PV per ha) in Central Scotland (CJC Consulting, 2004a).

Benefits will be greatest where trees are added to a landscape that lacks trees. This need not be in the form of sizeable woodlands; high benefits are likely from smaller woods and individual trees not traditionally supported under woodland intervention policy.

Deforestation

There is no specific evidence on the size of the benefits or disbenefits from a degree of deforestation, such as is occurring on parts of the public estate in Scotland (FCS, 2002). Based on the afforestation evidence, it would be reasonable to assume that the visual disbenefit of deforestation (without ameliorative measures) would be so high as to make this unacceptable in contexts where large numbers of people could see the change in landscape. Within woodland blocks and in more remote areas this would be less of an issue.

5.4.4 Implications for the policy agenda

There is a reasonable body of evidence on the measurement of public benefits from trees and woodlands in the landscape, and some information on species and design characteristics. But the topic is complex and there is limited economic evidence on the benefits or disbenefits from changes in the concentration of woodlands in a landscape or from changes in the design of existing woodlands (e.g. to create more open space). There are no valuation studies that specifically deal with the benefits from woodlands in relation to landscape character.

The economic evidence indicates that the landscape value of trees and woodlands can be substantial. Fundamentally, the valuation evidence only indicates benefits in landscapes frequented by large numbers of people (i.e. where they live, travel or recreate). The evidence mainly supports broadleaved planting where woodland cover is less than 20%. This suggests that one strand in woodland policy should reflect the role of trees in greenspace enhancement in close proximity to where people live (mainly urban and peri-urban locations). This is supportive of community policy especially in areas lacking in good quality greenspace. It also complements health policy but only where woodlands are accessible and part of a network suitable for physical activity.

The thrust of the economic analysis would also support planting in highly-visited areas (e.g. AONBs) if this enhanced the landscape appreciation by the public. A landscape character approach to policy would presumably support new planting if it strengthened existing landscape character. This could be at variance with the economic analysis if it supported planting in remote locations with a low population where visual benefits to the public would be minimal.

5.5 Soils, water protection and flood control

5.5.1 Policy background and developments since the EFS

The EFS gave no particular role to soils or water in forestry. This probably reflected uncertainty at the time about the precise benefits and disbenefits from forestry's impacts on water quantity, quality and flood control, and the lack of wider policy frameworks.

Soils policy

Defra introduced an action plan for soils in 2004 (Defra, 2004c). The aim was to help protect soil functions; the sustainable management of soils is stated as being a central pillar in sustainable development. Much of the concern is with loss of organic carbon in arable soils, soil erosion, ploughing on archaeological sites, and sediment in lakes.

There are few direct references to forestry or forest soils in the action plan. Forestry is stated as 'sometimes beneficial to soils and could be viewed as a strategic means of protecting soils but it can have negative impacts if good practice in no adhered to'. According to the action plan, poor soils management in forestry should be defined, discouraged and, where appropriate, penalised. The action plan states that 'where forestry delivers good soil management that goes beyond economic practice and legal minima it should be rewarded'. The FC issue guidelines for good forest soil management.

The main requirement for soil indicated in the action plan is that is should be in a suitable condition for plant growth and in a physical state that will resist run-off and erosion. Forestry can be a cause of erosion and sediment delivery but may also act as a buffer and reduce soil losses and consequent water pollution.

PPS7 gives national planning advice on the protection of land valued for agriculture, biodiversity, amenity and heritage.

Water Policy

The European Union (EU) Water Framework Directive (WFD) aims to ensure the integrity of the water environment and its associated eco-system functions by requiring the maintenance of 'high ecological and chemical status' of surface waters where it exists, and aiming to achieve 'good ecological and chemical status' for surface waters and Good Chemical status for ground waters. The WFD applies to all waters (rivers, lakes, estuaries, coastal waters out to one nautical mile, and ground waters). The WFD must also address both point source and diffuse source pollution to waters where it impacts on the achievement of WFD objectives. To implement the WFD, River Basin Management Plans (RBMPs) will be drawn up by 22 December 2009; programmes of measures to implement the WFD must be operational by 22 December 2012; with the aim of achieving the WFD objectives by 22 December 2015.

One of the decision criteria for the choice of measures which are used to achieve WFD objectives is cost-effective analysis (CEA). This will identify the most cost effective suit of measures to address the pressures identified. There are a number of exemptions that may be used when defining the objectives to be met during River Basin Management

planning. These include setting less stringent objectives if the water body is Heavily modified (HMWB) or is an artificial water body (AWB), here instead of aiming to achieve good ecological status, we aim to achieve good ecological potential. Exemptions may also be used in cases where (1) costs of achieving the status are disproportionately expensive, (2) the time scale for achievement of the objectives is technically infeasible or natural conditions do not allow timely improvement of the water body. All exemptions have detailed criteria which must be met for the alternative objectives to be applied.

Meeting the requirements of the WFD is likely to need reductions in the amount of nitrate, phosphate, potassium, herbicides and pesticides applied to crops (agriculture and forestry) and leaching into some water courses. The Nitrates Directive specifically deals with issues of nitrate pollution in surface waters from agriculture. It is relevant to forestry in so far as forestry may be a mitigating land use that reduces N leaching when substituted for agriculture. The Forest and Water Guidelines recommend that forestry follows the same rules as agriculture in NVZs.

Flood control

In relation to flood control, government has responded to its 2004 *Making Space for Water* consultation exercise (Defra, 2005a). It noted a gap in the evidence base relating to the role that rural land management techniques might play in managing flood risk at catchment level. This is also noted in the joint statement on wetlands, land use change and flood management (Defra, 2003).

5.5.2 Impact of forestry on water supply

There is some evidence that forestry impacts on stream flows and on water supply. This reflects that fact that because the surface area of trees is 2 to 12 times greater than the land area they cover, trees are very effective at intercepting and evaporating rainfall.

A hydrological land-use model of Greenwood Community Forest in Nottingham found that annual evaporation from broadleaved woodland on sandy soil was 93mm (20.2%) higher than that from grassland. This implied that afforestation would reduce the average recharge (of the aquifer) and runoff by 51%. The predicted reduction in recharge plus runoff on clay-loam soil was 62% (Calder, 2002). The impact of a three-fold increase in woodland cover from 9% to 27%, within Greenwood Community Forest, was estimated to reduce annual recharge and runoff by 11% (over a 24 year period).

There is no accurate and comprehensive assessment of the impact of forestry on water availability across England. A study by Willis (2002) used the Calder-Newson model (1979) (subsequently refined by Calder, 1999), to assess the impact on forestry on potable water availability. This model uses the interception rate (rain held and evaporated on tree leaves rather than reaching the ground), fraction of the year the canopy is wet, and the proportion of land under forest cover; compared to grass and moorland grasses as the alternative land cover. Transpiration from the canopy, when the leaves are dry, also reduces water availability.

However, there are a number of problems with this approach: the Calder & Newson model does not separate out the effects of broadleaves from conifers (recent evidence suggests that broadleaves over chalk have a lower water use compared to conifers and grass (see Roberts *et al.*, 2001). Nevertheless, forestry generally reduces run-off into rivers, and the amount of water percolating into the underlying aquifer, reducing the amount of potable water available from these sources.

If the amount of water available for abstraction is reduced through forestry then this may increase abstraction costs to the water industry, but only if alternative sources of water

supply have to be developed. Since water company customers have to pay increased water bills to permit water companies to develop alternative sources of water to meet demand, or to improve water quality to a specified standard, it seems reasonable to use replacement and mitigating costs as the relevant measure of value.

5.5.3 Cost of forestry to the water industry

The marginal cost (MC) of reduced surface and ground water available to the water industry will vary with the amount of forest cover in the area, and with the particular schemes each individual water company adopts to equate the marginal demand and supply of water in each of the water resource zones in its area. This might involve additional groundwater pumping from boreholes, the development of additional pipelines to import water from other catchment areas, or other infrastructure (e.g. reservoirs), etc. An indication of the potential cost of forestry to the water industry can be determined by the marginal costs (MC) that different water companies face. The long run marginal costs (LRMC) faced by different water companies are reported by OFWAT (2001)[13]. The maximum potential externality cost of forestry in terms of the increased costs of water abstraction can thus be approximated as the volume of water (m^3) lost through forestry multiplied by the LRMC minus the SRMC. The short run marginal cost (SRMC) is the cost of treating water (comprising a variety of chemicals and power), which has to be undertaken irrespective of the source; and since treatment costs are included in LRMC the SRMC need to be subtracted.

Assuming all intercepted water by trees which is lost through evaporation, is also lost to water companies, Willis (2002) estimated that this resulted in a capitalised externality cost of £52.491 million for England. This equates to an annual externality cost of £1.6 to £1.9 million (at 3.5% discount rate), depending upon the type of discounting (annual or exponential and time period). In practice the impact of forestry on the costs of water supply will be much lower. Resource managers of three water companies stated that they did not consider the present scale of forestry had implications for water costs in their areas (Willis, 2002). Thus the externality costs of forestry on water supply appear to be generally insignificant, although they might to important in localised areas.

5.5.4 Impact of forests on wetlands and flood management

Given that forests intercept rainfall, it might be expected that forests would attenuate run-off into streams and rivers during heavy rainfall, and therefore reduce or ameliorate flood events and damage. There is some evidence to support this view.

The Severn and Wye catchments at Plynlimon, are both of similar size, but with the Severn catchment under commercial forestry and the Wye catchment under short moorland vegetation. In a study of 100 storm events of differing severities, over a three year period in these catchments, Robinson and Newson (1986) noted that for small storms peak flows in streams were consistently higher in the moorland catchment than in the forested catchment. However, for large events there was no systematic difference between peak stream flows between the catchments. Recent field studies in the USA have shown that forest removal, *ceteris paribus*, will increase mean annual floods by about 10%, although the effect decreases for floods of greater magnitude (La Marche and Lettenmair, 2000)

Calder (2005) argues that land-use management of woodland might significantly affect the ability of forests to mitigate against flood events. For example, soils under natural

[13] LRMC is defined by OFWAT (2001) as the present value (PV) of the expected costs of the optimal supply strategy, per unit of water.

forests tend to be more porous leading to lower rates of surface run-off, compared to commercial forests planted on agricultural land with more compact soils. Lack of under-storey and vegetation, drainage, road construction, and logging in commercial forests have detrimental effects, increasing run-off. Indeed, a field study by Jones and Grant (1996) indicated that cultivation, drainage, and road construction, was more likely to influence flood response than the presence or absence of trees. The work of La Marche and Lettenmair (2000) indicates that forest roads increase mean annual flood by around 10% thus offsetting the effect of trees; although the USDA Forest Service (2000) in a synthesis of studies suggests that the effect of roads on stream flows is generally smaller than the effect of forest removal. Investigations of logging in Plynlimon show that forest felling had no significant influence on stream flow (Robinson and Dupeyrat, 2005), an effect probably attributable to modern forest management practices of limiting damage to soils.

Calder (2005) reviews the evidence on forests and floods and concludes that as the severity of the flood increases the benefits of having a forest cover appear to reduce; whilst the FAO (2005a) argues that large-scale afforestation will not significantly reduce the incidence or severity of catastrophic floods. The Forestry Commission itself (Gregory *et al*, 2003) recognises that forests 'might afford some protection against localised flooding' but that 'overall . . . the mix of management practices, species and tree ages found in large forests means that they have minimal effect on downstream flooding'. However, the FC argue that carefully designed and managed wet-woodland in low lying flood plain areas could slow down flood waters (Forestry Commission, 2000).

There may be longer term benefits in forests compared to other land-uses, in that woodland is a more permanent and stable land use type and hence less susceptible to changes in infiltration and runoff that can characterise agriculture (e.g. due to inappropriate farming practices) and other types of land use (e.g. where this compacts the spoil). This is an argument for maintaining existing woodland cover as well as extending it. There is some evidence to suggest that that since the 1940's farm intensification and practices have increased the likelihood of local flooding incidents.

The probability and risk of flooding is calculated to increase in over this century, with the main driver being climate change (Foresight, 2004). A long term increase in (50-100yrs) in woodland cover may have the potential to help buffer and counteract long-term climate change impacts of more intense rain and increasing flood flows that is anticipated.

Whilst there is a literature on the physical impact of woodland on flood reduction, there is a dearth of literature on the efficiency of woodland on flood reduction. Research needs to be undertaken in this area to assess the costs of creating flood defence measures with and without incorporating wet-woodland. It would not be necessary to estimate the economic benefits of flood reduction, but simply demonstrate if the inclusion of wet-woodland in any flood defence scheme is the most cost-effective way of reducing flood risk.

5.5.5 Policy on flood control

Defra is currently developing a flood risk and management strategy. On the available evidence, the role for forestry is expected to be minor since it is not clear that it is a cost-effective measure on upland extensive situations or on flood plains. Although trees can hold topsoil and sediment on flood plains, in severe conditions the trees themselves may be washed away and aggravate problems. Work is underway to improve the information base relating to forestry and flood risks.

5.5.6 Impact of forestry on soils and water quality

Environment Agency (2005) shows that water bodies are under a wide range of pressures that include point source discharges, diffuse pollution and acidification. Of direct or indirect relevance to forestry are the pressures from acidification, nitrogen, phosphorus and sediment delivery. The pressures from diffuse pollution have been mapped (Environment Agency, 2005a) and indicate that measures will need to be targeted in a catchment-specific manner.

Soils

The FC issue guidelines for soils and water management, and SFM is a condition for grant aid. This should cover the great majority of cases of new planting or re-stocking. In principle, therefore, policy addresses issues of sediment and other pollutants as required by the WFD and the soils action plan. But we are not aware of evidence on the effectiveness of these measures. It is possible that further action will be required but it is too early to identify what the most cost-effective mitigation measures will be or where they may be required.

Although the action plan states that forestry could be viewed as a strategic means of protecting soils, afforestation effectively removes the possibility for future agricultural use (without large conversion costs). As a strategy for soil protection forestry thus has limitations. It may imply high conversion costs for alternative land uses in the future.

Nitrates

Forestry may also have a role in reducing pollution from agriculture. Nitrate leaching is a major issue for many catchments in relation to WFD compliance, and taking land out of agriculture into forestry is one method of reducing N loss. IGER (2005) modelled a range of arable rotations on clay and sandy soils and estimated that conversion from arable to fallow or unfertilised grass reduced leaching by between 23 kg N per ha on sandy soils to 69 kg N per ha on some clay soils. This was the most effective mechanism for reducing leaching in terms of kg N reduction per ha. The costs of alternative options varied considerably, but £2-7 per kg N per year was typical. Fallow was more expensive (£6-23 per kg N per year) and would only be used if other mechanisms were exhausted or inapplicable. This might well be the case on all-arable farms.

Defra indicate that it is likely that the NVZ action programme will be a key vehicle for tackling N issues. The action programme is being revised and will be more stringent that the current programme. Measures are unlikely to include afforestation. However, in areas subject to high N pressures (e.g. East Anglia, Lincolnshire and Humberside) additional action may be required if the NVZ measures prove inadequate. This could be an opportunity for woodland creation but only where additional recreation or other benefits were forthcoming.

Phosphate and sediment

Evidence on the efficacy of buffer strips and alternatives is less well developed than that for nitrates (Haygarth, 2005; Haygarth *et al*., 2005). Even so, there is evidence that by providing physical barriers to soil and sediment movement (e.g. buffer strips) trees can reduce P and sediment losses into sensitive catchments.

Woodland has been shown to reduce sediment loading (Anthony *et al*, 2002; Nisbet and Broadmeadow, 2004), by stabilising soils; and it also provides benefits by helping to lock pollutants into the biomass, enhance soil properties and pollutant retention (Neal and Reynolds, 1998). Work by the FC in Bassenthwaite (Nisbet and Broadmeadow, 2004) has demonstrated that forestry can be used to address sediment issues, which can be a

serious problem for the quality of water in some lakes (Defra, 2004c). Woodland planting to stabilise soils could therefore help service requirements of the Water Framework Directive.

Defra has yet to develop a set of measures to respond to diffuse P and sediment pressures. It is therefore too early to assess what role woodlands may play. However, any role for forest buffers would presumably be part of agricultural policy, with regulation or incentives as the mechanism for creating strips in appropriate locations.

5.5.7 Implications for the policy agenda

Analysis of the role that forestry plays in soils and water quality appears to be patchy and this makes economic analysis of benefits and disbenefits difficult. More extensive information on the efficacy of forests in specific contexts in relation to flood control and sediment delivery is required. There appears to be adequate information to assess forestry's role in reducing N losses from agriculture but the evidence on P and sediment is less complete.

Current soils and water guidelines for forestry, and conditions attached to grant aid, appear to provide a satisfactory basis for the management of forest soils. However, additional measures may be needed to deliver on the WFD and the objectives of sustainable soil management. No analysis is available of the costs to forestry in England of meeting WFD requirements.

In terms of new planting, trees and woodlands may have a role in reducing N, P and sediment pollution from agricultural land. It is too early to identify precisely what this role may be. In catchments under pressure from diffuse N, the substitution of woodland for agriculture will reduce N losses but this is likely to be a costly mitigation option when compared to other measures including fallow and reduced intensity farming.

Buffer zones to reduce P and sediment delivery to water bodies are a useful mitigation measure that may form a useful element in policy to address WFD issues.

On current evidence it would be difficult to include flood control as an element in forestry strategy.

5.6 Renewable energy

5.6.1 Policy background and developments since the EFS

The EFS included a commitment to increase the use of renewable sources of energy through research and development, and use of opportunities to promote short-rotation coppice (SRC) as an alternative to agriculture.

Government has a policy of increasing the proportion of energy generation derived from renewable sources. This is primarily to increase energy security but net GHG emissions are also reduced. It has instituted a wide range of mechanisms to reduce dependency on non-renewable sources of energy. The Royal Committee on Environmental Pollution (RCEP) (2004) describes this programme which has a new urgency following the increases in oil prices in 2005.

The government's Biomass Taskforce (2005) has reported its emerging conclusions on biomass as a heat and power source. However, it has not indicated the costs of biomass production and processing. Defra and DTI have commissioned a scoping study on the amount of renewable heat from biomass that might be forthcoming at different levels of incentives.

Defra has operated an Energy Crops Scheme since 2000 which offers €45 per ha subsidy for energy crops (including SRC) on non-set-aside land. Establishment grants for SRC are £1,000-1,600 per ha, and 50% grant aid is available for setting up producer groups. This will finish in 2006 when the new Rural Development Plan is introduced but the Biomass taskforce (2005) recommends its continuation. SRC is not supported separately under the EWGS. Land in SRC is considered as eligible land under the SPS; conversion to SRC will not therefore lead to any loss in SPS entitlement.

The Bio-Energy Infrastructure Scheme was introduced in 2004 to help develop the supply chain for energy crops and wood fuels. The Bio-Energy Capital Grants Scheme provides support for investment in heat and/or power plants that use biomass.

Biomass for electricity generation: the renewables obligation

Government requires electricity companies to obtain and supply 10.4% of their electricity from renewables by 2010 (the Renewables Obligation, RO). Electricity suppliers failing to meet their obligation can trade in obligations or face a penalty of £30/MWh. Use of biomass energy either under the RO or in local plants is encouraged, for example through support for energy crops. The RO does not differentiate amongst sources of renewable energy; hence forestry has to compete with other renewables. NAO (reported by Biomass taskforce, 2005) calculate that the cost of the RO at £260-£290 per tC. Pearce (2005) estimates the buy-out fee of 3 pence/kWh implies a carbon value of £310 per tC.

Energy crops and utilisation

The subsidy for energy crops and energy infrastructure is evidence that the government wants UK biomass to contribute to its non-renewable target. Planning guidelines exist for biomass (PPS22). Whereas the RO places the additional costs of using renewables onto consumers, the incentives to biomass producers and processors is a cost to taxpayers and must compete with other priorities for government expenditure.

5.6.2 Cost of energy production from renewables

Enviros Consulting (2005) has reviewed the costs of producing energy from a wide range of renewables. These do not specifically include timber or forest waste but do include generic biomass. Co-firing biomass at a small proportion (usually 1-5%) is the least cost (£27/MWh) of all options because no investment in plant is required. To date most of the co-firing is from biomass pellets bought on the world market. The critical factor for forestry is whether timber can be converted into pellets at a competitive price. We have found no information on this but our impression is that processing and transport costs coupled with uncertainty in the market will restrict investment in this area. Pellet production could be an add-on option for timber processing plants that purchase low grade timber.

Following a review of co-firing in 2004 a timetable has been agreed for phasing it out of the RO. This follows difficulties with negative impacts on performance and concerns about emissions (which may be penalized in the future). The phase-out from the RO will restrict the amount of co-firing to 25% of the ROCs generated until 2006; 10% until 2011; and 5% until 2016. In 2016, biomass co-firing will no longer be eligible. The proportion of co-fired energy that has to come from energy crops (this excludes forestry but includes coppice) under the RO is being increased from 25% in 2009 to 2010, 50% in 2010 to 2011 and 75% from 2011 to 2016. Enviros Consulting (2005) state that power stations are not prepared to enter into long-term contracts for biomass at present until various difficulties are resolved. However, there is potential for more co-firing since only 16% of the capacity to use biomass is currently being used.

Stand-alone biomass plants fall in to a medium cost bracket (£66/MWh) which still compares reasonably with wind at £30-90/MWh. These may use power locally or sell it to power companies as a renewable element for the RO. Biomass use in stand-alone heat and power has had a chequered history but a number of plants are operating mainly with support under the Bio-energy Capital Grants Scheme. The Enviros Consulting report suggests that they are relatively high cost.

5.6.3 Biomass

The forestry sector interest in biomass is in terms of low-grade roundwood, wood waste and SRC. The Biomass Taskforce (2005) estimates that this could release 9.8TWh of energy and comprise around 30% of total potential UK biomass supply. The area of SRC is thought to be around 1,500 ha with a similar area of Miscanthus. These areas are small compared with the 60,000 ha of non-food crops grown on set-aside much of which is thought to be used for energy production.

As an example of heat production from low value wood, a new 300kW wood-fired heating plant has been installed by Tynedale Council in Kielder forest and supplies heat to 15 properties including a youth hostel, workshops and social housing. Wood is supplied by Forest Enterprise. The capital cost of £620,000, even at social discount rate of 3.5%, converts to an annual cost (excluding wood, labour and repairs) of £43,600 over 20 years. With fuel and running costs (excluding labour) of at least £12,000 per year, the plant appears to be producing heat at around 10p per kWhr[14]. This is not competitive with energy from power generators operating under the NFFO. But such pilot projects are valuable as development tools and should provide more information about the cost of heat production from wood. They would become more competitive if energy prices continued to rise.

Experience with biomass schemes has been patchy. For example, of the seven gasification projects listed under the Non-Fossil Fuels Obligations in 1998 none were operating successfully in 2005 (Natusch, 1998). Existing producers mainly intend to convert biomass to electricity through co-firing with coal or direct combustion.

SRC production is based on producer groups, with grant aid available to assist in establishing the groups and their supply of feedstock. The SRC is processed and sold on to power generators or used in local heat or combined heat and power (CHP) schemes. Evidence on the return on capital from such groups would provide a better basis for identifying the levels of biomass subsidy that will be required to expand production of SRC. The key issues for SRC is the supply prices in relation to other biomass, and hence the level of subsidy required to make them competitive.

There is considerable interest in CHP from biomass because of their higher efficiency and a small number of CHP plants operate in the UK. However, AEA Technology (undated) report that financial support for renewable heat in the residential sector would have to be very high before significant C savings were stimulated and that it is not cost-effective. They argue that most biomass potential is in the commercial and industrial sectors and propose a support scheme for renewable heat and renewable CHP of around £10 per MWh.

The Biomass Taskforce (2005) has come forward with a range of recommendations for increasing the contribution of biomass in energy production. These include proposals to help small generators. On SRC, they merely state that there is an urgent need for

[14] The benefit to carbon emissions is not included in this calculation (see Section 5.6.4).

government and industry to develop a 'planned approach' to short rotation and other forestry.

5.6.4 Carbon emissions

Burning low-grade wood, harvested as a by-product, emits carbon immediately whereas some other forms of utilisation (e.g. board manufacture) delay C release. However, where wood combustion substitutes for combustion of non-renewables there is no increase in CO_2 emission, assuming equal combustion and utilisation efficiencies. Accordingly, under the Guidelines for Greenhouse Gas Inventories agreed internationally, carbon emissions from wood and other biomass burnt as fuel do not count towards the UK's CO_2 emissions, because sustainable biofuels production is a renewable energy source. Substitution of biomass energy for non-renewables thus reduces net emissions as recorded in the inventory. Production of biomass specifically to displace fossil fuels is one of the more technically effective mechanisms for contributing towards the stabilization of atmospheric CO_2.

5.6.5 Implications for the policy agenda

The government's renewable agenda is developing rapidly and the information base is being extended. The Biomass Taskforce found varying opinions about the cost-effectiveness and environmental implications of SRC but do not provide any estimates of cost for biomass as an energy source. This suggests that there is a case for clarification in the supply price of SRC. The Taskforce recommends that 'the Forestry Commission should urgently undertake and publish a full assessment and set out a strategic plan for the development and use of short rotation forestry, forestry waste, recreational woodland management and commercial forestry'.

The lack of transparency in cost information would support further investigation into SRC and its competitive position with other biomass sources (although we note that Defra has commissioned a study on energy crops including SRC).

Whilst it is clear that biomass from wood should form part of the emerging policy agenda for renewables, it is less than clear what additional intervention is appropriate. One element will be to respond to the findings of the Biomass Taskforce. Clarification is required on the cost of SRC production and processing, its competitiveness with other energy corps, and the levels of subsidy required to expand production. Biomass production, including SRC, short rotation and existing forests, may represent considerable opportunities for renewable energy if government were to provide the required incentives.

6 Rural development and economic regeneration

6.1 Policy background and developments since the EFS

6.1.1 Rural development in policy

The government recognises the declining share of agriculture and other primary industries in rural employment, contrasting with the high rate of small firm location in rural areas. The latter appears to be related to perceived quality of life improvements, with the majority being incomers (in marked contrast to urban start-ups). The general message appears to be that, whilst there will be significant continuing employment in forestry and related sectors, and whilst woodlands may still make some contribution to farm diversification, particular future importance must be attached to woodlands in terms of 'value added' to customised and high quality timber products, field sports and other formal and informal recreation, tourism, and the attraction of entrepreneurs to well-wooded areas.

This is reinforced by data emerging from the new Rural Evidence Research Centre that draws attention, *inter alia*, to relative rural prosperity with a disadvantaged minority, economic weaknesses and social deprivation in lagging rural areas dependent on primary industries, convergence between urban and rural economies, increased mobility through the car for most rural residents, and conflicts between development pressures on the countryside and the requirements of biodiversity and human wellbeing.

6.1.2 Defra Rural Strategy

The Defra Rural Strategy 2004:

- Confirms that forestry (along with other primary sectors) is important to the prosperity of rural England, through both its direct and indirect contribution.
- Notes the importance of the new England Forest Industries Partnership between the Forestry Commission and the private sector which aims to identify and promote the contribution of forestry and woodland businesses to the sustainable development of the economy, environment and local communities.
- Notes the ways in which the ERDP helps farmers and foresters respond better to consumer requirements and become more competitive, diverse and environmentally responsible.

Generally, it notes that forestry (along with agriculture) has a particularly important part to play in the state of the rural environment, and its economic and social value; further, forestry practice and RFFs are viewed as important stimuli for diversification into recreation and tourism, countryside protection and biodiversity enhancement.

6.1.3 Economic regeneration

With regard to economic regeneration, a number of Government policies impact on the contribution of woodlands and related industries**:**

Planning Policy Statement 11 points out how Regional Spatial Strategies (RSS) articulate with (*inter alia*) RFFs and strategies for biodiversity, environment and health. PPS9 includes reference to the safeguard of ancient woodland and to building-in beneficial biodiversity elements within new development, whilst PPS7 encourages rural enterprise diversification and a high quality environment, and MPS1 and MPG7

encourage a range of after-uses for mineral developments, in places contributing to initiatives such as the creation of the National Forest or Community Forests.

Sustainable Communities: People,' Places and Prosperity' emphasises the importance of liveability, and draws attention to the importance of green spaces, environmental protection, efficient use of natural resources, safe and attractive corridors for walking and cycling, and a green infrastructure for biodiversity. In designing and managing these, social inclusion opportunities may be as important as environmental ones. Associated reports on "Making it Happen" illustrate various opportunities for woodland to contribute to the setting of major housebuilding programmes, integrated approaches to regeneration, increasing the confidence of investors, and contributing to a range of environmental service functions and community uses. Projects such as 'Newlands' in north-west England are seen to continue the tradition of urban parks started by the Victorians. RGP9a reinforces the Thames Gateway spatial framework and the role of open and green spaces in improving its environmental and ecological value and the quality and image of the area as a place to live.

Making the Difference: a new start for England's Coalfield Communities emphasises the importance of partnerships, and the scope for working with RDAs and their regional strategies.

The Urban White Paper's 'new vision of urban living' refers to the importance of attractive, well kept towns and villages, including well-managed public open spaces, which have benefits for enjoyment, health, direct and indirect contributions to business, wildlife, environmental services and education.

Planning for Leisure and Tourism recognises the importance of these growth industries to the countryside and the need for the planning system to respond to their requirements. By implication, woodland environments both have a direct role to play, and an indirect one in making major leisure developments more amenable to planning consent (or perhaps, like Center Parcs, an integral feature of the development itself).

6.2 Roles for forestry

Looking across the various policy documents, it appears that a role is seen for contributions from forestry in the following ways.

Rural development

- Providing direct rural employment.
- Providing rural employment in upstream and downstream industries, through valorisation of processed timber, and through the presence of timber-rich areas (game, tourism, arboriculture etc.).
- Facilitating domestic timber supply and use and providing information on productivity.

Economic Regeneration

- Dealing with former industrial land linked to areas of social deprivation with poor quality of life.
- Inclusion of forestry in planning strategies and development frameworks as an effective after-use of former industrial land.
- FC land acquisition within regeneration partnerships.
- Woodlands as a green setting for future development.
- Woodlands as foci for more socially inclusive and accessible recreation and other

'Quality of Life' functions.

6.3 Forestry for rural development

6.3.1 Rural economy

British forestry takes place within a context of a rural economy which is becoming more similar to urban areas and less dependent on primary industries (Eiser and Roberts, 2002). The decline in the relative contribution of the primary sector to GDP has been considerable and has been paralleled by a decline in employment, which is often, in percentage terms, even greater, because of the increasing degree of mechanisation in the primary industries (Johnson and Price 1996). Even so, in certain rural areas, agriculture and forestry still make substantial contributions to local economies.

Further, rural development is changing from a reliance on exogenous mechanisms of policy intervention to those that emphasise local resources and endogenous development. Thus, historically, rural development policy has often emphasised large-scale investment levered and supported by central government as a presumed stimulus to local or sub-regional economic growth. For example, major investments in pulp and paper mills and aluminium smelters effected during the 1960s exemplified this theory of exogenously driven growth investment. In view of the lack of sustainability of some of these investments, and their relative failure to generate multiplier effects in the host area, policy has tended to favour 'endogenous' activity. This centres on the possibility of exploiting local (social, economic, cultural, environmental) resources, and valorising raw materials, within a scenario based on self-reliance (Ray, 1998).

The emphasis thus shifts to the importance of the resources and talents within a particular 'territory', and the participation of local businesses and communities in seeking bottom-up solutions to investment, production, service provision and processing (Ray, 2003). This is now often perceived to be more sustainable and cost-effective. Given this emphasis, modern rural policy is likely to strike a balance between sustaining large-scale processing and marketing facilities, and local support for smaller sawmills, marketing networks and niche products from small woodlands.

Shucksmith's (2000) analysis of capacity-building within endogenous rural development processes points to the importance of instilling 'cross-cutting' measures affecting various sectors and having explicit social inclusion goals, rather than relying on traditional large-scale investment projects based on primary resources. Similarly, the EU's Draft Strategic Guidelines for Rural Development identify mobilising the endogenous potential of rural areas, in order to build local capacity for employment and diversification, as a priority area. This has important implications for the composition, location and scale of forestry.

6.3.2 Linkages and knock-on impacts

The core 'woodland industry' consists of establishment, maintenance, harvesting, marketing and distribution. Upstream linkages comprise suppliers of seeds, 'grow tubes', chemicals and fertilisers, fuel, equipment, professional services, and so forth. Downstream linkages comprise mainly the processing facilities (sawmills, paper and board plants, wood-based panel mills, etc.). In regions with large woodland and timber industries, these linkages are often provided internally, but given the large economies of scale and highly specialised equipment and services of the timber industry, economic 'leakage' can be extremely high.

The nature and magnitude of leakage varies according to type of activity and scale of analysis. Large-scale felling operations might require imported harvesting machines: in

such cases high-value activities leak from the national economy. Other leakage may be more local. In the West Midlands DTZ-PIEDA (2001) found that the region had the lowest proportion of large wood-using businesses of any region in England, and relied on outside processing capacity, especially in Wales.

Direct economic activity includes: forest managers, jobs created/retained in forest advice and contracting, jobs created/retained in knock-on forest activities (new wood-using businesses, arts, education, recreation), and training in skills for employment seekers. Indirect economic activity effects are broadly twofold in nature. First, are those indirect and induced effects related to the timber industry itself. These comprise the outputs and employment associated with suppliers to the core industry (*indirect first round effects*), the subsequent providers of goods and services to these suppliers (*indirect 2nd, etc., round effects*), and the spending of profits and wages of the forestry sector and suppliers (*induced multiplier effects*). Second, and more diffuse and difficult to quantify, are the wider impacts of woodland on net inward business investment and associated expenditure and employment, net retention of population and associated expenditure, and enhanced tourism/recreation and associated expenditure. A study of the forestry industry in Wales (Munday and Roberts, 2001) indicated not only the importance of direct employment, but also the strong linkages between private estates and harvesting, harvesting and hauliers, and harvesting and sawmills.

Based on an analysis from the West Midlands Regional Forestry Framework, Table 6.1. shows the ways/interlinkages by which forestry can potentially contribute to rural development and economic regeneration.

Table 6.1. Key linkages between forest and woodland functions (in green)

	Forestry and Woodland Industry	Wood Energy	Recycling	Recreation and Tourism	Health and Wellbeing	Learning and Skills	Social Inclusion	Landscape, Built Development and Land Reclamation	Biodiversity
Forestry and Woodland Industry									
Wood Energy									
Recycling									
Recreation and Tourism									
Health and Wellbeing									
Learning and Skills									
Social Inclusion									
Landscape, Built Development and Land Reclamation									
Biodiversity									

Source: Entec (2003, cited in and modified by Slee *et al*., 2004)

6.3.3 Rural employment

CJC Consulting (2003) comprehensively reviewed the generation of jobs and incomes by policy-induced woodland activity. Whilst noting that information on total (including indirect) employment associated with woodland was sparse, they drew attention to the estimates in two principal recent studies. Thus, the England multiplier study (PACEC, 2000) reported a figure of 18,840 jobs (excluding the FC) for an area of 885,000ha, giving 1.90 jobs per 100 ha. Overall, the employment multiplier was 1.84 but, because few suppliers are located locally the local employment multiplier was 1.38. Further, the study did not give insight into the differential impacts of different types of planting, although these are available from the Scottish multiplier study (Roberts *et al*., 1999). Here, for commercial conifers and broadleaves, the total impact was estimated at 3.8-4.4 FTEs per 100 ha although much of this impact only occurred at harvesting; as noted elsewhere, the amount of broadleaf MAI actually likely to be harvested is typically uncertain particularly in relation to small-scale 'farm' woodlands.

CJC Consulting (2003) observed that caution needed to be exercised regarding conclusions about the significance of rural employment and associated multipliers, as separate inclusion of these benefits can lead to double-counting. Notably, policy arguments in favour of forestry frequently cite a range of benefits associated with economic security, regeneration, and so forth. Employment may not, however, be additional to these, but rather their 'obverse side'. Further, local gains can be at the expense of foregone income/ employment elsewhere. However, even if there are problems in demonstrating net gains or local employment creation, forestry provision may still satisfy 'distributional' concerns. For example, sparsely populated areas tend to have lower levels of income, and it is then legitimate in terms of social inclusion objectives (Defra, 2004a; Commission for Rural Communities, 2005) to attach some social weighting to the gains in the low-income area relative to forgone gains in a richer area (H. M. Treasury, 2003).

With regard to employment, a very high proportion of direct labour is drawn from a local catchment – PACEC (2000) found this to be as high as 94% – lending some support to the case for forestry in rural development. Policy-induced woodland management activity will generate forestry jobs and incomes, part of which will be local. However, the size of these impacts has always been difficult to quantify because most of the impacts occur at felling which is at least 40 years away from planting, creating large levels of forecasting uncertainty with regard to developments in labour-substituting technology and changes in macroeconomic circumstances.

6.3.4 Forestry as a mechanism for rural development

Despite forestry having traditionally been used as an instrument of rural development, especially in the remoter areas, its suitability, especially in a context of very low timber prices and heavy reliance on taxpayer subsidy, does need to be questioned. The woodland creation review (FC, 2002c) argued that, with the collapse of timber prices, timber producers may be better to concentrate on growing quality timber rather than competing in bulk timber markets, though even this begs questions as to whether timber produced to a high quality specification can itself be a feasible and profitable activity. Thus, as CJC Consulting (2003) noted:

- Grant-aided forestry creation does not relate well to modern concepts of rural development, and generates an unusually uneven flow of economic activity for suppliers unless new planting continues over a long time period.
- Although the FC has tried to make WGS applicants engage more with local

communities (as in the WGS scoring and the Community Woodland Contribution), the evidence is that success is very patchy.

- New planting does not appear to induce concentrations of related businesses such as contractors or timber processors.

Equally, forestry establishment is associated with high costs per job created, albeit not excessively so relative to other land-based employment in remoter areas. Planting does create immediate jobs in establishment and these could be especially beneficial in areas with limited employment opportunities, although maintaining these jobs requires a continuing expansion of the woodland area.

Established woodlands

Whilst much of the debate surrounding forestry in rural development is concerned with new planting, the importance of established woods is often considerable. Two particular aspects are of interest. First, are those areas, particularly in lowland England, with a diversity of broadleaved and mixed cover, predominantly in private ownership. Whilst many such woodlands have active management plans and well-established markets, many also often fail to make their fullest contribution to local development both because of under-management and under-harvesting of the mean annual increment. This is undesirable from the reduction in local economic activity and, possibly, other public good benefits.

The second area of key interest is in 'heritage' woodlands, where there is often considerable scope for multiple benefits to be realised. One illustration is in the Hambleton and Howardian Hills Partnership Cultural and Natural Development Opportunity (CAN DO). Here, the partnership (which includes the Forestry Commission) aims to develop: 'an area of landscape, cultural heritage and biodiversity excellence benefiting the economic and social well being of the communities who live within it'. One of the area's key attributes is the high level of woodland cover, which is close to the presumed 'wildlife optimum' of 30%, and includes the highest concentration of ancient woodland in the region. In addition to its other functions, the woodland cover, combined with a wide range of other semi-natural habitats, supports an exceptional level of biodiversity. Whilst the area has experienced the loss of landscape and wildlife features over the last 50 years due to land use changes such as extensive conifer planting, often on ancient woodland sites, the Forestry Commission is now committed to restoration of PAWS and to the conservation of the area's nationally and internationally significant veteran parkland trees. The long-term intention is thus for forestry to contribute to an overall partnership aimed at 'heritage-led rural regeneration'.

Clusters

With regard to strategic approaches to rural development, increasing interest has centred on the creation of industry 'clusters' based on Porter's (2000) theories about cooperative behaviour amongst competing businesses within a dynamic economic sector. In this perspective, growth is stimulated by interaction between companies, suppliers, service providers and other institutions (especially the 'knowledge industry'). By identifying and supporting key clusters, governments can help construct advantage by stimulating conditions that enhance business competitiveness. The Porterian approach is most pertinent to regional development theory, and it has not surprisingly been espoused most enthusiastically within regional governance. Some have seen the forestry sector – with its closely linked production, harvesting, haulage, processing, marketing, quality assurance, technology, research, and education and training activities – as being a suitable case for 'cluster' treatment. Most notably, the Scottish Forest

Industries Cluster has developed since 2000 as a joint venture of the Scottish Executive and industry interests.

However, the scale of the industry far surpasses that in the English regions, and it is highly debatable whether this ambitious model could be adopted. Cluster development is usually associated with 'sunrise' industries which make a significant and growing contribution to regional economies, and which governments single out for particular growth potential. The Scottish Forest Industries Cluster adopts 'sunrise' terminology by promoting wood as 'the natural choice for sustainable and innovative customer solutions'. A more modest variant of a Porterian cluster may be appropriate in some English regions although, for example, the DTZ/Pieda report on the West Midlands concluded that the woodland and forestry sector was a suitable case for strategic support, but not for selection as a target cluster.

The inclusion of forestry in the EU Rural Development Regulation (RDR) has resulted in a number of relevant initiatives. A study by Buller *et al*. (2002) argued that a stronger realisation of benefits from the RDR would require the UK forestry policy community to, *inter alia*:

- Seek greater integration of forestry in the RDP process.
- Attempt to increase the engagement of local populations in establishing forestry priorities in regions and localities.
- Release greater funding for forestry related projects available under mechanisms such as the Rural Enterprise Scheme, where appropriate.
- Find ways of integrating certification procedures for timber and environmental certification instruments into the broader RDR objectives.
- Improve access to training and technology transfer.
- Consider new schemes or adaptations to the Energy Crops Scheme related to agroforestry and local fuel-wood schemes.
- Reward the genuine contribution of multifunctional forestry to rural development processes that go beyond the farm or the plantation through WGS and FWPS.
- Explore the use of land management initiatives in sustainable forestry management whether at the level of Natura 2000 sites, farm forest plans or other instruments.
- Seek a greater degree of integration and 'joining up' between forestry policy, rural development policy and environmental/nature protection policy.

6.3.5 Timber products and other economic impacts

Economic prospects are now often related, not only to 'mainstream' timber production and processing, but also to the more general effects of tree cover and sales of wood products. This 'marketisation' or 'commodification' of what were often seen as non-market goods is well illustrated in a study of two areas of lowland Britain (Slee *et al*., 2002), which estimated that the impact of 'shadow' or 'halo' economic effects of forestry and woodland are almost an order of magnitude greater than those derived from the conventional wood supply chain.

Intermark's studies of market data in the East of England (1994, 2002) investigated garden centres, garage forecourts, farm shops and DIY stores with gardening/ horticultural departments, and showed that sales of wooden products – such as fencing products, furniture, planters – had risen from £9.7m in 1994 to £17.9m in 2001. Given the continuing upward trends in purchases related to gardening, it was estimated that

growth in demand for wood products would be maintained, albeit at a lower rate than during the survey interval. However, much of this growth appeared to relate to tropical hardwood and imported pine products, and the use of domestic/regional timber had been more variable; even so, UK softwood was the main raw material for fencing, trellis and other smaller products. In a baseline study of the woodland sector in the West Midlands, a number of particular opportunities to improve access to existing markets were identified, namely – niche markets, certified timber products, user friendly services (e.g. providing and fitting timber for flooring), adding value to softwoods, and developing new and innovative products.

6.3.6 Tourism

Impacts on tourism are measured by identifying the direct expenditures and knock-on effects of changes in forestry in a region. These expenditures that can be associated with forestry either:

- Directly, through recreation, forest-based activities and forest use by visitors; or
- Indirectly, by improving the landscape and biodiversity of the region such that it attracts more visitors from outside the region.

Impacts on tourism depend critically on (i) whether tourism is important to the region's economy, and (ii) whether changes to the forest stock impact on visitor numbers and expenditures. It is thus not possible to generalise because each region will differ. Whilst there is substantial evidence about certain aspects of forest visits, a stronger case might be made if more research were to be conducted into the role of forests in tourism and the extent to which new planting contributes to landscape and improve the environmental image of a region for tourists.

The most comprehensive data on expenditures from forest-related tourism are in the study by Hill *et al*. (2003) for the Forestry Commission. Based on the UK Day Visits Survey and surveys of visitors to a sample of woodlands they estimated that 3.4% of tourism expenditure in England was forest related i.e. associated with tourism day visits to established forestry sites. However, 35% of day visits were from home and most of this expenditure should be considered as regional, domestic expenditure rather than tourist-driven. None would contribute to a net gain in national tourist expenditure except in so far as forestry-related attractions reduced the propensity to take holidays abroad.

They also calculated from interviews with visitors to six countryside areas that 13% of visits could be considered forest-related. However, the areas surveyed were areas where forestry is clearly an important scenic element (The New Forest, Lake District and Wye valley in England). For other important tourist regions, such as the south west, forestry is almost certainly much less important in attracting visitors. The key issue is whether additional forestry in such areas would attract additional visitors. Whilst there is no systematic evidence to confirm that new planting would cause an increase in tourist expenditure, there are some indications of a positive relationship. These include, for example:

- The use of heavily wooded environments to promote the image of particular tourist developments, such as Center Parcs;
- The attraction of specific forest-related activities, associated with substantial specialist expenditure, to relatively recent plantation forests, such as mountain biking in mid-Wales; and
- Substantial investment – including timber cabins, a youth hostel and marketing studies – is currently taking place in the National Forest in order to expand the

visitor economy and enhance tourism infrastructure.

A significant recreation/ tourism benefit is associated with field sports, and this is a principal management consideration for many private woodland owners. Sporting/shooting usage of woodlands is one of the activities most likely to generate significant income, and may thus strongly influence woodland management and contribute to local rural economies. In a study by Short *et al*. (1994), shooting holdings had three times as much woodland as non-shooting holdings and 3.5 times the average level of woodland for England. Importance of woodland appears to increase in direct proportion to the commitment to game conservation.

Regional tourism experts are best able to estimate how forest creation or the development of existing forests might increase tourism. To justify public expenditure on forests in terms of tourism it would have to be shown to be a cost-effective measure as compared with other routes for developing tourism. Given the amount of time taken for new plantations to mature, the most rapid gains from forest-related tourism is normally likely to be from existing woodlands by creating new types of interest. For example, in the Scottish public estate review it was suggested that activity-based recreation and nature-based tourism offered greatest potential to deliver local economic benefits (CJC Consulting, 2004).

6.4 Forestry for economic regeneration

CJC Consulting (2003) note that the key issue in respect of forestry for economic regeneration is to define the role that environmental improvement plays in this process. Woodland establishment can be an important means of regenerating urban and industrial wasteland and it is held to be one of the most cost-effective and technically successful 'soft' end-uses. The distinguishing features in the regeneration context are that forestry makes the urban space more attractive, and may encourage net inward movement of business and people.

Research into trees on difficult sites has noted that whilst over 300,000 ha of land in the UK may be contaminated, woodland provides a 'soft' end-use with relatively less stringent remediation objectives, and is an effective means of remediating land according to all criteria. Whilst there may be some problems of soil acidification and mobilisation of heavy metals, evidence suggests that woodland has a strong and positive part to play (Perry and Handley, 2000). The Land Restoration Trust partnership (comprising the Forestry Commission, English Partnerships, Groundwork and the Environment Agency) now has a ten-year aim to acquire, own and manage 10,000 ha of previously derelict and under-used land, to deliver environmentally informed, community-led regeneration.

6.4.1 Re-location and retention of businesses

The key factors traditionally determining whether or not a firm locates in an area have declined in importance because of technological change and lower transport and communication costs. Instead, intangible factors such as business culture, institutional capacity, community image, and quality of life are of growing importance in both determining inward investment and stemming business outflows. There are no studies that specifically relate to the impact of woodlands or forestry on business location decisions. In addition, most of the studies on the importance of the environment and quality of life factors on business location have concentrated on rural as opposed to urban areas.

Rather than being an impediment to economic growth, there is growing recognition that policies aimed at preserving the environment have assisted the urban to rural shift in industry that has taken place over the last two decades (Johnson and Rasker, 1995; Keeble *et al.,* 1992). Reports by CABE, which draw on similar sources of evidence, strongly indicate the transferability of findings to urban areas. Thus, Cabe Space (2002) mostly relates to perceptions from general public surveys, which show a strong belief in the links between well designed environments and productive working, higher property values, reduced length of hospitalization, educational performance and crime reduction. Cabe Space (2004) pulls together the arguments about the economic value of public space (especially property prices, industrial location), impacts on physical and mental health, benefits for children and young people, reducing crime and fear of crime, the social dimension of public space, movement in and between spaces, and value from biodiversity and nature.

Evidence on the relationship between landscape quality and quality of life factors to business location decisions is contradictory. For example, Keeble *et al.* (1992) claimed a positive relationship between landscape quality and attraction of investment. However, for only 3.8% of urban companies was it a reason for their choice of location. In contrast, Wong (1998) found that traditional economic factors such as human resources, infrastructure, finance and capital, and industrial structure were consistently assigned higher ranks by respondents than more intangible quality of life factors. Nickson and Cartwright (2002) provide a balance to this argument, claiming that a quality environment is important to business retention, and that corporate CEOs state quality of life for employees as the third most important factor in locating a business, behind access to domestic markets and availability of skilled labour.

Whilst the benefits of woodland to inward investment are somewhat unclear, it is possible to make a number of generalisations based on current knowledge: many business owners, especially those already in a scenically attractive area, state environmental quality as a significant influence on location; woodland can be an important and cost-effective means of improving the physical environment of industrial areas; there is a general shift in the relative importance of intangible factors in business location decisions; quality of life factors are significant for those areas dependent on the retention of highly footloose businesses; 'rising sun' industries, whilst principally seeking the agglomeration/cluster effects of major centres of population, tend to locate in well designed business parks with good environmental quality. It is therefore becoming popular to refer to the 'environment driver' as one of the cornerstones of regional economic policy.

6.4.2 Regeneration benefits

Evaluating the benefits from intermediate outputs poses difficulties for economic analysis (H. M. Treasury, 2003), but this is typical of regeneration policy, which invariably includes environmental and infrastructural improvements over long time horizons for the supposed general good of an area. CJC Consulting (2003) note that investment in the reclamation of degraded industrial areas using forestry cannot easily be evaluated as reclamation is often a small part of, and inseparable from, a wider development initiative.

An indication of the overall economic regeneration benefits of woodland may be inferred from a Capital Modernisation Fund investment on part-brownfield, part-agricultural land in three community forest areas of the UK. FC undertook an *ex-ante* CBA and listed a wide range of social, environmental and economic benefits that they expected to flow from the programme. An 'ex post' evaluation was conducted by Selman *et al.* (2003), indicating that overall value-for-money of the project was favourable, despite inevitably

high costs being incurred as a result of difficult physical and social conditions, and the pioneer nature of much of the work. In terms of direct project costs, the establishment of each hectare of community woodland in the project was around £10,000, albeit the cost to the Treasury and Forestry Commission was significantly less than this. Timber revenues from the project sites were likely to be very modest, although were sufficient to make a useful contribution to maintenance costs. The report surmised that the establishment and maintenance costs were not unduly high compared with other 'soft' end-uses for brownfield sites, and that the project's social and other non-market benefits should justify the scale of expenditure. A precise cost-benefit ratio was not calculated because of problems of sensibly reconciling substantial up-front costs with often intangible and long-term benefits, over unpredictable timescales, as the woodlands mature. Nonetheless, the analysis considered it likely that the annual public benefit eventually deriving from the project would exceed £4000/ha/year, although there were also long-term costs and risks which might need to be addressed by measures such as 'dowries' for maintaining some of the more difficult sites.

6.5 Recent experience from forestry/woodland partnership projects

Recent forestry projects have been cross-cutting and intended to demonstrate the increasingly multi-benefit nature of forestry policy objectives. It is therefore somewhat artificial to separate out projects as making specifically 'rural development' or 'economic regeneration' contributions. Further, not all projects have yet been formally evaluated and their benefits must be inferred from their development plans and other sources. However, a variety of recent experience is summarised below.

6.5.1 Economic regeneration

Greening for Growth

The Greening for Growth partnership aims to deliver a long-term programme of environmental improvement and community action as an important new measure to regenerate South East Northumberland, between Seaton Delaval and Shilbottle. The partnership aims to improve the future prospects of the area based on confidence, quality of life and new business opportunities, as well as adding value and impetus to more traditional regeneration measures. The programme draws upon the best practice from the national Community Forest programme and the work of the Groundwork Trusts, and was established as a result of the publication of the Northumberland Coalfield Environmental Enhancement Strategy (NCEES). The NCEES identifies a comprehensive £25 million programme, to be implemented over 20 years.

Newlands project

In North-West England, the Newlands project is a partnership principally between the North West Development Agency (NWDA) and the Forestry Commission, aiming to achieve a step change in land reclamation activity across the region. The scheme aims to economically and socially rejuvenate derelict land across England's Northwest, primarily through the development of new areas of community woodland, delivered through the partnership. Given the large number of sites (1,600 in total) and area (14,913 hectares), the approach needs to be sharply targeted, and a purpose-designed 'Public Benefit Recording System' (PBRS) has been used to target areas giving a high level of benefit from regeneration. Following initial site identification by PBRS, preliminary selections will be subject to an Additional Impact Assessment (AIA) which assesses each site's potential in more depth, again focusing on social, environmental and economic issues, both in the long and short term. The programme received an initial

allocation of £10m for a 3 year period from April 2002 although a figure of £23m has more recently been quoted.

6.5.2 Rural development

South West forest

The South West forest is a major rural development project in Devon financed through a partnership which includes EU development aid and Forestry Commission funding (FC, 2002). It aims 'to encourage tree planting as a way of stimulating and supporting farm businesses and rural incomes, and enhancing the lifestyles and landscapes of local communities' (South West Forest, 2003). The Forest area covers 300,000 ha with a population of 180,000. The development plan aspires to increase tree cover to 15% from the current level of 10% - i.e. some 15,000 ha over the next 15 years. Planting was around 50% conifers in 1999 and 2000 but has since fallen to under 10% in 2005. The SW forest project is currently being evaluated by PACEC for the Forestry Commission.

Given the multi-benefit nature of the exercise, types of planting differ greatly from the traditional 'industrial' model and will include commercial farm woodlands, mixed woodlands and copses, community woodlands, orchards, hedgerow trees and domestic plantings. Much of its wider work is associated with providing advice, educational benefits, training and apprenticeship, wood fuel, sustainable construction, tourism development, and showcasing products and services.

The focus of expenditure has been on new woodland creation. Payments have been almost entirely for new planting, with only 2.8% of the public expenditure for the management or improvement of existing woodlands. The average rate of WGS support on new planting to date has been £2,219 per ha. If the second planting grant instalment and the range of possible FWPS payments are included the range of possible NPVs, discounted at 3.5%, lies between £4,038 and 5,254 per ha. Staff and administrative costs of the programme will presumably be documented in the PACEC report. .

Forest Futures

Forest Futures – Cumbria's Woodland Rural Development programme – is aimed at land and woodland owners and related operations such as coppicing and sawmills. It also assists communities in rural towns and villages to open up or plant new woodlands for local people. It has also supported tourism businesses such as hotels and outdoor centres where the woodlands are part of their enterprise. The programme consists of new Forestry Commission grants for creating and managing woodlands, a new package of business support and grants, and help and advice for land and woodland owners.

This programme has a greater emphasis on existing woodlands than the South West forest but 80% of grant aid is still on new planting. To date WGS support of £1.52m has been given for around 362 ha of existing woodlands and 584 ha of new planting. Again this programme is currently being evaluated by PACEC.

Marches Woodland Initiative

In the West Midlands, the Marches Woodland Initiative (MWI) operated from May 1997 until March 2002, initially part funded through an Objective 5(b) programme. Areas of activity were: woodland management advice, primarily in support of WGS applications; assistance, mainly through small grants, to wood-using businesses; and information and networking activities aiming to update and connect different actors within the wood chain. The MWI also had environmental objectives. Performance in relation to these objectives was evaluated by Eco Tech (2000), who drew particular attention to the variable quality of woodland management in the region, and the generally adverse

implications of this for conservation value. The approach is typical of projects which aim to overcome the generic problems faced by woodland microbusinesses, for example in meeting the deadlines and technical requirements of end-users, or of end-users' awareness of local capacity.

Since the cessation of WMI the 'Heartwoods' project[15] has continued to provide a similar range of assistance in the area, with a vision to promote the sustainable management and production of West Midland's woodland resources and to develop their use in manufacturing and other industries in the region.

6.5.3 Importance of location

One key issue to emerge from evaluations of programme funding has been the importance of the location of new planting, which strongly influences its potential to contribute to policy objectives. Thus, on the one hand, accessibility to centres of population greatly affects the degree to which public benefits are realised, whilst on the other, proximity to access roads and processing facilities is important for commercial benefits. Some of the benefits are diffuse and cannot easily be disentangled from wider phenomena such as neighbourhood confidence, for example.

The locational dimension is well illustrated by a recent evaluation of the Grampian and Central Scotland Forests (CJC Consulting, 2004a). Both of these projects were associated with 'challenge funds' for expansion of the woodland area. The Grampian Forest was principally concerned with diversification of farmland, and the Central Scotland Forest with promoting multi-purpose woodlands in a populous and highly visible 'gateway' area of variable environmental quality and recreational opportunity. Timber production was the principal aim of the former, but was also prominent in the latter.

Despite some missed opportunities in Central Scotland, recreation and landscape benefits were an order of magnitude higher than for Grampian, resulting in a favourable cost-benefit ratio for the former but not latter. In neither location did timber and other cash values justify planting, underscoring the lack of a clear rural development case. In Grampian, income was calculated at £1,204/ha (present value at 3.5%) relative to costs of £3,586; in Central Scotland, the figures were £1,034 and £3,536 respectively.

6.5.4 Conclusions from case studies

Four key points stand out from the major programmes discussed above:

- Modern policy emphasises multiple benefits, and recent projects/ programmes strongly reflect this.
- Sharp falls in timber prices have undermined the case for timber production as an instrument of rural development.
- Given the growing emphasis on public benefits, the location of new planting is paramount.
- Outcomes are often diffuse and long-term, creating analytical problems such as risks of double-counting closely related benefits or of meaningfully predicting net benefits which might accrue in 40+ years time.

[15] http://www.heartwoods.co.uk

6.6 Implications for the policy agenda

Evidence

There is a plethora of information relevant to the rural development benefits from forestry but very little hard evidence on the performance of major schemes which have had rural development as a prime objective. Evaluation is problematic because benefits occur over a long time period and most are indirect and not easily measurable (e.g. on tourism or timber processing). A more detailed examination is needed into the case for intervention in commercial forestry if current price levels continue and economic activity in the sector declines because crops are not harvested and replaced.

More evidence is need on the way forestry may generate benefits to tourism. There is also a dearth of costed information on specific tourism projects in either the public or private sectors. The current evaluations of the South West Forest and Forest Futures projects being undertaken by PACEC should provide more information on impacts from new woodland creation and the development of existing woodlands.

Rural development

The case for intervention to develop rural areas is regional-specific i.e. where social and economic conditions provide a case for intervention. This would indicate that regional targeting is required. Most RFFs include economic development in their lists of priorities but in only one region is this the priority.

The strongest case for forestry as a mechanism for rural development is in terms of procuring valued public goods, with any contribution to the local economy seen as a desirable spin-off. The public goods need to be clearly identified and in remoter areas (where the case for rural development will be strongest) there have to be clear benefits for tourism because low populations density will limit the benefits to local people. There is a case for supporting the private sector in establishing and expanding the delivery of recreational goods.

The case for intervention in mainly commercial forestry to generate benefits to local economies is weaker. Without subsidy, timber production is not generally a profitable activity at current timber prices. Hence, government needs to be very circumspect in subsidising planting to generate knock-on benefits to rural economies when the basic activity (timber production) is not viable for private producers. But more information on this aspect would be useful. There may be scope for expansion of SRC production (see Section 5.6) and this would provide knock-on economic benefits.

There is an emerging consensus that forestry and timber need to be ‘embedded’ in the local economy, rather than be promoted as ‘free-standing’ sectoral activities. Forestry governance thus needs to promote endogenous growth which contributes to the building of capacity in local communities and businesses, and which assists increasing cohesion in the woodland supply and marketing chains, whilst optimising the multiple use of woodlands. The nature of this will clearly differ according to a region’s distinctive woodland mix.

Some degree of targeted economic development support may be appropriate, ranging from an industry ‘cluster’ in regions with a large-scale timber sector to more modest projects where revitalisation of traditional woodland cover is the aim. There is scope for adding value locally to timber harvests if deficiencies in training, woodland management, awareness, supply and marketing can be remedied. There is scope for targeted advisory and promotional activities in regions where there is evidence of poor knowledge of local (often hardwood) resources, poor coordination of local producers in supplying and

marketing timber, and missed opportunities to 'add value' to distinctive locally produced timber. Small scale processors may merit assistance in overcoming barriers to investment and expansion.

Regeneration and urban development

The case for intervention to facilitate woodland creation and improvement within and near urban areas in need of regeneration is very strong. Not only are there potential benefits to quality of life in terms of recreation, amenity, health and social inclusion but there are almost certainly impacts on business attraction and retention. This role of trees and woods to deliver on a range of community, environmental and development agendas should feature in policy.

Tree planting as a framework for new development and as an after-use for terminated development is already encouraged by the planning system. This is often achieved at little cost to the public, especially where developers contribute, through legal agreements, to creation and maintenance.

7 Cross cutting issues

7.1 Introduction

This chapter explores a number of cross-cutting issues that have developed from the analysis of evidence in previous chapters.

7.2 Sustainable forest management

Much of forestry in England is commercially unviable at current prices. Given the international agreements made by the UK and the crosscutting importance of sustainable development to the government's policy agenda there is a need to re-examine the interpretation of SFM. The case for encouraging 'sustainable' domestic timber production to substitute for imported timber harvested non-sustainably could form part of this assessment.

The UKFS is only one possible statement of SFM and its interpretation has changed radically in recent years in response to the economic reality facing forestry. The interpretation of SFM is an important issue facing not just the UK but the whole European forest sector (FAO, 2005).

7.3 Enhancing benefits - new planting or existing woodlands?

At the time the EFS was launched, forest expansion was a UK policy objective. In England, the Rural White Paper (but not the Rural Strategy) wanted a 'significant increase in woodland cover across England'.

In order to justify expansion the case has to be made in terms of what the expansion will deliver and what costs are involved. New woodlands can add to the carbon sink and increase the renewable energy and sustainable materials potential. Woodland creation generally has the greatest potential for impacts on local economies.

The key is to identify the locations where the creation of new woodlands of particular types will provide high levels of benefit. There are numerous examples in the review where new planting can deliver benefits to the biodiversity, health and the environment in which communities live. But creating woods may also imply expenditure liabilities for the future if government wishes to see woodlands under continued active management.

By way of contrast, the existing woodland stock is a major resource for biodiversity, recreation and health. Evidence is quite limited on the benefits from previous WGS expenditure because detailed evaluation has not been undertaken. The current FC proposal for their evaluation is also limited in scope. This should not prejudice investment in the existing estate; our view is that an increase in the proportion of expenditure on the existing estate (see Section 2.8) is likely to be beneficial. This is the case in relation to the biodiversity, recreation and health.

7.4 Adjustment to market conditions

The evidence now points to a decline in the competitive position of UK forestry as compared with that in the Baltic States, Eastern Europe and Russia. There is evidence of a possible bottoming-out in prices but they remain extremely depressed. Policy needs to define an adjustment strategy for both public and private estates that maximises the public interest. This needs to focus particularly on coniferous planting that is unprofitable

to restock. Creating opportunities to deliver public benefits (or avoid disbenefits) will form part of the adjustment where this is cost-effective.

7.5 Locational and regional aspects

The creation of RFFs injects a regional perspective into national strategy. Alongside this it is clear that many of the benefits from forestry are spatially determined by proximity to population centres, WFD-sensitive water catchments and the location of existing woodlands. This review supports most of the RRF regional priorities but not without some caveats. For example the economics of using wood and SRC as sources of non-renewable energy are questionable, as is the extent to which forestry can deliver a net increase in jobs.

RFFs raise some critical issues for the development of Defra forestry strategy:

- Regional differences exist in priorities for government action in forestry.
- There appears to be no formal way in which national requirements, such as that of delivering on SSSI and UKBAP targets, are linked to RFF expressions of regional priorities. Defra strategy has to address the issue of how regional and national interests are to be integrated.
- It is not clear what the regional priorities imply for the distribution of forestry expenditure.

7.6 Costs of forest creation on farmland

The expansion of forestry through new planting generally takes place on agricultural land. It is often assumed that savings in CAP support costs will go some way towards offsetting the budgetary cost to the UK exchequer of new planting. Where a farmer plants land s/he will typically have an entitlement under the SPS which it may not be possible to activate because forestry is not an eligible activity. This entitlement may be traded but if large areas of land were being planted the trading price would be very low because of a limit to the supply of land without entitlements. The situation is complex because of National Reserve issues. However, a reasonable assumption is that if there were a substantial increase in grant aid for forestry the grant aid would have to cover the loss of entitlement value. This would then keep the cost of the incentive needed to stimulate new planting at around £4,000+ per ha on improved land.

One thing that noone knows at present is what the market will be for entitlements without land. To activate entitlements one needs hectares and given that practically all agricultural hectares will have created an entitlement in 2005, where is that extra land going to come from? There will be some additional supply (reclaimed land, tenants concentrating entitlements on their home land) and there is the possibility of people trading high for low value entitlements in the early years of the scheme. But over time, as the agricultural area continues to decline, one would expect a surplus of entitlements, which will then have a low value. Farmers can keep hold of normal entitlements for three years before they disappear back to the national reserve.

To the extent that entitlements are not used or there is a surplus in the national reserve, this represents EU funds which are not drawn down. The gains to the UK from this will be minimal. In broad terms we can conclude that the cost of forest expansion will not be reduced by compensating savings in CAP support. This has implications for any substantial expansion that might be proposed to deliver carbon sequestration or biodiversity benefits. The budgetary costs could be substantial.

Farming can be associated with negative externalities especially from air and water pollution. Afforestation can deliver environmental benefits where the change in land use results in a reduction in the external damage from agriculture. To analyse forestry's contribution in reducing the full range of agricultural externalities was beyond the scope of this study. However, some key water pollution issues are examined in Section 5.5.

8 Conclusions for strategic policy

Prioritisation of action in relation to funding

Virtually all forests and woodlands produce multiple benefits. The size and mix of benefits depends on species, design, management, location and use. This review has identified several 'new' policy areas, not forming part of the EFS, where forestry has the capacity to contribute more strongly. These are:

- The health agenda
- Equity, community and other social agendas
- The climate change agenda
- Landscape and amenity
- Soils and water, including delivery on the WFD
- Renewable energy.

The fabric against which policy is developing has thus become more diverse and complex. We consider that the main *raison d'etre* for most intervention in forestry is to deliver public benefits that fall within other government policy agendas. It will therefore be important to assess how forestry measures up in cost-effectiveness terms against other mechanisms for delivering on each agenda. In many cases (e.g. delivering on health and social agendas) this points to the need for integration both in policy formulation and the activities of professionals on the ground. Limits on the size of both national and ERDP funding may well limit the extent of policy intervention. The issue for policy then becomes one of setting priorities.

Below we draw specific conclusions regarding the implications of the evidence base for the major elements of policy

Commercial timber production

The economic case for supporting commercial production through woodland creation or restocking is not strong. The current weak state of timber markets and low returns on capital is not by itself a reason for intervention since this may merely perpetuate unprofitable investment and delay adjustment.

However, woodlands are important in the landscape, fix carbon and may support biodiversity and access. If such benefits are at risk from less active management there is a case for considering intervention to maintain public benefits. What is needed is a policy that assists landowners to adjust to a changing market situation in which the UK has become less competitive as a timber producer.

A case can be made for grant-aided restocking where restocking is a condition of felling. Re-stocking conditions may be seen as placing an undue cost on owners which can lead to non-harvesting, but this is unclear. The re-stocking conditions need to be justified in terms of protecting the forestry resource and preventing negative landscape change.

The economic evidence supports adjustment through conversion on ancient woodland sites and demonstrates greater public value for native and broadleaved species. A degree of deforestation of conifers through open ground creation should not be ruled out where the environmental effects are not obviously negative. This has occurred on the public estate in some locations.

Access and recreation

The public estate is a major source of recreation benefit and there is a strong case for maintaining the facility and expanding it where this can be justified by additional visits. Benefits from increasing the total recreation stock (through woodland creation or conversion of use) will depend on location and woodland characteristics. The emphasis should be on accessibility to people and the avoidance of duplication. This suggests an urban and peri-urban focus, where even single trees and very small woods can be very highly valued. Conversion of existing woods for recreation will normally be more cost effective than new creation and offer much higher benefits in the short term. The large private sector, mainly broadleaved, estate should offer substantial opportunities for adding to recreation provision.

A strategy for woodland recreation provision has to take account of the locational distribution of both the supply of access and the demand by people for its use. This requires a carefully targeted approach. Woodlands can be substituted for other greenspace, which implies that integration between woods and other greenspace in local networks is needed. There is thus a strong case for using a GIS-based approach to deficit identification to cover all recreational greenspace.

Health

The evidence base on air pollution benefits is incomplete and health benefits may be substantially underestimated. There is a need for more evidence about the absorption effects of trees, woodland and shrubs in urban areas and along roads.

Forests located near to where people live are an important health resource and the evidence suggests a higher profile for health issues in forestry policy. The main health benefits from accessible woodlands derive from increased and frequent physical activity. This indicates an emphasis on providing greenspace suitable for walking and other non-specialised activities easily accessible to people on a regular basis.

The limited evidence on health impacts of autonomous use of greenspace supports the conclusion that a clean, green, accessible local environment will deliver increased health benefits. New woodlands will contribute most where they are widely used and part of larger greenspace area/path networks etc., where there is a local deficit in supply. This again indicates an urban/peri-urban focus on intervention.

The cost-effectiveness of programmes designed to encourage physical activity in greenspace is unclear but there is considerable potential for benefits. The success of programmes depends on converting sedentary people to more active lifestyles over the longer term.

Contributions to other social agendas

Woodlands contribute to a range of education and social agendas and services (including probationary and community services). Detailed information is not available on the cost or extent of these services but they are clearly widespread and form an increasing aspect of policy delivery. It would be useful to have more information on the benefits delivered to other social agendas. This would better enable priorities to be established.

Government wishes the benefits from intervention in forests to be available to all. This would strengthen the case for a more urban focus in forestry together with targeted measures to facilitate use by under-represented social groups.

The forest sector can play its part in delivering on these wider social agendas and this should be included in policy.

Climate change

A case can be made for including woodland sequestration within carbon trading and supporting measures that facilitate trading by forest owners. Owners would then have an additional income stream and an incentive to manage trees to sequester carbon. But there may be practical problems in taking this forward.

Without trading, government should factor in the benefits in decisions on intervention in forestry, where this is not already covered by existing support mechanisms, and especially as regards incentives for forestry expansion. At the government's central value of £70 per tC for the social cost of carbon the social benefit is of the order of £200-400 per ha per year and this would roughly justify the level of grant aid typically required to launch major programmes such as the South West forest. However, within the context of the current policy agenda for emissions reduction it would be more logical to price C sequestration at the marginal cost of controlling emissions. An expansion of forestry by say 20,000 ha per year for 5 years in order to increase the carbon sink would cost possibly £400-500m in grant aid.

Renewable energy

Forestry's role as a source of renewable energy will depend on its competitive position alongside other biomass and non-biomass sources. The Renewables Obligation already creates demand for biomass, although this also stimulates biomass imports. The Biomass Taskforce found varying opinions about the cost-effectiveness and environmental implications of SRC.

Biomass from wood and SRC should form part of the emerging policy agenda for renewables. There is a significant resource of underutilised woods in England. The report awaited from the Biomass Taskforce report will assist in formulating policy as will and Defra's current review of energy crop costs. Clarification is required on the cost of SRC production and processing, its competitiveness with other energy corps, and the levels of subsidy required to expand production. Biomass production may represent a considerable opportunity for forestry if government were to provide the required incentives.

Biodiversity

Evidence from benefit valuation studies on biodiversity is very limited but reveals a preference for restoring PAWS and creating new areas of semi-natural broadleaved forest adjacent to existing sites. There are strong drivers for forestry policy from other agendas (e.g. SSSI PSA target, woodland bird indicator, UKBAP, England Biodiversity Strategy), and policy needs to respond to these. The evidence indicates a particular priority for protecting SACs and achieving favourable condition on these and other SSSIs. A high priority is also indicated for the restoration of former non-wooded habitats of high conservation value that have been detrimentally impacted by afforestation.

The linkage between forestry strategy and the delivery of UK and England biodiversity policies and targets (in particular the achievement of the Defra PSA target for SSSIs, UKBAP HAPs and SAPs and the Biodiversity Strategy for England) should be enhanced. In particular greater emphasis should be given to existing woodlands rather than expansion, unless expansion has specific high priority biodiversity benefits, and to the implementation of HAPs and SAPs, through the development of a forest BAP delivery plan.

Biodiversity priorities are in the main best served by concentrating on the improvement and maintenance of ecological quality in existing woodland, especially ancient woodland, rather than an expansion of woodland. The scope for large-scale recreation of 'wildwood'

landscapes that are dominated by natural processes should also be investigated and acknowledged in future strategies.

Not withstanding the need to meet current biodiversity conservation policy objectives, it is necessary to take account of, and prepare for, climate change by developing a more dynamic and adaptive strategy towards forest biodiversity conservation. In the short-term there needs to be a commitment to more research and debate amongst stakeholders on likely impacts and adaptation strategies.

Landscape and amenity

The economics evidence indicates that positive landscape values for woodlands can be substantial but are largely confined to urban areas and travel routes where people obtain benefits from seeing trees in the landscape. One strand in woodland policy should be to enhance landscape and provide amenity close to where people live (urban and peri-urban locations). But planting in highly-visited areas may also be justified where the enhanced landscape is appreciated by the public.

The economic analysis would not support planting to maintain or enhance landscape 'character' in remote locations with a low population where visual benefits to the public would be minimal. However, it is not clear whether some wooded landscapes may have non-use or cultural values because no valuation research has been undertaken on this aspect. There is a need for more research to quantify the value of woodlands in cultural landscapes in order to better inform the development of forestry strategy.

Soils, water protection and flood control

More research is required on the economic efficiency of woodland in reducing the risk of flood. On current evidence it would be difficult to include flood control as an element in forestry strategy.

In catchments sensitive to N, P and sediment loading new woodlands can improve water quality if planted in appropriate locations, mainly by reducing pollution from agriculture. It is doubtful if woodlands are a cost-effective mechanism for reducing N losses when assessed solely in terms of WFD benefits. But woodlands and buffer strips may have an important part to play in reducing P and sediment pollution.

Defra are developing strategies to address WFD issues and the role that forests can play will be clearer when the costs of alternative mechanisms for reducing diffuse pressures are defined.

Rural development and tourism

Forestry has been used to stimulate economic activity in rural areas and so create employment and income directly and through knock-on effects. However, much forestry (existing and new planting) is now unprofitable as a commercial activity. Its viability for growers thus depends on a continuing stream of public subsidy if active management is to occur.

As a rural development activity forest creation is unsatisfactory in a number of respects. The protracted timescale is problematic for rapid impacts, and farmers mainly use grant-aided woodland to facilitate farm restructuring or retirement, or as a way of obtaining cash from grant aid, rather than as a diversification of production. Direct public benefits in remoter rural areas from landscape, recreation etc. are small because few people are there to appreciate them. However, all land-based mechanisms for rural development tend to be costly in relation to benefits, and forestry is no exception in this respect.

The case for forestry in rural development is likely to rest on:

- Stimulating innovation in business development related to woodlands and wood processing (business support, information, addressing skill shortages, specific areas with development opportunities such as nature-based tourism, sport).
- Assisting woodland owners to develop existing woodlands for tourism including nature-based tourism and specialised recreational activities.
- Knock-on effects on the regional economy (environmental improvements to attract businesses, benefits to tourism).
- Targeting areas in special need of development and rural regeneration (such as high IMD areas, EU structural policy target areas).

Evaluation of the benefits from major programmes which are underway should improve the evidence base. Until more evidence comes on line a cautious approach is needed, with a full assessment of expected benefits before intervention goes ahead.

Economic regeneration and the urban context

Woodlands do offer considerable potential as an element in regeneration and re-development. The evidence is fragmented and evaluations of major brownfield site regeneration schemes are lacking. Even so, we conclude that it should form part of policy to convert industrial and derelict sites and create an improved greenspace environment capable of attracting new business and housing, and contributing to government community polices. Because of the typically high cost of land, woodlands and trees are best seen as complementary elements in development.

Much of the assessment of the environment and social outputs (landscape, recreation and health) from forests points to much higher benefits close to where people live. Whilst this indicates that policy should focus more on intervention in and around major urban centres it does not exclude smaller centres where there are deficits in woodland and greenspace provision.

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10 Annex I Regional forestry frameworks – position at October 2005

Region / Conservancy (with agreed framework title)	Publication date	RFF Steering Group members[16] **(Chair role indicated *)**	**Relevant supporting work**	**Steering & Delivery arrangements**	**Main Themes and Priority Topics**
North East England Regional Forest Strategy	March 2005 – *Trees, Woodlands, Forests and People*	RFS Delivery Group - 1, 2, 3, 4, 5, NE Comm Forests, NE Forestry Action Group*, EN, HDA, Association of NE Councils, Woodland Trust. Industry representative	Strategic Study of the NE Regional Forestry Sector (May 2000)	Steering Group currently remains mainly the same with the addition of two new members. Action plan for 05-06 written alongside draft of final Strategy. Funding being sought for Framework Officer, hoped to start by end 2005. Meanwhile delivery will take place through the actions of steering group member organisations.	Improved Health Improved Quality of Life Sustainable Communities Improved State of the Environment Effective Response to Climate Change Improved Infrastructure Regenerated Economy Expanded Processing Sector and Increased Jobs Secure and Productive Forest Businesses Increased Tourism Capacity Communications Delivery
North West England Regional Forestry Framework	August 2005 – *Agenda for Growth*	1, 2, 3*, 4, 5, EN, Mersey Forest, EA, Univ Cent. Lancs, NT & woodland owner reps.	NWE Wd & Forest Industries Strat. Study (2003) led to evidence base publication (2004).; Links to NW Sust'y; developed Public Benefit Rec Syst. Recently established a Northern EFIP group	Steering Group will remain the same as they are keen to be involved moving the strategy forward. Advocate has been taken on part time to write the Action plan over 1 year, hosted by the Regional Assembly.	6 long lived key action areas: Biodiversity and Landscape Climate Change Health and Wellbeing Forest Industry Resourcing Image of the Region Key areas will each have identified priorities. This will link to the Action Plan, which will be developed during 2005-6 and reviewed after 3-5 years
Yorkshire and The Humber Regional Forestry Framework	July 2005 – *The Value of Trees in our Changing Region*	1*, 2, 3, 4, 5, and FC RAC.	Forestry Forward – Y&H Forestry Foundation Study (July 2002) Reg. Env. Enhanc. Strategy (2003)	Outline 1st year Action Plan will be published with the Strategy. A more detailed plan will be prepared as organisations reorder their priorities. Steering Group will initially continue with current constituents	The Regional setting Trees, Woods and People Sustainable Forestry Creating a setting – investment in the environment The Natural Environment The Healthy Environment Climate Change Delivering the Strategy

[16] 1 = Government Office; 2 = Regional Development Agency; 3 = Regional Assembly; 4 = Countryside Agency; 5 = FC (including FE input)

Region / Conservancy (with agreed framework title)	Publication date	RFF Steering Group members[16] **(Chair role indicated *)**	**Relevant supporting work**	**Steering & Delivery arrangements**	**Main Themes and Priority Topics**
East Midlands Regional Forestry Framework	August 2005 – *Space4Trees*	1*, 2, 3, 4, 5, EN, EA, EH, RDS	FC input to Assembly Reg. Energy (Renew.) and Env. Strategies, & Env. Econ. Report. RFF linked to the Regional Environmental Strategy	Framework around which the Strategy is based has been endorsed by the Regional Assembly. Strategy Document and 3-5 year Action Plan to be published together. Action Plan has been subject to consultation through workshops and short electronic consultation with earlier respondents. Delivery co-ordination under discussion.	Trees and People (Health and Recreation) Trees and the Environment (Landscape scale working and protection of ancient woodland) Trees and the Economy (Environmental management, Leisure and tourism, Renewable Energy, wood products, Creating attractive environment for investment) Communication and Collaboration (Community participation and learning, collaboration and networking)
West Midlands Regional Forestry Framework	*October 2004 – Growing our Future*	1*, 2, 3, 5, Natural England, West Mids Woodland & Forestry Forum, NGO/Woodland Initiative rep, Private sector rep,	WM Woodland & Forestry Forum. 'A Growing Resource' – baseline study.	Steering Group slimmed to 8 players, who direct West Midlands Woodlands Forum sub groups on each topic. Steering Group membership changed from those with Strategic knowledge to those with Delivery expertise.	Woodland cover The Woodland and Forestry Industry Wood Energy Recycling Recreation and Tourism Health and Well Being Education, Learning and Skills Fostering Social Inclusion Enhancing Biodiversity Environment and Cultural Benefits Supporting the Regeneration of the West Midlands
East of England Regional Woodland Strategy (EERA and FC)	Nov 2003 – *Woodland for Life*	1*, 2, 3, 4, 5, EN, EH, EA, FC RAC, RDS, Health Devel'mt Agency, DCMS	Wood Bank http://www.woodlandforlife.net This website is the primary means of communication for the strategy.	The Strategy has clearly focused the work of the Forestry Commission in the region, particularly the Economic Development and Social Development Officers' work. Steering Group arrangements post-launch are being reviewed. Reporting on the relevant activities of other organisations is being developed.	Quality of Life Spatial Planning Economic Development Renewable Energy Education and Learning Natural Environment
South East England Forestry and Woodlands Framework	*Octiber 2004 - Seeing the Wood for the Trees*	1, 2*, 3, 4, 5, EN, EA, FC RAC, FTA, WT, Local Authorities Woodland Network	Access study with Univ Brighton. Funding woodland mgmt report with Royal Agric College, Glos	Steering Group to continue with current members to assist overall direction and review progress. Meeting twice a year plus third meeting as an open forum/conference for wider stakeholders. Work will focus on Priority topics where others are not acting. Priority topics will be reviewed and replaced as action on each topic deemed complete.	Better places for people to live Enhanced environment and biodiversity A stronger contribution to the economy A secure future for our woodland resources: Initial Priority topics: Sustainable Communities Ancient Woodlands Renewable Energy Regional Spatial Planning Main actions at present to – Work to engage with Planners and Local Development Frameworks, promoting role of trees and woodlands in the priority topics. Develop 'one stop shop' information tool for the sector in the South East as part of reporting.

Region / Conservancy (with agreed framework title)	Publication date	RFF Steering Group members[16] **(Chair role indicated *)**	**Relevant supporting work**	**Steering & Delivery arrangements**	**Main Themes and Priority Topics**
South West England Regional Woodland and Forestry Framework	July 2005 – *SW Woodland and Forestry Framework*	1*, 2, 3, 4, 5, FC RAC, EN, FTA, Exmoor NPA, RSPB, Dorset CC, Comm Forests, Bill Slee (C&G)	SWE Woodland & For Strat. Econ Study http://www.southwestrda.org.uk/publications/regeneration.shtml Woodfuel Strategy Public questionnaire as part of consultation process	Implementation Plan will be prepared once Framework published. Resources being identified for implementation. Steering group will be reformed for implementation period. Information gathered in monitoring of activities should feed through to Regional Observatory.	Livelihoods (Economic issues eg use of local timber, renewable energy) Quality of life and society (eg sustainable communities, access) Cross-cutting issues – includes woodland management, integrated approach, climate change)
London London Trees & Woodland Framework	*March 2005* - Connecting Londoners with Trees and Woodlands	1, 2, 3, 4, 5, EN, Corp. of London.	The Mayor's Strategy Documents. Green Gateway Strategy	Strategy adopted as Greater London Authority Strategy. Implementation Plan to be produced by Framework Manager, in second half 05/06 alongside analysis of potential funding sources. Steering through the London Trees and Woodland Implementation Group.	To ensure trees and woodlands contribute to a high quality natural environment To help shape the built environment and new development Through people's contact with trees and woodland to help foster community and individual people's wellbeing and social inclusion To support the capital's economy

Source: Richard Britton, Forestry Commission

11 Annex II Priority Habitat targets, and biological trend and progress towards targets in England

UK BAP Habitat / targets	Biological trend condition/ progress towards target in England
Upland oakwoods	Increasing
Maintain the current extent (70,000 to 100,000 ha) and distribution of the upland oakwood system	Unknown
Improve the condition of the existing upland oakwood resource, using a mixture of management for timber (predominantly as low intensity high forest), as sheltered grazing, and minimum intervention	Some progress (behind schedule)
Avoiding other habitats of high nature conservation value, expand the area of upland oakwood by 7,000 – 10,000 ha (about 10%) by planting or natural regeneration on currently open ground, and by conversion from non-native plantations, by 2005	Some progress (behind schedule)
Complete the restoration to site-native species of 7,000 – 10,000 ha (10% of the total resource) of former upland oakwood that has been converted to non-native plantation on Ancient Woodland Sites	Some progress (behind schedule)
Upland mixed ashwoods	Unknown
Maintain the total extent (approx. 67,000 ha) and distribution of upland mixed ashwood.	Unknown
Maintain the current extent (40,000-50,000 ha) and distribution of ancient semi-natural upland mixed ashwood.	Unknown
Initiate by 2004 measures intended to achieve favourable condition in 100% of upland mixed ashwoods within the SSSI/ASSIs and Special Areas of Conservation	Not reported
Initiate by 2004 measures intended to achieve favourable condition in 80% of the total resource of upland mixed ashwoods	Some progress (behind schedule)
Achieve favourable condition over 50% of the total resource by 2010.	Not reported
Achieve favourable condition over 70% of the designated sites by 2010.	Not reported
Complete restoration to site-native species of 1,200 ha of former upland mixed ashwood which has been converted to non-native plantation on Ancient Woodland Sites by 2010.	No progress
Complete restoration to site-native species over a further 1,200 ha of former upland mixed ashwood which has been converted to non-native plantation on Ancient Woodland Sites by 2015.	No progress
Complete the establishment of 3,000 ha of upland mixed ashwood on unwooded sites, or by conversion of non-native plantations, by 2010.	No progress

UK BAP Habitat / targets	Biological trend condition/ progress towards target in England
Wet woodlands	Increasing
Maintain the total extent (50,000-70,000 ha) and distribution of wet woodlands.	Some progress (behind schedule)
Maintain the current area (currently estimated at 24,000-30,000 ha) of ancient semi-natural wet woodlands.	Unknown
Initiate measures intended to achieve favourable condition in 100% of wet woodlands within SSSI/ASSIs by 2004.	Unknown
Initiate measures intended to achieve favourable condition in 80% of wet woodlands of the total resource by 2004.	Some progress (behind schedule)
Achieve favourable condition over 50% of the total resource of wet woodlands by 2010.	Not reported
Achieve favourable condition over 70% of the designated sites by 2010.	Unknown
Complete restoration to site-native species of 1,600 ha of former native wet woodland that has been converted to non-native plantations on ancient woodland sites by 2010.	No progress
Complete restoration to site-native species of a further 1,600 ha of former native wet woodland that has been converted to non-native plantations on ancient woodland sites by 2015.	No progress
Complete establishment of 3,375 ha of wet woodland on unwooded sites or by conversion of plantations by 2010.	Some progress (on schedule)
Lowland beech and yew woodland	Declining (continuing / accelerating)
Maintain the total current extent (c. 30,000 ha) of lowland beech and yew woodland.	Unknown
Maintain the existing area of ancient semi-natural lowland beech and yew woodland (estimated to be between 15,000 and 20,000ha).	Unknown
Initiate by 2004 measures intended to achieve favourable condition in 100% of lowland beech and yew woodland within the SSSI/ASSIs and Special Areas of Conservation	Unknown
Initiate by 2004 measures intended to achieve favourable condition in 80% of the total resource of lowland beech and yew woodland	Unknown
Achieve favourable condition over 70% of the designated sites by 2010.	Unknown
Achieve favourable condition over 50% of the total resource by 2010.	Unknown
Restore to site-native species at least 750 ha of former lowland beech woodland which has been converted to non-native plantations on ancient woodland sites, by 2010.	Unknown
Restore to site-native species at least a further 750 ha of former lowland beech woodland which has been converted to non-native plantations on ancient woodland sites, by 2015.	Unknown

UK BAP Habitat / targets	Biological trend condition/ progress towards target in England
Establish by colonisation or planting 1,500 ha of lowland beech and yew woodland on unwooded sites or by conversion of non-native plantations by 2010.	Unknown
Wood pasture and parkland	Declining (slowing)
Maintain the current extent and distribution of the total resource of wood-pasture and parkland	Some progress (behind schedule)
Maintain the current extent, distribution and condition of wood-pasture and parkland that is in favourable ecological condition.	Some progress (behind schedule)
Initiate in areas where examples of derelict wood-pasture and parkland occur a programme to restore 2,500ha to favourable ecological condition by 2010.	Some progress (on schedule)
By 2002 initiate the expansion of 500 ha of wood-pasture or parkland, in appropriate areas, to help reverse fragmentation and reduce the generation gap between veteran trees	Some progress (on schedule)

Source: UKBAP online 2002 reporting forms (http://www.ukbap.org.uk/habitats.aspx)