

CONSULTATION

UK INDICATORS OF SUSTAINABLE FORESTRY

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**Economics & Statistics Unit
Forestry Commission
March 2001**

Introduction

1. This document contains a range of forestry indicators, seeking views on the development of UK Indicators of Sustainable Forestry. The intention is to give a fairly comprehensive indication of the topics that might be suggested for inclusion, and an indication of the possible contents of a few candidate indicators. It has been produced for an expert consultation, seeking views that are technical rather than political. It particularly seeks views on:

- What should be included in indicators for the UK?
- Are there any other relevant and important indicators?
- Which indicators would require further development?
- What other data sources exist?

2. These indicators are intended to monitor forestry's contribution to sustainable development, bringing together and extending the previous structures adopted for the Pan-European Criteria and Indicators and the UK Forestry Standard (FC, January 1998). The components are listed below. Cross-references to the heading numbers of the Pan-European Criteria and Indicators (Third MCPFE, Lisbon, June 1998) are shown in brackets after topic headings.

A	Forest area
B	Forest production
C	Forest condition and management
D	Biological diversity
E	Soil and water
F	Air
G	People & forests (workforce and communities)
H	Economic
I	Heritage and landscape

3. It is intended that these UK Indicators of Sustainable Forestry will be developed into a similar format to those published in "Quality of Life Counts" (DETR, December 1999) and "Towards Sustainable Agriculture" (MAFF, February 2000). Each indicator will typically occupy a full page, containing a chart or small table and up to 4 paragraphs of text. The first indicator in section A shows an example of this format.

4. Most of the indicators are long-term measures, and it is likely to be appropriate to update the full set at intervals of 3-5 years. However some indicators can be updated annually, and these have been marked "A". The annual indicators are not necessarily more important than the others, so have not been called "headline" indicators. An Internet publication would be updated annually with any new information available at that time.

Relevance and Importance

5. This document has tried to be as inclusive as possible, incorporating many suggestions for possible indicators. Some may not be directly relevant to measuring sustainable forestry, although they could be useful indirect indicators in the absence of direct indicators. To aid the process of selecting indicators, some have been assigned codes to signify one view of the importance of each indicator in the UK. Other views on their relative importance will be welcome in this consultation. The codes are:

I	important
N	neutral
U	unimportant
?	unclear

Targets

6. The document does not include any targets, and it is proposed that none should be included in the final publication. Forestry is a devolved subject, so questions about possible targets are more appropriate for indicators linked to the country Forestry Strategies.

Quality of Information

7. The current quality of information is indicated on a four-point scale:

1	Good data available – capable of being published as part of National Statistics
2	Estimate that could be published, based on available data (and perhaps modelling), but not National Statistics quality
3	Indicator that should be able to be developed, but sources are not yet well enough known to FC Statisticians to allow us to compile it
4	Relevant data do not exist at present – new surveys or data collection would be required

8. Any potential indicators marked as quality 1 can be compiled and published without any major additional resources. The same is true for quality 2, but it may be desirable to devote resources to improving the quality, over a period of months or years. Any indicator marked as quality 3 would require further investigation, after which it could be reassigned to a higher or lower category. For quality 4, new surveys or data collection could be very expensive, so it will be necessary to cost and prioritise any potential indicators which are thought to be desirable.

Data Sources

9. Many indicators use information for 1995, submitted by the UK in 1998-99 for the Temperate & Boreal Forest Resources Assessment 2000 (TBFRA 2000). This required estimates to be compiled on consistent definitions for all countries, that may differ from the definitions normally used in the UK.

10. Another source used for many indicators is the National Inventory of Woodland and Trees (NIWT), carried out in a rolling programme from 1994 to 2000. Some provisional results are included in this draft; full results should be published during 2001.

11. Much of the information about Forestry Commission (Forest Enterprise) woodlands comes from FE's geographic information system (GIS). Some of the data in this GIS (originally the sub-compartment database) have different definitions from the NIWT. For some topics it is only possible to obtain data from one source, or combined information from the two sources may not be fully consistent.

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March 2001

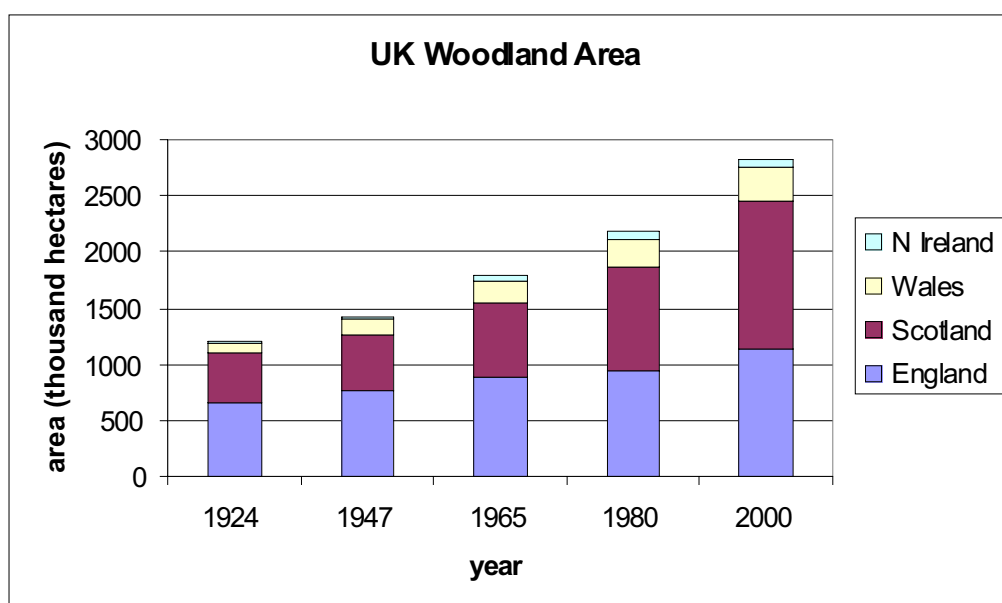
A. Forest Area (pan-European 1.1)

A1. Total area of woodland (quality 1) A

UK Woodland Area (Thousand hectares)

	1924	1947	1965	1980	2000	2000%
England	660	755	886	948	1135	8.7%
Scotland	435	513	656	920	1318	16.9%
Wales	103	128	201	241	291	14.0%
N Ireland	13	23	42	66	83	6.1%
UK	1211	1419	1785	2175	2827	11.6%

Source : GB Censuses / National Inventories of Woodlands + NI Statistics



Key Points The area of woodland in the UK has increased through the 20th century, from around 5% cover at the start of the century to over 11% now. In 2000, woodlands covered 9% of England, 17% of Scotland, 14% of Wales and 6% of Northern Ireland.

Relevance Forests and woodlands make an important contribution to our sustainable development goals. They enhance our landscape and are habitats for wildlife. They are places for leisure and recreation and are an economic resource for timber production, tourism, and local development and regeneration.

Trends Much of the increase in woodland areas this century came from new commercial conifer plantations in the 1950s to 1980s, especially in upland areas of Scotland, planted by the Forestry Commission and private owners. During the 1990s, 15-20 thousand hectares of new woodland have been created each year in the UK, mostly by private owners assisted by the Woodland Grant Scheme and other government grants, and the majority of new woodland creation is now broad-leaved woodland or native Caledonian pine.

Background Over previous centuries, there was a gradual loss of forest cover in the UK, which fell to its lowest level of 5 per cent at the start of this century. Today, the area of woodland has doubled from that low. The areas for 2000 are based on emerging results from the National Inventory of Woodland.

A2. Geographic distribution (quality 2)

The geographic distribution of woodland is relevant in considering its economic value to wood processing industries, and its social value for landscape and recreation.

The areas with greatest % woodland cover include SW Scotland and parts of NE Scotland, but also South Wales and southern home counties.

Map showing % woodland cover for each county/district or region.
Now available (for 2ha+) from Woodland Surveys for National Inventory bases 1995-1999.
To be updated to 2000, and include small woodlands, during 2001.

Could also compare with population, but more relevant to Communities indicators.

A3. By main species (quality 2)

This gives an indication of the overall diversity.

GB High Forest (Census of Woodland) for 1980 and earlier, National Inventory for 1995-2000

Areas, thousand hectares	1924	----	1965	1980	1995-2000
Total GB High Forest			1267	1881	
Scots Pine and broadleaves			602	801	
Scots pine			252	241	
Birch				68	
Beech			66	74	
Oak			166	172	
Ash				70	
Mixed & other broadleaves			118	176	
Other conifers			665	1080	
Sitka spruce			248	526	
Larches			147	152	
Lodgepole pine				127	
Corsican pine			37	47	
Douglas fir			43	47	
Norway spruce			106	117	
Mixed & other conifer			84	64	

The area of Sitka spruce doubled between 1965 and 1980, but there were also increases in the area of broadleaves. To update with 1995 when National Inventory complete

A4. By ownership : (quality 2)

The ownership of woodland may affect the supply of timber from the woodland, and also its availability for recreational use. But the simple totals may not be useful indicators.

UK , 1995, thousand hectares, estimates for TBFRA 2000		Avail	Other	Total
Total		2108	361	2469
Public		965	107	1072
Private		1143	254	1397
	Available for wood supply*			
Public	State (inc MoD, Crown Estates, etc)	885		
	Other public	80		
Private	Individuals	800		
	Forest Industries	25		
	Other private institutions	318		

* as defined for TBFRA-2000
 Note: new estimates will be available from National Inventory of Woodland

A5. Age class distribution (quality 2)

The age class distribution is relevant to an assessment of future timber production, but it also gives a measure of woodland diversity.

GB high forest 1998, as in Forestry Industry Handbook 1998

Planting year	Area (000 ha)
Pre 1861	69
1861-1900	136
1901-1910	51
1911-1920	40
1921-1930	73
1931-1940	88
1941-1950	145
1951-1960	305
1961-1970	395
1971-1980	345
1981-1990	339
1991-1997	223

Include all woodland, not just high forest?

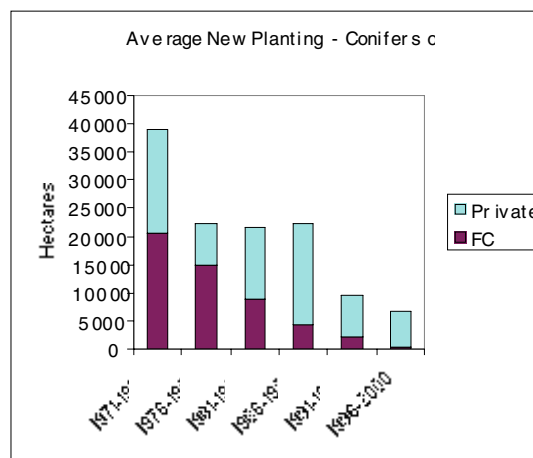
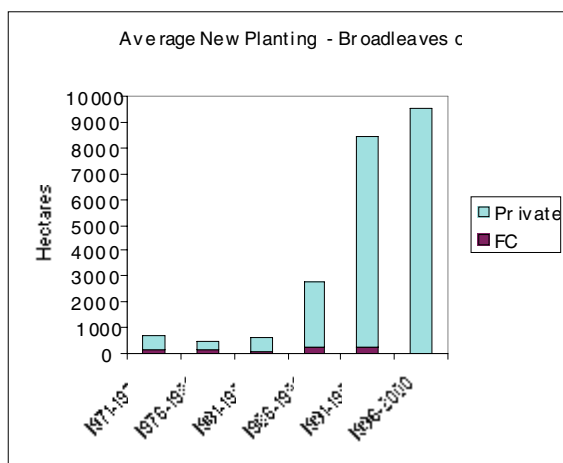
Update to 2000, based on National Inventory. Add Northern Ireland.

And compare with age distribution from an earlier census.

Show as bar-chart, instead of table

A6. New woodland creation (new planting) (quality 1) A

Annual averages for 5-year periods 1971-2000 (note different scales)



Perhaps (also?) combined chart for broadleaves and conifers separately (and if possible, Scots Pine identified), to show that the majority of new woodland creation is now broadleaves and SP

A7. Restocking (quality 1) A

Could include a chart giving annual data since 1970, with table in 5-year bands
Showing broadleaves and conifers separately (and if possible, Scots Pine identified)

But the area of restocking, on its own, is not a good measure of sustainable forestry, as there is an obligation to restock, so the area of restocking will just reflect the area harvested, with a time lag. A direct measure of area harvested and not restocked would be part of the following indicator (loss of woodland), or possibly as increased open space in woodland [depending on whether area of woodland includes integral open space]. Measures of quality of restocking would be in the section on forest management.

A8. Total planting, by species (quality 2)

This gives another measure of the changing overall species diversity (see also A3)

Annual averages, new planting plus restocking, UK

Areas, thousand hectares	1986-95 (TBFRA 2000)	1995- 2000
Scots Pine and broadleaves	10.4	
Scots pine	2.4	
Birch	1.6	
Beech	1.2	
Oak	1.2	
Ash	1.0	
Mixed & other broadleaves	3.0	
Other conifers	26.7	
Sitka spruce	17.4	
Larches	2.2	
Lodgepole pine	2.0	
Corsican pine	1.2	
Douglas fir	1.1	
Norway spruce	0.7	
Mixed & other conifer	2.1	

A9. Loss of woodland (quality 4)

It will be important to develop indicators of loss of woodland, but this is a serious gap in our current information. Need to cover (and distinguish) three types of loss – to agriculture, to development, and restoration of special habitats and landscapes (the latter could be a positive indicator).

In the future (but not as presently held) it may be possible to do something with WGS data on felling licences. Investigation of possible sources should concentrate on data from planning systems, data on land-use change, estimates from National Inventory of Woodland, and from 2000+ sample 1 km squares used for survey of Small Woods & Trees.

May also want to present matrix of land-use change (source DETR) to put the woodland changes in context.

A10. Summary : stocks and flows

Bring together in a single table information about the stock (area) and flows (new planting, losses and felling/restocking), possibly for 10-year periods.

B. Forest Production

Growing stock (1.2)

B1. Total volume (conifer, broadleaved) (quality 2)

Million cubic metres overbark (to 0 cm minimum), 1995, TBFRA-2000

	Conifer	Broadleaved	Total
On forest available for wood supply	188	105	293
On other forest	2	22	24
Trees outside forest			36

B2. Volume broken down by main species (quality 2)

This is relevant to an assessment of future timber availability. Data should be available, based on National Inventory

B3. Mean volume per hectare (quality 2)

[can be calculated, as below, but not viewed as meaningful for UK] (quality 2)

Forest available for wood supply

	Conifer	Broadleaved	Total
Growing stock (million m ³)	188	105	293
Forest area (thousand hectares)	1522	586	2108
Mean growing stock / hectare	124	179	139

Growth and removals of wood (3.1)

B4. Gross annual increment (quality 2)

Million cubic metres overbark (to 0 cm minimum), 1995, TBFRA-2000

	Conifer	Broadleaved	Total
On forest available for wood supply	12.85	1.86	14.71
On other forest			0.10
Trees outside forest			0.58

The estimates above, submitted to TBFRA 2000, were based on projecting forward results of 1980 Census. Update to National Inventory.

B5. Natural losses (quality 2/4)

Million cubic metres overbark (to 0 cm minimum), 1995, TBFRA-2000

	Conifer	Broadleaved	Total
On forest available for wood supply	0.11	0.01	0.12

These are rough annual estimates, compiled for TBFRA 2000. Desirable to review whether better estimates can be compiled. For this section, also relevant to record losses of volume resulting from loss of woodlands to development.

B6. Harvesting (quality 1) A**GB Timber Harvesting 000 m³ standing**

Year	Softwood	Hardwood	Total
1990	5660	1250	6910
1995	7440	990	8430
1998	8210	800	9020

B7. Harvesting + losses as % of annual increment (quality 2)

Million cubic metres overbark (to 0 cm minimum), 1995, TBFRA-2000

On forest available for wood supply

	Conifer	Broadleaved	Total
Gross annual increment	12.85	1.86	14.71
Natural losses	0.11	0.01	0.12
Annual fellings (exc fellings of natural losses)	8.20	1.20	9.40
Fellings & losses as % of increment	65%	65%	65%

Key Points The annual volume of timber harvested (or lost through natural causes) is around 65% of the gross annual increment, so the growing stock in the forest is increasing by about 5 million m³ a year.

Relevance This is an indicator of the sustainability of timber production over time – a ratio of over 100% in the long run would be unsustainable because the volume of timber growing in the forests would be gradually reduced.

Trends The volume harvested each year is increasing, as new plantations created in the 1950s to 1970s are approaching the end of their first rotation. For a similar reason, annual increment is also increasing (but less slowly), as these plantations are in a period of rapid volume growth during the years before harvesting. Harvesting as a % of annual increment is likely rise, but should remain below 100% because of the continuing (slower) increase in woodland area, and the increased extent of areas of long term retention.

Background Other European countries have similar ratios of harvesting to increment; e.g. Germany is around 55%, France around 65%, while Sweden and Finland are both around 75%. This is one of the Environmental Indicators adopted by the UN Commission on Sustainable Development and included in the Eurostat pilot Indicators of Sustainable Development in 1997 (ENV18 – Wood Harvesting Intensity).

Developments needed: Update increment estimates to be based on National Inventory. Break down by country. If estimate for losses not of adequate quality, alternative indicator would be total fellings as % of annual increment. Note UK/GB figures to 7cm min diameter, but TBFRA-2000 to 0 cm min

B8. Home-grown as % of consumption (quality 2) AAll wood and wood products million m³ WRME underbark

Year	Imports	Exports	Homegrown	Apparent Consumption	Homegrown %
1960	36.0	0.8	2.7	37.9	7.1%
1965	39.1	0.8	3.0	41.3	7.3%
1970	40.3	1.2	3.2	42.3	7.6%
1975	30.9	1.0	3.4	33.3	10.2%
1980	34.7	2.3	3.9	36.3	10.7%
1985	37.5	2.3	4.7	39.9	11.8%
1990	48.4	4.7	6.5	50.2	12.9%
1995	44.3	6.0	7.6	45.8	16.6%
1998	46.8	7.0	7.3	47.2	15.5%

Source (imports and exports) : UK Overseas trade statistics and conversion factors

Note : Apparent consumption = imports – exports + homegrown. It excludes recycled wood and waste paper of UK origin.

Key Points **Homegrown timber meets about 15% of UK consumption of wood products (excluding recycled material)**

Relevance The resource costs of transporting timber for international trade and the impacts on forests in other countries are considerations for sustainable development.

Trends The percentage of homegrown timber has risen from around 7% in the 1960s to 10% in the mid-1970s and around 15% in the 1990s. It could rise to around 25% when UK timber production reaches a peak in the period 2015-2025.

Background Total consumption of wood products has tended to increase with economic growth. However it is driven more strongly by specific requirements for construction timber and by the product life cycles for particular products. The growth in apparent consumption is less rapid, because of the increased use of recycled wood and waste paper.

B9. Energy uses of wood (quality 2/4)

The use of wood as a source of renewable energy can make a contribution to sustainable development.

- Firewood
- Charcoal
- forest residues for energy biomass

**B10. Non-timber forest products (pan-European 3.3)
(mostly quality 4 - see below)**

- Christmas trees – should this distinguish forest-grown from horticultural?
- Venison
- Mushrooms
- Game birds – wild woodland birds, or also include pheasants?

Some estimates in TBFRA 2000 for Christmas trees and venison, others could be developed.
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The tables below shows the information that can be obtained for Forest Enterprise and private (non-FC) woodland, with an assessment of data quality for each. For FE, data are available on a country level for up to 5 years; for the majority of the categories, it would not be possible to obtain data earlier than this.

Product		Data quality	
		FE	Private
Firewood	Volumes	1	2
	Income	1	4
Charcoal	Volumes	4	4
	Income	4	4
Forest residues	Volumes	4	4
	Income	4	4
Christmas trees	Volumes	4	4
	Income	1	2
Venison	Volumes	4	4
	Income	1	2
Mushrooms	Volumes	4	4
	Income	4	4
Other Game	Volumes	4	4
	Income	2	4

C. Forest Condition and Management

Deposition of air pollutants (2.1) A

The main measures which are available are nitrogen, sulphur, particulates and ozone. These are measured at 10 sites in the UK by FC (the Forest Condition Survey level II monitoring plots). CEH and DETR carry out a number of monitoring exercises, including the Environmental Change Network (ECN), but these are not specifically in woodland (there is one woodland plot in the ECN, sponsored by the FC). Nevertheless interpolating atmospheric deposition using a GIS may give a way to model average deposition on woodland by region (or areas of woodland within deposition classes); note that estimates may have a large modelling error. The Countryside Survey, which is rather infrequent, also provides information.

The ECN does some vegetation monitoring and possibly (though not certainly) includes some lichen plots as indicators of pollution. There are however, only 12 terrestrial sites in this network, so the coverage will be sparse.

Developments needed: Look at approach being developed by Erik Sollander for future WWF Forest Scorecards.

Indicator reference	Description	Availability and source	Frequency
C1 (quality 2) I/N	Deposition of nitrogen	Forest conditions survey level II plots and environmental change network. Available now.	Annual / variable
C2 (quality 2) I	Deposition of sulphur		
C3 (quality 2) N	Deposition of particulates		
C4 (quality 2) N	Concentration of ozone	Two FCS level II plots. Available from 2000.	

Serious defoliation (2.2) A

The *Forest Condition Survey* (see *Soil* (section 1) for more information) provides the best source. This is not a complete survey, as it only covers one age class, but it does provide some information in a well-designed study. Crown transparency is the measure which could be used as an indicator.

Note alternative bases for comparison – local or ideal conditions.

Amounts of sample plots in defoliation classes 2, 3 and 4 are used in the TBFRA criteria and indicators, but threshold between classes is arbitrary, and it may also be sensible to give alternative measures on mean and distribution.

The comments in *Serious damage*, below, are also relevant.

Indicator reference	Description	Availability and source	Frequency
C5 (quality 2) A I	Forest condition survey estimates of crown transparency	Forest condition survey level I plots; available now. Some development of mean and distribution aggregates may be needed.	Annual
C6	See <i>Serious damage</i> , below		
C7	See <i>Serious damage</i> , below		

Serious damage (2.3)

- By insects
- By diseases
- By fire
- By storm
- By game or other animals or grazing

There are numerous methodological problems. Possible partial sources include National Inventory of Woodland, DETR Countryside Survey, WGS reclaim (reason = damage), FE restocking survey.

There are control assessments for several species of insects – pine beauty moth, pine looper moth, gypsy moth, great spruce bark beetle and other bark beetles – some in particular regions. It is not clear what sort of indicator could be constructed from these since they are not designed for monitoring, but as an early warning system, or how it would be interpreted given that there will be large variations between years.

In addition there is information on the numbers of cases, and more anecdotal information from Forest Research's advisory service (Forest Pathology, Forest Entomology and the equivalents at NRS), which could be used as an additional source of information. In fact by obtaining a little extra data from any reports to the advisory service, particularly an estimate (however crude) of the area affected, this could be made into a more useful indicator. The causes which are likely to be notified through this source are

- insect damage
- diseases (mostly fungi)
- abiotic factors (for example frost damage)
- mammal damage

An exercise to encourage reporting of these events might increase both the coverage and precision of the indicator, although there will always be an element of self-selection in constructing it.

Damage through physical events – fire and storm – are less readily measured. The Forestry Commission and NI Forest Service collect information on the areas affected by fire on its own land, but there are no comparable compilations for woodland owned by others. There are two potential sources of such information, however, from grants administered by the Forestry Commission, and from insurance claims. There are measures of windspeed and forest gaps from windthrow at a series of windthrow monitoring areas. This suggests using the following indicator:

- area of windthrow;
- proportion of windthrow in monitoring plots.

Damage from vertebrates is less easily quantified. There is an occasional squirrel damage survey, but this is unlikely to give figures sufficiently often for an indicator which must be regularly updated and monitored. Damage caused by deer, sheep and other grazing animals is also difficult to quantify, and a definition of how much grazing is “damaging” is needed. Some instances of mechanical damage by animals are reported to Forest Pathology, and this total could be used. Some experimental plots are to be set up by Forest Research over the country to find models for predicting deer damage, and these may give some estimates although it is unclear how useful the results will be as an indicator, since this is not their primary purpose.

Further information on damage may be obtained from grant information. Much of the severe damage from browsing is to restocking and regeneration, so an estimate of planting failure will give an indicator largely based on browsing/grazing damage, but also including elements of failure of disease prevention, poor husbandry and so on. This should be available from the WGS database for private sector grant-supported woods, since in these cases the second grant instalments will not be paid. There are other causes for non-payment of second instalments too, however, so some weeding or interpretation of the data will be needed. Failed planting is also a separate category in the FC database. This gives the following potential indicator:

- area of planting failure

Planting surveys undertaken by Forest Research for FC (Scotland) are a source of information on the causes of damage to planting.

Indicator reference	Description	Availability and source	Frequency
C6 (quality 3) A N	Reports of numbers of cases affected by various diseases from Forest Research's advisory service	Pests/diseases already voluntarily reported to FR advisory service (there is no statutory duty to report the presence of pests). Data from Forest Pathology, Forest Entomology and NRS would need to be combined.	Can be aggregated as required; annual is probably best.
C7 (quality 4) U	Defoliation and disease voluntary monitoring survey: proportion of monitored sites affected	Was available, but has been discontinued	
C8 (quality 2) A U	Area affected by fire damage	Available now for FC. So similar data or estimates for private woodland.	Annual
C9 (quality 4) N/U	Areas replanted under WGS as a result of fire/frost/storm damage	No data currently available from WGS. Planting Surveys may give some information on causes.	
C10 (quality 4) U	Areas for which insurance claims are paid for fire/frost/storm damage	Not available from official sources, but may be from the TGA and insurance companies?	
C11 (quality 2) A N	Area of windthrow (perhaps proportion of windthrow in monitoring plots?)	Available now for FC monitoring plots	Annual
C12 (quality 4) A I	Cases/area of severe grazing/browsing damage	Some cases are reported (voluntarily) to Forest Pathology; area is not collected.	Annual
C13 (quality 2) N	Extent of squirrel damage	Available from FC survey	Occasional (>10-yearly)
C14 (quality 4) I/N	Deer damage	Plots to be set up to provide a model for deer damage. Estimates may be available as a by-product, although the study is not designed for this purpose.	One-off
C15 (quality 4) I	Average lag between WGS payment instalments (an overall indicator of the success of husbandry in getting a woodland from planting to reasonable growth – includes an element of delay between instalments due to serious damage)	Base data currently available, method of calculation needs developing (probably assuming a suitable model and using survival analysis methods). Changes to the way grants are paid in the future mean that this will not be a suitable indicator without additional data collection.	Potentially annual

Forest management (3.2)

C16. Area of managed forest (quality 4)

It will be important to develop indicators of the extent and quality of forest management. This is required for assessing sustainable forest management, and is one of the three UK forestry indicators required for UK Indicators of Sustainable Development.

The primary indicator should be area of woodland “managed”, but the definition of “managed” poses problems. The TBFRA expert group considered that the pan-European indicator was not satisfactory, but the definition adopted for TBFRA was itself unsatisfactory.

A full assessment would have to take account of the intentions of the woodland manager as well as the condition of the woodland, as is done for UKWAS certification. This would be prohibitively expensive as a separate exercise, but could be considered as part of the design of the next National Inventory of Woodland.

A proposed approach for the present (quality 2/4) is to estimate the area managed by summing the following categories:

- Areas certified under UKWAS (including FC estate) or any other recognised certification scheme
- Areas established with grant-aid since 1988
- Areas owned by conservation organisations (e.g. Woodland Trust, National Trust)
- Estimate for all other woodlands, based on National Inventory data for timber quality and any other relevant data

The summation will have to be done using a GIS, to avoid double-counting.

Possibility of producing an annual measure. **(A)**

Until this estimate can be compiled, the only estimate we have is for 1995, compiled for TBFRA 2000, which adopted a similar approach but with little firm data (before UKWAS). (quality 2)

UK 1995 (TBFRA)	Million hectares	
	Total area	Managed
Total	2.469	2.319
Public	1.072	1.072
Private	1.397	1.247

[Note on change from previous sets of indicators]

It had previously been proposed that indicators of forest management should be based on Forest Management Unit level monitoring for the UK Forest Standard. However, there are only a limited number of such studies, and not all FMU-level monitoring relates to forest management, so this programme will not give a good measure of forest management for many years. Any indicators available from this programme should be treated as supplementary to the main measure proposed above.

The first such indicator should be a measure of the success in restocking areas after harvest, for which a one-off survey of the private sector in 2000-01 will complement the regular surveys of FC restocking. A possible future topic is the extent of thinning, compared with models.

C17. Quality of Management (quality 4)

In conjunction with measures of area, it will also be important to develop measures of quality of management. Data for this are not collected at present.

C18. Management systems (quality 3)

It would be possible to compile measures of the areas (or %) of woodland managed under each of the following systems: patch fell, continuous cover, minimum intervention, coppice, wood pasture. But are these total areas relevant? E.g. is it a goal to increase the area of continuous cover forestry, or is the goal that management systems should be appropriate to the area?

C19. Number and size of holdings of woodland (quality 2)

The number and size of woodland holdings is relevant to an understanding of the structure of woodland ownership, which can affect how the woodland is managed.

<p>A table was compiled for TBFRA, giving estimates of the number of holdings in each size category, for both public and private woodland. The data for farm woodland holdings were firmly based on results from the Agriculture departments, but estimates for other woodland were projected forward from an old TGA survey. Better data for non-farm woodlands should be available from the National Inventory of Woodland, but the structure of the Inventory was designed to estimate the area owned by different types of owner, rather than the number of individual owners.</p>
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D. Biological Diversity

Areas of semi-natural and protected forest (4.1)

D1. Ancient woodland

Area (000 hectares)

	England	Scotland	Wales	Northern Ireland	UK
Ancient woodland	341	148	61	0	550
Ancient semi-natural woodland	206	89	31	0	326
Restored native woodland on an Ancient woodland site (quality 3)					
Loss of Ancient woodland quality 4)					

Key Points Because of the way in which *ancient woodland* is defined, it is impossible for the area to increase. The area of ancient woodland in UK is now estimated to be 550,000 hectares, of which 326,000 hectares is Ancient Semi-Natural Woodland (ASNW). ASNW accounts for around 12% of the total area of woodlands and around 1.4% of the total land area. Areas are now highly fragmented; the greatest concentrations are in SE England, the southern Welsh borders and the central Scottish highlands. Only about a quarter of ASNW is in nature conservation areas.

Relevance A key target is to maintain the area of ancient woodland, and the notion of ancient woodland has wide public appeal. Ancient semi-natural woodlands tend to be richer in plants and animals than other woodland areas, and have also has a role in preserving locally native genotypes; they are also important as part of the historic landscape.

Trend The area of ASNW has declined over the centuries and the woodlands have become increasingly fragmented. Of the area present in the 1930s, about 38% was converted to plantations and a further 7% cleared for other land uses; depletion has now largely ended.

Background Ancient woodlands are areas that have been continuously wooded since 1600 (since 1750 in Scotland). Because of the way in which *ancient woodland* is defined, it is impossible for the area to increase. Ancient woodland can be ancient semi-natural woodland (ASNW) or plantations on ancient woodland sites (PAWS), which may retain some of the native trees, shrubs and ground flora, and therefore be able to be restored to native woodland by removing the planted conifers.

D2. Native woodland (quality 2 and 4) A

	England	Scotland	Wales	Northern Ireland	UK
Area of native woodland (quality 2)	<i>area</i>				
Area of native woodland managed under an acceptable/ certified Management plan (quality 2)	<i>Area; need periodic sampling (maybe from NIWT) to assess compliance and achievement?</i>				
Native woodland condition measures (quality 4)	<i>There is a working group developing native woodland condition measures as part of HAP monitoring</i>				
Area of new and restored native woods (quality 2)	<i>area; need definition to say at what stage it counts</i>				

Background Native means with at least 50% site-native species. Certified schemes require that woods have a suitable management plan, and in the woodland areas above such plans are designed to produce native woodlands.

D3. Protected areas (quality 2)

If possible, this should use agreed international categories. Possible classifications are under discussion - there is a meeting of IUCN and the Pan-European Forest Process in April 2001. A recent study *Protected Forest Areas in the UK* by Simon Pryor and George Peterken pulled together the available information to approximate these categories, and this is the data given below.

IUCN category	hectares				
	England	Scotland	Wales	Northern Ireland	UK
I Strict nature reserve/ wilderness area					10,000
II National Park					20,000
III Natural monument	<i>country breakdowns not currently available</i>				
IV Habitat/species area					422,000
V Protected landscape					54,000
VI Managed resource					100,000
Total					633,000

Key Points It is estimated that about 30,000 hectares of woodland are in protected areas in IUCN categories I-II, and a further 600,000 hectares in IUCN categories III-VI.

Relevance The IUCN protected areas translate the UK's statutory protections (a wide range from National Nature Reserves and Sites of Special Scientific Interest to lower-level protection such as that from felling licenses) into an agreed international framework.

Trend

Background IUCN categories I-II are based on wild forests and strictly protected areas with non-intervention management. The UK has very few of these, mainly as a result of the history of woodland management and deforestation in the country. The figures, taken from the report *Protected Forest Areas in the UK* by Simon Pryor and George Peterken for the World Wide Fund for Nature and the Forestry Commission (published in January 2001), use many disparate sources, and hence are only approximate, although they are the best available.

Threatened habitats and threatened species (4.2)

D4. HAP habitats in woodland areas (quality 3/4)

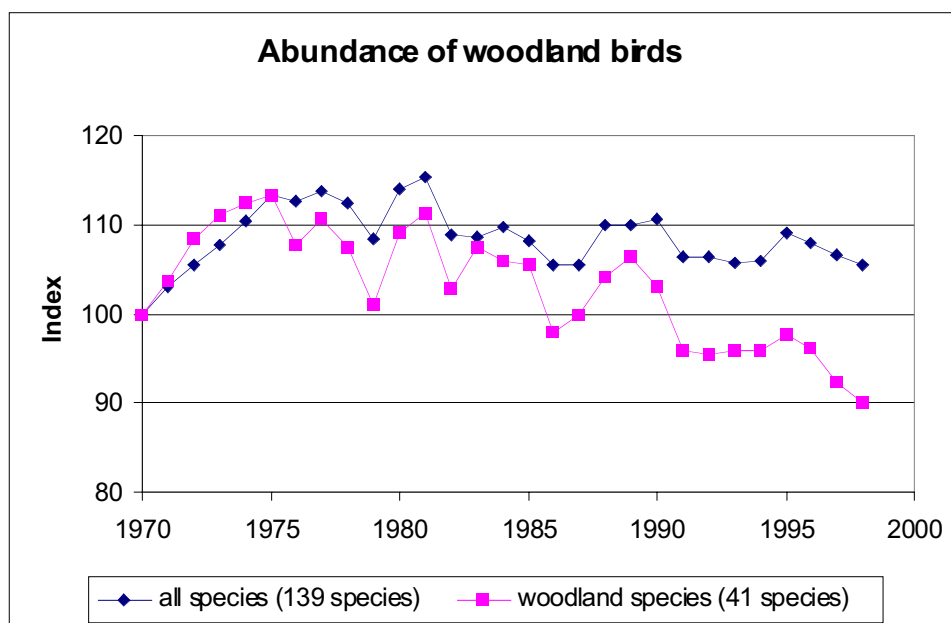
The areas of woodland habitats covered by Habitat Action Plans (HAPs) are being identified as part of the process of defining HAPs. Additional information on woodland HAPs will be available from the WGS in the future (approx 2002). There is no data on the resource of non-woodland habitats within forests at a broad habitat level from FC. It may be possible to develop these from CS2000 categories, and plan to move beyond this to identify priority habitats, perhaps within 5 years.

	England	Scotland	Wales	Northern Ireland	UK
Area of woodlands subject to HAPs	<i>Becoming available from HAPs (quality 3)</i>				
Area of non- woodland HAP habitats within woodland	<i>Not yet available (quality 4)</i>				
Area of woodland restored to open ground for conservation purposes	<i>Not yet available (quality 4)</i>				

D5. Species information (quality 3)

Woodland area managed for priority/protected species. Need to highlight some species – perhaps through an index of target species, or an index of flagship species (species with public appeal, for example dormouse, capercaillie). FC target species are a subset of species with SAPs (Species Action Plans) occurring in woodlands, which in turn are a subset of species of conservation concern (SoCC – about 1500 of these).

- Woodland birds populations – this can be taken from the DETR's quality of life indicators **A**
- Index of abundance of priority/protected species – needs a lot of development
- Index of flagship species abundance – needs a lot of development



(source: RSPB, BTO, DETR)

Key Points Woodland birds are less abundant relative to general bird populations than they were in 1970 (but populations have not declined as much as farmland birds).

Relevance We value wildlife for its own sake and because it is an integral part of our surroundings and our quality of life. Birds are regarded as good indicators of the broad state of wildlife and the countryside, because they are wide-ranging in habitat distribution and tend to be at or near the top of the food chain.

Trend Although populations of the more common woodland and farmland birds have been declining, populations of other birds, such as open water birds and many rare birds, have been stable or rising.

Background There are many factors affecting populations of birds and other wildlife species. These include short-term influences such as the weather and a range of longer-term influences such as changes in farming practices, loss of habitat diversity, urban development, road building, climate change, loss of habitats, changes to food supplies and pollution.

D6. Vegetation condition indicators (quality 2)

A series of indicator scores for pH, fertility, soil moisture and light, based on the plant species recorded in the CS2000 (Countryside Survey) sample plots, and using the Ellenberg scores for these plant species to construct the indicators. That is, the physical properties are not measured directly, but are approximated using the plant species as indicators.

Indicator	England & Wales		Scotland	
	1990	1998	1990	1998
PH				
Fertility	5.1	5.2	4.2	4.1
soil moisture				
Light	6.0	5.9	6.3	6.3
Species richness	13	16	21	20

(values read from graphs, so may have some inaccuracies)

Key Points **There has been a significant rise in nutrient status of woodlands in England and Wales between 1990 and 1998; woodlands in Scotland are unchanged.**

Relevance Maintaining sustainable woodland habitats means ensuring that there are no large changes in the characteristics of woodlands. These indicators show trends in nutrient status, and hence whether management is delivering a stable mosaic of woodland types, even though there are natural changes and successions between types.

Trend The changes in England & Wales identified in CS2000 point to gradual eutrophication of woodland habitats, with increased fertility and decreased mean light score.

Background Ellenberg scores are values given to different species of plants to represent their ecological preferences. By identifying which species occur in a particular area, this approach can be applied backwards to give an indication of the habitat condition as represented by the Ellenberg score.

Forest genetic resources (4.3)

D7. Extent of use of local stock in planting (quality 4)

% of all planting of native species using stock sourced from the same zone as the planting site. The extent of use of clonal/strongly selected material might be a useful complementary indicator.

Forest nurseries are due to be accredited under the UKFS, and part of this will involve their ability to provide trees from locally native seed. A survey would need to be instituted to collect this information.

D8. Numbers and areas of seed stands (quality 2)

Numbers and areas of *in-* and *ex-situ* seed stands, to include any genetic resource stands. The FC already has a system of registration of seed stands, and this is to be tightened and expanded in line with an EU regulation. Parts of the SSSI network could have the preservation of tree species genetic diversity added to their primary management objectives, in which case the total area with that objective would also be a useful indicator.

D9. Area of natural regeneration [grant-aided only] (quality 1) A

The figures given here are for new planting and restocking by natural regeneration, and for existing regeneration where grant is payable. In each case the data correspond to the area for which the second instalment of grant has been paid.

	England	Scotland	Wales	Northern Ireland	hectares UK (GB figs given here)
1995					72
1996					206
1997	<i>breakdown available at least for England, Scotland and</i>				340
1998	<i>Wales</i>				887
1999					2,248
2000					2,118

Key Points **Natural regeneration contributed 7% of the area of new planting and restocking in 2000.**

Relevance The extent of natural regeneration shows how much woodland is being planted or restocked without human intervention in the choice of genotypes to be established. It must be borne in mind that natural regeneration can occur on plantation sites, in which case the genetic variability is unlikely to wider than it was in the original plantation, and also if the plantation was of non-native genotypes then so will the natural regeneration be.

Trend There has been a steep rise in grant-aided natural regeneration, because there is a lead time between agreeing to plant/restock using natural regeneration and the trees achieving sufficient establishment and stocking density for the second instalment of grant to be paid. 1995 was early in the life of the scheme, and it is taking time for regeneration to reach a suitable stage.

Background The second instalment of grant is used as it is only paid when appropriate establishment and stocking densities have been achieved. In this way it corresponds to woodland being established. The first instalment is paid before establishment, and so does not so clearly relate to actual woodland at the time of payment.

Mixed stands (4.4)

D10. Within- and between-stand tree species diversity indices (quality 3)

Diversity indices of the Shannon-Weaver type or one of its derivatives. Additional breakdowns could be generated for conifer/ broadleaved woodland. For *trees* it may be sensible to use only the canopy layer.

D11. Structural and age diversity (quality 3)

Part of this is identifiable from woodland block size – decreasing block size is an indicator of increased structural and age diversity. A minimum age difference between two blocks before they would be counted as “distinct” would need to be enforced, to ensure that there was diversity.

Other aspects (not covered in pan-European 4.1 to 4.5)

D12. Dead wood index (quality 2)

Information on the amount of dead wood has been collected as part of the National Inventory of Woodland and trees.

D13. Edge/area ratio (quality 2)

Edge/area ratio of woodland polygons (>0.2ha) in the landscape

D14. Connectivity (quality 3)

Proportion of landscape units with >30% cover of woodland. By the time woodland cover is as high as 30%, there is a lot of connection in the landscape. The definition of a landscape unit needs to be sorted.

E. Soil and Water

• Forest soil condition (2.4) A

Measuring changes in nutrient balance and acidity requires data for soil pH (acidity) and CEC (cation exchange capacity). The *Forest Condition Survey* (FCS) level I and level II plots are the mainstays of monitoring in this topic; their coverage is relatively sparse, but they are well-designed and form a basis for monitoring. The FCS is undertaken to fulfil an EU obligation, but until now with an increased number of plots – 300 in GB – which enables some estimates to be produced; one option in the review of the research budget is to reduce the number of plots. Resin bags could be used for measuring cation concentrations (a relatively cheap process), but there is no indicator series currently available for this.

Soil quality indicators are being identified by an expert UK consortium. Relevant indicators can be included once they are agreed.

Indirect measurements have been obtained as part of the Countryside Survey 2000 – see D6

Indicator reference	Description	Availability and source	Frequency
See E1, below			

• Soil protection (5.1)

According to the UK return for TBFRA 2000, no UK forests are managed primarily for soil protection. However, areas of forest are used for stabilisation of the coast (and breckland), and for FC these may be identified from the sub-compartment database / GIS. There is no non-FC information. Riparian woodlands and trees on watercourses may prevent soil erosion (see *Water*, below, for potential indicators). The quality of management will have an effect, but this is difficult to measure and the proposed indicators focus on area.

Forestry is often beneficial or neutral for soils, but can have a *negative* contribution to soil structure in some areas. Examples include damage from forestry operations, peat and acidification (see *Forest soil condition* above). Damage includes disturbance, erosion and compaction from harvesting, cultivation and road building. Although the amount of harvesting and length of roads may be estimated, this does not actually indicate soil damage. Peat no longer accumulates under forest cover, and dries and therefore oxidises faster because the rainfall is intercepted by the forest canopy and absorbed by tree roots. There have been studies of the reduction in peat depth under the forest canopy, but there is no long-term monitoring of this variable.

There are other areas potentially relevant to soil protection in skeletal habitats, but these are dealt with in *Reclamation and restoration* (below).

Indicator reference	Description	Availability and source	Frequency
E1 (quality 3) U	Area of woodland with a primary or secondary function in coastal stabilisation/defence	Could be identified approximately from FC GIS and NIWT by proximity to the coast in a low-lying area. Information on management would be desirable but is not available.	
E2 (quality 4) N	Area of riparian woodland	Not separately identifiable from FC GIS or NIWT. Information on management would be desirable but is not available.	
E3 (quality 3) U	Area of woodlands on floodplains around watercourses	If areas of interest can be defined, then could be extracted from FC GIS and NIWT. Information on management would be desirable but is not available.	Continuously updated FC, 10-15 yearly NIWT

- **Reclamation and restoration**

This category is not included in the pan-European classification. In Britain, forestry is used for both reclamation and restoration of sites, particularly for creating soils on mine spoil by planting trees to form an organic litter layer. Reclamation of contaminated sites and stabilisation of landfill are both also achieved by planting trees (among other possibilities).

Woodland created with an objective of “restoring or improving industrial or derelict land” can be identified from WGS applications, and possibly from FC databases where the FC has planted the wood or taken over management. A composite indicator of all these uses could perhaps be defined by area.

An indicator could also be based on the area of woodland established on various land classifications (brown land, contaminated land, etc). This could be an annual indicator.

Indicator reference	Description	Availability and source	Frequency
E4 (quality 3/4) I	Area of woodland whose primary purpose is restoration/reclamation of spoil, toxic sites, landfill, etc	Some information from WGS applications on woodland which has “restoring or improving industrial or derelict land” as an objective. More may be available from statutory bodies such as the NCB? Needs some development to identify the sources and to construct a valid measurement.	Not known.

- **Water protection (5.2)**
(water quality, water yield, water discharge patterns)

There are several aspects to water protection; forests can filter nutrients from water before it reaches water courses, and thus provide a buffer to eutrophication. The extent of this can perhaps be measured by the amount of woodland on flood plains around watercourses from the GIS for FE sites, although similar private woodlands are harder to measure. Riparian woodlands are not identified separately, which is unfortunate as they can contribute to both water protection and to restriction of soil erosion when they are well planned and managed. A suitable definition of “protective riparian woodland” would be needed.

There has been research on the effects of forestry on various water quality measures (incidence of peak/low flows, sediment load, dissolved ions, turbidity, oxygen level, etc), and there is a range of studies in which FC is involved, but they have restricted geographic coverage. Pulling these together into a UK indicator is not straightforward.

The Environmental Change Network (ECN) run by CEH and DETR (see also Forest Condition - section 4a) monitors water budgets and looks at nutrient flow but has only one woodland site. Some composite measure of eutrophication could possibly be constructed by looking at nutrient concentration in water courses at a range of sites near woodlands. Eutrophication measures are also available intermittently from the Countryside Survey.

Indicator reference	Description	Availability and source	Frequency
E5 (quality 3) I	Water quality indicators (by region?), principally catchments likely to be affected by forests and forest management.	Available from sundry studies. Composite and UK-level indicators would need development. Ideally the various studies would be drawn together into a consistent program.	Various, from continuous to monthly
E6 (quality 4) I	Number of pollution incidents from forestry recorded by the Environment Agency, Scottish Environment Protection Agency and the NI authority (EHS?)	Not yet collated, but should be collected statutorily; provision of data would need to be negotiated.	
See E1			
See E2			
See E3			

F. Air

Net carbon sequestration (1.3)

F1 Carbon storage in growing stock (quality 2)

Million cubic metres overbark (to 0 cm minimum), 1995, TBFRA-2000

	Conifer	Broadleaved	Total
Biomass: Million tonnes oven-dry			
Trees on forest	82	106	188
Trees outside forest			27
Other woody biomass (shrubs/ bushes)			5
Stumps & roots			44
Million tonnes carbon			
Trees on forest	41	53	94
Trees outside forest			13
Other woody biomass (shrubs/ bushes)			2
Stumps & roots			22

Note: tree is total above stump, including branches, not just stem. Biomass is dry weight.

Text to describe how biomass calculated from growing stock, and statement that carbon estimated as 50% of biomass.

Also desirable to say something about annual carbon storage per hectare, comparing conifers with broadleaves. One source says 6 tonnes/ha for conifer and 2 tonnes/ha for broadleaves (both presumably annual). This difference looks too wide – is it just carbon in stemwood, ignoring broadleaves' larger proportion of branches etc?

F2 Carbon stock in forest soils

It is widely recognised that forest soils contain the greatest carbon store in forest ecosystems. However disturbance from forestry operations, including planting, can lead to losses of carbon from mineralisation and oxidation. Soil carbon is the subject of current research and there are proposals for more systematic monitoring of forest soils within the EU.

F3 Annual change (quality 2)

The best annual indicator of change is the annual UK return to the IPCC on carbon stocks. It includes an estimate for soil carbon and allowances for removal by felling. However, UK forestry's contributions to the Kyoto targets are small and arguable, so may not be good indicators of sustainable forestry.

F4 Air pollution

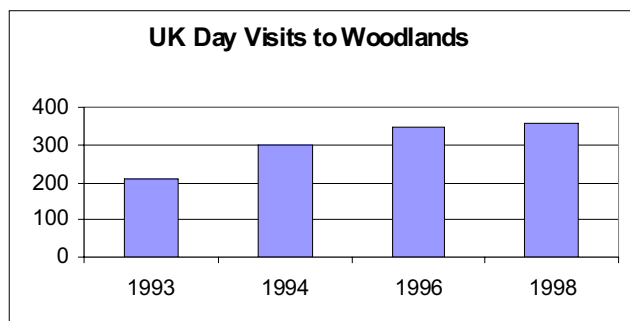
Effects of air pollution on woodlands are covered by indicators of Forest Condition.

This section would include possible air pollution caused by forestry operations, such as burning of lop and top, or disposal of waste materials by burning.

G. People and Forests (communities and workforce)

Public access to woodlands

G1. Number of visitors to woodlands in GB (quality 2)



Key Points It is estimated that there are around 350 million leisure day trips from home to woodland in GB each year, of which around 50 million day trips are to Forestry Commission woodlands. However there are no statistics at present on the number of non-leisure visits or trips made by holidaymakers.

Relevance Recreation in woodland contributes to quality of life

Trends The reported number of day trips to woodlands increased from 300 million in 1994 to 350 million in 1998 (the lower figure of 210 million in 1993 may have been affected by a difference in survey methodology).

Background There have been 4 UK Day Visits Surveys (UKDVS) in 1993, 1994, 1996, 1998, the last three by the National Centre for Social Research. The UKDVS estimates the total number of leisure day visits to woodlands from home, and the perceived woodland ownership, from which we estimate the number of visits to FC woodlands.

Trends Index data compiled by the Forestry Commission gives year on year changes of visitors to FC woodlands, but due to unreliability of the available data and lack of data for small sites, this is not recommended as an accurate source of data. A current project aims to develop an improved methodology for estimating the number of visitors to FC woodlands, by country and type of visitor.

Developments needed To obtain the total number of all visits to woodland in GB. The methodology described above will estimate the total number of visits to FC woodlands, but not all woodland visits (although the methodology developed should be able to be used on non-FC woodland).

G2. Extent of public access to woodland (quality 2/4)

Key Points	Open access beyond rights of way is estimated to exist for 281,000 hectares of woodland in England and 114,000 in Wales (of which 153,000 and 97,000 respectively is FC woodland).
<i>Relevance</i>	Open public access provides opportunities for social enjoyment of the forest through walking.
<i>Trends</i>	The area of private woodland with public access has been increasing, through the creation of community woodlands and through incentives to provide access (including management grants and the Walkers Welcome package introduced in 1994). The extent of access could be affected by “Right to Roam” legislation.
<i>Background</i>	<p>Estimates for England & Wales quoted above are from the joint report “Improving access to woods, watersides and the coast”, published by the Countryside Agency. Similar estimates have not been compiled for Scotland or Northern Ireland.</p> <p>Woodland location (proximity to community) and provision of walking routes may be more important to social enjoyment than a simple measure of area. Some reasons why public access can be limited:</p> <ol style="list-style-type: none"> 1. Many woodlands are difficult to reach/ pass through 2. Woodland could be surrounded by land not belonging to the owners (e.g. arable land) 3. Concerns about damage to property 4. Conflicts between user groups 5. Wildlife/ loss of privacy <p>There may also be temporary closure, for public health reasons (e.g. foot & mouth), forest operations or sporting activities. Woods with open public access may not be accessible by all (e.g. those with disabilities).</p>
<i>Developments needed</i>	Further work to estimate the extent of open public access to private woodland.

G3. Diversity of woodland use (quality 2)

Key Points	37% of visitors interviewed at FC sites between 1995-1999 were locals, 34% were holidaymakers, 26% were day-trippers and 3% unknown.
<i>Relevance</i>	Fulfilment of recreational needs contributes to quality of life.
<i>Trends</i>	The type of visitor to Forestry Commission woodlands has remained largely unchanged between 1995 to 1999.
<i>Background</i>	<p>The only data available on woodland use is the Forest Enterprise Visitor surveys. However these are carried out at large sites, so will give an overestimation of the number of holidaymakers and day-trippers. Small sites, which locals frequently use are not generally surveyed (apart from the Local Use survey 2000) due to the low level of response and the lack of recreation plans for small sites.</p> <p>The FE project to estimate the number of visits to Forestry Commission woodlands (see above) should also produce estimates of the type of visitor to Forestry Commission woodlands.</p>
<i>Developments needed</i>	<p>To obtain information on the type of visitor to all Forestry Commission woodlands (including small woodlands). Also there is a need for information on the type of visitor to non-FC woodlands.</p> <p>The FE Visitor surveys data also determines the 'geo-demographic classification' of respondents based on Acorn coding, which looks at the usage of woodlands by social group.</p>

G4. Availability of Recreational Facilities (quality 2)**Number of Forestry Commission recreational facilities**

	ENGLAND			SCOTLAND			WALES		
	1997	1998	1999	1997	1998	1999	1997	1998	1999
Picnic areas	343	137	240	175	183	169	90	90	98
Forest walks	312	287	277	330	355	335	94	94	91
Cycle trails	58	94	259	138	122	106	14	14	27
Horse trails	42	41	46	20	56	55	2	2	13
Orienteering	45	41	40	17	18	27	10	10	15
Visitor Centres	11	13	16	10	10	9	5	5	6
Car parks	-	410	403	-	287	277	-	80	104
Forest Drive	7	8	6	5	5	3	1	1	1
Wildlife hides	21	19	16	16	11	8	4	4	3
Toilets	-	62	55	-	33	34	-	12	18
Play areas	-	25	24	-	2	4	-	8	13
Forest classrooms	-	20	23	-	4	5	-	0	3

Key Points There is a wide range of recreation facilities at Forestry Commission woodlands, but variable reporting procedures. No information is collected about recreational facilities at other woodlands.

Relevance Recreational facilities are provided where needed. This is an input measure – more relevant is satisfaction of demand.

Trends The data shows no clear trend. Some of the large differences in figures over the years are likely to be due to reclassification. Therefore the figures must be treated with caution.

Background Forestry Facts & Figures publications contain data detailing the number of recreation facilities on FC woodland, by country, from 1997.

Developments needed Very little is known of the provision of recreational facilities for other public bodies, voluntary organisations and private woodland owners.

Employment in Forestry (6.3)

G5. Changes in employment by activity (quality 2)

Forestry and Wood Processing Employment - breakdown by activity (note that the most recent data is in the first column)

	England			Scotland			Wales		
	1998/99	1993/94	1988/89	1998/99	1993/94	1988/89	1998/99	1993/94	1988/89
Forest nurseries	421	380	250	201	200	240	2	0	55
Establishment	1088	1790	2352	1189	720	1487	252	60	482
Maintenance	1680	2530	1173	1304	795	773	380	400	298
Harvesting	2330	4220	5505	1947	3215	3625	493	1855	1585
Road Construction	181	285	-	179	255	-	47	90	-
Other Forest	466	1200	1035	372	360	585	144	175	105
Total Forest	6166	10405	10315	5192	5545	6710	1318	2780	2525
Haulage	326	325	640	593	445	660	142	215	195
Processing	5952	7555	7535	3083	3290	4990	2192	1470	1575
Other Non-forest	2295	1125	2535	1826	1380	2885	447	285	485
Total Non-forest	8573	9005	10710	5502	5115	8535	2781	1970	2255
Total	14739	19410	21025	10694	10660	15245	4099	4750	4780

Key Points Total employment in Forestry and the Wood Processing Industries in 1998/99 is estimated to be around 29,500 full-time equivalents (FTE's). England had around 14,700 FTE's, Scotland around 10,700 FTE's and Wales around 4,100 FTE's.

Relevance Employment provided by forestry contributes to sustaining rural economies.

Trends Employment in forestry decreased during the 1990s.

Background There have been 3 Forest Employment surveys that give the breakdown of employment by activity (1998/9, 1993/4 and 1988/9). Each survey used a different sampling frame and the results are not fully comparable.

The scope in the 1998 survey is wider than in previous years, to encompass Local Authorities, Research organisations and Woodland Associations and Other Woodland Initiatives, mostly shown in the other non-forest category.

Developments needed Improve sampling frame for forestry.

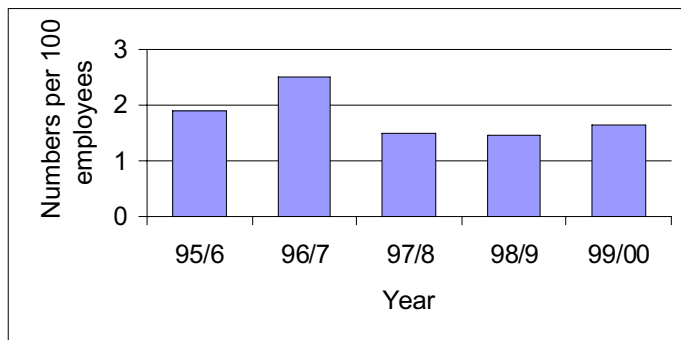
Accidents and safety

G6. Accidents

An indicator for reported accidents to Forestry Commission is given below. Data of similar quality are not available for private sector woodlands, or for contractors working in FC woodlands, because of the tendency to under-report. However, based on the number of serious accidents notified to HSE, there is concern about the level of accidents in the forestry sector.

A Safety Survey has been carried out for FASTCO, on two occasions during the 1990s. Based on interviews with forestry workers, this survey reported on awareness of safety issues and implementation of safe working practices.

- **FC - Number of accidents per 100 employees (quality 2)**



Key Points In 1999/2000 there were 51 injuries to FC staff resulting in 1.64 injuries per 100 employees.

Relevance Safe working practices should be promoted as part of Sustainable Forestry. However this indicator only gives a partial picture.

Trends The number of injuries per 100 employees has stayed about the same in the past 3 years.

Background These figures are the number of injuries within the Forestry Commission reported to HSE. A country breakdown is available for FE and industrial employees only. Also shows lost time and cost.

Developments needed FC accident statistics are likely to change so future figures are not likely to be compatible with those shown. Difficulty in obtaining accident statistics which are a true measure of the whole industry. FC also collects accident statistics for members of the public, but these will not cover all accidents, as they rely on members of the public reporting the accidents.

Training

Possible indicators could include

G7 Number of students in professional forestry related education (and the gender balance)

G8 The ratio of forest research funding to turnover in the industry

G9 The uptake of certified training by operatives and contractors

H. Economic

Forestry in GNP (6.1)

H1. Value of inputs to forestry (labour, materials, etc)

H2. Value of forestry output (timber harvested and other marketed outputs)

- Income and Expenditure

The tables shows the information that can be obtained from Forest Enterprise on a country level for up to 5 years worth of data, with an indication of data quality for each. For the majority of the categories, it would not be possible to obtain data earlier than this.

		FE
Timber Harvesting – Total	Volumes	1
	Income	1
	Expenditure	1
	Resource Split	1
Timber Harvesting – by Direct Production and Standing Sales	Volumes	1
	Income	1
	Expenditure	1
	Resource Split	1
Camp and Cabin Sites	Volumes	4
	Income	1
	Expenditure	1
	Resource Split	1
Recreation, Conservation & Heritage Totals	Income	1
	Expenditure	1
	Resource Split	1
Recreation, Conservation & Heritage Split	Income	1
	Expenditure	1
	Resource Split	1
Restocking	Income	1
	Expenditure	1
	Resource Split	1
New Planting	Income	1
	Expenditure	1
	Resource Split	1
Forest Roads	Income	1
	Expenditure	1
	Resource Split	1
Forest Maintenance & Protection	Income	1
	Expenditure	1
	Resource Split	1
Estate Management	Income	1
	Expenditure	1
	Resource Split	1

There is no equivalent information available for the private sector for incomes. It would be possible, assuming that the private sector's income per unit was similar to Forest Enterprise's, to estimate the private sector's incomes where the volume of the is known, for example with removal figures.

H3. Rates of Return

Forest Enterprise calculate their rate of return on an annual basis taking into account the social and environmental outputs of recreation and biodiversity. Other social and environmental outputs such as landscape and non-use values are not included. The Investment Property Databank (IPD) produces a rate of return based on a sample of privately owned Sitka spruce plantations on mainland Britain and doesn't take into account any social or environmental outputs. The methodology may not be consistent with any estimates compiled for other European countries - treatment of land values and subsidies. And also problems in comparing with other land uses in UK that have different tax/subsidy regimes.

		FE	Private
Rate of Return	Without Social & Environmental Outputs	1	2
	With Social & Environmental Outputs	4	4

H4. Timber Processing and Value Added

The main source for data on GDP or value added for forestry and timber processing has currently been identified as the ONS Input-Output tables. The example at the end of this section is such a set of data. The published data are in current prices. Figures at constant prices, i.e. after taking out the effects of inflation, are not currently published because they do not meet National Statistics standards.

The Forestry Industry includes timber production (IO Group 2), wood and wood products (IO Group 31), pulp, paper and paperboard (IO Group 32), articles of paper and paperboard (IO Group 33) and publishing and printing (IO Group 34).

		Forestry	Forest Processing
Output	Current Prices	1	1
Consumption	Current Prices	1	1
GDP	Current Prices	1	1
	Constant Prices	2	2

H5. Multipliers

UK wide multipliers can be obtained from the ONS Input-Output tables on a regular basis. There have been similar tables created for Scotland and Wales. For more detailed multipliers which look at different forest and processing types there has currently been only one study carried out for England, Scotland and Wales.

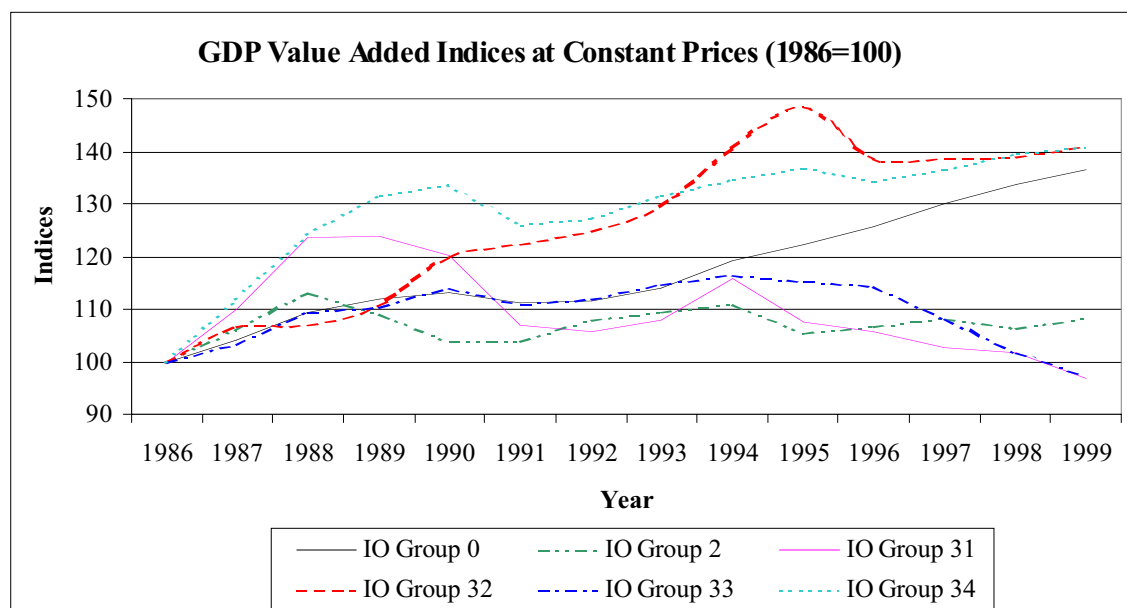
	Frequency	Forestry	Forest Processing
UK General Multipliers	Regular	1	1
Detailed Multipliers	Ad hoc	2	2
	Regular	4	4

H6. Other

Could also include:

- Environmental accounts and valuation of non-market benefits?

H7. GDP Value Added Indices (quality 2)



IO Group 0	Whole UK economy
IO Group 2	Forestry
IO Group 31	Wood and Wood Products
IO Group 32	Pulp, Paper and Paperboard
IO Group 33	Articles of Paper and Paperboard
IO Group 34	Publishing and Printing

Key Points Since 1986 [earliest available data?] the pulp, paper and paperboard along with publishing and printing sectors' GDP have grown at a faster rate than for the economy as a whole.

Relevance Timber production and processing contributes to the economy, especially in rural areas where there may be limited alternatives for employment

Trends Compared to the economy as a whole, the GDP growth rates for the forest industry, (forestry plus processing), has been erratic. Up to 1988 the forest industry was growing at least as well as the UK economy, but since then forestry has levelled off while wood and wood products has been experiencing a slow decline since 1988 and articles of paper and paperboard since 1995.

Background Since the mid 1980's more than £1.6 billion has been invested in timber processing in the UK, resulting a modern wood processing industry. The forestry processing industry can range from mobile sawmills to very capital intensive integrated pulp and paper mills. Product development has been taking place with new products including OSB and MDF. Throughout the industry though margins tend to be tight

Developments needed There may be concern over whether the ONS sample, which the above data is based on, is a true representation of the industry.

I. Heritage and Landscape

Archaeology/Heritage

The main indicators are from the number of Scheduled Ancient Monuments (SAMs) on FC land (presence in private sector woodlands is not separately recorded). Field visits of SAMs are undertaken on a 4-yearly cycle (this cycle is likely to get a longer period) by English Heritage, CADW and Historic Scotland, so an extract of their reports might be used as an indicator of SAM conditions if monuments in forests can be identified.

All WGS scheme applications are sent to an appropriate archaeologist before approval; the proportion of contracts which set specific conditions for maintenance of archaeological features would be a useful indicator, but is not currently separately recorded.

Indicator reference	Description	Availability and source	Frequency
I1 (quality 2)	Number of Scheduled Ancient Monuments (SAMs) on FC land	Available now	
I2 (quality 4) ?A	Condition of SAMs in woodlands	May be available by collating monitoring information from English Heritage, CADW and Historic Scotland; needs development	Annual monitoring, but 4 (or more)-yearly cycle of all SAMs
I3 (quality 4) A	Proportion of WGS contracts with an exclusion or other condition related to site archaeology.	Available by trawl through contracts, but not recorded in a useful form on a database	Annually

Landscape

UK forestry standard: monitoring of landscape quality

A UK Forestry Standard monitoring project in 1999-2000 looked at the landscape quality of upland conifer forests. The project was carried out in two parts. The first looked at whether sites with long term management plans would lead to improvement of landscape quality. The second part monitored a sample of sites over a long period of time to establish the pace of change. Overall 60 sites were evaluated (30 sites for each part of the project). 25 of the sites sampled were privately owned and 35 sites were managed by Forest Enterprise. 12 sites were sampled in each of England, Wales and Northern Ireland and 24 sites were sampled in Scotland.

Glossary

ASNW	ancient semi-natural woodland
BAP	Biodiversity action plan (see also HAP and SAP)
BTO	British Trust for Ornithology
CADW	Cadw: Welsh Historic Monuments Executive Agency
CEH	Centre for Ecology and Hydrology (formerly the Institute of Terrestrial Ecology)
CS2000	Countryside survey 2000
DETR	Department of the Environment, Transport and the Regions
ECN	Environmental change network
FASTCO	Forestry and arboriculture safety and training council
FC	Forestry Commission
FCS	forest conditions survey
FE	Forest Enterprise
FMU	forest management unit
FS	Northern Ireland Forest Service
FTE	full-time equivalent
GIS	geographic information system
GNP	gross national product
HAP	habitat action plan (part of the biodiversity action plan process)
HSE	Health and Safety Executive
IO	input-output
IPCC	International Panel on Climate Change
IUCN	The World Conservation Union
MAFF	Ministry of Agriculture, Fisheries and Food
MCPFE	Ministerial Conference on the Protection of Forests in Europe
MDF	medium density fibreboard
MoD	Ministry of Defence
NCB	National Coal Board
NIWT	National Inventory of Woodland and Trees
NRS	Northern Research Station – the Forest Research site in Scotland
ONS	Office for National Statistics
OSB	oriented strand board
OSNW	other (not ancient) semi-natural woodland
RSPB	Royal Society for the Protection of Birds
SAM	scheduled ancient monument
SAP	species action plan (part of the biodiversity action plan process)
SoCC	species of conservation concern
TBFRA	Temperate and Boreal Forest Resources Assessment
TGA	Timber Growers' Association
UKDVS	UK day visits survey
UKFS	UK forestry standard
UKWAS	UK woodland assurance scheme
WGS	Woodland Grant Scheme
WRME	wood raw material equivalent
WWF	World Wide Fund for Nature

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