

SECTION 3
Country specific data for the UK relating to
Articles 3.3 and 3.4 of the Kyoto protocol: An
Update.

Country Specific Data for the UK relating to Articles 3.3 & 3.4 of the Kyoto Protocol.

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Introduction

The Subsidiary Body for Scientific and Technological Advice (SBSTA), of the UNFCCC at its eleventh session, requested Parties to provide submissions by 1 August 2000 with views on, or proposals for, definitions on activities under Article 3.3 of the Kyoto Protocol. It also requested Parties to indicate how and which human-induced activities might be included under Article 3.4 of the Kyoto Protocol. Here we present the data submitted by the UK for this purpose, with some additional explanatory material and data. We also include updates of the estimates of i) stock of carbon in soils based on recently obtained re-assessment of bulk densities in Scottish peaty soils, and ii) projected carbon stock changes or activities within Article 3.4.

Preliminary data and information provided by UK on carbon stock changes and areas related to article 3.3 activities (TABLE I)

1. Definitions and accounting

- a) Forest is that planted land recorded in national surveys, the state forest sub-compartment database and private land receiving planting grants. This may include access roads and tracks but excludes nursery areas, land with buildings etc.
- b) Afforestation & Reforestation in IPCC approach: For Great Britain (GB - England, Scotland and Wales) is the area each year published by the Forestry Commission (FC) to have been approved for planting grant plus the new area actually planted by Forest Enterprise (FE - state forest organisation). For Northern Ireland, both state and private new planting is published by the Dept. of Agriculture for Northern Ireland (DANI). (see e.g. . Forestry Commission, 1999; Forest Service, 1999)
- c) Afforestation for FAO approach is same as for IPCC.
- d) Reforestation for FAO approach: The area of land recorded by the FC (GB - private) and FE (GB - state) and DANI (NI – state & private) as being restocked after recent clear felling for production purposes and includes natural regeneration.). (see e.g. . Forestry Commission, 1999; Forest Service, 1999)
- e) Deforestation: Change in land use from forest to non-forest. Statistics on deforestation in the UK are not specifically collected. Forest area information collated from surveys updated by annual planting information are published by the Forestry Commission for Great Britain e.g. Forestry Commission 1999a. The use of this data to generate deforestation rates is unreliable hence for this submission an indicative value of 1000 ha per year is used.
- f) Other Net approach uses same model as IPCC approach (see below) but areas of Afforestation plus Reforestation are reduced each year by the amount of Deforestation for broadleaf or conifer before changes in carbon pools are estimated.
- g) Within the FAO approach for Reforestation the following processes are included: FAO Land Based I includes (loss of old forest carbon due to felling + loss of slash/litter carbon from old forest + gain of carbon in new forest); FAO Land Based II includes (loss of slash/litter carbon from old forest + gain of carbon in new forest) and FAO Activity I includes (gain of carbon in new forest)

2. Carbon pools included

For afforestation and reforestation, above-ground biomass, litter and woody debris, below-ground biomass, soil carbon. Deforestation includes the removal of above and below ground biomass and decay of litter and woody debris as appropriate.

3. Stratification

Forestry data is stratified by broadleaf and conifer forests for state and private sectors in each of the 4 devolved administrative regions of the UK i.e. England, Scotland, Wales & Northern Ireland.

4. Methodologies and data

- a) Data sources: Forest areas from annual reports of Forestry Commission, Forest Enterprise and Forest Service of Northern Ireland). (e.g. Forestry Commission, 1999; Forest Service, 1999)
- b) Tree physiological and carbon data from Dewar & Cannell (1992) and references therein.
- c) Sampling techniques: Estimates are based on geographically specific data on forest status recorded by local forest managers.
- d) Models and key parameters: Estimates of changes in carbon pools due to afforestation and reforestation use the C-Flow model of Dewar & Cannell (1992) (see also Cannell *et al* (1996), Milne *et al* (1998), Cannell *et al* (1999)). All conifers are assumed to Sitka spruce Yield Class 12 or 14 (NI) and broadleaves beech Yield Class 6. For Deforestation the lost tree carbon pool is assumed to be the long run time-averaged equilibrium values in the C-Flow for Sitka Spruce and beech forests (60 tC ha⁻¹ & 50 tC ha⁻¹ respectively). Within the FAO approaches to Reforestation the clear felled forest is assumed to contain twice the carbon as these equilibrium values (since they would be at maturity) and decay of litter and woody debris from the felled forest occurs at the rates estimated by the C-Flow model. Deforestation rates are not well known, hence a representative conversion rate to non-forest of 1000 ha y⁻¹ in total for the UK is used for all years. This is under review.
- e) The estimates in the table have uncertainties of around ±15% see Milne *et al* (1998), DETR (2000).

5. Treatment of other GHG

Non-CO₂ greenhouse gases are not estimated.

6. Methods and Key assumptions in projections

Afforestation and Reforestation are assumed to continue until the first commitment period at the rates recorded in 1998. Deforestation rate is assumed constant for all years from 1990 until the end of the first commitment period.

Preliminary data and information provided by Annex I Party on carbon stocks and area estimates (TABLE II)

1 Land Categories

The land categories used are those used in the UK national assessments of carbon stock and are fully described in Milne and Brown (1997) and Cruickshank *et al* (1998) as are methods and data sources.

2 Carbon Pools

Vegetation carbon contains estimates of above and below ground biomass for all plant types, woody and non-woody. Soil carbon to a depth of 1m (or less as appropriate) for mineral soils and to bedrock for peat soils.

3. Data sources

See Milne and Brown (1997) and Cruickshank *et al* (1998)

4. Methods

See Milne and Brown (1997) and Cruickshank *et al* (1998)

5. Possible changes in carbon stocks

Carbon stocks in forests are increasing due to programmes of afforestation. Stocks of soil carbon, particularly in carbon rich soils of Scotland, may be decreasing due to past expansion of agricultural use but this trend is slowing due to a range of agri-environment policies which have expanded conservation areas and tended to extensify agricultural practices – see Cannell *et al.* (1999) and DETR (2000).

6. Uncertainties

The uncertainty in the sizes of the carbon pools is about $\pm 25\%$ (Milne & Brown 1997). Recently a reassessment of values of bulk density in peat layers and of the amount of carbon present between the depth of the parent material and 1m in Scottish soils has been made. In addition soils in urban areas of Scotland have now been assigned an indicative value calculated as the mean of the carbon in soils of equivalent land use in England and Wales. The effect of these improvements is shown in TABLE IIA.

Preliminary data and information provided by Annex I Party on Article 3.4 activities, related net GHG emissions, involved areas, and projected carbon stock changes (additional activities under Article 3.4) (TABLE III)

The estimates provided in this Table are for information only and do not imply that the UK seeks to include any activities under Art. 3.4 of the Kyoto Protocol for the first commitment period. The data originally submitted to UNFCCC is shown in Table III. Since the original submission estimates of soil carbon for the Bioenergy activity have been reassessed. This (Smith *et al.* 2000b) reconsidered the amount of carbon held in the top 30 cm of soil in the agricultural land of Great Britain. The reassessment suggested that carbon density in this layer should be reduced to 49% the previously used value. This, with correction of overestimates to the data for 1995 and 1999, are shown in Table IIIA.

1 Forest management

All but some 300 kha of the UK's 2.3 Mha forest estate is managed and is accumulating carbon. Some 1.4 Mha of this estate has been planted since 1920 and the increase in carbon stock in this area is accounted in the UK submission to the UNFCCC Greenhouse Gas Inventory. The increase in carbon stock in forests planted since 1990 is reported here in Table I under Article 3.3 of the Kyoto Protocol and the difference between this amount and that in the GHG Inventory is entered here in Table III (under forest management). These values therefore refer to the accumulation in carbon on the standing forest area in 1990 for periods subsequent to that date up to the end of the first commitment period. Account has not been taken directly of those areas planted prior to

1920 (which are implicitly assumed to be in equilibrium) or of deforestation prior to 1990 except in checking consistency between accumulated areas of planting and the total forest area from periodic survey data. The methods used for calculating the uptake of carbon by the UK forest stock are described in Milne *et al* (1998) and Cannell *et al* (1999).

2 Bioenergy crop production

The data show only enhanced soil carbon uptake in arable land planted with short rotation coppice (SRC), assuming the same accumulation of SOC under short-rotation woody bioenergy crops as seen under natural woodland regeneration ($1.17\% \text{ y}^{-1}$; see Smith *et al* 2000). Bioenergy is a renewable energy source and its direct emissions mitigation impact in displacing fossil fuel emissions would of course be reflected in the UK inventory, as would any associated emissions in producing and using the SRC.

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Article 3.3 Country specific data	Definitions	Accounting framework	a _I (kha)	C _I (kt C)	a _{II} (kha)	C _{II} (kt C)	a _{CP} (kha)	C _{CP} (kt C)	Methods and approaches
Afforestation Reforestation	IPCC	<i>Activity based</i>	117	555	183	1537	401	3070	
		<i>Land based</i>	117	555	183	1537	401	3070	see text
Afforestation	FAO	<i>Activity based</i>	117	555	183	1537	401	3070	
		<i>Land based</i>	117	555	183	1537	401	3070	see text
Reforestation	FAO	<i>Activity based</i>	94	458	151	1296	334	2311	see text
		<i>Land based I</i>	94	-10286	151	-16386	334	-7107	see text
		<i>Land based II</i>	94	-368	151	-501	334	226	see text
Afforestation	Other: IPCC(Net of Deforestation)	<i>Activity based</i>							see text
Reforestation		<i>Land based</i>	111	526	173	1457	378	2918	see text
Deforestation	IPCC/FAO	<i>Activity based</i>	6	-315	10	-525	23		see text
		<i>Land based</i>	6	-315	10	-525	23	-263	see text
	Other: IPCC(Net Calculation)	<i>Activity based</i>							see text
		<i>Land based</i>		0		0		0	see text

TABLE I: Afforestation, Reforestation and Deforestation for the United Kingdom relevant to Article 3.3 of Kyoto Protocol as submitted as preliminary data to UNFCCC in August 2000 prior to COP 6.

Land system	Area (Mha)	Vegetation Carbon stock in 1990 (Mt C)	Soil Carbon stock in 1990 (Mt C)	Total Carbon stock in 1990 (Mt C)
Woodlands	2.6	94.8	591.1	685.8
Arable	4.8	4.8	969.3	974.1
Pasture	7.2	7.1	1718.3	1725.3
Semi-natural	6.9	11.5	6913.7	6925.2
Other	2.2	0.1	31.9	32.0
Total (as listed above)	23.8	118.2	10224.2	10342.4

TABLE II: Total stock of carbon in the vegetation and soils of the United Kingdom as submitted as preliminary data to UNFCCC in August 2000 prior to COP 6.

Land system	Area (Mha)	Vegetation Carbon stock in 1990 (Mt C)	Soil Carbon stock in 1990 (Mt C)	Total Carbon stock in 1990 (Mt C)
Woodlands	2.6	94.8	484.1	578.8
Arable	4.8	4.8	938.8	943.6
Pasture	7.2	7.1	1665.3	1672.3
Semi-natural	6.9	11.5	6080.2	6091.7
Other	2.2	0.1	136.2	136.4
Total (as listed above)	23.8	118.2	9304.6	9422.8

TABLE IIA Revised estimate of total stock of carbon in the vegetation and soils of the United Kingdom.

Article 3.4 Country specific data	Accounting framework	a _i (1000 ha)	CO _{2, i} (kt CO ₂)*	a _{ii} (1000 ha)	CO _{2, ii} (kt CO ₂)*	a _{cp} (1000h a)	Δ C _{cp} (kt C) + = uptake; - = release	CO _{2, cp} (kt CO ₂)* + = uptake; - = release	Methods and approaches		
Forest management	<i>Land based</i>	1400	57000	1400	100000	1400	12250	45000	See explanatory text		
	<i>Activity based</i>										
Bioenergy crops	<i>Land based</i>	0.084	15	0.423	80	125	1250	4600	See explanatory text		
	<i>Activity based</i>										

TABLE III: Estimates of potential sink strength of Kyoto Article 3.4 activities in the UK submitted as preliminary data to UNFCCC in August 2000 prior to COP 6. Estimates for some other activities can be found in Smith et al (2000a, b) but the UK does not advocate including these activities or any others under the provisions of Art 3.4 of the Kyoto Protocol for the first commitment period.

Article 3.4 Country specific data	Accounting framework	a _i (1000 ha)	CO _{2, i} (kt CO ₂)*	a _{ii} (1000 ha)	CO _{2, ii} (kt CO ₂)*	a _{cp} (1000h a)	Δ C _{cp} (kt C) + = uptake; - = release	CO _{2, cp} (kt CO ₂)* + = uptake; - = release	Methods and approaches		
Forest management	<i>Land based</i>	1400	57000	1400	100000	1400	12250	45000	See explanatory text		
	<i>Activity based</i>										
Bioenergy crops	<i>Land based</i>	0.084	1.5	0.423	9	125	613	2247	See explanatory text		
	<i>Activity based</i>										

TABLE IIIA: Revised estimates of potential sink strength of Kyoto Article 3.4 activities in the UK .