Submission of information on forest management reference levels by United Kingdom of Great Britain and Northern Ireland in accordance with Decision 2/CMP.6

The content of this submission is the same as that included for the UK with the separate submission made by Hungary and the European Commission on behalf of the European Union and its Member States.

1. Forest management reference level value

Table 1: FM net removals/emissions (Gg, or 1000 tCO_2eq).

	1990	Average 1990-2007	Projection 2008-2012	Projection 2013-2020
UK with emissions/removals from HWP using first order decay functions	-14783	-15539	-12611	-8268
UK assuming instantaneous oxidation	-12170	-12913	-8331	-3442

2. General description

In 2008 the UK had a forest area of 2841 kha. (Forestry Statistics 2009)[1]. 283 kha have been established since 1990, and are reported under Afforestation/Reforestation for Article 3.3 of the Kyoto Protocol. Of the remaining area, 1376 kha has been established since 1921, when these records began. Net emissions or removals from this area are reported under Article 3.4 Forest Management. The remaining area is forest was established before 1921, and is assumed to be in long-term dynamic carbon balance. There is ongoing research on the carbon stock changes associated with pre-1921 forest.

The UK Greenhouse Gas Inventory (GHGI) approach to estimating forest carbon stock changes currently uses a carbon accounting model, C-Flow, driven by historical planting data. Standard management scenarios are assumed for conifer and broadleaf woodland. Regular thinning is assumed, with harvesting occurring at the time of maximum area increment based on yield tables, followed by restocking with the same woodland type. Emissions from wildfires are included. It is assumed, on the

[1] Forestry Statistics 2009 is published at http://www.forestry.gov.uk/forestry/infd-7aqdgc

basis of existing UK practice, that these do not result in a permanent loss of forest cover and burnt areas will undergo replanting or natural regeneration.

The projections take account of the inventory data, age class structure and current management practice in accordance with the UK forestry standard and its supporting guidelines. These can be accessed via www.forestry.gov.uk. The projections are methodologically consistent with those published in the UK's 4th and 5th National Communications, and with the Submission by Belgium and the European Commission on behalf of the European Union and its Member States to the UNFCCC dated 23 July 2010. No additional allowance is made for additional use of bioenergy. The Harvested Wood Product (HWP) estimates have been made using first-order decay functions approach and half lives as set out in paragraphs 27 and 28 on page 31 of FCCC/KP/AWG/CRP.4/Rev.4

More detailed information on the methodology and data sources is provided in the NIR available on the UNFCCC website[2] and also at the LULUCF inventory project website http://ecosystemghg.ceh.ac.uk/.

The elements contained in footnote 1 of paragraph 4 of the Cancun LULUCF decision were taken into account as follows in the construction of the forest management reference level:

(a) Removals or emissions by forest management as shown in greenhouse gas inventories and relevant historical data:

The forest management reference level for the UK was estimated using the same methodology as the UNFCCC LULUCF inventory, the Kyoto Protocol LULUCF inventory and national projections of LULUCF emissions and removals to 2020. The methodology is described in the NIR

(b) Age-class structure:

The age distribution of UK forests is an input to the model C-Flow used to calculate the carbon stock dynamics in the pools considered in C-Flow.

(c) Forest management activities already undertaken:

Harvesting is assumed to take place through periodic thinning, and felling at the time of maximum mean annual stem volume increment. This corresponds to UK forestry practice[3]. There is no allowance made in the projections for changes in management practice due, e.g. to increased demand for bioenergy feedstock (which might involve shorter rotations) or more widespread application of continuous cover management (which might involve longer rotations).

(d) Projected forest management activities under a business-as-usual scenario:

Same response as (c)

(e) Continuity with the treatment of forest management in the first commitment period:

[2] Unless otherwise specified references to the NIR are to the 2010 submission, which was the one on the UNFCCC website at the time of writing. By the time the review takes place, the 2011 update should be available. The reference level information in Table 1 is consistent with the inventory data submitted in 2011.

[3] Hibberd (1991) *Forestry Practice*. Forestry Commission Handbook 6. HMSO: London.

Same response as (c).

(f) The need to exclude removals from accounting in accordance with decision 16/CMP.1, para 1:

C-Flow models forest response to management practice and therefore implicitly factors out the removals referred to in pararaph 1 (h) of Decision 16/CMP.1

Pools and gases

The following pools and sources of greenhouse gas emissions are included in the reference level:

- Above-ground biomass
- Below-ground biomass
- Litter
- Dead wood
- Mineral and organic soil
- CO_2, CH_4 and N_2O from biomass burning in wildfires.

Further details are given in Chapter 11 of the NIR.

Reasons for omitting a pool from the reference level construction:

No pools are omitted from the reference level construction and there is no double-counting. The pools included in the reference level are consistent with those reported in the Kyoto Protocol LULUCF inventory and the UNFCCC LULUCF inventory. Below-ground biomass is included with the above-ground biomass pool, and dead wood is included with the litter pool.

3. Approaches, methods and models used

The methods for producing the forest management reference levels are the same as those used for the production of the GHGI. Details are given in Annex 3.7 of the NIR.

Growth trends and levels of production in major UK conifer and broadleaf tree species have been monitored in a network of permanent forest mensuration sample plots since 1915[4] [5]. The data collected have been used to construct forest growth and yield models covering representative tree species, growth rates and managment prescriptions[6]. These yield models are used as inputs to the carbon

[4] Hummel, F.C., Locke, G.M.L., Jeffers, A.I.S. and Christie, J.M. (1959) *Code of Sample Plot Procedure*. Forestry Commission Bulletin No. 31. HMSO: London.

[5] Matthews, R., and Mackie, E.D. (2004) Mensuration: Growth and Yield. In Burley, J., Evans, J. and Youngquist, J.A. (eds.). *Encyclopaedia of Forest Sciences.* Elsevier: Oxford, **2**, 573-580.

[6] Edwards, P.N. and Christie, J.M. (1981) *Yield Models for Forest Management*. Forestry Commission Booklet 48. Forestry Commission. Edinburgh.

accounting model, C-Flow, in order to estimate the net change in pools of carbon in living biomass, litter and soil in conifer and broadleaved forests. Standard management scenarios are assumed for conifer and broadleaf woodland. It is assumed that all conifer plantations have the growth characteristics of Sitka Spruce (Picea sitchensis (Bong.) Carr.) under an intermediate thinning management regime and following the growth pattern of Yield Class (YC) 12 m^3 ha^{-1} a^{-1} (14 m^3 ha^{-1} a^{-1} in Northern Ireland). It is assumed that broadleaf forest have the characteristics of beech (Fagus sylvatica L.) of YC 6 m^3 ha^{-1} a^{-1}. Beech was selected as the representative species as it has characteristics midway between fast growing species such as birch and very slow growing species such as oak. Previous analyses (Milne et al. 1998)[7] suggest that overall carbon uptake is not very sensitive to different species assumptions. Harvesting is assumed to occur at the time of maximum area increment (59 years for Sitka spruce YC12, 57 years for Sitka spruce YC14 and 92 years for Beech YC6), followed by restocking with the same woodland type. Details of the carbon model parameters are included in Annex 3.7 of the NIR. Emissions from wildfires are included in the reference level estimates: in line with UK practice it is assumed that these do not result in a permanent loss of forest cover and burnt areas will undergo replanting or natural regeneration.

Annual data on forest planting are provided by the Forestry Commission at a higher precision than that published in the annual Forestry Statistics. This gives a dataset of annual afforestation since 1921.

It is assumed that deforestation occurs on Forest Management (FM) land, so the area of FM land and carbon stock changes are adjusted to reflect deforestation losses. This is done by running the model with the initial FM land area and calculating the implied carbon stock changes per unit area (as in the CRF tables). The Forest Management land areas are then adjusted to take account of annual deforestation as reported in the 2010 KP CRF tables, and the resulting areas multiplied by the implied carbon stock changes per unit area to give total carbon stock changes.

Greenhouse gas emissions from wildfires are estimated using a Tier 1 approach. There is currently no collated information on the location of wildfires in forests in the UK, so it is currently not possible to split burning between Afforestation/Reforestation land and Forest Management land. Therefore, emissions from wildfires are all reported under Forest Management. Wildfires would only affect a very small area of Afforestation/Reforestation land area (less than 1% since 1990) if the burnt areas are distributed in proportion to forest area.

For projections to 2020, the same standard management is assumed and levels of afforestation are held constant at the 2009 rate. This approach has been used to produce projections of LULUCF emissions and removals for the UK for many years, as reported in the annual LULUCF project reports produced by CEH (these are available at http://ecosystemghg.ceh.ac.uk/). Areas of deforestation which will be removed from the Forest Management area are projected using an autoregressive model fitted to the 1990-2009 data, which takes into account the trend and variability in the historical data. Areas affected by wildfires are projected using the same approach. The approach is under review as outlined below.

[7] Milne, R., T. A. W. Brown, et al. (1998). *The effect of geographical variation in planting rate on the uptake of carbon by new forests of Great Britain.* Forestry 71: 298-309.

5. Description of construction of reference levels

I. Description of how elements were considered or treated in the construction of the forest management reference level, taking into account the principles in decision 16/CMP.1

(a) Area under forest management

The area under forest management between 1990 and 2020 was compiled using records of afforestation since 1920, adjusted to take account of losses to deforestation (Table 2). This is the area reported under Forest Management for Article 3.4 of the Kyoto Protocol. In addition, there is an area of c. 1182 kha of forest established before 1921 which is assumed to have overall zero net carbon stock change, because of the assumption of dynamic equilibrium.

Table 2: Area under forest management and emissions/removals from forest management 1990-2020 (*numbers in italics are projected*).

Year	Area of FM land, kha	Net CO2 emissions/removals from carbon stock changes, Gg CO2	Emissions from wildfire biomass burning, Gg CO2eq	Net emissions/ removals, Gg CO2eq
1990	1395	-12222	52	-12170
1991	1394	-12879	87	-12792
1992	1394	-13533	22	-13511
1993	1393	-13821	39	-13782
1994	1392	-14126	31	-14095
1995	1391	-13645	243	-13402
1996	1391	-13167	126	-13041
1997	1390	-12692	166	-12526
1998	1389	-12352	92	-12260
1999	1388	-12230	15	-12216
2000	1387	-12329	51	-12278
2001	1386	-12693	70	-12623
2002	1384	-13206	59	-13147
2003	1383	-13587	50	-13537
2004	1381	-14032	67	-13965
2005	1380	-13280	14	-13265
2006	1379	-12609	163	-12446
2007	1378	-11567	186	-11381
2008	1377	-10888	177	-10711
2009	1375	-9912	114	-9798
2010	*1374*	*-7594*	*99*	*-7495*
2011	*1373*	*-7347*	*41*	*-7306*
2012	*1372*	*-6424*	*79*	*-6345*
2013	*1371*	*-5347*	*141*	*-5206*
2014	*1370*	*-4745*	*85*	*-4660*

2015	*1370*	*-4248*	*66*	*-4181*
2016	*1369*	*-3893*	*55*	*-3839*
2017	*1368*	*-3654*	*78*	*-3576*
2018	*1367*	*-3441*	*119*	*-3322*
2019	*1366*	*-2198*	*168*	*-2030*
2020	*1366*	*-815*	*93*	*-722*

(b) Emissions and removals from forest management

1) Historical emissions and removals from forest management

Historical and projected emissions and removals from 1990 to 2020 are also shown in Table 2. These are consistent with the 2011 national GHGI, as they are based on the same activity data and use the same methods. Wildfire emissions are also shown, both historical and projected, on a statistical basis as described below.

2) The relationship between forest management and forest land remaining forest land as shown in GHG inventories and relevant historical data, including information provided under Article 3.3., and, if applicable, Article 3.4 forest management of the Kyoto Protocol and under forest land remaining forest land under the Convention

The activity data and methods used for calcualting the forest managment reference levels are consistent with the UK GHGI which is available on the UNFCCC website.

The Forest Management area is the area converted to forest land between 1921 and 1989 (1,395.19 kha), adjusted to reflect losses from deforestation 1990-2008 (19.76 kha), giving a total of 1375.43 kha in 2009. In the UNFCCC GHGI the deforestation area is deducted from the Forest remaining Forest Land area established after 1921. Emissions from and carbon stock changes in soils and biomass due to deforestation are fully accounted for in the GHGI. A new reporting structure has been put in place in the 1990-2009 inventory, so that the transition between Land converted to Forest and Forest remaining Forest takes 20 years but there has been no change in the underlying method or in the overall emissions and removals calculated in sector 5A. Data on forest area and Kyoto Protocol activities are consistent.

Projections are made using the same assumptions as the inventory and assuming that the historical pattern of land-use continues. A description of the inventory and projections methodology can be found at http://www.edinburgh.ceh.ac.uk/ukcarbon. Work for the 2010 Global Forest Resources Assessment is currently ongoing - a copy of the UK report is at http://www.forestry.gov.uk/forestry/infd-7aqfxg. Information on fires for the period up to 2003-4 is available for state forests. These figures are reported annually to UNECE and were published in Forestry Statistics 2004 (http://www.statistics.gov.uk/hub/agriculture-environment/forestry/forest-and-woodlands) and used for Global FRA report. Data from 2004 onwards are estimated for GHGI purposes and projections using the Burg Regression as set out on the CEH website (see above). UK 2008 returns on roundwood production (underbark) are available at http://www.forestry.gov.uk/website/forestry.nsf/byunique/infd-7aqhzh.

(c) Forest characteristics and related management

1) Age class structure

The age class structure for UK forests is shown in Table 3. This information is based on the 1995-1999 National Inventory of Woodland and Trees (NIWT), as reported in Forestry Statistics 2010[8], and extended to include Northern Ireland and planting since 2000. These data do not take account of deforestation losses of approximately 16kha since the 95-99 NIWT.

Table 3: Area of woodland in UK by planting year classes

Planting year	Conifers, kha	Broadleaves, kha	Total, kha
Pre-1861	6	47	53
1861-1900	14	144	158
1901-1910	2	28	30
1911-1920	13	75	88
1921-1930	21	85	106
1931-1940	37	92	129
1941-1950	89	128	217
1951-1960	235	124	360
1961-1970	335	91	425
1971-1980	330	63	393
1981-1990	283	54	337
1991-2000	200	135	335
2001-2008	125	101	226

2) Increment

Increment of UK forests in relation to fellings is reported by Forestry Commission[9] as shown in Table 4. On average, annual fellings are observed to be about one half of the annual increment.

[8] "Forestry Statistics 2010" is available at http://www.forestry.gov.uk/forestry/infd-7aqdgc

[9] Sustainable Forest Management Indicators 2010 – Productive Functions of Forests (Wood and Non-Wood), at http://www.forestry.gov.uk/website/sfmindic2010.nsf/LUContents/F22CF27796710B85802576B00058E931

Table 4. Increment and fellings in UK forests (millions of cubic metres over bark)

	Year			
	1990	2000	2005	2010
Gross annual increment	18.1	20.8	20.8	20.8
Natural losses	0.1	0.1	0.1	0.1
Net annual increment	18.0	20.7	20.7	20.7
Fellings	8.0	9.7	10.6	10.5
of which: felling of natural losses	0.1	0.1	0.1	0.1

Rotation length

Harvesting is assumed to occur at the time of Maximum Area Increment (59 years for Sitka spruce YC12, 57 years for Sitka spruce YC14 and 92 years for Beech YC6), followed by restocking with the same woodland type. Conifer forest assumed to be Sitka spruce yield class 12 accounts for three quarters of the forest planted since 1921 and broadleaf forest similar to beech yield class 6 for the remainder of the planted forest area.

3) Information on forest management activities under business as usual

Harvesting rate on forest management land is driven by historical planting rates. A large proportion of the UK forest was planted in the mid-20th Century and is now being harvested. This is reflected in reduced carbon removals after 2009 as shown in Figure 1 and will help determine the future trends.

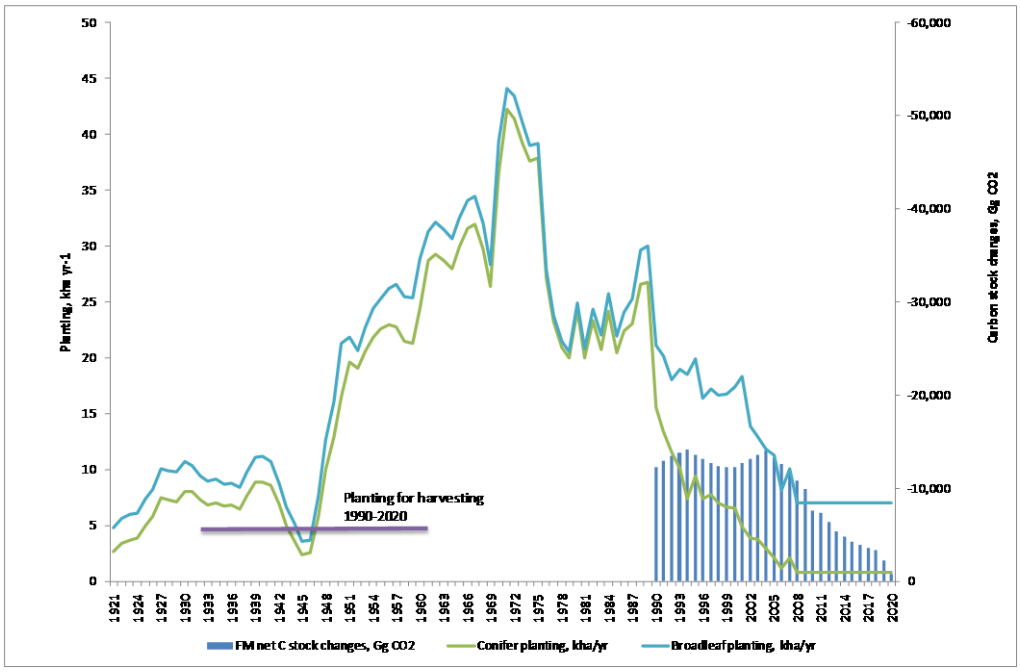

Figure 1: Conifer and broadleaf planting and Forest Management net carbon stock changes 1921-2020.

4) Other relevant information

The UK has a significant work programme underway to model explicitly the dynamics of carbon stocks in the pre-1921 forest, and to introduce more detailed representation of managment practice, linked to harvest data as a rolling boundary condition. Results from this work should start to become available in the summer of 2011 and will enable the UK to capture, for example, differential effects should any changes in management practice or product ratios occur due to increased bioenergy demand. The UK will use provisions for technical adjustment of reference levels agreed by the CMP to ensure consistency between the reference levels and historical data, and to continue ensuring that post mid-2009 management changes are not reflected in the reference level.

(d) Harvesting rates

1) Historical harvesting rates

Table 5 (see end of document) shows historical harvest rates

2) Asumed future harvesting rates

Table 5 shows future harvest rates calculated using the same model, and making the same assumptions about management practice

(e) Harvested wood products

Table 5 shows historical and future harvesting rates calculated by C-Flow, and changes in the corresponding solid wood and paper product pools using the product categoires, half lives and methodologies outlined in para 27, page 31 of FCCC/KP/AWG/2010/CRP.4/Rev.4. The Table also shows the amounts of carbon assumed to instantaneously oxidised, which includes bioenergy. The estimates assume that the HWP pools arising from forests planted before 1921 are in dynamic equilibrium, consistent with treatment of the other pools from these forest areas. As already outlined, this assumption is under review and if it is revised, the UK will maintain consistency between the reference level and the HWP estimates in accordance with relevant CMP decisions.

Allocation of felled timber from C-flow to the required HWP classes involves an assumption of 10% losses in the forest during harvesting. The allocation of harvested wood to specific HWP categories has been based on timber utilisation statistics reported recently and historically by the Forestry Commission[10]. These statistics are already expressed in terms of consumption of UK wood, within the UK, by sawmills, panel mills and paper mills. Additional categories in the statistics cover wood used for fencing, woodfuel and other (which includes e.g. veneer material and long poles). Wood categorised as fencing or other has been included with the wood consumed by sawmills. Wood exports (a relatively small quantity of UK wood) are reported separately in the statistics and have been assumed to supply paper mills and panel mills in equal proportions. The conversion of sawlogs to sawnwood within sawmills has been assumed to involve an efficiency of 50%, with the secondary wood being utilised for paper, panels and woodfuel in equal proportion. The consumption statistics for UK wood are available for the years 1994 to 2009. The allocation of harvested wood to HWP categories from 2010 onwards has been based on the average allocations for the period 2005-2009. Allocation before 1994 is based on an extrapolation of the allocations for the period 1994-1998, also allowing for the expansion of the wood panel industry in the second half of the 20th century.

(f) Disturbances in the context of force majeure

Force majeure disturbances in UK forests could include weather-related damage (storms, wind, snow), disease outbreaks, biotic damage (insects, fungi, mammals) and wildfires. Estimates of disturbances

[10] Forestry Statistics 2010 at http://www.forestry.gov.uk/website/forstats2010.nsf/LUContentsTop?openview&RestrictToCategory=1

are reported in the Global Forest Resource Assessment 2010 for the UK. Catastrophic storm damage or disease outbreaks are the most likely to result in force majeure in the UK.

There have been no catastrophic storms with estimated windthrown growing stock exceeding 2 million m^3 or 2000 ha since 1990 (the last was in October 1987). A sufficiently large event could qualify as force majeure and would be dealt with as it arose, consistent with any CMP Decisions.

There are concerns over recent tree disease outbreaks, particularly *Phytophthora ramorum* infection of larch, which has resulted in notices to fell being issued in England, Wales and Northern Ireland. Although not covered explicitly in reference level calculations, the impact is likely to be relatively small as owners are encouraged to restock such that the net effect is likely to be a reduction in rotation length over a small proportion of UK forest area. The impact on inventory projections will be kept under review and modified as necessary.

Wildfire is estimated to affect less than 1000 ha a^{-1} and is included in inventory reporting and in the reference level, using a statistical model driven by forest fire data from 1990-2004, as already described. Table 2 shows the results of this calculation. Storm damage and disease attack are not included in the projections.

(g) Factoring out in accordance with paragraph 1(h) (i) and 1(h) (ii) of decision 16/CMP.1

The UK inventory approach to estimating forest carbon stock changes is curently uses C-Flow, which is based on yield class tables, and implicitly assumes constant weather and management conditions. Therefore further factoring out of climate change effects is unnecessary. Work has been undertaken to model the impact of climate, CO_2 and land use change on the carbon balance of terrestrial ecosystems in Great Britain (Levy and Clark 2009)[11] and interaction between these factors. This suggested that interactions are small and the effects of these environmental factors are additive. Nitrogen dynamics were not considered in this work: the extent to which enhanced nitrogen deposition affects forest carbon sequestration remains contentious (Magnani *et al* 2007[12]; Sutton *et al* 2008[13]).

II. Description of any other relevant elements considered or treated in the construction of the forest management reference level, including any additional information related to footnote 1 in paragraph 4 of decision [-/CMP.6]

[11] Levy, P. and A. Clark (2009). Modelling the impact of climate, CO_2 and land use change on the carbon balance of terretrial ecosystems in Great Britain. K. E. Dyson (ed.), Inventory and projections of UK emissions by sources and removals by sinks due to land use, land use change and forestry. Annual report July 2009. Centre for Ecology and Hydrology. http://www.edinburgh.ceh.ac.uk/ukcarbon/reports.htm

[12] Magnani, F., M. Mencuccini, et al. (2007). "The human footprint in the carbon cycle of temperate and boreal forests." Nature **447**(7146): 848-850.

[13] Sutton, M. A., D. Simpson, et al. (2008). "Uncertainties in the relationship between atmospheric nitrogen deposition and forest carbon sequestration." Global Change Biology **14**(9): 2057-2063.

None, but see above for developments which will allow explicit consideration of the dymanics of the pre-1921 forest, and the effect of differential chnages in management practice.

4. Policies included

Pre-2010 domestic policies included

The Forestry Act, Felling Licence ***re***quirements and Environmental Impact (Forestry) Regulations (http://www.forestry.gov.uk/website/forestry.nsf/byunique/infd-74adb6) provide a strong regulatory framework for forest management in the UK, placing controls on deforestation and unsustainable management practice. In Scotland, a specific policy has been introduced on the Control of Woodland Removal (http://www.forestry.gov.uk/pdf/fcfc125.pdf/$FILE/fcfc125.pdf) while in England, a new policy on restoring open-ground habitat from woodland has been linked to increasing woodland creation rates (http://www.forestry.gov.uk/england-openhabitats). The UK Forestry Standard (UKFS) and its underpinning Guidelines series is currently being revised with new Forests and Climate Change Guidelines drafted (http://www.forestry.gov.uk/UKFS). The UKFS is the national standard for sustainable forest management and is the management standard adopted across Forestry Commission and Forest Service woodlands and a requirement for receiving grant-aid and the issuing of felling licences. The UK also has a system of certification for sustainable woodland management, the UK Woodland Assurance Standard (UKWAS) which is the central component of forest certification programmes operated in the UK by the Forest Stewardship Council (FSC) (http://www.fsc-uk.org/) and the Programme for the Endorsement of Forest Certification Programmes (PEFC). As of March 2010, 1288 kha of woodland in the UK (45%) was certified (Forestry Statistics 2010). The management practices in certified woodlands are reviewed annually. All state-owned forests are certified and an increasing proportion of non-state-owned woodlands are becoming certified (24% in 2010). This does not include all woodland that is managed in a sustainable manner, such as smaller or non-timber producing woodlands where certification is not considered worthwhile. In particular, it may omit many broadleaved woodlands even though they are managed for their social and environmental benefits (Forestry Commission, 2003)[14]. In the UK's country report to the Global Forest Resource Assessment 2010 83% of UK forests are managed for production and 18% are managed for conservation of biodiversity (these have protected status

I. Confirmation of factoring out policies after 2009

The projections used for the forest reference level are based on the methodology used for the 1990-2008 inventory. Standard mangement regimes are rolled forward and do not take account of any policies implemented after mid-2009. The UK will estimate the differential effects of future changes

[14] Willis, K.G., Garrod, G., Scarpa, R.,Powe, N., Lovett, A., Bateman, I.J., Hanley, N. and Macmillan, D.C. (2003). THE SOCIAL AND ENVIRONMENTAL BENEFITS OF FORESTS IN GREAT BRITAIN. Social & Environmental Benefits of Forestry Phase 2Report to Forestry Commission, Edinburgh. Centre for Research in Environmental Appraisal & Management. University of Newcastle

management practice and has a work programme in place to achieve this, with the first results scheduled to become available in the summer of 2011.

Table 5. Projected HWP production, net removals/emissions and stocks in UK HWP for the categories of sawn timber, wood-based panels, paper and material undergoing instantaneous combustion (e.g. wood fuel, waste wood)

Year	Production (1000 m^3)					Net removals/emissions (1000 tCO_2)					Carbon stock (1000 tCO_2)				
	Sawn	Panel	Paper	Instant	Total	Sawn	Panel	Paper	Instant	Total	Sawn	Panel	Paper	Instant	Total
1990	2545	2066	1619	1129	7359	-1385	-1083	-145	0	-2613	21234	11832	3368	0	36434
1991	2549	2087	1632	1140	7409	-1353	-1066	-110	0	-2529	22587	12897	3478	0	38963
1992	2534	2065	1617	1128	7344	-1320	-1023	-68	0	-2411	23907	13920	3546	0	41374
1993	2634	1986	1740	1153	7513	-1367	-943	-131	0	-2441	25274	14863	3677	0	43815
1994	2606	1951	1709	1134	7399	-1328	-895	-73	0	-2295	26602	15758	3750	0	46110
1995	2756	2357	1806	1221	8140	-1408	-1141	-117	0	-2666	28010	16899	3867	0	48776
1996	3002	2469	1771	1349	8591	-1531	-1180	-59	0	-2770	29541	18079	3926	0	51547
1997	3042	2713	1889	1390	9033	-1530	-1311	-119	0	-2960	31071	19390	4045	0	54507
1998	3305	2684	1901	1476	9366	-1681	-1254	-95	0	-3030	32752	20645	4140	0	57537
1999	3348	2734	1699	1490	9270	-1681	-1251	64	0	-2868	34434	21895	4076	0	60405
2000	3501	2963	1835	1579	9878	-1759	-1368	-49	0	-3176	36192	23263	4126	0	63581
2001	3313	2816	1748	1513	9390	-1586	-1230	25	0	-2792	37778	24494	4101	0	66373
2002	3121	2438	1728	1422	8709	-1431	-949	29	0	-2350	39209	25443	4072	0	68724
2003	2897	2281	1695	1317	8190	-1262	-814	38	0	-2038	40471	26257	4034	0	70761

2004	2722	2189	1519	1214	7644	-1124	-729	140	0	-1713	41595	26986	3894	0	72475
2005	3140	2483	1762	1368	8753	-1399	-903	-59	0	-2360	42993	27889	3953	0	74835
2006	3626	2699	1911	1619	9854	-1686	-1021	-115	0	-2822	44680	28909	4069	0	77658
2007	4136	3014	2157	1961	11267	-2003	-1202	-234	0	-3439	46683	30111	4303	0	81097
2008	4333	3089	2353	2171	11947	-2102	-1218	-295	0	-3616	48785	31329	4598	0	84712
2009	4927	2906	2286	2920	13039	-2459	-1063	-164	0	-3687	51245	32393	4762	0	88399
2010	5362	3899	2846	2675	14781	-2701	-1690	-495	0	-4887	53946	34083	5257	0	93286
2011	5262	3871	2821	2650	14605	-2560	-1625	-333	0	-4518	56506	35708	5590	0	97804
2012	5499	4050	2952	2772	15274	-2670	-1699	-321	0	-4691	59176	37408	5911	0	102495
2013	5996	4095	3010	2839	15940	-3103	-1685	-277	0	-5064	62279	39092	6188	0	107560
2014	6069	4133	3040	2867	16109	-3099	-1664	-216	0	-4979	65378	40757	6404	0	112539
2015	6277	4262	3135	2958	16632	-3192	-1704	-217	0	-5113	68570	42460	6621	0	117652
2016	6156	4239	3113	2934	16442	-3017	-1641	-136	0	-4795	71587	44102	6758	0	122447
2017	6046	4119	3029	2857	16051	-2900	-1518	-42	0	-4460	74487	45619	6800	0	126906
2018	5961	4014	2956	2790	15721	-2804	-1407	17	0	-4193	77291	47027	6783	0	131100
2019	6282	4234	3117	2942	16574	-2976	-1514	-95	0	-4585	80266	48541	6878	0	135685
2020	6911	4690	3451	3255	18307	-3353	-1774	-289	0	-5416	83619	50315	7167	0	141101