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Advice on LULUCF accounting policy changes for forestry

Robert Matthews, Ewan Mackie and Amanda Thomson, Forest Research and Centre for Ecology and Hydrology

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Enquirer: Daniel Hinze

1. Key Points

- Changes to accounting rules for LULUCF for the second commitment period of the Kyoto Protocol or its successor were agreed by a Conference of the Parties held in Durban in December 2011.
- A proposed EU Decision is currently under discussion amongst stakeholders and negotiation amongst Member States. The Decision aims to implement to LULUCF accounting rules already agreed in Durban consistently across the EU.
- There is concern amongst some stakeholders and Member States that in places the LULUCF accounting rules proposed in the EU Decision 'go further' than agreed at Durban, although this could be viewed as consistent with the EU's 'greater ambition' for action on climate change.
- The proposed Decision would also require Member States to draw up National Action Plans for climate change mitigation in the LULUCF sector, which would be reviewed by the EU. This has created some concerns amongst Member States because e.g. forestry is a national rather than EU competency.
- Even if the proposed EU Decision were to be adopted, it would only come into force if the EU moves from a 20% overall greenhouse gas (GHG) reduction target across all sectors to 30% (which is the subject of a separate negotiation between Member States).
- Existing and future annual GHG emissions inventories compiled and reported to the UNFCCC by the UK will be unaffected by the new accounting rules, which only apply for the Kyoto Protocol and for the EU reduction commitment (if the proposed EU Decision is adopted). The separate annual GHG emissions inventories for Scotland, England, Wales and Northern Ireland prepared by the UK on behalf of the devolved administrations will be similarly unaffected.
- The development and implementation of Scottish domestic policies aimed at achieving GHG emissions reductions, including contributions due to LULUCF and in particular forestry, are unaffected by the new accounting rules agreed at Durban and proposed as part of the EU Decision, because Scottish domestic policies do not (and do not need to) refer to Kyoto Protocol or proposed EU accounting rules which only apply to EU-wide and international commitments made by the UK as a whole.
- This situation would only change if Scotland deliberately chose to adopt the accounting rules in developing and implementing domestic policies on reducing GHG emissions, or if Scotland were to have its own separate commitments to GHG reductions within the EU, or internationally under the Kyoto Protocol.
- The new accounting rules will have some impacts on Scotland's potential to contribute to UK commitments to reduce GHG emissions through LULUCF mitigation activities, notably forestry.

- The new accounting rules agreed at Durban, and repeated in the EU Decision, require Parties to account for GHG emissions due to Forest Management or 'FM' (management of forests in existence before 1990) on a mandatory basis. (Previously, Parties could elect whether or not to do so.) However, the UK has already elected to account for FM, and has done so during the first commitment period of the Kyoto Protocol.

- The detailed accounting rules for FM have also been changed. Under the accounting rules for the first commitment period of the Kyoto Protocol, Scotland's forests contributed a removal of about –1.2 $MtCO_2$ per year (note that removals are reported as negative numbers), i.e. most of a modest but notable removal due to carbon sequestration in forests in existence in the UK before 1990. This contribution would have been bigger (about –7 $MtCO_2$ per year) had it not been for caps imposed on the levels of removals due to FM that Parties (including the UK) could claim towards their emissions targets for the first commitment period.

- For the second commitment period, the cap on the contribution made by removals due to carbon sequestration in forests in existence in the UK before 1990 is much larger (around –18 to –20 $MtCO_2$ per year) but, unlike in the first commitment period, Scotland and the UK will not be able to account for any carbon sequestration 'already happening' in pre-1990 forests. Rather, it will be necessary to take measures involving the management of these forests and to demonstrate that these are leading to additional removals (i.e. carbon sequestration over and above that already occurring in these forests under current management).

- If Scotland were to adopt the new accounting rules in developing and implementing domestic policies on reducing GHG emissions, or if Scotland were to have its own separate commitments to GHG reductions within the EU, or internationally under the Kyoto Protocol, then the cap on the potential contribution made by removals due to FM activities would be about –2.8 $MtCO_2$ per year, i.e. much lower than the UK cap of about –18 to –20 $MtCO_2$ per year.

- Accounting rules covering GHG emissions and removals due to Afforestation, Reforestation and Deforestation activities since 1990 (mandatory under the first commitment period but with no cap imposed) effectively remain unchanged.

- The new accounting rules also require Parties to account for contributions to GHG emissions and removals due to carbon stocks in wood products harvested from forests in existence before 1990.

- There is provision within the new accounting rules for Parties to 'allow for' the impact of major natural disturbance events on GHG emissions outside the control of Parties (e.g. forest fires, storms, disease outbreaks).

- Certain other details of the accounting rules in the proposed EU Decision are still undecided and hotly debated (e.g. how to define a 'forest', accounting for forest areas planted in compensation for permanent forest clearance).

2. Introduction

The Scottish Government has sought CXC advice on:

A. impact of proposed EU accounting rules on the Scottish emissions total ("Proposal for a Decision of the European Parliament and of the Council on accounting rules and action plans on greenhouse gas emissions and removals resulting from activities related to land use, land use change and forestry" – 7639/12),
B. data requirements (and cost of collection) for implementation of accounting rules, and
C. potential policy impacts and costs.

Advice on these points has been sought in three separate areas:

1. Cropland and grassland management
2. Change in forest area, forest management, harvested wood products
3. Wetlands and revegetation.

This paper addresses the subject area of "change in forest area, forest management, harvested wood products".

Before responding to specific questions it may assist to review how forestry activities have been accounted for until now, how this will change as a result of a Decision of the Conference of the Parties (COP) to the Kyoto Protocol held in Durban in December 2011 and how this relates to the accounting rules of the proposed EU Decision.

3. Existing accounting

Under the Kyoto Protocol (KP), developed countries took on quantified greenhouse gas (GHG) emission limitations and reduction obligations (also known as 'Kyoto targets'). Parties must also implement and/or elaborate policies and measures to protect and enhance carbon sinks and reservoirs, promote sustainable forest management, afforestation and reforestation, and sustainable forms of agriculture, in support of climate change mitigation. The Kyoto targets are defined in relation to national total emissions, usually for a base year of 1990, without LULUCF. The scope of reporting and accounting under the KP is concerned with "direct human-induced" activities. The accounting rules of the KP require that emissions and removals due to certain LULUCF activities, specifically afforestation, reforestation and deforestation that have taken place since 1990, must be counted towards the achievement of Kyoto targets. **For the first commitment period of 2008 to 2012 (5 years),** Parties may include emissions and removals due to certain other LULUCF activities (forest management, cropland management, grazing land management and revegetation) on a voluntary basis. The accounting rules and definitions of the different LULUCF activities for the first commitment period are set out in Articles 3.3, 3.4 and 3.7 of the KP[1], and in subsequent decisions of the Conference of the Parties (i.e. Parties to the KP), most notably Decision 16/CMP.1[2].

Although forestry is a devolved policy area, international climate change policy remains a UK responsibility, for example annual inventories of GHG emissions are reported under the United Nations Framework Convention on Climate Change (UNFCCC) for the UK as a whole (GHG emissions inventories for devolved administrations are

[1] See http://unfccc.int/resource/docs/convkp/kpeng.pdf
[2] See pp. 3-9 in FCCC/KP/CMP/2005/8/Add.3, http://unfccc.int/resource/docs/2005/cmp1/eng/08a03.pdf#page=3

prepared primarily for internal use) and international commitments under the KP have also been negotiated for the UK as a whole.

Accounting for LULUCF activities

Under the first commitment period of the KP, Parties needed to account for some emissions or removals on a mandatory basis, whereas accounting for certain other emissions or removals has been optional. Accounting is **mandatory** for emissions and removals related to **afforestation, reforestation** and **deforestation (ARD)** activities which have taken place since 1990. Parties have been allowed to account for emissions and removals related to one or more of **forest management (FM, i.e. management of forests in existence before 1990), cropland management (CM), grazing land management (GM) and revegetation (RV)** on an **optional** basis. Parties had to declare their decisions on which, if any, of these activities they would elect to account for.

For the first commitment period, the UK elected to account for FM but not for CM, GM or RV.

It should also be noted that, under accounting rules for the first commitment period, any contributions towards emissions or removals due to carbon stocks in **harvested wood products (HWP)** are **not accounted for.** In effect, carbon stocks in HWP are assumed to be emitted to the atmosphere instantaneously on harvesting.

ARD activities and **FM** activities have been accounted for on a **'gross-net'** basis during the first commitment period of the KP. Under gross-net accounting, emissions or removals for relevant LULUCF activities are included in calculations for the commitment period, but equivalent emissions or removals are not included in calculations for the base year or base period. This approach should be compared with **'net-net'** accounting (used for CM and GM) which includes emissions or removals for relevant LULUCF activities in calculations both for the commitment period and the base year or base period. Examples illustrating the application of gross-net and net-net accounting are given in Annex 1.

Net-net accounting is the strictly correct way to compare emissions in a commitment period with emissions in a base year or base period. Gross-net accounting could be viewed as giving a misleading picture of the actual change in emissions achieved by a Party. However the adoption of gross-net accounting for FM aimed to address legitimate concerns that Parties that had already embarked on significant programmes of forest expansion in preceding decades could be unfairly penalised when accounting for emissions and or removals due to forestry activities (see Annex 1 and particularly Annex 2 for more details).

For **ARD** activities undertaken since 1990, the application of gross-net accounting is more defendable. Effectively it involves the assumption that there were no emissions or removals due to the activity before 1990 (since the activity wasn't going on), so there are zero emissions or removals due to the activity before the base year. Thus, from the base year onwards, the party simply reports the emissions or removals due to the activity, as observed during a commitment period.

Gross-net accounting with cap applied to FM

Whilst it has been expedient to adopt gross-net accounting for FM activities in the first commitment period of the KP, at the same time the quantity of removals generated would have been bigger than the overall obligation to reduce emissions, limiting the effectiveness of the KP. In general, the Parties with large forest areas would have been able to claim substantial removals due to FM without taking any new mitigation actions. Therefore, under the first commitment period of the KP, the annual quantity of removals a Party could claim was 'capped', with different Parties assigned specified caps. As a general rule but with some notable exceptions, the cap was set at

15% of the annual removals expected for FM (if elected) during the commitment period. An example of gross-net accounting with a cap is given in Annex 1, see also Annex 2.

4. Changes to accounting under the second commitment period

The full details of accounting for the second commitment period have not been decided. For example, the duration of the commitment period has not yet been set, although one possibility may be 2013 to 2020 (a commitment period of **8 years**).

As a result of a Decision taken by the Conference of the Parties at Durban in December 2011[3], accounting for **FM** during the second period of the KP (or its successor) will be **mandatory** for all Parties. Additionally, **FM** needs to be accounted for using an approach known as **'reference-level'** accounting. **ARD** activities are still accounted for using gross-net accounting. In addition, certain contributions towards emissions or removals due to carbon stocks in **HWP** may be accounted for. There are also provisions to allow for so-called 'compensatory planting' and for the impacts of major natural disturbance events.

Reference-level accounting

The reference-level accounting approach involves comparing the observed net emissions or removals in a commitment period with a reference value which represents the 'expected' or 'projected' level of net emissions or removals for the period. The reference value is estimated allowing for the natural development of forests, e.g. due to age class structure, while assuming no additional mitigation activities are taken by the relevant Party. In other words, the reference value is estimated based on a Business as Usual (BAU) projection of FM emissions and removals for the commitment period.

Some stakeholders have expressed concerns that reference-level accounting could be 'rigged' by some Parties. Specifically, a Party could negotiate for a reference level that is very easy to achieve, or such that emissions or removals due to FM would improve upon the reference level easily, without the Party taking any additional action on FM aimed at mitigation, effectively generating free credits for the Party (referred to by some commentators as 'hot air'). In order to address such concerns, the Durban accounting rules include a cap on the removals that can be claimed under reference-level accounting for FM.

Examples illustrating reference-level accounting are given in Annex 1, see also Annex 2.

Accounting for HWP

For decades, Parties to the UNFCCC and KP debated what to do about carbon stocks and stock changes due to HWP and whether and how to account for them. Eventually agreement was reached at the Conference of the Parties in Durban in December 2011 that HWP should be accounted for in the second commitment period, and that this should be on the basis of the so-called 'production approach" (see Annex 3 for more details about the different possible accounting approaches and the reasons for selecting the production approach).

Under the production accounting approach, carbon stocks and associated removals or emissions due to HWP remain 'attributed' to country where wood was harvested (even if wood products are exported). The Durban accounting rules therefore require Parties to keep track of wood production, and to allocate harvested wood to four 'raw' wood product types:

- Sawn timber

[3] See Decision 2/CMP.7 in FCCC/KP/CMP/2011/10/Add.1, http://unfccc.int/resource/docs/2011/cmp7/eng/10a01.pdf

- Wood-based panels
- Paper
- Other (which would include for example wood fuel).

Harvested wood is thus assumed to be converted into these four product types. The carbon in wood forming these products is assumed to have a characteristic 'residence time', after which it is released back to the atmosphere as CO_2. As a default assumption, the release of CO_2 back to the atmosphere from HWP is assumed to follow an exponential trajectory, with specified half lives for sawn timber, wood-based panels and paper of 35, 25 and 2 years respectively. Carbon in HWP forming the 'other' category is assumed to be released to the atmosphere on the basis of instantaneous oxidation.

Although the Durban accounting rules offer this default approach, Parties can use different half-lives or decay functions to describe carbon stock dynamics of HWP for domestically-consumed wood if they can provide evidence to support the approach they adopt. Parties must use the default assumptions of exponential decay and the specified half-lives when accounting for any exported wood.

Allowing for 'compensatory planting'

Under the first commitment period of the KP, activities involving Afforestation/Reforestation and Deforestation since 1990 were accounted for on a strictly 'gross' basis.

For deforestation, this meant that if 'X hectares' of forest in existence before 1990 was felled and cleared, and the land converted to another use, then this had to be reported as X hectares of deforestation even if an equivalent area of forest ('X hectares') was created (i.e. planted) in compensation. In fact, this newly-created forest area would need to be reported separately as X hectares afforestation.

As a result of agreement reached at the Conference of the Parties in Durban in December 2011[4], for the second commitment period, activities involving Afforestation/Reforestation and Deforestation since 1990 are accounted for in almost the same way as in the first commitment period. However, special provisions allow that if 'X hectares' of specifically 'plantation forest' (for which there is a tortuous definition) in existence before 1990 is felled and cleared, and the land converted to another use, but an equivalent area of plantation forest ('X hectares') is created in compensation, then this is not accounted for as either deforestation or afforestation, but is regarded (and accounted for) as continued management of existing forest areas, i.e. it is accounted for as part of Forest Management. For these types of activity, the Party is still required to report any carbon stock changes associated with the felling and clearing of areas of plantation forest and (effectively) the restocking of forest areas with new plantations (as part of Forest Management).

The impact of this facility within the accounting rules is probably not to change 'the bottom line' in terms of reported emissions and removals due to forestry activities, but to change where certain emissions or removals get reported (i.e. under Forest Management instead of under Afforestation and Deforestation).

It should be noted that this arrangement was included in the Durban agreement largely to accommodate the requirements of New Zealand, where large areas of pine plantations are grown on relatively short rotations (e.g. 30 to 35 years) and there can be (at least in principle) a cycling of land between pasture and plantation forest on quite short timescales.

[4] See Decision 2/CMP.7 in FCCC/KP/CMP/2011/10/Add.1, http://unfccc.int/resource/docs/2011/cmp7/eng/10a01.pdf

Allowing for major natural disturbance events

As a result of agreement reached at the Conference of the Parties in Durban in December 2011[6], an arrangement was put in place within the accounting rules which aims to assist Parties faced with significant emissions due to major natural disturbances (e.g. forest fires, storms, disease outbreaks). Specifically:

- Parties must declare that the disturbance has occurred
- The impact of the disturbance on emissions must be quantified
- The emissions due to the disturbance must be reported but are not counted towards a Party's reported emissions
- The Party must demonstrate that it has a plan for remediation in place and also show progress towards remediation.
- Remediation has to be achieved within a certain time.

This mechanism was included to accommodate the concerns of some Parties that commitments to achieve specified levels of mitigation, particularly related to FM (e.g. attainment of FM reference levels) could be subject to significant risks due to disturbance events outside the control of Parties.

5. Accounting rules for forestry in the proposed EU Decision

A proposal for an EU Decision on LULUCF is currently under discussion amongst Member States. This is partly in response to the agreement on LULUCF accounting rules achieved at Durban[5], but is also an attempt by the EU to take a definite position towards LULUCF as part of its commitment to reduce GHG emissions. The proposed EU Decision sets no specific emissions reduction targets for LULUCF mitigation activities. However, it does specify accounting rules, which in places may be 'tougher' than those agreed at Durban (see Table 1). Whilst there are no hard targets for LULUCF mitigation, implicitly, Member States will need to manage the LULUCF sector to avoid undermining commitments to emissions reductions in other sectors. The proposed EU Decision would also require Member States to formulate and implement National Action Plans for LULUCF, including forestry. In principle, this gives Member States flexibility over implementation but Member States have objected that forestry is a national, not an EU, competence. Equally critically, the EU Decision would only come into force if EU moves from a 20% overall GHG reduction target to 30%.

The key differences between the accounting rules (specifically for forestry) for the first and second commitment periods of the KP (or its successor), and the accounting rules currently being debated in negotiations amongst Member States over the EU Decision, are summarised in Table 1.

In addition to the points outlined in Table 1, it should be noted that Sweden has recently advocated an amendment to the EU Decision that would require Member States to include a *report* accompanying accounted emissions (and removals) due to FM, giving details of impacts on emissions in other sectors due to the utilisation of harvested wood (i.e. avoidance of consumption of fossil fuels for energy or of emissions-intensive materials for construction). To emphasise, these impacts would only be *reported alongside* emissions and removals due to forests, they would not form part of the accounted emissions and removals due to forestry, as such impacts should already be accounted for in the Energy and Industry sector(s), and to account for them as part of forestry activities would be to double-count. The Swedish proposal could be viewed as non-contentious provided that inclusion of the accompanying report on impacts on emissions in other sectors is *discretionary rather than a requirement*.

[5] See Decision 2/CMP.7 in FCCC/KP/CMP/2011/10/Add.1, http://unfccc.int/resource/docs/2011/cmp7/eng/10a01.pdf

6. Impact of proposed EU accounting rules on the Scottish emissions total

In assessing the impact of the proposed EU accounting rules on the Scottish emissions total, it is important to be clear what is meant by the term “Scottish emissions total”. As already discussed, the UK, on behalf of the Devolved Administrations, submits annual inventories of GHG emissions under the UNFCCC for the UK as a whole. GHG emissions inventories for Devolved Administrations are prepared primarily for internal use. These emissions inventories, including the inventories compiled separately for Scotland, will not be changed in any way by the new Durban accounting rules or those adopted as part of any EU Decision. On the other hand, accounted emissions and/or removals as part of achievement of any emissions targets for the second commitment period of the KP (or any successor), or towards GHG reduction commitments made within the EU, will be affected. However, currently any such commitments would only apply to the UK as a whole. This situation would change if Scotland were to have its own separate commitment to the KP or any successor or its own separate contribution to the EU GHG reduction commitment.

Table 1. Key differences between forestry accounting rules for the first and second commitment periods of the KP and under discussion for the proposed EU Decision

Commitment/activity	KP first commitment period	Durban rules	Proposed EU Decision
Duration of commitment period	2008-2012 (5 years)	Undecided but possibly 2013-2020 (8 years)	Undecided but possibly 2013-2020 (8 years)
Accounting for Afforestation/Reforestation and Deforestation	Mandatory, gross-net	Same as first commitment period	Same as first commitment period
Accounting for Forest Management	Voluntary, gross-net with cap	Move to mandatory accounting, reference-level with cap	Same as Durban
Definition of forest	Use definitions already referred by countries in their existing National Forest Inventories	Same as first commitment period	Two options being proposed: 1. Same as first commitment period 2. Stricter definition than currently referred to in UK (i.e. minimum crown cover of 10% as opposed to minimum crown cover of 20%). The second option is viewed as a 'show stopper' by the UK.
Accounting for HWP	Not accounted for	Mandatory	Same as Durban with some elaborations that appear non-controversial (e.g. recognising bark as different to other forms of harvested wood).
Allowing for 'compensatory planting'	Not permitted, counts separately as deforestation and afforestation	Can be counted as part of FM (voluntary), otherwise counts separately as deforestation and afforestation	The option of counting as part of FM does not appear to be strongly supported
Allowing for major natural disturbance events	No mechanism	New mechanism, voluntary	Same as Durban, with some additional technical details specified
Obligations to undertake specific actions/measures on forestry	None	None	Requirement for National Action Plans

Accounting rules applying as part of the KP (or a successor) or as part of the EU's GHG reduction commitment also do not necessarily affect the setting and achievement of GHG reduction targets as part of domestic policy in Scotland (i.e. Scotland does not need to refer to these rules in determining and implementing its domestic policies, unless it is considered appropriate to do so). Thus, for example, levels of emissions and removals quoted, and any targets for GHG reductions included in the proposals and policies laid out in the report, "Low Carbon Scotland: Meeting the Emissions Reduction Targets 2010-2022"[6], are based on the analysis of annual GHG inventories for Scotland, without the application of accounting rules; in this context, the application of any accounting rules may be considered as not relevant and/or inappropriate.

Table 2 illustrates the *potential* impacts on the Scottish emissions total *in the event that* a decision was taken in Scotland to adopt the FM accounting rules in the proposed EU Decision (which are the same as the rules agreed at Durban for FM for the second commitment period of the KP or any successor). Such circumstances might occur, for example, if Scotland were to make a separate[7] contribution to the EU GHG reduction commitment or to the KP or any successor. As already noted, currently, domestic policies in support of the Climate Change (Scotland) Act[8], refer to national GHG emissions inventories for Scotland which are consistent with those submitted by the UK under the UNFCCC. The UNFCCC values are thus shown in comparison with those based on the proposed EU Decision. For interest, results are also shown in Table 2 based on the accounting rules for the first commitment of the KP. Results are shown for the KP base year of 1990 and for the years 2020 and 2050, for which, respectively, target emissions levels in Scotland of 40 $MtCO_2$ yr^{-1} and 14 $MtCO_2$ yr^{-1} have been assumed. To avoid complicating the presentation results, contributions to removals and emissions due to afforestation and deforestation activities in Scotland since 1990 are not shown.

As things stand, it would seem that the main point of interest would not concern Scotland's domestic policies on GHG emissions reduction, but may be concerned with the removals contributed by Scottish forests to the UK's commitments under the KP (and any successor) and under the EU GHG reduction commitment. In the first commitment period, removals contributed by FM to the UK's account have been capped at about –1.4 $MtCO_2$ yr^{-1}.

Under the rules for the second commitment period (which would also apply for the EU's proposed Decision covering the EU reduction commitment), the UK collectively would only be able to claim removals due to FM that exceed the projected reference level. Assuming the reference level has been calculated reliably, this implies that, if existing forests were to make a contribution towards future GHG reductions, then this would require the introduction of policies in support of measures aimed at conserving and/or enhancing carbon stocks in existing (pre-1990) forests across the UK. Whilst this would require additional action on GHG mitigation by existing forests, reflecting this, the cap on the extent of removals that can be accounted is much higher than was the case in the first period, and is calculated as 3.5% of gross emissions in other sectors in the base year. For the UK, the cap on FM removals for the second commitment period is thus around –18 to –20 $MtCO_2$ yr^{-1}. In principle, therefore, the potential contribution made towards GHG reduction made by mitigation activities in existing forests in the UK during the second commitment is potentially quite large. However, realising some of this potential would require the development of a strategy for achieving *additional* GHG mitigation in existing forests in the UK, whilst from a practical standpoint, it is unlikely that such a high level of removals could be achieved through such actions. *In the event that* Scotland were to make a separate[8] contribution to the EU GHG reduction commitment or to the KP or any successor, the equivalent cap on additional GHG removals due to FM would be much smaller but potentially more achievable, at about –2.8 $MtCO_2$ yr^{-1}.

[6] http://www.scotland.gov.uk/Resource/Doc/346760/0115345.pdf

[7] (i.e. separate from the UK).

As already noted, if the proposed EU Decision were to be adopted, it would only come into force if EU moves from a 20% overall GHG reduction target to 30%.

Table 2. Examples of emissions and removals in Scotland as calculated for the purposes of domestic policy, and how these might change if existing KP accounting rules or proposed EU accounting rules were to be applied

GHG budgeting/accounting approach	Acounted emissions/removals ($MtCO_2\ yr^{-1}$)		
	Other sectors	Forest Management	Net emissions
1990 (KP base year)			
UNFCCC GHG inventory reports*	80[a]	–8.3	72
KP first commitment period	80[a]	0[b]	80
Proposed EU Decision**	80[a]	0[c]	80
2020			
UNFCCC GHG inventory projections*	46[d]	–6.6[e]	40[f]
KP first commitment period	41[d]	–1.2[g]	40[f]
Proposed EU Decision**	40[d]	0[h]	40[f]
2050			
UNFCCC GHG inventory projections	14[i]	–0.3[j]	14[k]
KP first commitment period*	14[i]	–0.3[l]	14[k]
Proposed EU Decision**	14[i]	0[m]	14[k]

Notes to Table 2:

* Currently referred to for Scottish domestic policy on GHG emissions reduction.

** For FM accounting, the rules agreed at Durban for the second commitment period of the KP (or any successor) are the same as proposed in the EU Decision currently under consideration by Member States.

a. Emissions in other sectors for base year are rounded to the nearest 10 $MtCO_2\ yr^{-1}$.
b. Removals due to FM not included in base year result because gross-net accounting is being applied.
c. Removals due to FM not included in base year result because reference-level accounting is being applied.
d. Emissions in other sectors are inferred as the target level of emissions in other sectors, given the accounted removals due to FM and an assumed target for overall emissions in 2020 of 40 $MtCO_2$.
e. Based on the official projection of FM removals for the year 2020 (see Figure A2.2, Annex 2).
f. Assumed target level for overall emissions in 2020.
g. Based on KP accounting rules for first commitment period (gross-net accounting with cap), removals due to FM would be capped at 15% of removals reported for the base year, i.e. 15% of –8.3 = –1.2 $MtCO_2\ yr^{-1}$.
h. Based on reference-level accounting as applicable in the second period of the KP and under the proposed EU Decision. If it is assumed that no additional mitigation measures are taken in forest areas in existence before 1990, and that the reference level was set correctly, then the removals reported in 2020 should be the same or close to the projected reference level, therefore would be no net removals or emissions to account for. If additional mitigation measures were to be taken in forest areas in existence before 1990, the magnitude of removals in 2020 might be expected to exceed the reference level and these could be claimed towards the target, but only up to a cap of 3.5% of gross emissions in the base year, i.e. 3.5% of 80 $MtCO_2$, or removals of up to –2.8 $MtCO_2\ yr^{-1}$.
i. Emissions in other sectors are inferred as the target level of emissions in other sectors, given the accounted removals due to FM and an assumed target for overall emissions in 2050 of 14 $MtCO_2$.
j. Based on the official projection of FM removals for the year 2050 (see Figure A2.2, Annex 2).
k. Assumed target level for overall emissions in 2050.
l. Based on KP accounting rules for first commitment period (gross-net accounting with cap), removals due to FM would be capped at 15% of removals reported for the base year, i.e. 15% of –8.3 = –1.2 $MtCO_2\ yr^{-1}$. However, projected emissions in 2050 (–0.3 $MtCO_2\ yr^{-1}$) are less than the cap.
m. Same as note h but for the year 2050 rather than 2020.

The results shown in Table 2 focus on the contributions made by FM to the emissions total; contributions due to deforestation and afforestation activities since 1990 have not been shown explicitly, however, currently such contributions are small and tend to cancel out. Crucially, any contributions due to such activities are effectively the same for the three reporting/accounting systems considered in Table 2.

The potential impacts of accounting rules covering 'compensatory planting' are not considered in the results shown in Table 2 and in any case their main effect is likely to be on how any associated emissions and removals get reported, rather than on the overall contribution of forestry activities to total emissions. It should be stressed that these accounting rules apply to the second commitment period of the KP but currently do not appear to be favoured for inclusion as part of the accounting rules for the proposed EU Decision.

In the event that a decision was taken in Scotland to adopt the FM accounting rules in the proposed EU Decision, the facility to deal with the impacts of major natural disturbance events could *potentially* be useful in a Scottish context, should a major catastrophe occur across forests in Scotland. (Such a disturbance event would have to be extremely serious for 'disturbance accounting' to become relevant.)

7. Data requirements for implementation of EU accounting rules

For reasons explained in the preceding section of this note, the implementation of the proposed EU Decision would be at UK level, therefore any additional burden of data collection would fall on the UK collectively rather than on Scotland. The Centre for Ecology and Hydrology and Forest Research have been asked to carry out a review of the implications of adoption of the new accounting rules for LULUCF under the second commitment period of the KP (or any successor); this review is ongoing so any statements made in this note on data requirements must me regarded as preliminary. Possible additional forestry data requirements implied by the adoption and implementation of the proposed EU Decision are summarised in Table 3.

The UK National Forest Inventory (NFI) programme[8], or suitable extensions to the existing programme, could be an important source for much of the data needed for implementation of the EU Decision. However, it should be noted that there some areas where additional data could be improved upon even for existing GHG reporting for forestry, and which would involve improved coverage within the NFI, or may be difficult to cover using the NFI (e.g. extent and spatial distribution of gross afforestation and deforestation, management plans/intent in privately owned woodlands).

8. Potential policy impacts (and implications)

For reasons explained in the preceding two sections of this note, the adoption of the proposed EU Decision on LULUCF would have negligible impacts on Scottish domestic policies on forestry and climate change. This situation would only change if Scotland were to purposefully adopt the accounting rules of the EU Decision for domestic policies for some reason, or were to have its own separate commitment to the KP or any successor or its own separate contribution to the EU GHG reduction commitment.

There are, however, potential impacts on UK international policies on forestry and climate change and therefore on Scotland's contributions to these.

Policy on **ARD** activities will not be affected by adoption of the EU Decision as the accounting rules are the same as those already referred to under the KP (and any successor). Consequently the GHG mitigation due to any existing policies towards encouraging afforestation or limiting deforestation will continue to be registered. Similarly, any future policies aimed at enhancing rates of afforestation or reducing deforestation will be accounted for as under the first commitment period.

[8] See http://www.forestry.gov.uk/statistics.

Table 3 Preliminary assessment of possible additional data requirements for implementation of proposed EU Decision

Commitment/ Activity	Comments on additional data requirements	Additional cost/ technical complexity
Reference-level accounting for FM	Projections of emissions and removals due to FM (assuming BAU management) are already made as part of the preparation of annual national GHG inventories for reporting under the UNFCCC. If the intention is to continue to manage UK/Scottish forests according to BAU, there is no need to collect additional data. However, if it is considered appropriate to realise some of the mitigation potential of existing forests through the introduction of additional FM measures, then as a minimum it will be necessary to characterise the types of measures being implemented and extent (in terms of area) to which these measures have been implemented in forests. This information is needed in order to be able to demonstrate that a departure of emissions or removals in forests from the assigned reference level for a commitment period is due to identifiable and quantifiable additional FM activities. Information on the geographical distribution (e.g. at least for England, Scotland, Wales and Northern Ireland and ideally the precise location) of additional FM activities would also be needed. Arguably, some departures from BAU management are already being considered as part of certain national policies (e.g. in England, possible measures aimed at restoring management including harvesting in areas of neglected broadleaf woodland). It might be possible to minimise the marginal costs of any such monitoring by: • Maximising the use of data from the UK National Forest Inventory (possibly involving some enhancements to data collection) • Harmonising monitoring with any carried out in support of domestic forest and climate change mitigation policies.	None to high
Definition of forest	If the existing definition can be used, there are no additional data requirements. However, if the EU Decision involves a tighter definition, then the existing National Forest Inventory will need to be amended to monitor forest areas to a finer-scale resolution.	None to high
Accounting for HWP	Projections of emissions and removals due to HWP are already made as part of the preparation of annual national GHG inventories for reporting under the UNFCCC. However, this is based on data sets on domestic production and consumption of harvested wood which are known to be less than perfect (e.g. they are not comprehensive). There could be a case for improving the monitoring of domestic wood production and consumption even if the EU Decision is not adopted, although it must be acknowledged that it has been possible to 'get by' with existing data until now. If there was a desire to develop 'bespoke' mathematical functions and time constants for representing the retention of carbon in HWP produced and consumed in UK or Scotland, this could require a significant programme of research and monitoring.	None to high
Dealing with natural disturbance events	Costs could be reduced by making use of remote sensing data (aerial photography, satellite imagery). The impacts of large natural disturbance events would have to be accounted for anyway in estimating emissions and removals associated with FM so arguably this does not involve additional costs.	Moderate
Report on emissions in other sectors due to utilisation of harvested wood	If the inclusion of an accompanying report is discretionary, then this would not be needed. If it was a requirement under the EU Decision, this would require a major exercise to monitor how harvested wood is used, what it replaces (fossil fuels, specific materials) and the quantification of impacts on GHG emissions. Significant supporting research on Life Cycle Assessment of wood products and non-wood materials would be needed.	None to high
Requirement for National Action Plans	Could be viewed as increasing the likelihood of specific actions being taken in the UK/Scotland on mitigation activities in the LULUCF sector including forestry. See earlier comments on reference-level accounting for FM.	Low to high

Accounting rules for **FM** have changed for the second commitment period of the KP and these rules are also proposed for adoption as part of the draft EU Decision. Under the previous accounting rules, the UK could account for a modest (capped) level of removals due to forest areas in existence before 1990. Under the new rules, the UK can only account for additional removals in these forest areas, occurring as a result of changes to BAU management aimed at GHG mitigation. However, the level of removals due to FM that could *potentially* be accounted for is much larger (perhaps up to 20 $MtCO_2$ yr^{-1}).This may suggest a case for reviewing the scope for mitigation activities in existing forests and their potential contribution towards achieving future GHG emissions targets. Such a review would need to take account of possible antagonistic impacts on emissions in other sectors (Energy and Industry) due to mitigation measures aimed at mitigation in existing forests (see for example Matthews, 1996; Matthews and Broadmeadow, 2009; Matthews *et al*., 2012).

Accounting rules for **HWP** have also been introduced for the second commitment period of the KP and as part of the proposed EU Decision, and these emphasise the contribution of domestically-produced HWP. This might suggest a case for a policy aimed at encouraging the domestic consumption of UK/Scottish-produced wood, even if this consisted primarily of communication (i.e. an information campaign and 'carbon labelling' of UK/Scottish wood). The scope and technical details of 'bespoke' rather than 'default accounting for carbon stocks and stock changes due to domestic consumption of UK/Scottish-harvested wood (i.e. referring to UK/Scottish categories for wood products and UK/Scottish-national mathematical functions and time constants for the retention of carbon in HWP) may also be worth of exploration.

9. References

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Annex 1. Examples of key accounting approaches relevant to Forest Management

Gross-net and net-net accounting example

Suppose that, for the first commitment period of 2008 to 2012 (5 years), a Party reports removals for FM (which has been elected by the Party) during the commitment period of –50 $MtCO_2$ (–10 $MtCO_2$ per year).

Suppose that, in the base year, the Party reported a total removal due to FM of –20 $MtCO_2$.

The resultant change in emissions between the base year and the commitment period accounted for by the Party, as calculated under gross-net accounting, is shown in Table 1 and compared with the result that would be obtained under net-net accounting.

Table 1 Illustration gross-net accounting and comparison with the result that would be obtained using net-net accounting

Quantity	**Emissions(+) or removals (-) $MtCO_2$**	
	Gross-net	**Net-net**
Removals in 5-year commitment period	–50	
Removals in base year	–20	
5 × removals in base year	5 x (–20) = –100	
Accounted emissions/removals	**–50***	**–50 – (–100) = +50**

*Note that removals due to FM in the base year are not referred to in the calculations when gross-net accounting is being applied.

The term 'gross-net' has been used by some commentators because, effectively, **removals due to forests are not included** in the sum of emissions and removals for all sectors **for the base year**, but **removals due to forests are included** in the sum of emissions and removals for all sectors **during the commitment period**. Since other sectors usually report emissions, and forestry generally reports a removal, a sum of emissions for all sectors that does not include the contribution due to forestry may be referred to loosely as 'gross emissions', whereas a sum of emissions for all sectors that does include the contribution due to forestry may be referred to loosely as 'net emissions'. Thus, under gross-net accounting, 'net emissions' for the commitment period are being compared with 'gross emissions' for the base year. As a corollary, under net-net accounting, 'net emissions' in the commitment period would be compared with 'net emissions' in the base year. It should be noted that the adoption and wide reference to this terminology has caused years of confusion over how KP accounting rules for LULUCF, and forestry in particular, actually work or worked.

Example of gross-net accounting with cap

Consider the example of gross-net accounting already illustrated in Table 1. Suppose in addition that the Party was assigned a cap on removals due to FM during the first commitment period of –0.2 $MtCO_2$ yr^{-1} or –1 $MtCO_2$ for the full 5-year commitment period. The resultant change in emissions accounted for by the Party, as calculated under gross-net accounting, is shown in Table 2.

Table 2 Illustration of gross-net accounting with cap

Quantity	Emissions(+) or removals (-) $MtCO_2$
Removals in 5-year commitment period	–50
Cap on removals in commitment period	–1
Accounted emissions/removals	**MAX (–50, –1) = –1**

*Note that removals due to FM in the base year are not referred to in the calculations, because gross-net accounting is being applied.

Reference-level accounting example

Consider the examples of gross-net accounting already illustrated in Tables 1 and 2. Suppose in addition that the Party reported a removal due to FM during the second commitment period (taken to cover the 8 years from 2013 to 2020) of –64 $MtCO_2$, (–8 $MtCO_2$ per year) but is also assigned a reference level for FM during the second commitment period of –60 $MtCO_2$. The resultant change in emissions accounted for by the Party, as calculated under reference-level accounting, is shown in Table 3.

Table 3 Illustration of reference-level accounting

Quantity	Emissions(+) or removals (-) $MtCO_2$
Removals in 8-year commitment period	–64
Reference level for commitment period	–60
Accounted emissions/removals	**–64 – (–60) = –4**

*Note that removals due to FM in the base year are not referred to in the calculations, because reference-level accounting is being applied.

As illustrated by the example in Table 3, reference-level accounting has the advantages of avoiding either 'perverse debits' due to FM under net-net accounting (see Annex 2), as well as avoiding the arguably 'non-additional credits' that can result from gross-net accounting. If the reference value can be set reliably at the level that would result under BAU management of forests, then the reference value represents a baseline value against which the impacts of any additional FM activities (either positive or negative with regard to FM) can be assessed. It follows that reference-level accounting implemented on this basis should 'incentivise FM measures at the margin' (i.e. additional relative to BAU) and, as such, is an approach that could be viewed as consistent with the original intent of Article 3.4 of the KP.

Clearly implementation of reference-level accounting would require care and would need to include appropriate safeguards, notably strong independent technical review of calculations before 'signing off' the FM accounting for a commitment period. Situations in which a Party repeatedly introduces new data or calculation approaches following the conclusion of a commitment period would also need close scrutiny if the potential impacts on outcomes for past commitment periods were to have substantive implications for compliance with emissions targets.

The difficulty with reference-level accounting lies in its dependence on the reliable estimation of the projected trajectory of net emissions or removals for forests managed according to BAU. In practice the construction of such projections may prove technically challenging, particularly for KP Parties with limited technical capacity (e.g. no access to forest carbon accounting models) or limited data on forests (e.g. incomplete information on age class structure).

Example of reference-level accounting with cap

Consider the example of reference-level accounting already illustrated in Table 3. Suppose in addition that the Party was assigned a cap on removals due to FM during the second commitment period of –0.2 $MtCO_2$ yr^{-1} or –1.6 $MtCO_2$ for the full 8-year commitment period. The resultant change in emissions accounted for by the Party, as calculated under reference-level accounting with a cap, is shown in Table 4.

Table 4 Illustration of reference-level accounting with cap

Quantity	**Emissions(+) or removals (-) $MtCO_2$**
Removals in 8-year commitment period	–64
Reference level for commitment period	–60
Result of comparison with reference level	–64 – (–60) = –4
Cap on removals in commitment period	–1.6
Accounted emissions/removals	**MAX (–4, –1.6) = –1.6**

*Note that removals due to FM in the base year are not referred to in the calculations, because reference-level accounting is being applied.

Annex 2. Human and natural causes of forest GHG balances and their implications for accounting approaches for Forest Management

The key accounting methods relevant to FM of **net-net accounting, gross-net accounting and reference-level accounting** are described and discussed in the main text of this note. This annex presents a supporting technical discussion explaining why the KP accounting rules for FM have been the subject of considerable debate and have evolved over time.

Decisions have been made about FM accounting rules for a number of reasons, but particularly out of recognition of the interaction between human and natural drivers of the GHG balance of forests, as illustrated by the example in Figure A2.1. It should be stressed that the purpose of the following example is to illustrate how direct, human action to manage vegetation stocks inevitably interacts with natural plant and soil processes involving growth, respiration and decay which are not under human control, and to enable discussion of the implications of this phenomenon for FM mitigation activities and how to account for them.

Figure A2.1a shows how the carbon stocks on an area of land might change over time as a consequence of trees having been planted on former grassland in the year 1955. The example is based on a stand of Scots pine (*Pinus sylvestris*) with a maximum mean stem growth rate of 6 m^3 ha^{-1} yr^{-1}, subject to neither thinning nor clearfelling and assumed to be free to develop undisturbed. As can be seen in the figure, over 100 years, following some initial losses of carbon stocks due to site preparation, the carbon stocks in the trees, litter and soil on the area of land increase from just over 150 tC ha^{-1} up to 450 tC ha^{-1}, according to a nonlinear trajectory.

The carbon stock changes in Figure A2.1a imply a pattern of annual net CO_2 emissions and removals as shown in Figure A2.1b. As can be seen, following the short initial period involving net emissions due to site preparation, net carbon removals occur and increase over time, reaching a maximum rate of –13 tCO_2 ha^{-1} yr^{-1} around the year 1990, after which the rate of net carbon removal progressively decreases.

The human and natural influences on carbon stock changes are relatively easy to distinguish for this example. Specifically, it required direct human intervention to stop managing the area of land as grassland in 1955 and to plant trees and establish a forest stand instead. The cause of the change in carbon stocks and the instigation of a process of overall net carbon removals over subsequent years is thus clearly human. However, the actual timecourse of the development of carbon stocks from 1955 onwards, including the overall magnitude and rate of carbon stock change is due to the natural growth characteristics of the Scots pine trees, the productive potential of the land, and the response of soil carbon processes to the change in vegetation. Thus, for example, the time taken for carbon stocks to rise from 150 tC ha^{-1} to 450 tC ha^{-1} and the magnitude of the maximum rate of removal are determined by natural processes rather than human action. Humans can of course exert some influence over these processes, for example by choosing to plant a different species of tree. However, choosing another tree species simply results in a different pattern of carbon stock change ultimately determined by the trees and soil on which they are planted. It is also the case that carbon stocks can be 'managed' by manipulating the vegetation, for example by thinning or clearfelling stands of trees, but the subsequent response of vegetation and soil to such management interventions is again driven by natural processes.

A key point to note in the example in Figures A2.1a and A2.1b is that the decision to plant trees in the year 1955 effectively 'committed' the affected land area to follow a trajectory of carbon stock changes driven by natural processes which are not under strong human control. It should also be noted that the description given above applies equally to a single stand of trees (as in the example) or to a collection of very many stands of trees (e.g.

those forming the entire forest estate of a country), in particular where there has been a programme of afforestation activities over recent past decades, as has been the case in the UK and particularly in Scotland (see Figure A2.2), and across Europe (see Figure A2.3).

This phenomenon raises issues when trying to account for GHG mitigation activities involving FM. For example, under the KP, Parties need to demonstrate increased removals or reduced emissions compared to levels observed in the year 1990; on this basis, strictly, Parties should use **net-net accounting** when calculating changes in emissions for a commitment period when compared with the base year emissions in 1990. For example, suppose that Parties were required to demonstrate net reductions in emissions in the single-year commitment period of 2020, compared with the base year of 1990. For the forest area illustrated in Figure A2.1a and A2.1b, the net CO_2 removed in the year **1990** would have been observed to be **–13 tCO_2 ha^{-1} yr^{-1}**. In the year **2020**, a net removal of about **–10 tCO_2 ha^{-1} yr^{-1}** would need to be reported. Under strict **net-net accounting**, the result would be a reduction in the rate of removal (i.e. effectively an increase in net emissions) of **–10 – (–13) = +3 tCO_2 ha^{-1} yr^{-1}**. However, as discussed above, the trajectory of net CO_2 removals in the example forest area between 1990 and 2020 is primarily due to natural processes; it is not due to human activity between 1990 and 2020. At the same time, the existence of a net CO_2 removal is due to the creation of the forest stand by humans in 1955, and without this intervention there would be no CO_2 removal at all in either 1990 or 2020. Therefore it can be argued that it is 'fairer' to permit the Party to account for the whole net removal of **–10 tCO_2 ha^{-1} yr^{-1}** due to the forest area in 2020 (**gross-net accounting**), rather than having to account for the reduction in the net removal of **+3 tCO_2 ha^{-1} yr^{-1}** compared with 1990 (**net-net accounting**). This is the essence of the argument against applying net-net accounting and for applying gross-net accounting to FM.

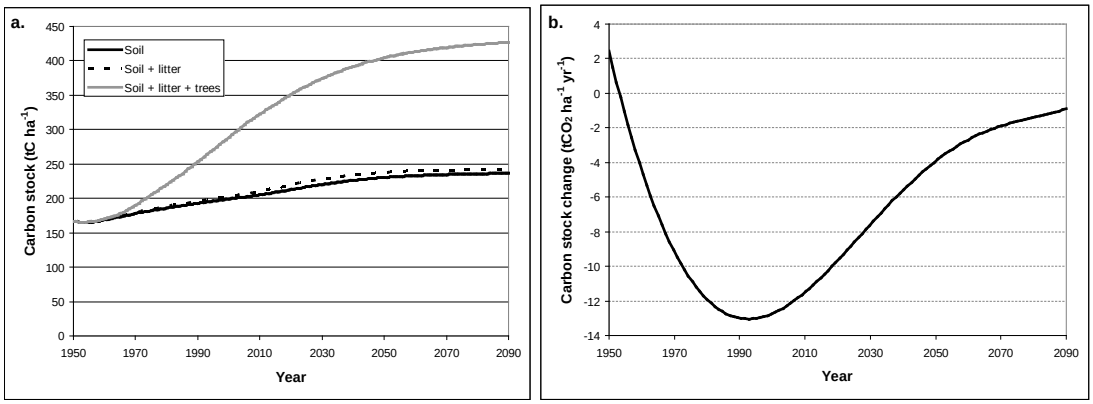

Figure A2.1. The timecourse of carbon stock changes in a stand of Scots pine established in the year 1955 on former grassland. Figure A2.1a shows the accumulation of carbon stocks over time in trees, litter and soil. Figure A2.1b shows the equivalent annual CO_2 emissions or removals over time. In this figure, emissions are shown as positive numbers and removals are shown as negative numbers. The Scots pine stand has a maximum mean stem growth rate of 6 m^3 ha^{-1} yr^{-1}, is subjected to neither thinning nor clearfelling and is assumed to be free to develop undisturbed. The results were produced using the Forest Research CSORT model (Morison *et al.*, 2012).

At the same time, it is possible to argue that the application of gross-net accounting to FM is also unfair, because it allows Parties to claim the whole removal due to FM during a commitment period, when it may well be the case

that not all of this removal is due to past actions taken by the Party such as afforestation programmes (i.e. at least some of the removals may be occurring 'by chance', i.e. simply because of the current age class structure of forests, which may not be entirely due to human intervention, see for example Figure A2.3). A simple way of addressing any such concerns is to limit the amount of removals that can be claimed under **gross-net accounting**, i.e. to impose a **cap** on the accounted removals. The adoption of gross-net accounting with cap for FM in the first commitment period can thus be viewed as a crude but pragmatic compromise approach.

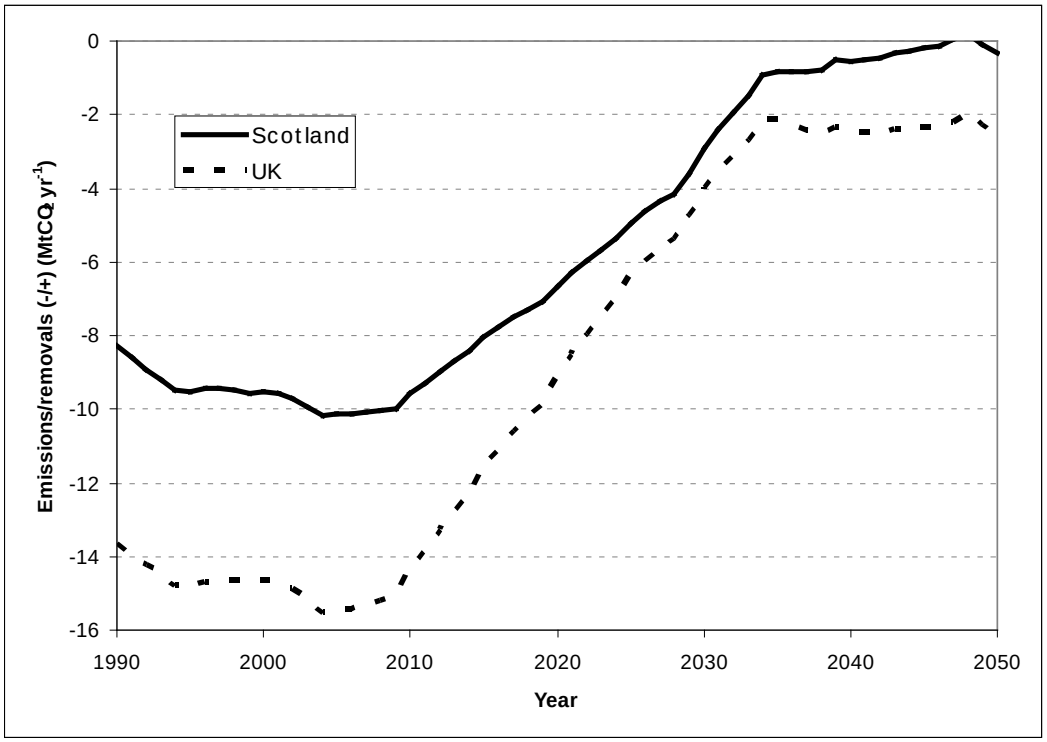

Figure A2.2. Reported and projected net removals to 2050 due to forests in existence before 1990 in Scotland and the UK. The reduction in removals occurs due to a number of factors but a major driver is the age class structure of Scottish and UK forests, which is strongly influenced by (but not entirely due to) afforestation programmes undertaken in the previous century. The reported data come from GHG emissions inventories and projections reported by the UK. The projection was made using the CEH C-FLOW model.

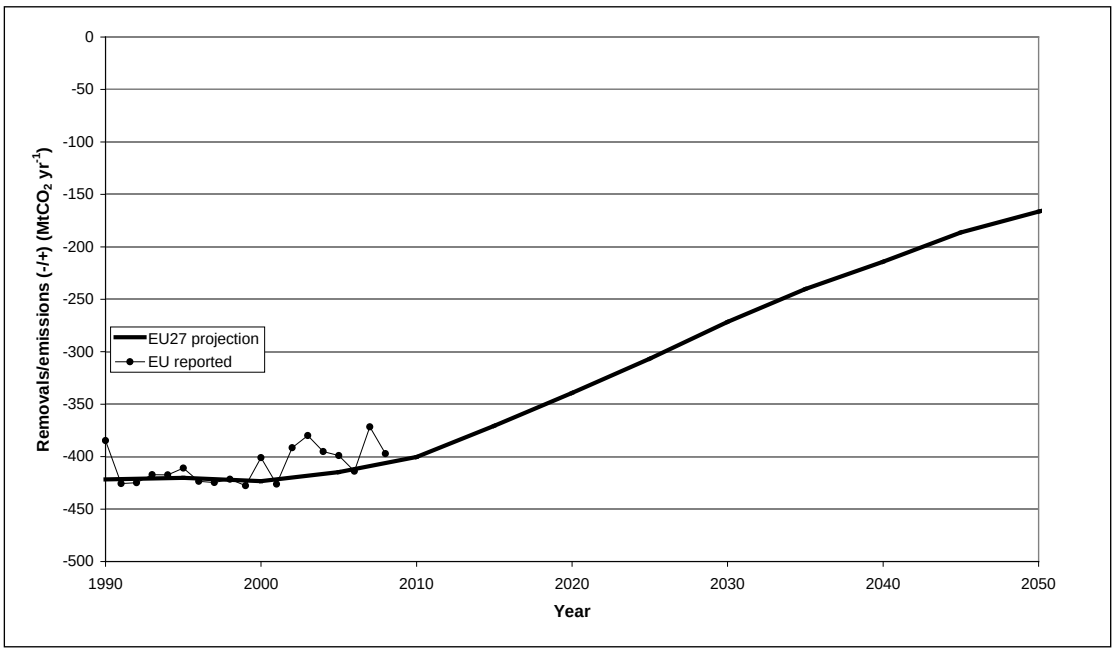

Figure A2.3. Reported and projected net removals to 2050 due to forests in existence before 1990 in the EU27. The reduction in removals occurs due to a number of factors but a major driver is the age class structure of EU27 forests, which is strongly influenced by (but not entirely due to) afforestation programmes undertaken in a number of Member States in the previous century. The reported data come from GHG emissions inventories reported by EU27 Member States. The projection was made using the Forest Research CARBINE model (Thompson and Matthews, 1989; Matthews, 1991, 1994, 1996).

Reference-level accounting has been proposed for FM during the second commitment period, with the aim of neither penalising nor rewarding Parties for the consequences of historical forest management activities, but to reward Parties for improving on the emissions or removals that would be expected due to existing forests during the commitment period under 'business as usual' management, i.e. to reward Parties for '*additional, human-induced*' activities involving existing forests and aimed at mitigation[9]. To illustrate, consider again the earlier example in this annex in which Parties were required to demonstrate net reductions in emissions in the single-year commitment period of 2020, compared with the base year of 1990. For the forest area illustrated in Figure A1.1a and A1.1b, a projection can be constructed to show that, even if the Party takes no additional action (positive or negative), the net CO_2 removal in the year **2020** will be **–10 tCO_2 ha^{-1} yr^{-1}**, a reduction in the net removal when compared with the removal reported for the base year of **1990** (**–13 tCO_2 ha^{-1} yr^{-1}**). In recognition of this 'inevitable' change in the magnitude of removals, under reference-level accounting, the Party would be required to compare their actual removals or emissions due to FM in the commitment period (the single year of 2020) with the projected reference level of –10 tCO_2 ha^{-1} yr^{-1}, rather than with the base year level of –13 tCO_2 ha^{-1} yr^{-1}. If the Party is able to take action to improve on the reference level (i.e. through additional FM activities) and consequently is able to report a bigger removal due to FM than indicated by the reference level, then they may claim the difference between the reported removal and the reference level as a net emissions reduction. On the other hand, if reported removals in the commitment period are smaller in magnitude than indicated by the reference level (or perhaps are net emissions), the Party must declare the difference between the reported value and the reference level as a net emissions increase.

[9] The terms 'additional' and 'human-induced' are used in the wording of Article 3.4 of the KP.

Annex 2 references

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Annex 3. Accounting for carbon stocks and stock changes in HWP

Under the HWP accounting rules for the first commitment period (known as the 'IPCC default approach'; IPCC, 1997), when woody biomass is harvested from forests, the timber is assumed to be oxidised to the atmosphere instantaneously as CO_2. However, some parties considered that correct GHG accounting should recognise that carbon can in fact be retained for some time in harvested wood products (HWP). The debate about whether and how to account for HWP effectively within the LULUCF sector has been protracted (see for example Fry, 2007; Matthews *et al.*, 2007).

Discussions about how the reporting and accounting for HWP should be conducted involved trying to answer the key question, when a forest is harvested and wood products are manufactured, which Party should report the carbon stocks or flows related to wood products? For example, should the Party that owns the forests that produced the HWP show that some of the carbon was not emitted as CO_2 when the trees were cut, or will the Party that imported the wood products show an increase in carbon stocks? In 1998, a meeting in Senegal (see Brown *et al.*, 1998; Lim *et al.*, 1999) outlined three possibilities for carbon reporting methods beyond the simple 'IPCC default' approach mentioned above:

The 'atmospheric flow' approach would report actual GHG emissions to the atmosphere resulting from the decay and/or destruction of HWP, at the time and place these emissions occurred. However, the approach would not account for flows of carbon from forests into HWP pools, with the result that reporting is 'one-sided', effectively treating HWP in the same way as fossil carbon.

The 'stock change' approach would report net GHG emissions or removals resulting from the balance between flows of carbon from forests into HWP and emissions resulting from the decay and/or destruction of HWP, at the time and place these in-flows and emissions occurred. The approach thus faithfully represents all the flows of carbon associated with production and consumption of HWP, with carbon stocks being transferred between Parties when HWP are imported or exported, The stock change approach cold have the effect that a big importer of harvested wood could get credit for accumulating carbon stocks in HWP, whilst the suppliers (exporters) may have to declare debits due to reduction in forest carbon stocks taking place as part of harvesting.

The 'production' approach (Figure A3.4) would track the flows of carbon from forests into HWP and emissions resulting from decay and/or destruction of HWP, similarly to the stock change approach. However, any carbon stocks in HWP (and associated removals and emissions) would remain attributed to the point of origin (i.e. to the Party owning the forests that produced the HWP), regardless of where the HWP happened to end up as a result of trade in HWP[10].

Under the arrangements developed in the run-up to the Conference of the Parties held in Durban in December 2011, it was proposed that, as a default, accounting would be on the basis of estimates of when emissions occur, and attributed to the Party owning the forests that produced the HWP (i.e. the production approach). Adoption of the production (or any other) approach would require estimates to be based on verifiable and transparent data on the fate of HWP, or to be supported by credible default values. The production approach makes it easier for HWP emissions to be modelled (e.g. there is no need to represent complex exchanges of HWP carbon between Parties).

[10] A fourth approach, the 'simple decay' approach, is similar to the production approach but the carbon in HWP is effectively included as part of the carbon stock account for the forests that produced them. In other words, there is no real distinction between HWP carbon and the carbon in the forests from which they are harvested. Arguably, the differences between the simple decay and production approaches are conceptual and minor.

The accounting methodology has been further elaborated to involve the allocation of harvested wood into four product types – 'sawn wood', 'wood panels', 'paper and pulp' and (effectively by exclusion from the first three types) 'other' (e.g. wood for energy or waste wood). These categories are already consistent with those already used in international reporting of timber production statistics by countries to the FAO. Parties considered the application of default assumptions about the pattern of loss of carbon (and implicit emissions) from the four categories of HWP. Emissions from the 'other' category of HWP would be accounted for on the basis of instantaneous oxidation, while sawn wood, wood panels and paper would beaccounted for on the basis of exponential decay (i.e. loss) or emission with default half-lives of 35, 25 and 2 years respectively.

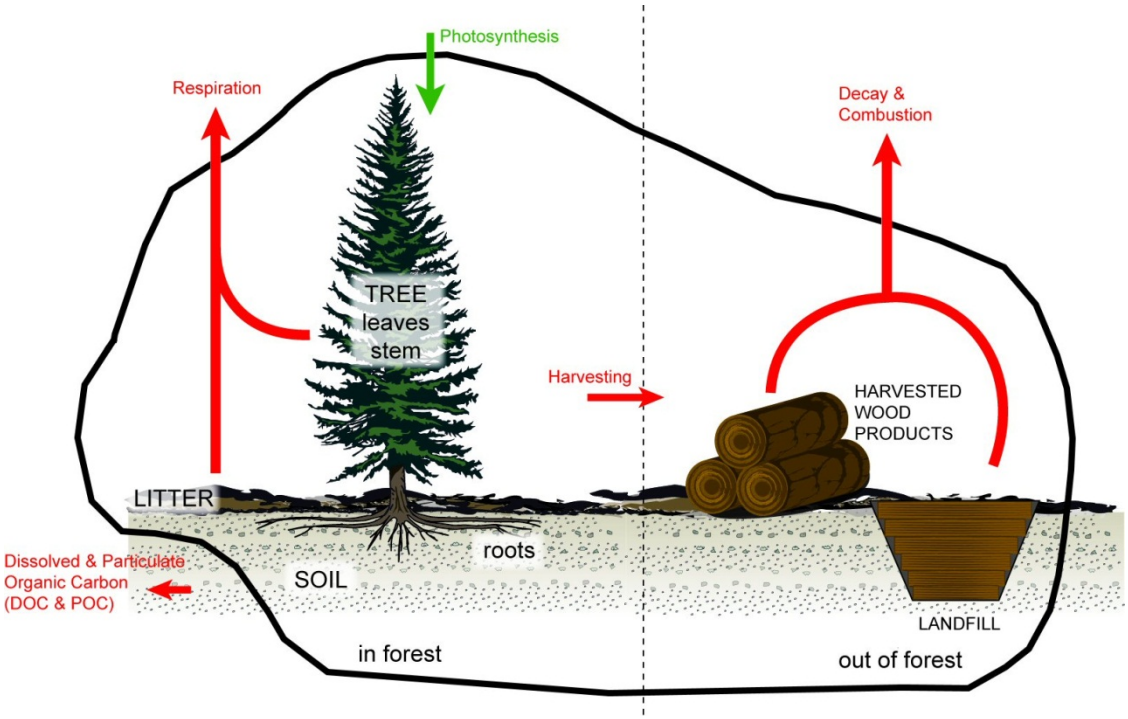

Figure 3.4 The black boundary in the picture indicates how forest and HWP carbon stocks are accounted for under the 'production approach'. Essentially, carbon stocks in HWP (and any emissions when they decay or are destroyed) are accounted for in association with the forests from which they were produced, even if the HWP are transported some considerable distance away from the forest, including export to another country. In principle this also extends to waste HWP disposed of in landfill. (However, under arrangements currently under discussion, waste woody material is accounted for on the basis on instantaneous oxidation.)

The production accounting approach has the main advantages that:

- The approach is relatively simple and easy to understand
- There is a clear rationale for adopting the approach. In particular, keeping HWP carbon associated with the forests that produced the HWP helps to avoid creating disincentives for harvesting of forests (where harvesting is an appropriate activity). Effectively, allowing for the HWP alongside forest accounting acts as a partial, compensatory 'buffer' against the negative impacts of harvesting (i.e. implicit emissions), by including the 'removals' into HWP as part of the same the same account.

Disadvantages of the production approach include:

- The method relies on the ability to model flows of harvested wood as HWP and the availability of suitable data (e.g. national production statistics, broken down into suitable HWP categories, estimates of half-lives of HWP types).
- In principle, Parties retain 'sovereign rights' on carbon in HWP, even when these have been exported and reside in the territories of other Parties. (This may not necessarily be a significant issue, depending on the stance taken on the matter by Parties.)
- The approach creates possible issues concerning ownership of HWP carbon. Implicitly, forest owners retain the ownership of the carbon content of HWP, even though they have sold the harvested wood to processors and end users. This may lead to problems, for example if HWP were to be included in carbon trading systems.

It is possible to identify the advantages and disadvantages with any of the main HWP accounting approaches; perhaps a key advantage of production approach is the general agreement or consensus that has been reached amongst Parties.

Annex 3 references

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