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An analysis of recent Member State proposals on rules for accounting of managed forest land and the impact on the atmosphere

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1. Introduction and aim

The land use sector includes categories that can be either net sources of greenhouse gas (GHG) emissions or net sinks. Accounting rules for LULUCF (Land Use, Land Use Change and Forestry) had been introduced already in the first commitment period of the Kyoto Protocol to ensure environmental integrity of credits generated from emission reductions and enhanced sinks from this sector. Under the second commitment period of the Kyoto Protocol the rules for accounting of managed forest land have been changed from a gross-net approach to accounting against a projected forest reference level (FRL). While the gross-net accounting rules resulted in net credits for all EU Member States (MS) in the first commitment period, some MS are expected to have net debits from their managed forests when they apply accounting against the FRL. The specifications for estimating the FRL for the period after 2020 are currently under debate.

The Commission proposed a forest reference level based on historic management practice and intensity while acknowledging age dynamics in forests. The EU Presidency of Malta has now suggested introducing a national threshold based on an increase of the harvest rate of up to 80%. Potential debits from the zone between the historically based FRL and this national threshold would be discounted factor for reducing the risk of non-compliance of MS with the no-debit rule introduced by the Commission proposal for LULUCF in 2016 (EC 2016c). **This factor reduces potential debits resulting from accounting of managed forest land in MS but increases simultaneously the amount of GHG emissions being released without being accounted for.**

Some member states have asked to increase the maximum harvest rate to 100% of forest increment and replace the discount factor of 0.5 by zero.

This paper aims two address the following questions:

1. How many emissions could remain unaccounted if the Presidency proposal would be applied with a discount of 0.5 and a maximum harvest rate of 80%:
    a. compared to the historic emissions/removals 2000-2009
    b. compared to using a forest reference level based on historic management intensity 2000-2009
2. How many emissions could remain unaccounted if one or both key parameters of the Presidency proposal for a applying a national threshold were changed into a discount of zero and/or a maximum harvest rate of 100%:
    a. compared to the historic emissions/removals 2000-2009
    b. compared to using a forest reference level based on historic management intensity 2000-2009

The amount of GHG emissions not being accounted for depends on the expected credits or debits in MS from managed forest land and the size of the discount factor. Credits or debits result from the difference between FRL and observed emissions and removals during the accounting period and are essentially driven by the difference between expected and actually occurring harvest levels compared to forest increment.

We analyse here the following hypothetical cases:

1. All MS harvest 100% of the annual forest increment in 2021-2030; accounting is done against historic emissions/removals 2000-2009
2. All MS harvest 100% of the annual forest increment in 2021-2030; accounting is done against a hypothetical FRL based on historic management intensity 2000-2009 while considering age dynamics of forests
3. All MS harvest at least 80% of their forest increment in 2021-2030; accounting is done against historic emissions/removals 2000-2009
4. All MS harvest at least 80% of their forest increment in 2021-2030; accounting is done against a hypothetical FRL based on historic management intensity 2000-2009

These four cases are varied by discounting debits by factor 0 and factor 0.5.

2. Methodology

We use historic data reported by MS on managed forest land to UNFCCC until June 2016 and EUROSTAT[1] and combine them with projections of LULUCF emissions and removals presented by European Commission (EC 2016a, 2016b). For consistency reasons the projected data were scaled by the difference between projected and reported data observed during the overlapping period 2008-2012.

The observed net sink of carbon in EU forests in the past was due to the fact that MS did not harvest 100% of the forest increment – carbon stocks increased in EU forests as a consequence. According to EUROSTAT data, most MS, however, have reported increasing harvest levels since 1990 at a higher rate than increments are increasing, leading to a reduction of annual removals.

Simulating the case that all MS harvest 100% of their forest increment, we assume that the forest sink will be zero in 2021-2030. This rough estimate addresses biomass carbon only. We ignore effects of Harvested Wood Products (HWP) and soil carbon during that period.

For the assessing the implications of MS having harvested 80% of their forest increment we analysed available data on historic forest harvest and increment. We applied the following methodology: We took EUROSTAT data[2] on annual forest fellings and forest increment. These data are not always consistent with those used by MS for their GHG inventories, but they are a rather consistent data source across MS and are publically available. We compared average historic harvest amounts for 2000-2010 with the increment for that period and identified those MS that are have had harvest levels below 80% of forest increment.

We then calculated expected emissions from these MS simulating increased harvest levels to 80% of forest increment by assuming that 1.7 t CO_2 are emitted for every extra m^3 harvested.

The level of FRLs is an important factor for estimating emissions that might be unaccounted against a reference. However, it can only be speculated what the level of FRLs for the future will be. We use two different references for accounting: historic inventory data on emissions and removals for the period 2000 to 2009 and a projected FRL.

We assume that the forest sink will decline due to age-class effects that can be excluded from accounting if the estimation of FRLs was based on historic management intensity and projected age-

[1] http://ec.europa.eu/eurostat/web/products-datasets/-/tsdnr520

[2] http://ec.europa.eu/eurostat/web/products-datasets/-/tsdnr520

class transition, as suggested by EC (EC 2016c). We simulate FRLs for individual MS where a fraction of the sink reduction is assumed to be due to age-class effects a. To get to MS estimates we use projections of emissions and removals for managed forest land provided by the EC Reference scenario (EC 2016a). It has to be noted that this is a policy-driven forecast, i.e. it is based on the harvest needed to fulfil renewable energy targets broken down from a modelling exercise of the non-ETS sectors. It thus includes a number of existing and market-driven policy effects. We assume that half of the sink reduction can be attributed to age-class effects. Age-class effects differ between MS as they depend on forest structure. Therefore this value needs to be considered only a rough estimate.

3. Results

Projection of harvest and forest increment

Table 4-1 presents fellings and forest increment for the period 2000-2010. On average fellings in EU28 were 521 Mm^3 during that period. Five out of 28 harvested more than 80% of their annual increment in that period already, namely Sweden, Denmark, Belgium, Czech Republic, and Austria. On average at EU28 level 71% of the forest increment was extracted.

MS harvest 100% of forest increment

Table 4-2 presents results for the four cases if all MS harvest 100% of their increment. The sink from managed forest land would potentially go to zero. Accounting against the historic sink of 376 Mt CO_2/year this would result in a debit for all EU countries of the same value. In case a discount factor of 0 would apply, the 376 Mt CO_2/year of sink reduction would be left unaccounted despite the fact that they are associated with increased harvest levels and a potential credit for emission reduction in the energy sector. A discount factor of 0.5 would reduce this amount to about 188 Mt CO_2/year but still leave a large fraction of the sink reduction unaccounted.

The accounting rules suggested by EC acknowledge that a fraction of the sink reduction can be attributed to age-class effects, i.e. forests getting older. Taking into account the reduction of the historic sink due to such effects would lower the unaccounted debit to 334.6 Mt CO_2/year and 167.3 Mt CO_2/year, respectively, since part of the reduction would be excluded from accounting (cases 1c and 1d).

MS harvest 80% of forest increment in 2030

Assuming an extra harvest of MS up to 80% of the annual forest increment would leave 142 Mt CO_2/year of the reduced carbon sink unaccounted compared to historic data, if the discount factor for debits was set to 0 (Table 4-3). In the case of a discount factor of 0.5, the amount would be 71 Mt CO_2, respectively. The differences to cases 1a) and 1b) are that most of the larger forest countries cannot apply the national threshold and the associated discount factor because they are already close or even above the harvest level of 80%.

Again, if a part of the sink reduction is attributed to age–class effects and excluded from accounting, the amount of the potential reduced carbon sink would be reduced further to 107.3 Mt CO_2 (case 2c) or 53.7 (case 2d).

4. Conclusions

The observed net sink of carbon in EU forests in the past was due to the fact that MS harvested less than the annual increment of forests. Most MS, however, have reported increasing harvest levels since 1990 at a higher rate than increments are increasing, leading already to a reduction of the sink strength in managed forests.

Overall, harvest levels are expected to increase and reduce the sink further with implications for atmospheric CO_2 concentrations and global warming. Sequestration of more carbon through natural sinks is important for achieving carbon neutrality and meeting the 1.5° C target of the Paris Agreement.

Therefore an unambiguous accounting framework is needed to ensure that changes in forest management with implications for carbon storage are accounted for. We tested the current proposal by the EU Presidency of Malta to introduce a discount factor for reducing the risk of non-compliance of MS with the no-debit rule introduced by the Commission proposal for LULUCF in 2016 in the case of increasing harvest rates in EU MS. The implications would be that between 53 and 376 Mt CO_2/year could potentially be left unaccounted. This would mean that MS would be incentivised to lower the forest carbon sink actively by increasing harvest levels as there would be no risk of non-compliance with implications for CO_2 concentration in the atmosphere.

Table 4-1: Projected fellings and forest increment per MS in 1000 m3 per year

Country	Average annual fellings in 2000-2010 in 1000 m3	Average annual forest increment in 2000-2010 in 1000 m3	Ratio of fellings to increment
Austria	21,504	26,397	**0.81**
Belgium	3,902	4,600	**0.85**
Bulgaria	5,897	14,015	0.42
Croatia	4,886	8,183	0.60
Cyprus	15	43	0.34
Czech Republic	17,158	20,984	**0.82**
Denmark	4,295	5,053	**0.85**
Estonia	8,804	11,548	0.76
Finland	68,767	87,767	0.78
France	55,273	85,228	0.65
Germany	93,406	118,654	0.79
Greece	1,842	4,337	0.42
Hungary	7,133	9,289	0.77
Ireland	3,062	5,642	0.54
Italy	13,460	31,352	0.43
Latvia	13,848	18,075	0.77
Lithuania	8,334	10,485	0.79
Luxembourg	268	650	0.41
Malta	0	0	0.00
Netherlands	1,321	2,567	0.51
Poland	38,768	65,629	0.59
Portugal	13,409	19,004	0.71
Romania	16,054	28,852	0.56
Slovakia	8,752	12,710	0.69
Slovenia	3,060	8,250	0.37
Spain	17,983	33,784	0.53
Sweden	79,900	80,063	**1.00**
United Kingdom	10,637	22,048	0.48
EU28	**521,737**	**735,208**	**0.71**

Source: EUROSTAT 2017: http://ec.europa.eu/eurostat/web/products-datasets/-/tsdnr520

Table 4-2: Results of analysis per MS in Mt CO_2 per year for different cases

Country	1a) Unaccounted emissions if MS increased their harvest to 100% of forest increment; accounting against historic emissions/removals 2000-2009; debits are discounted by 0	1b) Unaccounted emissions if MS increased their harvest to 100% of forest increment; accounting against historic emissions/removals 2000-2009; debits are discounted by 0.5	1c) Unaccounted emissions if MS increased their harvest to 100% of forest increment; accounting against FRL reflecting historic management intensity 2000-2009; debits are discounted by 0	1d) Unaccounted emissions if MS increased their harvest to 100% of forest increment; accounting against FRL reflecting historic management intensity 2000-2009; debits are discounted by 0.5
Austria	5.3	2.7	3.6	1.8
Belgium	3.6	1.8	3.6	1.8
Bulgaria	10.1	5.1	9.8	4.9
Croatia	8.2	4.1	6.5	3.3
Cyprus	0.6	0.3	0.6	0.3
Czech Republic	5.3	2.6	5.5	2.8
Denmark	0.6	0.3	2.4	1.2
Estonia	2.7	1.3	1.6	0.8
Finland	37.0	18.5	30.7	15.3
France	52.7	26.3	42.2	21.1
Germany	45.9	23.0	46.3	23.2
Greece	1.8	0.9	0.9	0.4
Hungary	1.6	0.8	1.5	0.8
Ireland	0.9	0.4	0.6	0.3
Italy	26.9	13.5	24.3	12.2
Latvia	8.1	4.1	3.6	1.8
Lithuania	6.3	3.2	8.8	4.4
Luxembourg	0.5	0.2	0.3	0.2
Malta	0.0	0.0	0.0	0.0
Netherlands	1.7	0.9	1.4	0.7
Poland	37.6	18.8	30.5	15.3
Portugal	4.9	2.4	5.0	2.5
Romania	22.3	11.2	16.5	8.3
Slovakia	5.4	2.7	4.9	2.5
Slovenia	6.8	3.4	5.2	2.6
Spain	26.6	13.3	27.0	13.5
Sweden	37.9	19.0	38.7	19.3
United Kingdom	14.4	7.2	12.7	6.3
EU28	**376.0**	**188.0**	**334.6**	**167.3**

Source: own compilation

Table 4-3: Results of analysis per MS in Mt CO_2 per year for different cases

Country	2a) Unaccounted emissions if MS increased their harvest to 80% of forest increment; accounting against historic emissions/removals 2000-2009; debits are discounted by 0	2b) Unaccounted emissions if MS increased their harvest to 80% of forest increment; accounting against historic emissions/removals 2000-2009; debits are discounted by 0.5	2c) Unaccounted emissions if MS increased their harvest to 80% of forest increment; accounting against FRL reflecting historic management intensity 2000-2009; debits are discounted by 0	2d) Unaccounted emissions if MS increased their harvest to 80% of forest increment; accounting against FRL reflecting historic management intensity 2000-2009; debits are discounted by 0.5
Austria	-	-	-	-
Belgium	-	-	-	-
Bulgaria	9.0	4.5	8.7	4.3
Croatia	2.8	1.4	1.1	0.6
Cyprus	-	-	-	-
Czech Republic	-	-	-	-
Denmark	-	-	-	-
Estonia	0.7	0.4	-	-
Finland	2.5	1.2	-	-
France	21.9	11.0	11.4	5.7
Germany	2.6	1.3	2.9	1.5
Greece	2.8	1.4	1.9	0.9
Hungary	0.5	0.3	0.4	0.2
Ireland	2.5	1.2	2.2	1.1
Italy	19.8	9.9	17.2	8.6
Latvia	1.0	0.5	-	-
Lithuania	0.1	-	2.6	1.3
Luxembourg	0.4	0.2	0.2	0.1
Malta	-	-	-	-
Netherlands	1.2	0.6	1.0	0.5
Poland	23.3	11.7	16.3	8.1
Portugal	3.1	1.5	3.2	1.6
Romania	11.9	6.0	6.1	3.1
Slovakia	2.4	1.2	1.9	1.0
Slovenia	6.0	3.0	4.4	2.2
Spain	15.4	7.7	15.7	7.9
Sweden	-	-	-	-
United Kingdom	11.9	6.0	10.2	5.1
EU28	**142.0**	**71.0**	**107.3**	**53.7**

Source: own compilation

Table 4-4: Underlying historic and projected emissions (+) and removals (-), national thresholds and FRLs

Country	Average historic emissions (+) and removals (-) 2000-2009	Projected net emissions (+) and removals (-) 2021-2030	National threshold, projected net emissions (+) and removals (-) applying only to MS harvesting less than 80% of forest increment	Assumed FRL reflecting historic management intensity 2000-2009
Austria	-5.3	-1.8	-	-3.6
Belgium	-3.6	-3.7	-	-3.6
Bulgaria	-10.1	-9.4	-1.1	-9.8
Croatia	-8.2	-4.8	-5.4	-6.5
Cyprus	-0.6	-0.6	-0.6	-0.6
Czech Republic	-5.3	-5.7	-	-5.5
Denmark	-0.6	-4.1	-	-2.4
Estonia	-2.7	-0.5	-1.9	-1.6
Finland	-37.0	-24.4	-34.5	-30.7
France	-52.7	-31.7	-30.7	-42.2
Germany	-45.9	-46.7	-43.4	-46.3
Greece	-1.8	0.0	1.0	-0.9
Hungary	-1.6	-1.5	-1.1	-1.5
Ireland	-0.9	-0.3	1.6	-0.6
Italy	-26.9	-21.8	-7.2	-24.3
Latvia	-8.1	1.0	-7.1	-3.6
Lithuania	-6.3	-11.3	-6.2	-8.8
Luxembourg	-0.5	-0.1	-0.1	-0.3
Malta	0.0	0.0	-	0.0
Netherlands	-1.7	-1.1	-0.5	-1.4
Poland	-37.6	-23.4	-14.2	-30.5
Portugal	-4.9	-5.2	-1.8	-5.0
Romania	-22.3	-10.7	-10.4	-16.5
Slovakia	-5.4	-4.4	-3.0	-4.9
Slovenia	-6.8	-3.5	-0.8	-5.2
Spain	-26.6	-27.3	-11.3	-27.0
Sweden	-37.9	-39.4	-	-38.7
United Kingdom	-14.4	-11.0	-2.5	-12.7
EU28	**-376.0**	**-293.2**	**-181.2**	**-334.6**

Source: UNFCCC, EC 2016a, own compilation

5. References

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