**Submission of information on forest management reference levels by ROMANIA**

as requested by the Cancún decisions, i.e. „Consideration of further commitments for Annex I Parties under the Kyoto Protocol, Draft conclusions proposed by the Chair", contained in FCCC/KP/AWG/2010/L.8, and its Addendum: Draft decision [-/CMP.6], Land use, land-use change and forestry, contained in FCCC/KP/AWG/2010/L.8/Add.2

## 1. ***Forest management reference level value***

The averages of the projected FM data series for the period 2013-2020, taking into account policies implemented up to 2009, under two scenarios (the first one with emissions/removals from HWP using the first order decay functions, and the second one assuming instant oxidation) are present in the table below:

Forest management reference levels **Table 1**

| FM RL including HWP decay functions [Mt $CO_2$eq] | FM RL assuming HWP instant oxidation [Mt $CO_2$eq] |
|---|---|
| (-28.044 - 0.422) **-28.466** | **-28.044** |

## 2. ***General description***

Projections for Romania are provided by the Joint Research Centre of the European Commission (JRC), based on elaboration of the results of independent EU modelling groups, coordinated by the International Institute for Applied Systems Analysis (IIASA), assisted by the JRC and funded by the Directorate General of Climate Action (DG CLIM). Elements contained in the footnote 1 to Document FCCC/KP/AWG/2010/L.8/Add.2 were considered as follows:[1]

(a) Removals / emissions from FM are obtained by adjusting the results of the modelling exercise through an "ex-post processing of models results" (see section 5 "Description of construction of reference levels"), which took into account the need for consistency with the inclusion of carbon pools;

(b) Models used the latest available country specific age-class structure data (see section 5);

[1] As stipulated in the document FCCC/KP/AWG/2010/L.8/Add.2, the forest management reference levels are constructed on the basis of:
(a) Removals or emissions from forest management as shown in greenhouse gas inventories and relevant historical data;
(b) Age-class structure;
(c) Forest management activities already undertaken;
(d) Projected forest management activities under a business as usual scenario;
(e) Continuity with the treatment of forest management in the first commitment period;
(f) The need to exclude removals from accounting in accordance with decision 16/CMP.1, paragraph 1.

(c) Forest management activities already undertaken are taken into account through the use of the latest available forest time series data (from national forest inventory and other statistics), and the implementation of forest policies by 2009. The projection of harvest demand by 2020;

(d) Projected forest management activities by 2020 under a business as usual scenario are estimated on the basis of macroeconomic drivers and the further application of these policies (see section 6, "Policies included");

(e) FM was selected for reporting/accounting in the first commitment period, and is assumed to be mandatory for reporting in the 2nd commitment period;

(f) The projections included in this submission follow the general rules for treating the LULUCF sector under the KP reporting.

## 3. ***Pools and gases***

Pools and gases **Table 2**

| Changes in C pools included in the RL | | | | | | | GHG sources included in the RL | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HWP | Above ground biomass | Below ground biomass | Litter | Deadwood | Soil a) | | Fertilization b) | Drainage of soils c) | Liming b) | Biomass burning | | |
| | | | | | mineral | organic | $N_2O$ | $N_2O$ | $CO_2$ | $CO_2$ | $CH_4$ | $N_2O$ |
| *yes* | *yes* | *yes* | *no* | *no* | *no* | *no* | *no* | *no* | *no* | *yes* | *yes* | *yes* |

a) Based on a national study, changes in soil carbon stocks were assumed 0 (i.e., it was shown that soil pool is not a source of GHG emissions) in the last National Inventory Report to the UNFCCC, August 2010;

b) As shown in the Romania's NIR 2010, fertilization and liming do not occur in areas on which FM activity applies. The emissions from N fertilization are not subtracted from those in the agriculture sector, but included there (IE);

c) As shown in the Romania's NIR 2010, drainage in forest soils have not been performed/documented in the period from 1990 on. Associated $N_2O$ emissions are therefore 0.

## 4. ***Approaches, methods and models used***

Projections of GHG emissions/removals from FM activity for Romania have been elaborated by the JRC (2010-2011). The models used to project emissions and removals from FM are G4M (from IIASA) and EFISCEN (from the European Forest Institute, EFI). Table 3 and figure 1 below provide the essential features of the main models involved and an overview of the modelling architecture.

The reference level builds on macro projections of GDP and population which are exogenous to the models used. They reflect the recent economic downturn, followed by sustained economic growth resuming after 2010. This data is entering the GLOBIOM model that uses these projections to translate them into demand for timber (see main assumptions for the BASELINE scenario on pp.13-16 in Capros et al. (2010)[2]. Bioenergy demand was projected by the PRIMES biomass model[3]. The biomass system model is incorporated in the baseline scenario of the PRIMES large scale energy model for Europe[4]. It is an economic supply model that computes the optimal use of resources and investment in secondary and final transformation, so as to meet a given demand of final biomass energy products, driven by the rest of sectors as in PRIMES model. The primary supply of biomass and waste has been linked with resource origin, availability and concurrent use. The total primary production levels for each primary commodity are restricted by the technical potential of the appropriate primary resource.

Data on potential yields and GHG emissions and removals for diverse forest management alternatives are derived from the more detailed forestry models (G4M and EFISCEN). For baseline scenario (BAU), the economic land use models project domestic production and consumption, net exports and prices of wood products and changes in land use for EU member states and other world regions. The sector specific information from the economic models is used by the forest models to project GHG emissions and removals.

A more detailed description of modelling steps is provided in the following sections.

Essential features of the main models involved in projection of FM emissions and removals **Table 3**

| | |
|---|---|
| **G4M** | The Global Forest Model (G4M) provides spatially explicit estimates of annual above- and belowground wood increment, development of above- and belowground forest biomass and costs of forestry options such as forest management, afforestation and deforestation by comparing the income of alternative land uses. |
| **EFISCEN** | The European Forest Information Scenario Model (EFISCEN) is a large-scale model that assesses the supply of wood and biomass from forests and projects forest resource development on regional to European scale, based on forest inventory data. EFISCEN provides projections on basic forest inventory data (stem wood volume, increment, age-structure), as well as carbon in forest biomass and soil. |
| **GLOBIOM** | GLOBIOM is a global static partial equilibrium model integrating the agricultural, livestock, bioenergy and forestry sectors with the aim to give policy advice on global issues concerning land use competition between the major land-based production sectors. |

[2] P. Capros, L. Mantzos, N. Tasios, A. De Vita, N. Kouvaritakis (2010), EU energy trends to 2030 — UPDATE 2009, European Commission, Directorate-General for Energy in collaboration with Climate Action DG and Mobility and Transport DG. Luxembourg: Publications Office of the European Union, 2010. ISBN 978-92-79-16191-9. Available online: http://ec.europa.eu/energy/observatory/trends_2030/doc/trends_to_2030_update_2009.pdf

[3] http://www.e3mlab.ntua.gr/e3mlab/PRIMES%20Manual/THE_NEW_PRIMES_BIOMASS_MODEL.pdf

[4] http://www.e3mlab.ntua.gr/e3mlab/PRIMES%20Manual/The_PRIMES_MODEL_2008.pdf

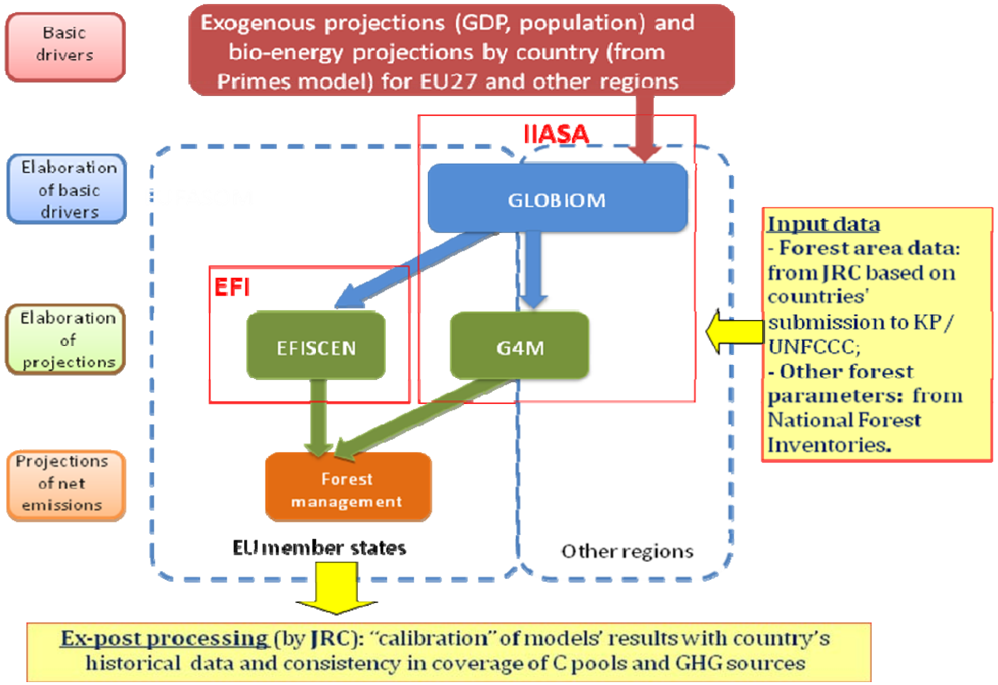


**Figure 1:** Synthetic flowchart of information exchange between models.

The modelling approach essentially included the following steps:

1) *Selection of relevant input data*

- Forest area used by the models is taken from national forest inventories and scaled to match the area reported in GHG inventories (EFISCEN) or from recent literature (G4M), see Table 4.
- Main forest and forest management parameters (age structure, increment, historical harvest) are taken from national forest inventories and other country statistics (see the sections below).
- Future harvest demand under a business as usual (BAU) scenario (see table 11) was derived from key macroeconomic drivers (GDP, population), based only on policies and measures enacted by Member States up to April 2009 (the EU 2020 renewable target and the 20% GHG reduction targets are not included in this baseline). In particular, the bio-energy demand was estimated by the PRIMES model and the timber demand was estimated by the GLOBIOM model. See section 6 "Policies included" for more information.

2) *Elaboration of input data*: the input data (area, age structure, increment, management characteristics, rotation length, future harvest demand, etc.) were elaborated by the two forest models (G4M and EFISCEN) to produce estimates of emissions and removals from FM until 2020 (for the above and below ground biomass carbon pools). The two models differ in the way they allocate harvest demand to thinning and final felling (including rotation lengths) with implications on emissions and removals from the forest. In general, both models follow the rules of sustainable forest management, securing sustainable yields. Further they follow different growth concepts (EFISCEN forest growth is based in inventory data, whereas G4M estimates growth from productivity maps, i.e. NPP maps) representing alternative approaches of forest growth estimation and projection. Given the unavoidable uncertainties which characterize any projections of emissions and removals from the forest sector, it was considered that the average of two different models makes the future trend illustrated below (table 8) more robust. Elaborations also included a simulation of the impact of +/-20% harvest as compared as BAU harvest (see sensitivity analysis in table 8).

3) *Ex-post processing of models' results:* In order to ensure consistency between models' results and historical data reported by the country, the emissions and removals estimated by the models for the entire time series (up to 2020) were "calibrated" (i.e. adjusted) using historical data from the country for the period 2000-2008 (for which both data from the GHG inventories and data projected by the models were available). To this aim, an "offset" was calculated for the biomass pools, as difference between the average of country's emissions and removals from biomass for the period 2000-2008 (table 5) and the average of models' estimated emissions and removals from biomass for the period 2000-2008 (table 8).

The calibrated average of models, which is used for the setting of reference level, is obtained by adding the total offset (biomass offset + non-biomass pools and GHG sources offset) to the models' average. In other words, models' results were adjusted to match the average historical data provided by each country for the period 2000-2008. This ensures consistency between country data and models' data in terms of:

(i) absolute level of emissions and removals from biomass, i.e. the calibration „reconciles" differences in estimates which may be due to a large variety of factors, including different input data, different parameters, different estimation methods;

(ii) coverage of non-biomass pools and GHG sources. The calibration procedure automatically incorporates into the projections the average rate (for the period 2000-2008) of the GHG impact of past disturbances, not estimated by the model (e.g. emissions from fires).

The future trend of emissions and removals up to 2020, predicted by the model, is not affected by this calibration procedure, but only by the current forest characteristics (e.g., age structure) and the future harvest demand.

To maintain consistency in the future, technical corrections (as referred in paragraph 15 quarter and 15 quinquies of the document FCCC/KP/AWG/2010/ CRP.4/Rev.4 ) will be needed in the following cases:

(i) if recalculations of emissions and removals from FM (or forest land remaining forest land) for the period 2000-2008 will be carried out in any future submission of annual GHG inventories;

(ii) if any future threshold selected for "force majeure" indicates that an event in the 2000-2008 period can be considered "force majeure", the impact of event (in terms of GHG) should be removed from historical FM emissions/removals (according to provisions of any future force majeure decision), thus affecting the calibration procedure described above.

## 5. *Description of construction of reference levels*

### *I. Description of how each of the following 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

Areas applicable for FM activity used by the models [kha] **Table 4**

| | 2000 | 2005 | 2008 | 2010 | 2015 | 2020 |
|---|---|---|---|---|---|---|
| G4M | 6,332 | 6,308 | 6,294 | 6,284 | 6,256 | 6,230 |
| EFISCEN | 6,685 | 6,685 | 6,670 | 6,660 | 6,633 | 6,608 |

- Historical data used by the G4M model are taken from Gallaun et al 2010[5] (Based on CORINE and TBFRA);
- Historical data used by the EFISCEN model were obtained by the JRC from the UNFCCC reporting;
- Projected data were obtained by the JRC based on 2008 data minus deforestation projected by G4M.

### (b) Emissions and removals from forest management

#### 1) Historical emissions and removals from forest management

Time series of historical removals from FM activity, included in the Romania's NIRs **Table 5**

| [Gg $CO_2$eq] | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | av. 2000-2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Biomass (1) | -35595 | -37049 | -37866 | -39145 | -39743 | -38993 | -38009 | -38392 | -40485 | -39218 | -38098 | -39035 | -36634 | -36195 | -35495 | -37187 | -37226 | -36195 | **-36222** | **-36,921** |
| Non-biomass pools | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| GHG sources (2) | 12 | 8 | 20 | 14 | 9 | 6 | 6 | 2 | 4 | 10 | 98 | 28 | 98 | 21 | 3 | 6 | 26 | 80 | 23 | 43 |
| TOTAL | -35583 | -37041 | -37846 | -39131 | -39734 | -38987 | -38003 | -38390 | -40481 | -39208 | -37999 | -39007 | -36536 | -36174 | -35492 | -37181 | -37200 | -36114 | **-36199** | **-36,878** |

(1) Above and below ground biomass (2) GHG emissions from forest fires

[5] Gallaun, H., G. Zanchi, G. J. Nabuurs, G. Hengeveld, M. Schardt and P. J. Verkerk 2010, "EU-wide maps of growing stock and above-ground biomass in forests based on remote sensing and field measurements." Forest Ecology and Management 260(3): 252-261

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**

Time series of historical removals from Forest Land remaining Forest Land, included in the Romania's NIRs **Table 6**

| [Gg $CO_2$eq] | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | av. 2000-2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Biomass (1) | -35595 | -37049 | -37866 | -39145 | -39743 | -38993 | -38009 | -38392 | -40485 | -39218 | -38098 | -39035 | -36634 | -36195 | -35495 | -37187 | -37226 | -36195 | **-36438** | **-36,945** |
| Non-biomass pools | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| GHG sources (2) | 12 | 8 | 20 | 14 | 9 | 6 | 6 | 2 | 4 | 10 | 98 | 28 | 98 | 21 | 3 | 6 | 26 | 80 | 23 | 43 |
| TOTAL | -35583 | -37041 | -37846 | -39131 | -39734 | -38987 | -38003 | -38390 | -40481 | -39208 | -37999 | -39007 | -36536 | -36174 | -35492 | -37181 | -37200 | -36114 | **-36415** | **-36,902** |

(1) Above and below ground biomass (2) GHG emissions from forest fires

Based on the assumption that all forests in Romania are managed (i.e., made subject to management plans), the areas of Forest Management in the KP reporting for the period 1990-2007 (and the associated emission/removal figures) equalled the areas of Forest Land remaining Forest Land in the reporting under the Convention. Exception is made by the year 2008 (first year of KP-LULUCF reporting), for which the FM figure was obtained by discounting the areas affected by ARD activities from 1990-2008.

Emissions and removals (Gg $CO_2$eq) from AR, D and FM activities, based on the 2010 (2008) KP-LULUCF reporting **Table 7**

| A. Article 3.3 activities | | | B.1 Forest management |
|---|---|---|---|
| A.1 Afforestation / Reforestation | | A.2. Deforestation | |
| A.1.1 Lands not harvested | A.1.2 Lands harvested | | |
| -272 | NA,NO | 74 | -36,199 |

Emissions and removals from FM as estimated by models, calibration of models' results, and sensitivity analysis **Table 8**

| Gg $CO_2$eq | | av. 2000-2008 | 2000 | 2005 | 2010 | 2015 | 2020 | av. 2013-2020 |
|---|---|---|---|---|---|---|---|---|
| Step 1: models' results (only biomass) | EFISCEN (1) | -42965 | -47513 | -41092 | -39090 | -41851 | -36656 | -39696 |
| | G4M | -34795 | -38367 | -34425 | -27344 | -21293 | -17692 | -20396 |
| | Average of models | -38880 | -42940 | -37758 | -33217 | -31572 | -27174 | -30046 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Step 2: ex-post processing | Offset (2) | biomass | 1959 | | | | | | |
| | | non-biomass pools and GHG sources | 43 | | | | | | |
| | | total offset | **2002** | | | | | | |
| | Calibrated average of models (3) | | -36878 | -40981 | -35799 | -31258 | -29612 | -25214 | **-28044** |
| Sensitivity analysis (4) | | *+20% harvest* | | | | *-27614* | *-26509* | *-22536* | *-25099* |
| | | *-20% harvest* | | | | *-35068* | *-32917* | *-27754* | *-31142* |

## (c) Forest characteristics and related management

### 1) age class structure

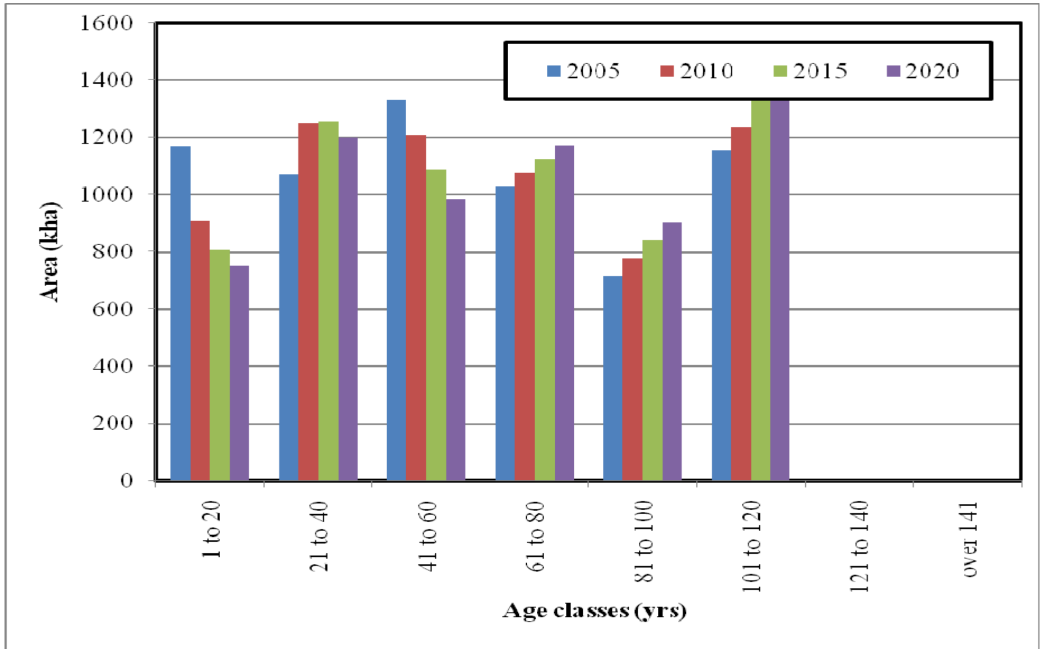


**Figure 2.** Evolution of the forest age class structure modelled by EFISCEN

As seen above, it is expected for the next decade that significant forest areas will leave the middle-age classes (21-40 and 41-60 years) to enter the pre-harvesting and harvesting classes (61-80, 81-100 and above 101). Moreover, the area of the higher age classes will increase. The relatively significant amount of forest area of harvesting age (above 100 years) also contain forest in the even higher age classes (121-140, 141-160), of which a significant part are un-even aged forests in protected areas, for which strict limitations of harvest apply. Considering also that growth (increment) appeases with age and the shrinking amount of young to mid age forests, the sink of Romanian forests is expected to decrease slowly, *ceteris paribus*.

**2) increment**

Increments as estimated by models ($m^3\ ha^{-1}\ yr^{-1}$) **Table 9**

| Model | 2000 | 2005 | 2010 | 2015 | 2020 |
|---|---|---|---|---|---|
| G4M | 8.3 | 8.0 | 7.1 | 6.2 | 5.7 |
| EFISCEN | 7.5 | 7.4 | 7.4 | 7.6 | 7.4 |

The figure of annual growth of Romanian forests obtained from the last completed National Forest Inventory (1984) and used in the NIRs (5.6 $m^3$/ha*yr) is lower than those reported by models for the present and future periods. Nevertheless, figures closed to those in the table above are expected following the completion of the ongoing NFI (2011). These differences can be explained by the ageing of forest stock, coupled with the limited harvest. Some changes could also be attributable to the changing inventory methodology.

**3) rotation length**

Romanian forestry is largely geared toward close-to-nature management of high forests, based on the principles of sustainable yields, assurance of protection functions and promotion of valuable indigenous tree species. The rotation for the main tree species depends largely on site conditions, predominant function assigned to a particular forest area, technical harvesting age, and are in average as following:

- Beech (Fagus sylvatica): 100-120 yr
- Spruce (Picea abies): 100-120 yr
- Oaks (Quercus ssp.): 110-130 yr

**4) information on forest management activities under “business as usual”**

Assuming that the figures on FM sink in Romania does not change following the completion of the ongoing NFI (2011) and the future NIR submissions and ERT reports, and based on the assumptions used in projections, the continuation of the present forest management norms will lead to a slow decrease of sink for the period 2012-2020. An abrupt decrease of the sink figures will depend, above all, on the following conditions (not necessarily likely):

- revision of forestry technical norms regarding management planning and harvesting works (ed. 2000);
- large-scale investments in forestry infrastructure (i.e., transportation network is now among the lowest in Europe);
- large-scale natural disturbances (e.g., windfalls followed by bark beetle outbreaks), which may imply larger/concentrated cuttings in some years.

**5) other relevant information**

Sources of the main forest parameters and characteristics used by the models **Table 10**

| | **Forest parameters and characteristics** | | | | | |
|---|---|---|---|---|---|---|
| | **Area (ha)** by species group and age class | **Growing stock ($m^3$)** by species group and age class | **Increment ($m^3$ $ha^{-1}$ $y^{-1}$)** by species group and age class | **BEF**, root/shoot ratio, **wood density** by species and age-class | | **Management regime** (rotations, thinning…) by species (years, …) |
| | | | | BEF and R/S ratio (dimensionless) | Wood density (t dry matter/ $m^3$ fresh volume) | |
| **EFISCEN** | Recent inventory data were provided by the European Forest Sector Outlook Study in 2006[6] | | Increment functions are based on national forest inventory data and yield tables | Species-specific and age-dependent BEFs have been developed for selected number of countries for EFISCEN by Vilén et al. 2005[7] and national reports and are applied to neighbouring countries | Basic wood densities are based on IPCC defaults[8] | Management regimes have been derived from a country-wise compilation of guidelines, handbooks and personal communication[9]. |
| **G4M** | Input data for all countries: for land areas Global Land Cover 2000 and for forest area (Gallaun et al 2010[10] scaled to JRC data to the degree possible); for the increment NPP 1999 [11] scaled to MCPFE 2005); BEF and root/shoot ratio are assumed to be constant; carbon in biomass, soil, litter and dead trees are from Kindermann et al., based on FAO and GLC 2000[12]; the age structure is taken from NFI. | | | | | |
| **GLOBIOM** | Same input data of G4M | | | | | Input data from G4M |

[6] Schelhaas, M.J., Brusselen, J.V., Pussinen, A., Pesonen, E. Schuck, A., Nabuurs, G.J., Sasse, V. (2006). Outlook for the development of European forest resources. UN-ECE

[7] Vilén, T., Meyer, J., Thürig, E., Lindner, M., Green, T., 2005. Improved regional and national level estimates of the carbon stock and stock change of tree biomass for six European countries, (Deliverable 6.1). Improved national estimates of the carbon stock and stock change of the forest soils for six European countries (Deliverable 6.2). CarboInvent Project http://www.joanneum.at/carboinvent/D_6_1_6_2.pdf European Forest Institute, Joensuu, p. 31.

[8] IPCC, 2003. Good practice guidance for land use, land-use change and forestry. IPCC national greenhouse gas inventories programme.

[9] Nabuurs, G., Pussinen, A., van Brusselen, J., Schelhaas, M., 2007. Future harvesting pressure on European forests. European Journal of Forest Research 126, 391-400.

[10] Gallaun, H., G. Zanchi, G. J. Nabuurs, G. Hengeveld, M. Schardt and P. J. Verkerk (2010). "EU-wide maps of growing stock and above-ground biomass in forests based on remote sensing and field measurements." Forest Ecology and Management 260(3): 252-261. (Based on CORINE and TBFRA)

[11] Cramer . W, D. W. Kicklighter, A, Bondeau, B., Moore, III, G. Churkina, B., Nermy, A. Ruimy, A., L., Schloss, and the Participants of the Potsdam NPP Model Intercomparisson (1999). Comparing global models of terrestrial net primary productivity (NPP) : overview and key results. Global Change Biology, Volume 5 Issue 51, pp 1-15

[12] Kindermann G., McCallum I., Fritz S., Obersteiner M., 2008. A global forest growing stock, biomass and carbon map based on FAO statistics. Silva Fennica, Vol 42(3), pp 387-396.

### (d) Harvesting rates

#### 1) Historical harvesting rates

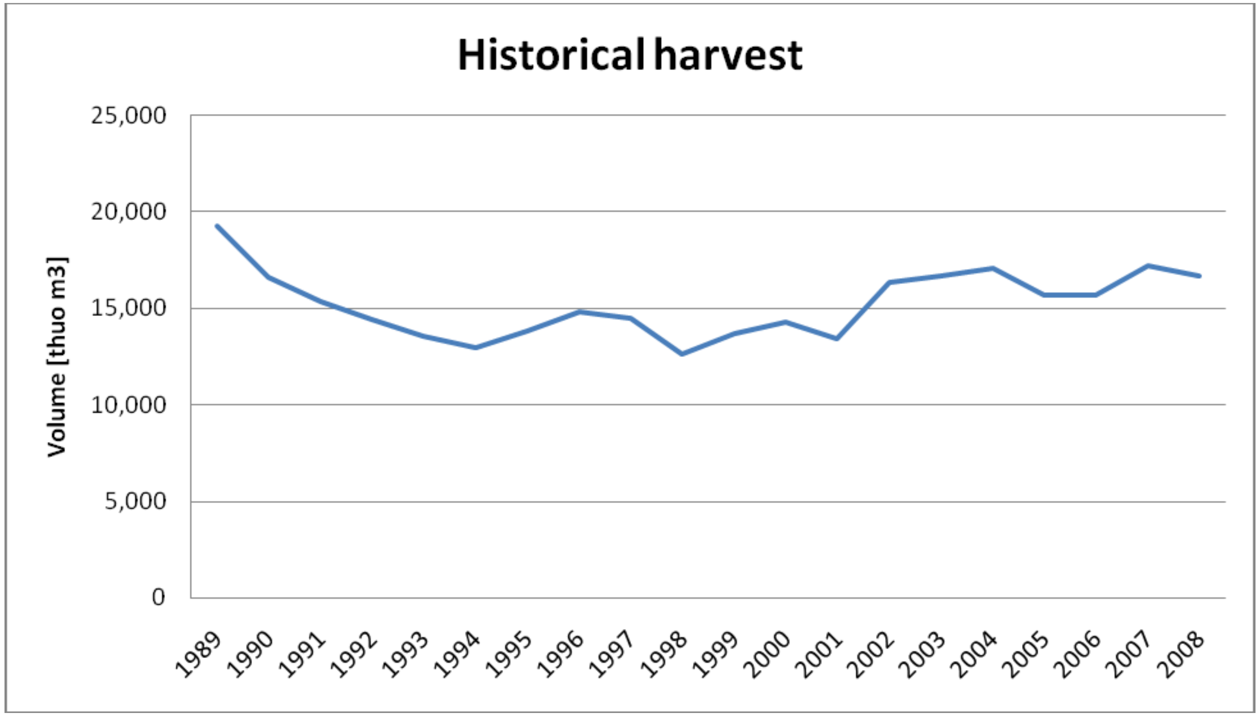


**Figure 3**: Historical harvest figures, as included in the Romania's NIR 2010

#### 2) Assumed future harvesting rates

Historical harvest rate for FM activity and projected BAU harvest demand used by models [Mio $m^3$] **Table 11**

| 2000 | 2005 | 2010 | 2015 | 2020 | Av. 2013-2020/2002 | Source of historical data |
|---|---|---|---|---|---|---|
| 14.827 | 17.104 | 16.926 | 16.749 | 16.571 | 0.98 | FAO June 2010 |

**(e) Harvested wood products**

Estimations of the size of the pool are estimated by Rüter (2011)[13], using a common methodology for the EU member states.
The contribution of HWP to the reference level of Romania amounts to **-0,422 Mt $CO_2$**. It was calculated using the C-HWP-Model, which estimates delayed emissions on the basis of the annual stock change of semi-finished wood products as outlined in the 2006 GL (Rüter, 2011). The estimation uses the product categories, half lives and methodologies as suggested in paragraph 27, page 31 of FCCC/KP/AWG/2010/CRP.4/Rev.4.

The activity data (production and trade of sawn wood, wood based panels and paper and paperboard) is derived from the TIMBER database (UNECE 2011) (time series 1964-2009).

In order to achieve accurate results, the HWP numbers have been calculated applying the sub-categories of sawn wood, wood based panels and paper and paperboard as specified in Table 1. Sawn wood includes the Items 1632 and 1633, wood based panels comprising of Items 1634, 1640, 1646, 1647, 1648, 1649 and 1650, and paper and paperboard corresponds to Item 1876.

Conversion factors of considered commodities* **Table 12**

| Classification | | Description of commodity | Air dry density | C conv. factor | Source |
|---|---|---|---|---|---|
| FAO | UNECE | | [g/cm³] | [Gg C/1000m³] | |
| 1866 | 1.2.C | Industrial round wood, coniferous | 0,450 | 2,250E-01 | Kollmann (1982), (oak, beech) |
| 1867 | 1.2.NC | Industrial round wod, non-coniferous | 0,670 | 3,350E-01 | Kollmann (1982), (oak, beech) |
| 1632 | 5.C | Sawn wood, coniferous | 0,450 | 2,250E-01 | Kollmann (1982), (oak, beech) |
| 1633 | 5.NC | Sawn wood, non-coniferous | 0,670 | 3,350E-01 | Kollmann (1982), (oak, beech) |
| 1634 | 6.1 | Veneer sheets | 0,590 | 2,950E-01 | IPCC (2003) |
| 1640 | 6.2 | Plywood | 0,480 | 2,402E-01 | IPCC (2003) |
| 1646 | 6.3 | Particle board | 0,630 | 2,898E-01 | Hasch (2002), Barbu (2011) |
| 1647 | 6.4.1 | Hardboard | 0,850 | 4,165E-01 | Kollmann (1982), Barbu (2011) |
| 1648 | 6.4.2 | Medium density fibreboard | 0,725 | 3,190E-01 | Hasch (2002), Barbu (2011) |
| 1649 | 6.4.x | Fibreboard, compressed | 0,788 | 3,504E-01 | (50 % hardboard / 50 % medium density fibreboard) |
| 1650 | 6.4.3 | Other board (Insulating board) | 0,270 | 1,148E-01 | Kollmann (1982), Barbu (2011) |
| 1876 | 10 | Paper and paperboard | 0,900** | 4,500E-01** | IPCC (2006) |

* Items 1866 and 1867 are needed for methodological reasons only (see following section), ** in [g/g] and [Gg C/1000t]

[13] Rüter S (2011): „Proposal for setting a Reference level for Harvested Wood Products", Draft Working Paper, Johann Heinrich von Thünen-Institute (vTI), Hamburg 31.01.2011

In order to only estimate emissions from HWP removed from forests which are accounted for by Romania under Article 3, in a first step, the annual share of carbon in HWP coming from domestic forests has been calculated. The following equations were used as industrial round wood is assumed to serve as raw material for the production of HWP.

(1) $$ratio_{INDRW\ consumption\ from\ dom\ harvest} = \frac{(Production_{INDRW} - Export_{INDRW})}{(Production_{INDRW} + Import_{INDRW} - Export_{INDRW})}$$

(2) $$Production_{HWP\ from\ dom\ harvest} = Production_{HWP} \cdot ratio_{INDRW\ consumption\ from\ domestic\ harvest}$$

The ratio (Equation 1) was calculated both for coniferous and non-coniferous industrial round wood (*INDRW*, Items 1866 and 1867). For coniferous sawn wood and paper and paperboard, the ratio for coniferous industrial round wood was applied. For non-coniferous sawn wood the ratio for non-coniferous industrial round wood was applied. For the other HWP, the ratio of the annual mass weighted average of coniferous and non-coniferous industrial round wood was applied.

As a result, this share of HWP produced from domestically harvested timber is presented as a percentage in Table 2.

The present approach relies on the assumption that all Romanian forests are managed and that all harvest is allocated to forest management (i.e., consistent with the NIR). The final allocation of carbon in HWP to forests which are accounted for under Article 3 shall be part of a technical correction as suggested in paragraph 15 quarter, page 27 of FCCC/KP/AWG/2010/CRP.4/Rev.4.

Historic time series of amounts and share of accountable carbon Inflow to the HWP pool [in 1,000 t C and %] **Table 13**

| 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1417 | 1535 | 1676 | 1826 | 1874 | 1942 | 1968 | 2093 | 2133 | 2138 | 2085 | 2052 | 2042 | 2103 | 2215 | 2164 | 2114 |
| 93,5% | 94,2% | 95,4% | 96,2% | 96,3% | 96,9% | 96,1% | 96,9% | 98,1% | 97,9% | 97,3% | 96,5% | 98,0% | 98,9% | 99,1% | 96,1% | 95,7% |

| 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2119 | 2171 | 2240 | 2277 | 2105 | 1856 | 1651 | 1623 | 1626 | 1428 | 1058 | 1150 | 1149 | 784 | 798 | 722 | 756 |
| 98,1% | 99,2% | 99,3% | 98,7% | 98,7% | 99,3% | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% | 99,9% | 100,0% | 99,2% | 99,4% | 99,7% |

| 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 802 | 946 | 1118 | 1125 | 1317 | 1540 | 1681 | 1570 | 1473 | 1696 | 1717 | 1681 |
| 99,7% | 98,4% | 97,5% | 99,2% | 99,0% | 99,3% | 98,0% | 96,2% | 94,4% | 95,7% | 96,6% | 94,9% |

The annual carbon Inflow (= carbon in produced HWP) to the HWP pool prior to the year 1964 (first year for which activity data from TIMBER database

(UNECE 2011) is available for Romania) has been calculated from the 5 years average from 1964 to 1968 and was assumed to be the constant carbon pool Inflow for the time period 1900-1963. To provide a projection for the development of the HWP pool consistent with the assumptions on the future harvest, the rates of change of the projected harvest (Model GLOBIOM) as compared to the last 5 years average of historic harvest, for which up-to-date data is available, was calculated (see Table 3).

These projected growth rates as compared to the average of the years 2003-2007 for Romania were applied to the same 5 years average of historic carbon inflow to the HWP pool in order to receive the future inflow to the HWP pool.

Projection of carbon inflow to the HWP pool **Table 14**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Average of historic harvest (2003-2007) [in 1,000m3] | 17.104 | | | | | | | | | | |
| Average HWP pool Inflow* (2003-2007) [in 1,000t C] | 1592 | | | | | | | | | | |
| years | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
| Projected harvest rate [in 1,000m3] | 16926 | 16891 | 16855 | 16820 | 16784 | 16749 | 16713 | 16678 | 16642 | 16607 | 16571 |
| Change as cp to historic harvest (2003-2007) [in %] | -1,04% | -1,25% | -1,45% | -1,66% | -1,87% | -2,08% | -2,28% | -2,49% | -2,70% | -2,91% | -3,11% |
| Projected carbon Inflow to HWP pool [in 1000t C] | 1575,55 | 1572,25 | 1568,94 | 1565,63 | 1562,33 | 1559,02 | 1555,72 | 1552,41 | 1549,1 | 1545,8 | 1542,49 |

*a similar approach was chosen by Kangas and Baudin (2003): ECE/TIM/DP/30

For calculating the pool of HWP in use, three half-lives for application in the first order decay function have been used as suggested by paragraph 7, page 31 of FCCC/KP/AWG/2010/CRP.4/Rev.4.

- Sawn wood: 35 years
- Wood based panels: 25 years
- Paper and paperboard: 2 years

The projected net-emissions are calculated from the annual stock change estimates following the calculation method provided in IPCC 2006, Vol.4, Chapter 12 (Equation 12.1).

Historic (up to 2009) and projected net-emissions from HWP pool [in 1,000 t $CO_2$] **Table 15**

| 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1072 | 2259 | 1746 | 1618 | 2824 | 2658 | 2834 | 2606 | 2354 | 1760 | 1086 | 1055 | 352 | -442 | -910 | -487 | -133 |

| 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | **Average** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| -902 | -931 | -1625 | -467 | -485 | -489 | -483 | -471 | -455 | -436 | -415 | -393 | -371 | -348 | **-422** |

**(f) Disturbances in the context of force majeure**

Emissions from forest wildfires (i.e., controlled fire is no permitted in Romania) are regularly estimated in the Romania's NIR, and amounts insignificantly compared to the LULUCF removals and the country's total emissions. Windfalls are actually the major threat for Romanian forests (e.g., windfalls in November 2005 affected ca. 72,000 ha in only 2 counties, see Gancz et al 2010[14] ). Nevertheless, according to the Romanian forestry norms, windfalls are actually included in the annual allowable quotas, and hence internalised by / considered an issue of forest management.

Emissions from forest fires (Gg $CO_2$eq and % of 1990 total GHG without LULUCF) **Table 16**

| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | av. 2000-2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gg$CO_2$eq | 12 | 8 | 20 | 14 | 9 | 6 | 6 | 2 | 4 | 10 | 98 | 28 | 98 | 21 | 3 | 6 | 26 | 80 | 23 | 43 |
| % 1990 GHG | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

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

Not relevant, as presented in section 2 above and chapter 11 (KP-LULUCF) of the NIR 2010.

***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]***

No additional information is necessary/available.

## *6. Policies included*

### *I. Pre-2009 domestic policies included*

All relevant commitments made at the international level, EU regulations, national legislation and technical norms concerning forest management, in force before 2009, have been taken into consideration when providing estimations of past and projected emission/removal figures. Most relevant in this regard are the successively amended Forest Laws (no. 3/1962, no. 26/1996, no. 46/2008) and the subsequent regulations and norms, representing the regulatory framework for the forestry activity.

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[14] V Gancz, B Apostol, M Petrila, A Lorent, 2010: „*The windthrow detection based on satellite imagery and the assessment of their effects*". Revista Padurilor 6/2010. http://www.revistapadurilor.ro/Arhiva/2010_6_preview_RC2.pdf

The relatively high figures on FM sink (compared to the country's total forest resource) are the result of favourable forest structure (i.e., standing volume, annual growth), the conservation of large sinks within large nature protection areas and „protection forests", strict limitation of annual harvest to ca. ½ of annual growth, the inclusion, as far as practical, of both natural disturbances and illegal logging into the annual allowable quota and GHG estimations, the extent of close-to-nature forestry (based on natural regeneration), and not least the legal limitation of deforestation activities.

### *II. Confirmation of factoring out policies after 2009*

Forest policies above presented above, together with the projections on the relevant socio-economic parameters of the country and the essential forest data are the main prerequisites for establishing the reference levels, thoroughly presented in the preceding sections. These projections do not assume changes to the regulatory, institutional and policy framework in the country.