Training Handbook
on generic methods for estimation
of CO2 removals by sinks and, CO2 and non-CO2 emissions by sources associated to land use

This handbook is a simplified tool on generic methods to be used to estimate CO_2 removals and emissions from C stock changes in C pools and emissions from non-CO_2 sources from land use, for the national GHG inventory of LULUCF (land use, land use change and forestry). It is entirely based on *Chapter 2: Generic Methodologies Applicable to Multiple Land-Use Categories* of the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* ("IPCC 2006 Guidelines") and does not intend to replace that whatsoever. For in-depth understanding of the methods, readers must refer to original reference and extract appropriate default factors values referred inhere.

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Introduction

The "annual national GHG inventory" is a systematic approach for measuring, estimating and reporting carbon (C) stock changes and corresponding removals and emissions of CO_2 and non-CO_2 from processes affecting biomass, dead organic matter and soils. The purpose of the annual national GHG inventory is to report anthropogenic, i.e. related to managed lands only, GHG emissions by sources and CO_2 removals by sinks from C stock changes in land's C pools. Specifically, they are reported in land use, land use change and forestry (LULUCF) sector of the national GHG inventory.

Notably, a C pool can be a source (when C stock change in the reported year results in CO2 emissions) or a sink (when C stock change in the reported year results in CO_2 removals). Other gases relevant for LULUCF are CH_4 and N_2O which are generally reported as emissions from sources.

For an Annex I country to UNFCCC, reporting of annual GHG inventories is governed by decision 24/CO19[1], the "UNFCCC guidelines". However, actual estimation methodologies are provided in IPCC 2006 Guidelines[2], "IPCC 2006 Guidelines". Notably, the methodologies allow prevailing the country circumstances (e.g. in defining the land use categories or C pools, methods and data to be used).

LULUCF inventory results by summing up the emissions and removals associated to changes in C pools and GHG emissions from all lands across the country territory, in a year. Namely, reporting covers six broad land use categories: Forestland, Cropland, Grassland, Wetlands, Settlements and Other Land. Each is further subdivided into *land remaining in that category* (e.g. Forest Land Remaining Forest Land) and *land converted from one category to another* (e.g. Forest Land converted to Cropland). According to land use particularities, C stock changes in five C pools (aboveground and belowground living biomass, dead wood, litter, soil organic matter from mineral and organic soils) and one C reservoir (harvested wood products) must be reported. LULUCF also includes GHG emissions from many GHG sources associated to land (e.g. wildfires, mineralization of organic matter in managed or conversion of undisturbed soils, fertilization, drainage, etc).

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[1] Decision 24/CP.19 Revision of the UNFCCC reporting guidelines on annual inventories for Parties included in Annex I to the Convention. UNFCCC 2013. FCCC/CP/2013/10/Add.3

[2] 2006 IPCC Guidelines for National Greenhouse Gas Inventories, available at: http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html. However, there is an update on wetlands chapter in **"**2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands, available at: http://www.ipcc-nggip.iges.or.jp/public/wetlands/index.html. Moreover, a "2019 refinement" of 2006 IPCC Guidelines is underway by IPCC with final adoption and publication planned for mid-2019

IPCC 2006 Guidelines provide tiered methodologies and guidance where inventory should be estimated under higher tiers, i.e. for key categories (e.g. which contribute to cumulated 95% of annual national inventory) and for significant pools (i.e. C pools cumulatively contributing more than 60% to key category).

For estimating CO_2 emissions and removals from changes in C pools three methodological tiers are provided. Toward optimization of reporting effort, guidelines provide simplified Tier 1 approaches for non-key categories like: default values for large number of parameters; assumption of no change in below-ground living biomass; assumption that dead wood and litter pools aggregate in one unique 'dead organic matter' pool whose net change is nil; dead organic matter is assumed to be zero for non-forest land-use categories; post-disturbance emissions are included in the estimates of the disturbance event.

Under higher methodological tiers (Tier 2, Tier 3), fundamentally three methods can be involved in estimating CO_2 emissions and removals from C stock changes and non-CO_2 emissions from sources:

C stock changes methods		**Non-CO_2 emissions method**
Gain-Loss Method	***Stock-Difference Method***	**Flux of emission to atmosphere**
$\Delta C = \Delta C_G - \Delta C_L$	$\Delta C = \frac{(Ct2 - Ct1)}{(t2 - t1)}$	**Emission = A x EF**
ΔC = annual carbon stock change in the pool (tC yr^{-1}); Δ*CG* = annual gain of carbon (tC yr^{-1}); Δ*CL* = annual loss of carbon (tC yr^{-1}). Ct1 and Ct2= carbon stock in the pool at time t1 and at time t2 (tC). Measurement unit "t" represents a metric ton (1000 kilograms). Emission = non-CO2 emissions (tCH4 or tN2O). A = activity data for the emission source. EF = emission factor for a specific greenhouse gas and source category (t per unit of activity data)		

In reporting tables of the C stock changes, a positive sign ("+") associates with an increase of the C stock in the pool, while a negative one ("-") with a decrease. To estimate the CO_2 emissions and removals, it is assumed a full mass balance between C stock change in a pool in a well-defined period and the amounts of CO_2 released to, or stored from, atmosphere by that pool. By convention, C stock increase converts in CO_2 removals from atmosphere ("-" negative sign for the net emissions/removals in the reporting tables), while a decrease in CO_2 emissions to atmosphere ("+"), i.e. by multiplication of C stock change estimate with 44/12 and changing the sign. Estimation of non-CO_2 emissions to atmosphere results by multiplication of activity data (e.g. area) with an emission factor, i.e. these estimates are always positive numbers in the inventory ("+").

Estimating methods have generic features on land subcategories and C pools. **Living biomass** represents a significant C stock or change for majority of land use types, especially for managed woody based land use. Methods to estimate C stock change differ if land remains under the same, or converts to another use, and on availability of data:

for **LAND "REMAINING" IN A LAND-USE CATEGORY**[3]		for **LAND "CONVERTED TO" A NEW LAND-USE CATEGORY**
Gain-Loss Method	***Stock-Difference Method***	
$\Delta C = \Delta C_G - \Delta C_L$	$\Delta C = \frac{(Ct2 - Ct1)}{(t2 - t1)}$	$\Delta C = \Delta C_G + \Delta C_{conversion} - \Delta C_L$
ΔC = annual carbon stock change (tC yr^{-1}); Δ*CG* = annual gain of carbon (tC yr^{-1}); Δ*CL* = annual loss of carbon (tC yr^{-1}). Ct1 and Ct2= carbon stock at time t1 and at time t2 (tC). $\Delta C_{CONVERSION}$ = initial change in carbon stocks in biomass on land converted to other land-use category (tC yr^{-1}) which refers to old biomass that continues in the new land use (e.g. standing trees) and any input of new biomass in the conversion year. It can be assumed zero when Approach 1 for land representation of IPCC is used (i.e. only total net area at the end of year is available, no data on conversions among various land uses).		

[3] Acronyms for various parameters are explained in the box where they are first used.

Calculation of annual carbon stock change in biomass by such formulas requires estimation of several underlying variables (e.g. forestry parameters and quantitative indicators already available in the country or use of default values in IPCC 2006 Guidelines on each land use category under Tier 1), as follows:

for **LAND "REMAINING" IN A LAND-USE CATEGORY**		for **LAND "CONVERTED TO" A NEW LAND-USE CATEGORY**
For Gain-Loss Method	***For Stock-Difference Method***	
A. Estimation of Gain (ΔC_G) $\Delta C_G = \Sigma(A \times G_{total} \times CF)$ $G_{total} = \Sigma(I_V * BCEF_I * (1+R))$ **B. Estimation of Losses (ΔC_L)** ΔC_L is aggregate loss from **regular harvest** (**$L_{wood-removals}$**), **fuelwood collection and gathering** (**$L_{fuelwood}$**) and **disturbances** (**$L_{disturbance}$**), derived as: $L_{wood-removals} = H*BCEF_R*(1+R)*CF$ $L_{fuelwood} = [(FG_{tree}*BCEF_R*(1+R)) + FG_{part}*D]*CF$ $L_{disturbance} = A_{disturbance}*B_W*(1+R)*CF*fd$	$C_{t2,t1} =$ $\Sigma(A*V*BCEF_S*(1+R))*CF$	$\Delta C_{conversion} =$ $\Sigma((B_{AFTER} - B_{BEFORE})*A)*CF$
ΔC_G = annual increase in C stock due to biomass growth (tC yr^{-1}); A = area (ha) (of various strata, e.g. administrative boundaries, land use classes and categories, climatic zones, etc); G_{total} = average annual growth of above and below-ground biomass (t of dry matter, t dm ha^{-1} yr^{-1}); I_V = average net annual increment in volume for specific vegetation type (m^3 ha^{-1} yr^{-1}); $BCEF_I$ = biomass conversion and expansion factor for conversion of net annual increment in volume to growth of total woody above-ground biomass (default values are given for specific vegetation types). Instead $BCEF_I$, the product of country specific BEF_I (biomass expansion factor) * D (wood density). Under Tier 1, term "I_V • $BCEF_I$" can be substituted with "Gw" default values for specific vegetation types. R = ratio of below-ground biomass to above-ground biomass for a specific vegetation type (under Tier 1 R = 0 under both "Gain" and "Losses"). $L_{wood-removals}$ = annual carbon loss due to biomass removals (tC yr^{-1}); H = annual wood removals of harvested roundwood (m^3 yr^{-1}); $BCEF_R$ = biomass conversion and expansion factor for conversion of harvested volume to total aboveground biomass removals including bark and branches (t m^3 yr^{-1}). Instead $BCEF_R$, the product of country specific BEF_R and D can be used. $L_{fuelwood}$ = annual carbon loss due to fuelwood removals (tC yr^{-1}); FG_{trees} = annual volume of fuelwood removal of whole tree (m^3 yr^{-1}); FG_{part} = annual volume of fuelwood removal as tree parts (m^3 yr^{-1}). $L_{disturbance}$ = other annul losses of carbon (tC yr^{-1}); $A_{disturbance}$ = area affected by disturbance (ha yr^{-1}); B_W = average above-ground biomass of affected land (t dm ha^{-1}); fd = fraction of biomass lost in disturbance (includes transfers to other pools or directly emitted to atmosphere). C_{t1}, C_{t2} = total carbon in biomass at time t1, t2 (tC); V = merchantable growing stock volume (m^3 ha^{-1}). $\Delta C_{conversion}$ = initial change in carbon stocks in biomass on land converted to other land-use category (tC yr^{-1}) which can be zero if there is no living biomass from previous maintained under new land use. In land conversions, ΔC_L should also include loss of foliage. CF = carbon fraction of dry matter (tC $(t\ dm)^{-1}$). Σ – symbol for sum of estimates of C stock changes stratified on administrative regions, climates, forest types, etc.		

Selection of the method depends on level of preparedness of the inventory process and the type of country specific data available.

Dead organic matter is composed from two pools with different natural decomposition pattern: litter and dead wood. C stock change in this pool has relevance for land use conversions, as well as for land management and natural disturbances. For a *land remaining in the same land-use category*, Tier 1 simplified approach assumes dead organic matter pool (an aggregation of dead wood and litter pools) does not change over time. Under higher tiers a C stock change may be estimated by stock-difference method, if repeated measurements in time are available, or by gain-loss method, if annual inputs and outputs are available. In case of *land conversions*, several assumptions are made under tier 1, including: C stock change to be reported in the new land-use category; in non-forest land categories DOM is zero after the conversion; DOM loss occurs in the year of land-use conversion (so one year transition, only); conversion to Forest Land results in a build-up of litter and dead wood carbon pools starting from zero carbon (linearly over a transition period, by default 20 years) while longer transition period is possible; C contained in biomass killed during a land-use conversion (less harvested products) is emitted directly to the atmosphere.

Higher tiers mainly rely on stock difference method. Following generic formulas apply:

<table>
<tr><td colspan="2">for LAND "REMAINING" IN A LAND-USE CATEGORY</td><td>for LAND "CONVERTED TO" A NEW LAND-USE CATEGORY</td></tr>
<tr><td>For Gain-Loss Method</td><td>For Stock-Difference Method</td><td>For Stock-Difference Method</td></tr>
<tr><td>$\Delta C_{DOM} = A*((DOM_{in} - DOM_{out}) * CF)$</td><td>$\Delta C_{DOM} = \left[A * \frac{(DOM_{t2} - DOM_{t1})}{(t2 - t1)} \right] * CF$</td><td>$\Delta C_{DOM} = Aon * \frac{Cn - Co}{Ton}$</td></tr>
<tr><td colspan="3">ΔC_{DOM} = annual change in C stocks in dead wood or litter pool (tC yr^{-1}); A = area (ha); DOM_{in} = average annual transfer of biomass into the dead wood or litter pools (t dm ha^{-1} yr^{-1}); DOM_{out} = average annual loss out of dead wood or litter pool (t dm ha^{-1} yr^{-1}).
DOM_{t1}, DOM_{t2} = dead wood or litter stock at time t1 and t2 (t dm ha-1); T = (t2 – t1) is the period of time between the two successive assessments (yr).
Co and Cn = dead wood or litter C stock, under the old land-use category and the new land-use category (t C ha^{-1}); A_{on} = area undergoing conversion (ha); T_{on} = time of the transition from old to new land-use category (yr).
CF = carbon fraction of dry matter, tonne C $(t\ dm)^{-1}$.</td></tr>
</table>

For **mineral soils**, the change in C stock may be significant under management practices for some land remaining with the same use for some land sub-categories, while it may be significant for all land conversions. Under Tier 1 assumptions that (i) over time, soil organic C stock stabilizes to a spatially-averaged value specific to the soil type, climate, land-use and management practices and (ii) transition to a new equilibrium occurs in a linear fashion. For **lands with drained organic soils**, estimation consists in assigning a default emission factor to the concerned land use category area. Notably, for a land in conversion, the emission factor applied is the one specific to the final land use category. Following generic formulas apply:

<table>
<tr><td>for mineral soils</td><td>for organic soils</td></tr>
<tr><td>$\Delta C_{Mineral} = Aon * \frac{SOCo - SOC(o-T)}{D}$

$SOC\ o, o\text{-}T = \Sigma\ (SOC_{REF} * F_{LU} * F_{MG} * F_I * A)$</td><td>$L_{organic} = \Sigma\ (A * EF_i)$</td></tr>
<tr><td colspan="2">$\Delta C_{Mineral}$ = annual change in C stocks in mineral soils (tC yr^{-1}). $SOC_{0,\ 0\text{-}T}$ = soil organic C stock in the last year of an inventory period and at the beginning of the inventory period (tC); T = number of years over a single inventory period (for less than 2o years) or 20 years by default. For periods longer than 20 years, an annual rate of change is applied to respective inventory period.
SOC_{REF} = reference carbon stock (tC yr^{-1}); F_{LU} = stock change factor for land-use systems or sub-system for a particular land-use (dimensionless); F_{MG} = stock change factor for management regime (dimensionless); F_I = stock change factor for input of organic matter (dimensionless).
$L_{Organic}$ = annual carbon loss from drained organic soils (tC yr^{-1}); A = area of drained organic soils under land use category for concerned climate type (ha); EF_i = emission factor specific to land use and climate type (tC ha^{-1} yr^{-1}).
Σ = summation over various disaggregation available (e.g. climate zones, soil types, and management/land use systems).</td></tr>
</table>

Higher tiers to estimate C stock change in soils take into account the country specific soils management systems at detailed scale, inputs of organic matter and organic matter decomposition patterns.

Harvested Wood Products refers to all wood materials including bark that leave harvest sites. As a minimum, reporting requires historical statistics for three semi-finished products from wood harvested no matter the land use category of origin (sawnwood, cartoon, papers). CO_2 emission is estimated as the stock change in wood *products in use* resulted from annual C input of new products and decay of the historical C stock. Discarded HWP can be deposited as solid waste disposal sites where they may persist for long periods of time and continue anaerobic decomposition resulting in CH_4 emissions. There is a legacy effect created by the long-term decay of historical stock which leads to situation where oxidation of old harvested wood products could be less, or potentially more, than the total amount of wood harvested in that year. Three different estimation approaches, differing on how domestic harvest and imports are considered, are based on first order decay functions of three generic types of semi-finished wood products (i.e. decomposition with a constant percentage). *HWP Contribution* to LULUCF sector can be considered negligible when C stock change of HWP from domestic consumption or from domestic harvest are insignificant (< smallest key category in national GHG inventory). Tier 1 requires estimating HWP contribution based on forest products data from

FAO (the "default activity data") starting in 1961 (procedure to reconstruct annual time series backward to 1900) and given default parameters. While Tier 3 imply country specific models, both T1 and T2 rely on estimation of five/seven variables (1A – annual change in C stock in use from domestic consumption, 1B - annual change in C stock in solid waste deposits sites from domestic consumption, 2A - annual change in C stock in use from domestic production, 2B - annual change in C stock in solid waste deposits sites from domestic production, 3 – C amount in annual imports, 4 - C amount in annual exports, and 5 - harvest). HWP contribution is reported as a separate category in the LULUCF sector (not linked to any land category).

Non-CO_2 greenhouse gas emissions may have important contribution to annual GHG inventory, especially from wild fires and soil mineralization.

Soils under management practices represent an aggregated source of **direct N_2O emissions**. Estimation methodology includes several contributing sources, as follows: a) *human-induced net N additions applied to soils, respectively*: synthetic N fertilisers; organic N fertilizers (e.g., animal manure, compost, sewage sludge, rendering waste); urine and dung N deposited on pasture, range and paddock by grazing animals; N in crop residues (above-ground and below-ground), including from N-fixing crops and from forages during pasture renewal; b) *mineralisation of N in soil organic matter following drainage/management of organic soils, respectively*: drainage/management of organic soils (i.e., Histosoils) and c) *cultivation/land-use change on mineral soils, respectively*: N mineralisation associated with loss of soil organic matter resulting from change of land use or management of mineral soils. Default emission factors are provided as N_2O-N (which represents the amount of N convertible to N_2O gas from the N amount applied/available) for each direct N_2O source. Following generic formulas apply:

Direct N_2O emissions from managed soils (Tier 1)	***Direct N_2O emissions from managed soils (Tier 2)***
$N_2O_{Direct} = N_2O_{Direct}–N * 44/28$	$N_2O_{Direct} = N_2O_{Direct}–N * 44/28$
$N_2O_{Direct}–N = N_2O–N_{N\ inputs} + N_2O–N_{OS} + N_2O–N_{PRP}$, where: $N_2O–N_{N\ inputs} = (F_{SN}+F_{ON}+F_{CR}+F_{SOM})*EF_1$ $N_2O–N_{OS} = \Sigma(F_{OS}*EF_2)$ $N_2O–N_{PRP} = \Sigma(F_{PRP}*EF_3)$	$N2O_{Direct} – N = \Sigma(F_{SN}+F_{ON})_i*EF_{1i} + (F_{CR}+F_{SOM})*EF_1 + N_2O–N_{OS} + N_2O–N_{PRP}$

N_2O_{Direct} –N = annual direct N_2O –N emissions produced from managed soils (kg N_2O –N yr^{-1}).
$N_2O–N_{N\ inputs}$ = annual direct N_2O –N emissions from N inputs to managed soils (kg N_2O –N yr^{-1}).
$N_2O–N_{OS}$ = annual direct N_2O –N emissions from managed organic soils (kg N_2O –N yr^{-1}).
$N_2O–N_{PRP}$ = annual direct N_2O –N emissions from urine and dung inputs to grazed soils (kg N_2O –N yr^{-1}).
F_{SN} = annual amount of synthetic fertiliser N applied to soils (kgN yr^{-1}); F_{ON} = annual amount of animal manure, compost, sewage sludge and other organic N additions applied to Soils (kgN yr^{-1}); F_{CR} = annual amount of N in crop residues (above-ground and below-ground), including N-fixing crops, and from forage/pasture renewal, returned to soils (kgN yr^{-1}); F_{SOM} = annual amount of N in mineral soils that is mineralised, in association with loss of soil C from soil organic matter as a result of changes to land use or management (kgN yr^{-1}). F_{OS} = annual area of managed/drained organic soils (ha), to be estimated for each relevant land use category (Cropland, Grassland, Forest Land), ecoregion (Temperate, etc), soil nutrient status (Rich, Poor); F_{PRP} = annual amount of urine and dung N deposited by grazing animals on pasture, range and paddock (kgN yr^{-1}).
EF_1 = emission factors for synthetic fertilisers and organic N application, which is specific to disaggregated strata under tier 2 (i.e. regions, crops, etc) (kg N_2O –N (kg N input)-1); EF_2 = emission factor for N_2O emissions from drained/managed organic soils following a consistent disaggregation as activity data in F_{OS} (kg N_2O –N ha^{-1} yr^{-1}); EF_3 = emission factor for N_2O emissions from urine and dung N deposited on pasture, range and paddock by grazing animals (kg N_2O–N (kg N input)$^{-1}$.
Σ = summation over various disaggregation (e.g. climate zones, soil types, and management/land use systems).

Same sources of direct N_2O emissions associated to managed soils (with exception of organic soils) are also subjects to **indirect N_2O emissions** through volatilization and deposition, leaching and runoff for various nitrogen compounds. Estimation methodologies include default values for the fraction of available N which is subject to volatilization or loss by leaching/run off (Frac) to which applies a default specific emission factor (EF). Following generic formulas apply:

Emissions of N_2O from atmospheric deposition of N volatilised from managed soils (Tier 1, Tier 2)	***Emissions of N_2O from N leaching/runoff from managed soils in regions where leaching/runoff occurs (Tier 1)***
$N_2O_{(ATD)} = N_2O_{(ATD)}-N * 44/28$	$N_2O_{(L)} = N_2O_{(L)}-N * 44/28$
$N_2O_{(ATD)}-N = [\Sigma(F_{SNi} * Frac_{GASFi}) + (F_{ON} + F_{PRP}) * Frac_{GASM}] * EF_4$	$N_2O_{(L)}-N = (F_{SN} + F_{ON} + F_{PRP} + F_{CR} + F_{SOM}) * Frac_{LEACH-(H)} * EF_5$
$N_2O_{(ATD)}$–N = annual amount of N_2O–N produced from atmospheric deposition of N volatilised from managed soils (kg N_2O –N yr^{-1}). $N_2O_{(L)}$ –N = annual amount of N_2O–N produced from leaching and runoff of N additions to managed soils in regions where leaching/runoff occurs (kg N_2O –N yr^{-1}). $F_{SN\,i}$ = annual amount of N based synthetic fertiliser applied to soils on available disaggregation (kg N yr^{-1}); $Frac_{GASF\,i}$ = fraction of N based synthetic fertiliser that volatilises as NH_3 and NOx on available disaggregation (kg N volatilised (kg of N applied)$^{-1}$); F_{ON} = annual amount of managed animal manure, compost, sewage sludge and other organic N additions applied to soils (kg N yr^{-1}); F_{PRP} = annual amount of urine and dung N deposited by grazing animals on pasture, range and paddock (kg N yr^{-1}); $Frac_{GASM}$ = fraction of applied organic N fertiliser materials (F_{ON}) and of urine and dung N deposited by grazing animals (F_{PRP}) that volatilises as NH_3 and NO_x (kg N volatilised (kg of N applied)$^{-1}$). $Frac_{LEACH-(H)}$ = fraction of all N added to or mineralised from managed soils in regions where leaching/runoff occurs that is lost through leaching and runoff (kg N (kg of N additions)$^{-1}$). EF_4 = emission factor for N_2O emissions from atmospheric deposition of N on soils (kg N_2O-N (kg NH_3–N + NO_x–N volatilised)$^{-1}$); EF_5 = emission factor for N_2O emissions from N leaching and runoff (kg N_2O–N (kg N leached and runoff)$^{-1}$). Σ = summation over various disaggregation (e.g. climate zones, soil types, and management/land use systems).	

CO_2 and non-CO_2 from **wildfires** need to be annually reported for managed lands. Exceptions are CO_2 from Grassland and annual crops on Cropland where there is a reasonable assumption that loss and gain of C in herbaceous biomass is simultaneous in the reported year. Wildfire of unmanaged land need not to be reported, unless there is followed by a land-use change. Particularly, emissions of CO_2 from dead organic matter can be neglected if forest stands do not die because of fire. Accuracy of variables needed for estimation of GHG emissions, e.g. amount of fuels available for combustion, affected area, is crucial. Following generic formula apply:

for **all land categories**
$L_{fire} = A * M_B * C_f * G_{ef} * 10^{-3}$
L_{fire} = amount of greenhouse gas emissions from fires (t each of CO2/CH4/N2O, etc); A = area burnt (ha); M_B = mass of fuel available for combustion (t ha^{-1}), which may include biomass, ground litter and dead wood (default values provided); C_f = combustion factor (dimensionless); G_{ef} = emission factor (g kg^{-1} dry matter burnt, default values provided for each greenhouse gas type).

IPCC 2006 Guidelines **assist selecting a consistent methodology by decision trees**. Decision trees give higher priority to best data available in the country, while drive the effort toward reporting key categories under higher tiers, and, as the last resort, provides Tier 1 methods and data for sources and sinks mandatory to be reported.

However, users of default data must be aware that using default values may result in over or under estimation of actual emissions or removals occurring in the reporting country. When combining country specific data with default values care should be given to the definitions of the combined variables. For this reason, UNFCCC guidelines for reporting requires that Annex I Parties should make every effort to use a recommended method as corresponding to the source or sink contribution in the national inventory (i.e. higher tiers for the key categories).