LEAF Technical Training on Reference Level Development

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Calculating Deforestation Emission Factors
Steps for Emission Factor (EF) Creation

1. Assess Existing Data
2. Stratify Forests
3. Carbon Stock Field Sampling: Design, Implement, and Analyze Data
4. Calculate Deforestation Emission Factors

RL Design
Calculating Emission Factors

- Calculate pre-deforestation carbon stocks for each pool
- Identify carbon stocks of post-deforestation land use
- Estimate carbon stocks stored as wood products
- Determine soil carbon emitted as a result of deforestation, if significant
- Sum carbon stock changes across pools
Emission Factors

- The carbon stocks for each forest stratum undergoing change is determined to define emission factors.
Carbon Stocks to Emission Factors

\[ EF_{deforestation} = \left( C_{bio.pre} - C_{bio.post} - C_{wp} + C_{SOC} \right) \times \frac{44}{12} \]

Where:

- \( EF_{deforestation} \) = Emission factor for deforestation, tCO₂ ha\(^{-1}\)
- \( C_{bio.pre} \) = Carbon stock in biomass prior to deforestation, t C ha\(^{-1}\)
- \( C_{bio.post} \) = Carbon stock in forest biomass after deforestation, t C ha\(^{-1}\)
- \( C_{wp} \) = Carbon stock in wood products following deforestation, t C ha\(^{-1}\)
- \( C_{SOC} \) = Soil carbon stocks emitted, t C ha\(^{-1}\)
- \( \frac{44}{12} \) = Conversion factor from carbon to CO₂

Include emissions from non- CO₂ gases if relevant
Pre-deforestation C stocks

\[ C_{bio\,pre} = (C_{agb} + C_{bgb} + C_{dw} + C_{lit} + C_{sap}) \]

Where:

- \( C_{bio\,pre} \) = Carbon stock in biomass, t C ha\(^{-1}\)
- \( C_{agb} \) = Carbon stock in aboveground biomass, t C ha\(^{-1}\)
- \( C_{bgb} \) = Carbon stock in belowground biomass, t C ha\(^{-1}\)
- \( C_{dw} \) = Carbon stock in deadwood pools, t C ha\(^{-1}\)
- \( C_{lit} \) = Carbon stock in litter, t C ha\(^{-1}\)
- \( C_{sap} \) = Carbon stock in saplings, t C ha\(^{-1}\)
Post deforestation C stocks

\[ C_{bio.post} = (C_{agb} + C_{bgb} + C_{dw} + C_{lit} + C_{sap}) \]

- Use carbon pool stocks from appropriate post-deforestation land use
  - May include more herbaceous vegetation and fewer trees, such as in agriculture
- Proxy areas may be measured
- Default values – from IPCC or regionally developed
Carbon in wood products

• Harvested carbon may be stored in short and long term wood products - $C_{wp}$
• Landfilled wood also stores harvested carbon
• Need to account for life span of wood products
• Default values – from IPCC or regionally developed
Carbon Stocks to Emission Factors

\[ C_{SOC} = [C_{soil} - (C_{soil} \times F_{LU} \times F_{MG} \times F_l)] \]

Where:

\( C_{SOC} = \text{Soil carbon stocks emitted, } t \text{ CO}_2 \text{ ha}^{-1} \)
\( C_{soil} = \text{Carbon stocks in soil organic matter pool (to 30 cm), } t \text{ C ha}^{-1} \)
\( F_{LU} = \text{IPCC stock change factor for land-use systems for a particular land-use, dimensionless} \)
\( F_{MG} = \text{IPCC stock change factor for management regime, dimensionless} \)
\( F_l = \text{IPCC stock change factor for input of organic matter, dimensionless} \)
## Soil Factors (IPCC 2006)

<table>
<thead>
<tr>
<th>Converted to</th>
<th>$F_{LU}$</th>
<th>$F_{MG}$</th>
<th>$F_{I}$</th>
<th>Combined factors</th>
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Example

- Excel worksheet and exercise