ACCOUNTING FOR EMISSIONS FROM AGRICULTURE, FORESTRY, AND OTHER LAND USE ACTIVITIES

2014
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WINROCK INTERNATIONAL
PRESENTATION OVERVIEW

1. Introduction to climate change and emissions from land use sector
2. Basic approach to calculating emissions from land use change
3. International climate negotiations and accounting standards
4. IPCC Tiers
5. Rationale for developing the AFOLU Carbon Calculator
LAND USE AND CLIMATE CHANGE

Carbon is emitted to the atmosphere when:
• Forests are cleared or disturbed
e.g. Fire, logging
• Soils are disturbed
e.g. tilling croplands, draining peat soils
• Fossil fuel use

Carbon is removed from the atmosphere through:
• Photosynthesis
• Creation and burial of hydrocarbons and coal
• Ocean absorption

Tropical deforestation ~10% of GHG emissions (Harris et al., 2012).

However, mitigating emissions from forest loss is relatively quick, and inexpensive in stabilizing and reducing CO₂ emissions. (Parrotta et al., 2012)
Mitigating climate change: land use activities

### Reducing deforestation and forest degradation
- Forest conservation
- Fire management
- Combatting illegal logging
- Improving timber harvesting practices
- Improving efficiency of fuelwood and charcoal usage in rural and urban centers

### Increasing forest cover and productivity
- Forest restoration
- Agroforestry
- Afforestation/Reforestation
  - Homogeneous stands
  - Heterogeneous stands

### Climate-Smart Agriculture and Land Management
- Adopting practices that increase productivity, resilience, and reduce/remove GHGs:
  - Reduced tilling to lower CO$_2$ emissions from disturbed soil
  - Promoting permanent crops to reduce emissions from slash and burn farming
  - Reduced fertilizer inputs to reduce runoff and N$_2$O emissions
  - Livestock management to mitigate enteric fermentation and CH$_4$ emissions
  - Improved production efficiency
SO HOW TO ACCOUNT FOR CO₂ BENEFITS FROM AFOLU PROJECTS?

Peru: The Initiative for Conservation in the Andean Amazon – Madre de Dios

- Forest protection
- Recovering degraded areas through A/R

Colombia: BIOREDD

- 14 REDD+ Projects totaling over 1 million ha
- Agricultural intensification
- Ecological restoration through A/R
- Sustainable forest and land use management


Forest protection - Recovering degraded areas through A/R
Activity Data

“Data on the magnitude of human activity… taking place during a given period of time” – IPCC

- Deforestation rate
- Area planted with native species
- Volume of timber extracted
- Number of animals raised
- Fertilizer input to crop lands

Emission/Removal Factors

“The average emission rate of a given greenhouse gas… relative to units of activity” – IPCC

- Carbon stocks of cleared forests
- Carbon accumulation rate of native forests
- Dead wood created to extract a cubic meter of timber
- Volatilization/Oxidation rate of fertilizers
HOW ARE CO$_2$ BENEFITS CALCULATED?

**Activity Data:** Which changes occurred? Which changes would have occurred in the absence of the project? Where? On how many hectares?

- High area loss
- High C stocks
- High emissions

- Low area loss
- High C stocks
- Intermediate to High Emissions

**Emission/Removal Factors:** How much carbon was emitted/removed per unit of area change? How much carbon would have been emitted/removed per unit area of change?

- High area loss
- Low C stocks
- Low to intermediate emissions

- Low area loss
- Low C stocks
- Low emissions
HOW DO I DEVELOP EMISSION FACTORS AND ACTIVITY DATA?
International environmental treaty with the objective to "stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system."

Intergovernmental Panel on Climate Change – UNFCCC’s scientific, technical, and socio-economic body that advises the UN on climate change assessment and mitigation.
2003: **Good Practice Guidance for Land use, Land-Use Change and Forestry (GPG-LULUCF)** produced by IPCC

2003: Parties agreed that Annex I Parties should use the GPG-LULUCF for preparing their GHG inventories in national communications under the UNFCCC. Non-Annex I Parties encouraged to use it.

2006: IPCC Guidelines for National Greenhouse Inventories, **Volume 4 ‘Agriculture, Forestry, and Other Land Use (AFOLU)’** replace GPG-LULUCF as the standard guidelines
IPCC ‘TIERS’

Three methodological tiers representing different levels of complexity.

**Tier 1:** Basic method. Uses default values for broad continental default values provided in LULUCF and AFOLU guidelines. Large uncertainties.

**Tier 2:** Approach using country-specific data (e.g. from field measurements). Smaller uncertainties.

**Tier 3:** Approach using data at a finer resolution or detailed modeling (e.g. comprehensive field sampling repeated at regular time intervals, soils data, and use of locally calibrated models)
### EXAMPLES OF ACTIVITY DATA AND EMISSION FACTORS

<table>
<thead>
<tr>
<th>Approach for activity data: Area change</th>
<th>Tiers for emission factors: change in C stocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Non-spatial country statistics (e.g. FAO) — generally gives net change in forest area</td>
<td>1. IPCC default values at a continental scale-high uncertainty</td>
</tr>
<tr>
<td>2. Based on maps, surveys, and other national statistical data</td>
<td>2. Country specific data for key factors—medium to low uncertainty</td>
</tr>
<tr>
<td>3. Spatially specific data from interpretation of remote sensing data-only approach to use for deforestation and degradation</td>
<td>3. National inventory of key carbon stocks, repeated measurements or modeling — medium to low uncertainty</td>
</tr>
</tbody>
</table>
### Example of Tier 1 Data

From IPCC Guidelines for National Greenhouse Inventories, *Volume 4* ‘Agriculture, Forestry, and Other Land Use (AFOLU)’

<table>
<thead>
<tr>
<th>Climate Domain</th>
<th>Ecological Zone</th>
<th>Aboveground biomass in natural forests (tonnes dry matter ha⁻¹)</th>
<th>Aboveground biomass in forest plantations (tonnes dry matter ha⁻¹)</th>
<th>Aboveground net biomass growth in natural forests (tonnes dry matter ha⁻¹ y⁻¹)</th>
<th>Aboveground net biomass growth in forest plantations (tonnes dry matter ha⁻¹ y⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tropical</td>
<td>Tropical rain forest</td>
<td>300</td>
<td>150</td>
<td>7</td>
<td>15</td>
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<tr>
<td></td>
<td>Tropical moist deciduous forest</td>
<td>180</td>
<td>120</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Tropical dry forest</td>
<td>130</td>
<td>60</td>
<td>2.4</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Tropical shrubland</td>
<td>70</td>
<td>30</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Tropical mountain systems</td>
<td>140</td>
<td>90</td>
<td>1</td>
<td>5</td>
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<tr>
<td>Subtropical</td>
<td>Subtropical humid forest</td>
<td>220</td>
<td>140</td>
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<td>10</td>
</tr>
<tr>
<td></td>
<td>Subtropical dry forest</td>
<td>130</td>
<td>60</td>
<td>2.4</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Subtropical steppe</td>
<td>70</td>
<td>30</td>
<td>1</td>
<td>5</td>
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<tr>
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<td>Subtropical mountain systems</td>
<td>140</td>
<td>90</td>
<td>1</td>
<td>5</td>
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<tr>
<td>Temperate</td>
<td>Temperate oceanic forest</td>
<td>180</td>
<td>160</td>
<td>4.4</td>
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<td>Temperate mountain systems</td>
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<td>3</td>
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<tr>
<td>Boreal</td>
<td>Boreal coniferous forest</td>
<td>50</td>
<td>40</td>
<td>1</td>
<td>1</td>
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<tr>
<td></td>
<td>Boreal tundra woodland</td>
<td>15</td>
<td>15</td>
<td>0.4</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td>Boreal mountain systems</td>
<td>30</td>
<td>30</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
EXAMPLE OF TIER 2 DATA

EXAMPLE OF TIER 3 DATA

- Measurements of carbon pools are recorded in the field
- Models and conversion factors are used to estimate carbon stocks in each major pool based on field measurements
- Statistical analysis is used to calculate average forest carbon stocks based on plot data
• Employs IPCC approaches and data – or better!
• Much of default data is IPCC tier 2
  – Allows user to enter site-specific data
• Subnational unit resolution of data – allows for finer resolution estimates
• Methods and data peer reviewed and transparently documented
THANK YOU!

For questions and comments:

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