Charcoal, carbon emissions, and international conventions/protocols

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Overview/Outline

- Emissions
- Charcoal and Firewood
- Forests
- Reduced Carbon storage
- Forest degradation
- Deforestation
- Energy
- Loss of species
- Reduced Carbon storage
- Emissions
Charcoal/Firewood consumption

![Graph showing the relationship between population (millions) and wood biomass consumption (million m3) for various countries.](image-url)
## Emission rates (g/kg dry matter)

<table>
<thead>
<tr>
<th></th>
<th>CO2</th>
<th>CO</th>
<th>CH4</th>
<th>NOx</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fuelwood</strong></td>
<td>1500</td>
<td>70</td>
<td>4.5</td>
<td>1.0</td>
</tr>
<tr>
<td><strong>Charcoal</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(making)</td>
<td>1593</td>
<td>254</td>
<td>39</td>
<td>0.073</td>
</tr>
<tr>
<td><strong>Charcoal</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(combustion)</td>
<td>2740</td>
<td>230</td>
<td>8</td>
<td>3.9</td>
</tr>
</tbody>
</table>
More: Carbon Emission Factors (tC/TJ)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasoline</td>
<td>18.9</td>
</tr>
<tr>
<td>Natural gas</td>
<td>15.3</td>
</tr>
<tr>
<td>Solid biomass</td>
<td>29.9</td>
</tr>
<tr>
<td>Diesel</td>
<td>20.2</td>
</tr>
<tr>
<td>LPG</td>
<td>17.2</td>
</tr>
</tbody>
</table>
$\text{CO}_2$ emissions in Fuelwood

1 m-stere = 290 kg dry matter \rightarrow 435,000 g CO$_2$
CO$_2$ emissions in Charcoal

1 charcoal bag = 45 kg dry matter

71,685 gCO$_2$

15% efficiency

194,985 gCO$_2$

123,300 gCO$_2$
Emissions from biofuel combustion in Africa (Tg/year)

<table>
<thead>
<tr>
<th></th>
<th>CO₂</th>
<th>CO</th>
<th>CH4</th>
<th>NOx</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuelwood</td>
<td>433</td>
<td>21</td>
<td>1.33</td>
<td>0.30</td>
</tr>
<tr>
<td>Charcoal</td>
<td>27</td>
<td>2</td>
<td>0.08</td>
<td>0.04</td>
</tr>
<tr>
<td>Crop residue</td>
<td>56</td>
<td>4</td>
<td>0.22</td>
<td>0.03</td>
</tr>
<tr>
<td>Dung</td>
<td>11</td>
<td>1</td>
<td>0.03</td>
<td>0.03</td>
</tr>
<tr>
<td>Total</td>
<td>527</td>
<td>28</td>
<td>1.66</td>
<td>0.4</td>
</tr>
</tbody>
</table>

Note: 1 Teragram = $10^{12}$ grams
Mozambique fuelwood and charcoal combustion emissions (Tg/year)

<table>
<thead>
<tr>
<th></th>
<th>Biomass (Tg DM)</th>
<th>CO₂</th>
<th>CO</th>
<th>CH₄</th>
<th>NOₓ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chacoal</td>
<td>0.8</td>
<td>2.3</td>
<td>0.2</td>
<td>0.006</td>
<td>0.003</td>
</tr>
<tr>
<td>Fuelwood</td>
<td>9.3</td>
<td>14.0</td>
<td>0.6</td>
<td>0.04</td>
<td>0.009</td>
</tr>
</tbody>
</table>

Note: 1 Teragram = $10^{12}$ grams
Reduced sinks

1.27% - annual deforestation rate


1.17% - annual deforestation rate


25% forest land degradation
Fuelwood availability

Simulation for Northern Sofala province (Sitoe et al 2004)
LUCC emissions and avoided sequestration in Mozambique

Deforestation: 219000 ha/year

C-release

11 TgC

Avoided sequestration

0.15 TgC

75-80% of the national emissions originate from LUCCF
LUCC: Carbon stock and species diversity

- $H' = 2.5$
  - 100 tC/ha
  - 0.75 tC/ha/year

- $H' = 1.5$
  - 10 tC/ha

- $H' = 0.75$
  - 2 tC/ha
  - 0.2 tC/ha/year
Multilateral Environmental Agreements

- Climate Change
- Desertification
- Drought
- Adaptation
- Land cover change
- Arid zone biodiversity
- Biodiversity
- Adaptation
Implementation mechanism

- **CBD**
  - National Reports
  - National Biodiversity Strategy and Action Plan (NBSAP)
- **UNCCD**
  - National Reports
  - National Action Plan (NAP)
- **UNFCCC**
  - National Communications
  - National Adaptation Programs of Action (NAPA)
Concluding Remarks

- Understanding of the processes and underlying causes
- Build capacity to improve local institutions
- Technology transformation
- Modern-biofuels
- Opportunities for Carbon sequestration
Thank you