Climate mitigation by managed and un-managed forests in Europe: The role of products

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UNFCCC changed with the Paris agreement

Kyoto protocol: Focus on storage mainly in forests

Paris agreement: Focus on products, with periodic “stock-taking”.
These changes take place in a strange world:

- The public of rich nations wishes a romantic vision of an undisturbed environments
- Other nations supply the products
  - 10% palm-oil as EU gasoline norm
  - Pellets for heating come from the US, Canada, Russia
  - Soya for animal feed comes from South America

For Germany:

- 5% of forest land shall be unmanaged (15% of state forest)
- 2% of national area shall be wilderness (18% of state forest)
- This affects remaining forest land under climate change (insect pests, browsing, economy)
Product flow

Wood flow: Forest storage → Harvest → Products → Energy

Accountable Forest sector

Wood industry

renewable Energy industry
A **Fagus** – unmanaged

- Hainich (D)
- Suserup (DK)
- Lady Park Wood (UK)
- Heilige Hallen (D)

yield table

standing stocks

dead wood + standing stocks

regeneration | growth | optimal phase | decay phase

B **Picea** – unmanaged

- Bayer. Wald (D)
- Rothwald (A)

yield table

standing stocks

dead wood + standing stocks

regeneration | growth | optimal phase | decay phase

Korpel, 1995: The virgin forest of CZ republic
Total production of energy & products

Average annual total production
(m3/ha/yr)

douglas
spruce
beech
pine
oak

\[ y = 0.4043x + 0.4467 \]

\[ R^2 = 0.9268 \]

0,0 5,0 10,0 15,0 20,0

douglas
Factor 1.3: regulated competition increased CO2 uptake

GPP $\xrightarrow{R_a}$ NPP $\xrightarrow{R_h}$ NEE

Harvest

Fire DOC

NEE $\xrightarrow{\text{emission from fossil fuel}}$ NBP

saving (factor 1.7 more CO$_2$)
<table>
<thead>
<tr>
<th></th>
<th>wood (Fagus)</th>
<th>Diesel</th>
</tr>
</thead>
<tbody>
<tr>
<td>volume (m³)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>weight (kg/m³)</td>
<td>480</td>
<td>840</td>
</tr>
<tr>
<td>weight C (kgC/m³)</td>
<td>240</td>
<td>714</td>
</tr>
<tr>
<td>energy (MJ/kg)</td>
<td>15</td>
<td>43</td>
</tr>
<tr>
<td>energy (MJ/m³)</td>
<td>7200</td>
<td>36120</td>
</tr>
<tr>
<td>CO₂ emission (kgCO₂/m³)</td>
<td>880</td>
<td>2617</td>
</tr>
<tr>
<td>energy diesel/wood</td>
<td>5</td>
<td>36120/7200 = 5</td>
</tr>
<tr>
<td>CO₂ emission of wood at energy gain of diesel</td>
<td>4415</td>
<td>4415/2617=1,7</td>
</tr>
<tr>
<td>CO₂ Emission Wood/Diesel</td>
<td>1,7</td>
<td></td>
</tr>
</tbody>
</table>
Conclusion
- The eddy flux community should take into account the C-export
- Forestry distinguishes between growth and total growth. EddyFlux should do the same
- Without accounting for export the eddy flux remains at the level of Kyoto
Thanks
$y = 0.5111x + 203$

$R^2 = 0.9305$
Eddy flux tower
- Storage
- Discards export
  - Harvest
  - Fire
  - DOC

Tall Tower
Accounts for energy
- CO2 does not change with renewables
- CO2 changes with fires, DOC
Waldgeschichte (Bestandesalter)

Klima
T?, P?, Frühjahr?

Disposition

Windwurf, Schneebruch

Käfergradation

Katastrophe

Management