Comparative Life Cycle Assessment: - RSPO-certified vs non-certified

Jannick Schmidt
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2.-0 LCA consultants
Rendsburggade 14, room 1.431
9000 Aalborg, Denmark
www.lca-net.com
Jannick.Schmidt@lca-net.com
Background

- Sustainable palm oil: Certification is the most acknowledged choice
- But what is the benefit?
  - GHG emissions
  - Biodiversity and nature conservation
  - Other impacts

- Crowdfunded project: https://lca-net.com/clubs/palm-oil/
- Launched November 2016
- Finalized August 2019
- 16 members

Project promoted and supported by RSPO
Carried out independently of RSPO
Life cycle assessment (LCA)
Methods

- Functional unit = 1 kg refined palm oil
- Scope: 2016 and Indonesia and Malaysia
- Land use changes and nature conservation included
- Consequential and attributional LCA model
- Very detailed models
  - N-balances
  - Peat emissions
  - Oil mill boiler energy balance and stack emissions
  - Palm oil mill effluent (POME) model
Data collection

- Total industry
  - Statistics and GIS
  - LCA coefficients to close gaps
- RSPO certified: Assessment reports
  - 634 estates (58% of all certified FFB)
  - 165 oil mills (58% of all certified CPO)

Picture: Jannick Schmidt. Hanau palm oil mill, Sinarmas, Central Kalimantan 2018
### What do the data show?

#### Estates

<table>
<thead>
<tr>
<th>Flows</th>
<th>Unit</th>
<th>Total Industry (IO &amp; MY)</th>
<th>RSPO-certified</th>
<th>Non-certified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total planted area</td>
<td>Million ha</td>
<td>14.4</td>
<td>2.44</td>
<td>12.0</td>
</tr>
<tr>
<td>Share of oil palm on peat</td>
<td>%</td>
<td>18%</td>
<td>11%</td>
<td>19%</td>
</tr>
<tr>
<td>Drainage depth (DD) of peat</td>
<td>cm</td>
<td>73</td>
<td>57</td>
<td>75</td>
</tr>
<tr>
<td>FFB yield, mature</td>
<td>t/ha</td>
<td>18.9</td>
<td>21.1</td>
<td>18.5</td>
</tr>
<tr>
<td>Fuel use</td>
<td>MU/ha</td>
<td>2,940</td>
<td>2,940</td>
<td>2,940</td>
</tr>
<tr>
<td>Applied mineral N</td>
<td>kg N/ha</td>
<td>82</td>
<td>170</td>
<td>64</td>
</tr>
<tr>
<td>Applied organic N</td>
<td>kg N/ha</td>
<td>21</td>
<td>24</td>
<td>21</td>
</tr>
<tr>
<td>Applied mineral P2O5</td>
<td>kg P2O5/ha</td>
<td>41</td>
<td>103</td>
<td>28</td>
</tr>
<tr>
<td>Applied organic P2O5</td>
<td>kg P2O5/ha</td>
<td>28</td>
<td>31</td>
<td>27</td>
</tr>
<tr>
<td>Applied mineral K2O</td>
<td>kg K2O</td>
<td>156</td>
<td>245</td>
<td>138</td>
</tr>
<tr>
<td>Applied organic K2O</td>
<td>kg K2O</td>
<td>138</td>
<td>153</td>
<td>135</td>
</tr>
</tbody>
</table>

#### Oil mills

<table>
<thead>
<tr>
<th>Flows</th>
<th>Unit</th>
<th>Total Industry (IO &amp; MY)</th>
<th>RSPO-certified</th>
<th>Non-certified</th>
</tr>
</thead>
<tbody>
<tr>
<td>OER</td>
<td>%</td>
<td>20.2%</td>
<td>21.9%</td>
<td>19.8%</td>
</tr>
<tr>
<td>KER</td>
<td>%</td>
<td>5.4%</td>
<td>5.6%</td>
<td>5.4%</td>
</tr>
<tr>
<td>Share of POME treated with biogas capture</td>
<td>%</td>
<td>5.0%</td>
<td>16%</td>
<td>2.4%</td>
</tr>
<tr>
<td>Share of landbank in supply base set-aside as HCV</td>
<td>%</td>
<td>0.6%</td>
<td>3.1%</td>
<td>0%</td>
</tr>
</tbody>
</table>

*Picture: Jannick Schmidt. UIE palm oil mill, United Plantations, Peninsular Malaysia 2017*
Where do the LCA results take us?

GHG emissions

-36%

Biodiversity impact

-20%

Respiratory inorganics

+3%

Picture: Jannick Schmidt. Nature conservation, Sungai Rungau estate, Sinarmas, Central Kalimantan 2017
The devil lies in the detail...
- GHG emissions

<table>
<thead>
<tr>
<th>Life Cycle Stage</th>
<th>Contribution</th>
<th>Certified</th>
<th>Non-certified</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Oil crop cultivation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field emissions (related to nutrient cycle)</td>
<td>0.72</td>
<td>0.92</td>
<td></td>
</tr>
<tr>
<td>Field emissions (related to peat drainage)</td>
<td>0.77</td>
<td>2.36</td>
<td></td>
</tr>
<tr>
<td>Indirect Land Use Changes (ILUC)</td>
<td>0.49</td>
<td>0.62</td>
<td></td>
</tr>
<tr>
<td>Material inputs: fertiliser, pesticides, capital goods etc.</td>
<td>0.33</td>
<td>0.21</td>
<td></td>
</tr>
<tr>
<td>Energy</td>
<td>0.07</td>
<td>0.08</td>
<td></td>
</tr>
<tr>
<td>Other (transport, waste treatment, assets and services)</td>
<td>0.20</td>
<td>0.27</td>
<td></td>
</tr>
<tr>
<td><strong>Total crop cultivation stage</strong></td>
<td><strong>2.58</strong></td>
<td><strong>4.46</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Palm oil mill</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>POME treatment</td>
<td>1.19</td>
<td>1.51</td>
<td></td>
</tr>
<tr>
<td>Energy inputs</td>
<td>-0.03</td>
<td>-0.06</td>
<td></td>
</tr>
<tr>
<td>Other (transport, waste treatment, assets and services)</td>
<td>0.17</td>
<td>0.18</td>
<td></td>
</tr>
<tr>
<td>By-product: kernel</td>
<td>-0.43</td>
<td>-0.70</td>
<td></td>
</tr>
<tr>
<td>By-product: energy and EFB to field application</td>
<td>-0.04</td>
<td>-0.04</td>
<td></td>
</tr>
<tr>
<td>HCV nature conservation</td>
<td>-0.01</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td><strong>Total palm oil mill stage</strong></td>
<td><strong>0.85</strong></td>
<td><strong>0.89</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Refinery</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Materials: chemicals, water etc.</td>
<td>0.02</td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td>Energy</td>
<td>0.03</td>
<td>0.03</td>
<td></td>
</tr>
<tr>
<td>Other (transport, waste treatment, assets and services)</td>
<td>0.02</td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td>By-products: PFAD/PKFAD</td>
<td>-0.08</td>
<td>-0.08</td>
<td></td>
</tr>
<tr>
<td><strong>Total refinery stage</strong></td>
<td><strong>-0.01</strong></td>
<td><strong>-0.01</strong></td>
<td></td>
</tr>
<tr>
<td><strong>All stages</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3.41</strong></td>
<td><strong>5.34</strong></td>
<td></td>
</tr>
</tbody>
</table>

Picture: Jannick Schmidt, Nature conservation, Hanau estate, Sinarmas, Central Kalimantan 2018

- Low peat share
- Low drainage depth
- More biogas capture
- High yield
- Higher fertiliser
What matters? Peat and water management

Account for 22-45% of GHG emissions
Average: 73 cm ⇒ 41 t CO₂/ha*year
Certified: 57 cm ⇒ 32 t CO₂/ha*year

Good water management
RSPO certified grower

Poor water management
non-certified grower

Peat = Organic soil (high carbon)

Picture: Jannick Schmidt. Peat water management, Central Kalimantan, 2018
What matters? Biogas capture

- Anaerobic ponds $\Rightarrow$ methane
- POME emissions account for around 1/3 of GHG emissions
- Can be more than eliminated by biogas capture
What matters? Nature conservation

- Nature conservation – how to calculate impacts?
  - Net-saving = local saving minus remote impact
  - Local saving: Avoiding local transformation of forest to oil palm (dLUC)
  - Remote impact: Nature conservation does not reduce demand for palm oil
    => land needed somewhere else (iLUC)
- 1 ha*year nature conservation (mineral soil) = saves 1 tonne CO₂
- 1 ha*year nature conservation (peat soil) = saves 33-42 tonne CO₂
Conclusions

- Model
  - Detailed and compatible with SimaPro
  - Runs with >600 estates and >150 oil mills
  - Two sets of results:
    - Consequential (cause-effect)
    - Attributional (similar to PalmGHG)

- Results: RSPO certified vs. non-certified
  - 36% lower GHG emissions
  - 20% lower nature occupation
  - 3% higher respiratory inorganics
  - LCA guides what matters

Pictures: Jannick Schmidt, Tanjung Puting, Central Kalimantan 2018
Conclusions

- What can the results be used for?
  - Now the impact of certification can be measured!
  - Companies can include the benefits of committing to certified oil in their environmental accounts
  - The industry can document that palm oil can be produced more sustainable
  - Inputs for next criteria for certification
  - Now RSPO can set measurable targets for reductions in GHG emissions and biodiversity impacts

Pictures: Jannick Schmidt. Tanjung Puting, Central Kalimantan 2018
What is next?

- **New crowdfunded project**
- **Features**
  - 2016  ➔ Time-series
  - ID&MY ➔ ID, MY, TH, CO, NG etc.
  - All growers ➔ estates, smallholders
- **Become a member and:**
  - Shape the scope of the study
  - Get access to all data and materials

Pictures: Jannick Schmidt, Tanjung Puting, Central Kalimantan 2018
References

- **Crowdfunded project**
  - Schmidt J and De Rosa M (2019). Comparative LCA of RSPO-certified and non-certified palm oil. 2.-0
    LCA consultants: https://lca-net.com/clubs/palm-oil/
  - LCA of RSPO certified palm oil: https://lca-net.com/clubs/palm-oil/

- **iLUC**

- **Nature conservation**

Pictures: Jannick Schmidt. Tanjung Puting, Central Kalimantan 2018