New and updated data in the agri-food sector

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Overview

- Introduction
- Updated datasets in the LCI biofuel project
  - N emissions
  - LUC
- New datasets in the LCI biofuel project
- New datasets in the catch crops for biogas project
- Fruit and vegetable data
- External data supply
- Outlook
New and updated datasets for agriculture

- 178 updated crop inventories (N emissions, LUC)
- 5 new biofuel inventories Switzerland and Germany
- 6 new biofuel inventories overseas
- 33 datasets for fruit and vegetables
- 1 update soybean production, US (external data supplied)
Biofuel projects
Background and motivation

- Datasets from 2 projects presented here:
  1. Harmonisation of extension of biofuel life cycle inventories and LCAs
  2. Life cycle assessment of catch crop growing for biogas production

- The environmental impact of biofuels from agricultural biomass is dominated by the agricultural phase
- The emission of greenhouse gases is a key criterion for the evaluation of biofuels

- Dynamic context
  - New emission models and factors for nitrous oxide ($\text{N}_2\text{O}$), ammonia ($\text{NH}_3$) and nitrate ($\text{NO}_3$)
  - New methods and better data on land use change
  - Emerging sources of biomass like Jatropha, Miscanthus, Salix

→ An update, harmonisation and extension of the data for the assessment of biofuels is required
## Biofuel LCIs:
Harmonised and updated nitrogen emission models

<table>
<thead>
<tr>
<th>N compound</th>
<th>Applied</th>
<th>Emission model used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonia (NH₃)</td>
<td>Global</td>
<td>AGRAMMON</td>
</tr>
<tr>
<td>Nitrate (NO₃)</td>
<td>Europe</td>
<td>SALCA-NO3</td>
</tr>
<tr>
<td></td>
<td>Non-European</td>
<td>SQCB / de Willigen (2000)</td>
</tr>
<tr>
<td></td>
<td>countries</td>
<td></td>
</tr>
<tr>
<td>Nitrous oxide (N₂O)</td>
<td>Global</td>
<td>IPCC 2006, Tier 1</td>
</tr>
</tbody>
</table>
## Biofuel LCIs: N emissions: relative changes between ecoinvent V2 and V3

<table>
<thead>
<tr>
<th></th>
<th>kg NH3-N/ha</th>
<th>kg NO3-N/ha</th>
<th>kg N2O-N/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>ecoinvent v2.1</td>
<td>13.69</td>
<td>40.28</td>
<td>1.38</td>
</tr>
<tr>
<td>ecoinvent v3</td>
<td>13.04</td>
<td>45.70</td>
<td>1.01</td>
</tr>
<tr>
<td>Relative change</td>
<td>-4.8%</td>
<td>+13.4%</td>
<td>-26.4%</td>
</tr>
</tbody>
</table>

ecoinvent V3: New and updated agricultural data

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Biofuel LCIs: Update LUC inventories

- Goal: update of the emission from direct LUC for all relevant crop activities:
  - Soybean, Brazil (BR)
  - Sugarcane, BR
  - Palm fruit bunches, Malaysia (MY)

- Consistent consideration of all carbon pools (IPCC 2006)
  - Above Ground Biomass (AGB)
  - Below Ground Biomass (BGB)
  - Dead Organic Matter (DOM)
  - Soil Organic Carbon (SOC)
Biofuel LCIs: Overview: LUC Results

- Transformation, shrubland
- Transformation, primary forest
- Occupation - Gain in AGB/BGB
- Occupation - SOC - peat
- Occupation - SOC - mineral - from N2O
- Occupation - SOC - mineral - from C
- Total CO2 from Crop
- Total

Soybean BR, v.2.2: 1.47
Soybean BR, v.3.0: 5.21
Oil palm MY, v.2.2: 0.39
Oil palm MY, v.3.0: 1.03
New biofuel crop inventories

- Sugar cane, Colombia
- Oil palm, Colombia
- Jatropha, India, East-Africa
- Alfalfa-grass mixture, CH
  Miscanthus, DE
- Willow, DE
New biofuel inventory - Colombia

Sugar cane cultivation
National average data from field visits (20% of total SC area) validated and completed with literature data / expert interviews

Oil palm cultivation
National average data from field visits (26% of total palm area) validated and completed with literature data / expert interviews
New biofuel inventory - Jatropha

Hedge/fence (East Africa):
- Grown since more than 60 years
- Protection of crops/livestock, soil conservation
- Average data from 9 Sites in Et, Ke, Tz
- No crop management

Small-scale plantation (East Africa):
- Since a few years
- Additional income source, risk distribution
- Average data from 9 Sites in Et, Ke, Tz
- Little crop management

Large-scale plantation (India):
- Since a few years
- Data from field trials in Hyderabad, India
- Extensive management (little organic fertilizer / rain fed)
- Intensive management (min. fertilizer / pesticides / irrigation)
Alfalfa/Red clover-grass mixture
Reduced energy and GHG emissions

![Graphs showing energy and GHG emissions for different crop mixtures.](https://example.com/graphs)

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Catch crops for biogas

Green manure:
- mustard (*Sinapis alba*)
- phacelia (*Phacelia tanacetifolia*)

Autumnal catch crops
- mustard, phacelia
- sunflower
- SM 101: oat-vetches-mixture
- SM 106: grass-clover-mixture

Overwintering catch crops
- SM 200, SM 210: grass-clover-mixtures
- Italian Ryegrass
Variants of catch crops

Yield variability for each crop according to sowing date, fertilisation intensity and harvest frequency, but no yield differences were assumed between different fertiliser types

- Fertilisation levels: (0), 20-80 kg N
- Fertiliser type: mineral fertiliser, cattle slurry
- Harvest: 1-3 times (grass-clover-mixtures)
33 new horticultural products in ecoinvent v3
GHG of 83 % of fruits and vegetables sold at the retailer’s stores

www.ifu.ethz.ch/ESD
Datasets soybeans, US, 2007

- Author: Anne Creig, Four Elements Consulting, LLC
Outlook

- Revision of fertiliser modelling
- Further parametrisation of emission models
- Animal products
- Food sector
- Larger geographical coverage
- More data suppliers