A joint initiative of the ETH domain and Swiss Federal Offices

Swiss Centre for Life Cycle Inventories

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ecoinvent data v2.0
biomass production
new agricultural products

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Overview

- What is new in ecoinvent V2.0?
- Comparison of agricultural products between countries:
  - Wheat
  - Rape seed
- How to choose appropriate inventories resp. extrapolate inventories?
- Outlook

New agricultural products in ecoinvent V2.0

<table>
<thead>
<tr>
<th>Switzerland</th>
<th>USA</th>
<th>Brasil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rape seed, organic</td>
<td>Cotton</td>
<td>Soybeans</td>
</tr>
<tr>
<td>Grass from meadow</td>
<td>Corn</td>
<td>Sugarcane</td>
</tr>
<tr>
<td>Grass from natural meadow</td>
<td>Potatoes</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Europe</th>
<th>Germany</th>
<th>France</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemp</td>
<td>Barley</td>
<td>Barley, Protein peas</td>
</tr>
<tr>
<td>Rye</td>
<td>Protein peas</td>
<td>Rape seed</td>
</tr>
<tr>
<td></td>
<td>Rape seed</td>
<td>Wheat</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Spain</th>
<th>India</th>
<th>China</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barley</td>
<td>Jute</td>
<td>Cotton</td>
</tr>
<tr>
<td>Protein peas</td>
<td>Kenaf</td>
<td>Sweet sorghum</td>
</tr>
<tr>
<td>Sunflower</td>
<td>Ramie</td>
<td></td>
</tr>
<tr>
<td>Wheat</td>
<td></td>
<td>Malaysia</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Philippines</th>
<th>Malaysia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coconut</td>
<td>Palm fruit branches</td>
</tr>
</tbody>
</table>
## Inventory of wheat production

|    | yield main product | seeds | K-Fertiliser (as K2O) | P-Fertiliser (as P2O5) | K-Fertiliser (as K2O) | pesticides | diesel use | field | operations | land occupation |
|----|--------------------|-------|-----------------------|------------------------|-----------------------|-------------|-----------|-------|--------|------------|----------------|
|    | kg/ha              | gkg/yield | kg/ha | kg/gkg yield | kg/ha | gkg/yield | kg/ha | kg/gkg yield | kg/ha | gkg/yield | kg/ha | kg/gkg yield | m²/kg |
| US  | 2253               | 94      | 41.7   | 76          | 33.7   | 42       | 18.6  | 53          | 23.5 | 0.26      | 0.115 | 66             | 29.3  | 4.50 |
| Saxony, DE | 7567           | 180    | 23.8   | 187         | 24.7   | 51       | 6.7   | 46          | 6.1  | 2.59      | 0.342 | 129            | 17.0  | 1.48 |
| Castilla, ES | 3049          | 175    | 57.4   | 80          | 26.2   | 72       | 23.6  | 111         | 36.4 | 0.77      | 0.253 | 95             | 31.2  | 2.83 |
| Barrois, FR | 6760           | 141    | 20.9   | 154         | 22.8   | 49       | 7.2   | 45          | 6.7  | 3.48      | 0.515 | 96             | 14.2  | 1.52 |
| CH, org | 4069             | 200    | 49.2   | 66          | 16.2   | 65       | 16.0  | 196         | 48.2 | 0          | 0     | 108            | 26.5  | 1.93 |
| CH, ext | 5305             | 180    | 33.9   | 124         | 23.4   | 55       | 10.4  | 49          | 9.2  | 1.29      | 0.243 | 117            | 22.1  | 1.44 |
| CH, IP | 6425             | 180    | 28.0   | 140         | 21.8   | 66       | 10.3  | 59          | 9.2  | 2.66      | 0.414 | 120            | 18.7  | 1.19 |

Range factor: 3.4 2.1 2.8 2.8 2.1 1.7 3.5 4.4 7.9 2.0 2.2 3.6

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## Impact of wheat grains, at farm, Various countries

![Impact of wheat grains, at farm](image)

### Fossil & nuclear energy demand, MJ-eq.
- **US**: 4.63 MJ-eq.
- **Castilla, ES**: 6.42 MJ-eq.
- **Saxony, DE**: 3.49 MJ-eq.
- **Barrois, FR**: 3.58 MJ-eq.
- **CH, org**: 2.31 MJ-eq.
- **CH, ext**: 3.45 MJ-eq.
- **CH, IP**: 3.30 MJ-eq.

**Range factor (max/min): 2.8**

### GWP 100a, kg CO2-eq.
- **US**: 0.60 kg CO2-eq.
- **Castilla, ES**: 0.76 kg CO2-eq.
- **Saxony, DE**: 0.55 kg CO2-eq.
- **Barrois, FR**: 0.63 kg CO2-eq.
- **CH, org**: 0.59 kg CO2-eq.
- **CH, ext**: 0.67 kg CO2-eq.
- **CH, IP**: 0.59 kg CO2-eq.

**Range factor (max/min): 1.4**
Impact of wheat grains, at farm, Various countries

![Graph showing wheat grains at farm data for different regions.]

Range factor (max/min): 4.3

Presentation: Thomas Nemecek & Thomas Kägi

Inventory of rape seed production

<table>
<thead>
<tr>
<th>Rape seed production</th>
<th>Yield main product</th>
<th>Seeds</th>
<th>N-Fertiliser (as N)</th>
<th>P-Fertiliser (as P2O5)</th>
<th>K-Fertiliser (as K2O)</th>
<th>Pesticides</th>
<th>Diesel use field operations</th>
<th>Land occupation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>kg/ha</td>
<td>kg/ha</td>
<td>g/kg yield</td>
<td>kg/ha</td>
<td>kg/ha</td>
<td>kg/ha</td>
<td>kg/ha</td>
<td>m2/kg yield</td>
</tr>
<tr>
<td>US</td>
<td>1182</td>
<td>5.5</td>
<td>4.65</td>
<td>112</td>
<td>94.8</td>
<td>22</td>
<td>18.6</td>
<td>95</td>
</tr>
<tr>
<td>DE</td>
<td>3413</td>
<td>3.5</td>
<td>1.03</td>
<td>227</td>
<td>66.5</td>
<td>122</td>
<td>35.7</td>
<td>84</td>
</tr>
<tr>
<td>Saxony, DE</td>
<td>3500</td>
<td>3.5</td>
<td>1.00</td>
<td>83</td>
<td>23.7</td>
<td>60</td>
<td>17.1</td>
<td>141</td>
</tr>
<tr>
<td>Barrois, FR</td>
<td>3020</td>
<td>3.0</td>
<td>0.99</td>
<td>177</td>
<td>58.6</td>
<td>75</td>
<td>24.8</td>
<td>93</td>
</tr>
<tr>
<td>CH, ext</td>
<td>2683</td>
<td>5.5</td>
<td>2.05</td>
<td>107</td>
<td>39.9</td>
<td>44</td>
<td>16.4</td>
<td>98</td>
</tr>
<tr>
<td>CH, IP</td>
<td>3113</td>
<td>5.6</td>
<td>1.80</td>
<td>125</td>
<td>40.2</td>
<td>50</td>
<td>16.1</td>
<td>103</td>
</tr>
</tbody>
</table>

Range factor 3.0 1.9 4.7 2.7 4.0 5.5 2.2 10.4 8.2 1.7 3.3 3.1

Presentation: Thomas Nemecek & Thomas Kägi
Impact of rape seed, at farm, various Countries

![Bar chart showing impact of rape seed at farm in various countries](image1)

- US: 13.14
- DE: 9.91
- Saxony, DE: 8.90
- Barrois, FR: 7.38
- CH, org: 5.11
- CH, ext: 6.09
- CH, IP: 6.27

**Range factor (max/min):** 2.6

![Bar chart showing impact of rape seed at farm in various countries](image2)

- US: 1.86
- DE: 1.32
- Saxony, DE: 0.90
- Barrois, FR: 1.27
- CH, org: 0.68
- CH, ext: 1.08
- CH, IP: 1.04

**GWP 100a, kg CO2-eq. (IPCC):** 2.7

Impact of rape seed, at farm, various Countries

![Bar chart showing impact of rape seed at farm in various countries](image3)

- US: 0.136
- DE: 0.073
- Saxony, DE: 0.047
- Barrois, FR: 0.138
- CH, org: 0.116
- CH, ext: 0.116
- CH, IP: 0.074

**Range factor (max/min):** 2.9

![Bar chart showing impact of rape seed at farm in various countries](image4)

- US: 0.870
- DE: 0.591
- Saxony, DE: 0.328
- Barrois, FR: 0.475
- CH, org: 0.451
- CH, ext: 0.381
- CH, IP: 0.320

**EcoIndicator 99 (H,A), points (EDIP):** 2.7

Presentation: Thomas Nemecek & Thomas Kägi
Common problem of LCI data user

What should I do, if a crop produced in a different country has to be assessed, for example wheat in Italy?

Best solution

to collect the necessary data and to create a new inventory for the specific situation

-> often, there are not sufficient resources to perform a detailed analysis, or the dataset is not of great importance for the considered system.
-> so, what else could be done?
Guide for choosing adequate inventory

Possible solutions:

1. to use an existing inventory
   i. with the most similar site specific conditions.
   ii. with the most similar management criteria per ha.
   iii. with the most similar input of means of production per kg yield.

2. to use two or more existing inventories and interpolate between them (for example 70% wheat Spain and 30% wheat France).

3. to use the existing inventory with the most similar site specific or management criterias and consider a correction factor for the difference in the relation of yields to inputs of means of production (if the necessary data of wheat in Italy is known), depending on the considered impact.

Key parameters to compare situations

There are two important criteria sets to be considered for agricultural production inventories:

- **Site specific parameters**: climate, soil conditions etc.
  - especially precipitation (amount and distribution): important for nutrient leaching

- **Management parameters**: yield, means of production (machines, fertilisers, pesticides, water, land occupation):
  - **Yield**: key factor for land use in ecoindicator99
  - **Diesel input**: important factor for energy demand and global warming potential
  - **Nitrogen input**: type and amount of fertiliser -> important factor for energy demand, global warming potential, nutrient enrichment and acidification
  - **Pesticide input**: key factor for human- and ecotoxicity
  - **Irrigation**: important for the energy demand and the water resources
Summary: extrapolation of inventories

- A large variation exists between countries and regions
  - extrapolation is problematic
  - a closer look to the data is inevitable.
- There is not a simple rule that works in all situations
- The procedure depends on the goal, the considered system, the considered impacts or methods, the particular situation
- There is not a simple correction factor with universal use

Outlook

There is ongoing work on inventories of agricultural products.
What should we focus on from the user’s point of view?

- CH crops produced in mountain areas
- Cereals in other countries
- „exotic“ crops such as banana, coffee, ananas etc.
- Products from animal production
- Processed food
- Different modules for processes and means of productions
- …
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