Environmental impacts of beef production systems in different countries

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Introduction

- Beef production systems important for maintaining and promoting grasslands
- Effects of meat production on environment topic of great concern
- LCA: Impacts of beef much higher than pork or poultry meat
  ⇒ Beef production is under pressure!

Goals of this study:
- Identify hot-spots in beef supply chain
- Determine reduction potentials for environmental impacts
Methods

Life cycle assessment (LCA): cradle to farm gate

System boundary = farm gate

- SALCA (Swiss agricultural life cycle assessment)
- 13 environmental impacts
- Functional unit: kg live weight (LW)
- Biodiversity assessment

**Infrastructure**
- buildings
- equipment
- machines

**Plant production**
- labouring
- sowing
- fertilisation
- weeding
- irrigation
- harvest
- transports

**Purchased means of production:**
- energy carriers
- fertilisers
- seeds
- pesticides
- feedstuffs, straw
- animals
- water

**Fodder conservation**

**Manure storage**

**Animal production**
- feeding
- milking
- manure management
- pasture

**Animal products:**
- meat

**Indirect emissions**

**Direct emissions**
### Systems analysed

<table>
<thead>
<tr>
<th>System</th>
<th>Abbreviation</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switzerland PEP</td>
<td>BF_conv_CH</td>
<td>Model farms (swiss average)</td>
</tr>
<tr>
<td>Bull fattening</td>
<td></td>
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<tr>
<td>Switzerland organic</td>
<td>BF_org_CH</td>
<td>Model farms (swiss average)</td>
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<tr>
<td>Germany</td>
<td>BF_conv_DE</td>
<td>Literature (typical production system)</td>
</tr>
<tr>
<td>Switzerland PEP</td>
<td>SC_conv_CH</td>
<td>Model farms (swiss average)</td>
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<tr>
<td>Suckler cow systems</td>
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<td>Switzerland organic</td>
<td>SC_org_CH</td>
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<tr>
<td>Brazil</td>
<td>SC_BR</td>
<td>Literature (typical production system)</td>
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# Production parameters

<table>
<thead>
<tr>
<th></th>
<th>BF_conv_DE</th>
<th>BF_conv_CH</th>
<th>BF_org_CH</th>
<th>SC_conv_CH</th>
<th>SC_org_CH</th>
<th>SC_BR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Starting age [weeks]</strong></td>
<td>10</td>
<td>4</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Daily weight gain [g/d]</strong></td>
<td>1 200</td>
<td>1 049</td>
<td>747</td>
<td>987</td>
<td>987</td>
<td>650</td>
</tr>
<tr>
<td><strong>Slaughter age [months]</strong></td>
<td>21</td>
<td>15</td>
<td>22</td>
<td>10</td>
<td>10</td>
<td>24</td>
</tr>
<tr>
<td><strong>Final weight [kg LW]</strong></td>
<td>700</td>
<td>525</td>
<td>538</td>
<td>366</td>
<td>366</td>
<td>470</td>
</tr>
<tr>
<td><strong>Pasture [days / year]</strong></td>
<td>-</td>
<td>27</td>
<td>166</td>
<td>133</td>
<td>133</td>
<td>365</td>
</tr>
<tr>
<td><strong>Concentrate intake [kg/animal]</strong></td>
<td>1 135</td>
<td>716</td>
<td>109</td>
<td>125</td>
<td>125</td>
<td>-</td>
</tr>
</tbody>
</table>
Land use per kg meat produced

- BF_conv_DE
- BF_conv_CH
- BF_org.CH
- SC_conv.CH
- SC_org.CH
- SC_BR

Legend:
- arable land
- grassland intensiv
- grassland extensiv
- forest
- other surfaces
- kg meat produced per ha land used

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Martina Alig, Agroscope
Overview: Env. Impacts per kg meat

- Non renewable, fossil and nuclear
- GWP 100a
- Ozone formation (Vegetation), GLO
- Resources (phosphorus)
- Land competition
- Arable land
- Deforestation
- Eutrophication terr., GLO
- Eutrophication aq. EP(N), GLO
- Ecotox aq. 100a, CML
Biodiversity assessment

Overall species diversity (OSD) vs kg LW ha\(^{-1}\) year\(^{-1}\)

- Max. OSD
- SC\_conv\_CH
- SC\_org\_CH
- BF\_conv\_CH
- BF\_org\_CH
- Max. productivity

Sustainable development
Conclusions

- **3 main factors** determine env. impact of beef production:
  - Design of the system (bull fattening / suckler cows)
  - Efficiency of the system
  - Composition of feed and feedstuff production

- **Grassland based systems:**
  - Mostly suckler cow systems
  - Due to allocation of mother cow high results for many categories, but advantages for deforestation, use of arable land and ecotoxicity
  - Higher biodiversity potential

⇒ No clear advantages for one system

⇒ Level of **intensity** decisiv

=> Possible alternative: Combination of milk production with bull fattening based on grassland