PRODUCTIVITY AND SUSTAINABILITY OF BEEF PRODUCTION SYSTEMS

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Background
Climate impact
CO₂-eq, kg/kg product

- Suckler: 27
- Dairy Bull: 16
- Dairy Cow: 10
- Pig: 5
- Milk: 1
- Barley: 0.4
- Carrot: 0.2
Planetary safe threshold boundaries

Source: Rockström et al. (2009)
Aim

To develop a method for evaluating the overall impact of different beef production systems using a holistic approach
Method for evaluation of sustainability

- An indicator-based sustainability index
- Express the sustainability of beef production at farm level, typically for 1 year
- Based on data that already exist at the farm (or that is easy to collect)
- Applicable for very different beef production systems - developed for Nordic systems (Denmark and Sweden)
The sustainability index

- Animal Welfare
- Climate impact
- Use of resources
- Environmental impact
- Social responsibility
- Bio-diversity
- Economy
Two beef production systems

• An extensive pasture based system with specialized beef breeds

• An intensive indoor fattening system based on bull calves of dairy breeds
Extensive pasture based system

- High Land Cattle
- High level of grazing 180 days, permanent pasture
- Winter: housed at deep litter
- Maximum roughage to stimulate growth during summer
- 0.9 weaned calves/cow/year (20% replacement)
- Heifers: first calving at 36 months
- Bull calves slaughtered at 22 months (430 kg LW)
Intensive indoor fattening system

- Dairy calf of 55 kg LW (30 days)
- Slaughtered at 9.4 months (380 kg LW)
- Produced on contract ‘Danish veal’
- Requested: Deep litter until 6 months, age of 8-10 months, 180-240 kg carcass
- 1410 kg DM/produced bull, 10% roughage (straw, grass silage)
Subindex: ‘Use of resources’

- Animal Welfare
- Climate impact
- Economy
- Social responsibility
- Biodiversity
- Environmental impact

Use of resources

- Feed use, kg DM/kg ‘meat’
- Land use, m²/kg ‘meat’
**Subindex: ‘Use of resources’**

- **Suckler cows**
- **Bull calves from dairy herds**

**Suckler:**
Per kg ‘meat’:
Feed use: 30 kg DM -> score 0
Land use: 14 m²  -> score 9
**Sub-index:** score 5

**Bull calves:**
Per kg ‘meat’:
Feed use: 7 kg DM  -> score 10
Land use  9 m²    -> score 9
**Sub-index:** score 9.5
Subindex: ‘Climate impact’

- Economy
- Social responsibility
- Biodiversity
- Environmental impact
- Use of resources
- Animal Welfare

Climate impact

CO₂-eq per kg ‘meat’, kg
Subindex: ‘Climate impact’

Per kg ‘meat’ from bull calf:
CF: 9 kg CO₂ -> score 10
Sub-index score 10

Per kg ‘meat’ from suckler system:
CF: 30 kg CO₂ -> score 3
Sub-index score 3
Subindex: ‘Biodiversity’

- Animal Welfare
- Climate impact
- Use of resources
- Environmental impact
- Bio-diversity
- Social responsibility
- Economy

‘Biodiversity’

- Production intensity
- Pesticide use
- Small biotopes
- Grassland utilization
- Permanent pasture

‘Biodiversity’ Subindex:
- Grassland utilization
- Permanent pasture
- Small biotopes
- Pesticide use
- Production intensity
**Subindex: ‘Biodiversity’**

**BD bull calves:**
Prod. Int.: 138 kg N/ha -> score 8  
Pesticide, % area: 99% -> score 0  
Grassland util.: 80% silage -> score 0  
Perm. Past. % of area: 0% -> score 0  
Small biotopes % of area: 0% -> score 0  
**Sub-index:** score 2

**BD suckler:**
Prod. Int.: 19 kg N/ha -> score 10  
Pesticide, % area: 2% -> score 9  
Grassland util.: 20% silage -> score 10  
Perm. Past. % of area: >60% -> score 10  
Small biotopes % of area: -> score 10  
**Sub-index:** score 10
Subindex: ‘Environmental impact’

- Environmental impact
- Ammonia emissions
- Pesticide use
- N and P balance

Economy
Social responsibility
Biodiversity
Animal Welfare
Climate impact
Use of resources
Sustainability Index
Subindex: ‘Environmental impact’

Environment impact **bull calf**:
- Ammonia em.: 29 g NH$_3$-N -> score 6
- N balance: 71 kg N/ha -> score 5
- Pesticide use: -> score 5
**Sub-index:** score 5

Environment impact **suckler**:
- Ammonia em.: 112 g NH$_3$-N -> score 5
- N balance: 29 kg N/ha -> score 6
- Pesticide use: -> score 5
**Sub-index:** score 5
Subindex: ‘Animal welfare’

Sustainability Index

- Animal Welfare
- Climate impact
- Use of resources
- Environmental impact
- Biodiversity
- Social responsibility
- Economy

Animal welfare

- Health
- Behaviour
- Feeding
- Housing
Subindex: ‘Animal welfare’

**Suckler:**
- Behaviour score: 10
- Health score: 9
- Feeding score: 9
- Housing score: 9
**Sub-index score:** 9

**Bull calf:**
- Behaviour score: 4
- Health score: 9
- Feeding score: 9
- Housing score: 9
**Sub-index score:** 8

- Suckler cows
- Bull calves from dairy herds
Subindex: ‘Economy’

- Animal Welfare
- Climate impact
- Use of resources
- Bio-diversity
- Environmental impact
- Social responsibility
- Economy

Economy

- Fixed capital
- Gross Margin for meat
- Variable costs
Sub-index: ‘Economy’

**Suckler:**
- Fixed capital: 4
- Gross margin: 6
- Var. Costs: 5

**Score:** 5

**Bull calf:**
- Fixed capital: 7
- Gross margin: 8
- Var. Costs: 4

**Score:** 7

- Suckler cows
- Bull calves from dairy herds
Subindex: ‘Social responsibility’

Social responsibility

Responsible production of beef with consideration for neighbours, labour and social issues etc.
Subindex: ‘Social responsibility’

- Suckler cows
- Bull calves from dairy herds

‘Social responsibility’
The sustainability index

- Animal Welfare
- Economy
- Social responsibility
- Biodiversity
- Environmental Impact
- Use of Resources
- Climate Impact

- Suckler
- Bull calves
A holistic approach, like a sustainability index, is needed to evaluate different beef production systems to secure a sustainable development that at the same time considers nature, climate, animal welfare and socioeconomic conditions.
Thank you for your attention
What’s next?

- This first version of the index shows that it was able to assess the sustainability of various beef production systems.
- The index needs to be evaluated before it is ready for general use, including data collection from a larger number of farms.
- Validation of the translation from calculated indicator value to score value (from 1 to 10, with 5 as medium level).
- So far no weighting between individual indicators within sub-indexes, or between sub-indexes.
RISE from Switzerland:
Indicators: Soil fertility, Animal welfare, N surplus, water use, energy and climate, biodiversity and plant protection, labour, economic sustainability, quality of life,

Agri-environment footprint index from Ireland:
Indicators:

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<thead>
<tr>
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<th>Natural ressources</th>
<th>Biodiversity</th>
<th>Landscape</th>
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<td>Crop and animal husbandry</td>
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<td>Physical farm infrastructure</td>
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<td>Natural and cultural heritage</td>
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