Landscape based metrics to assess livestock carrying capacities associated with selected planetary boundaries

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   • Why looking beyond the farm?
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Livestock, a good or a bad?

Livestock, a good or a bad?

• Is a major threat to the environment
  • 10% EU GHG emissions (with current accounting methods)
• Consumed in large quantities contributes unhealthy diet
• Driver of land use change (planted fodder)
Livestock, a good or a bad?

In Europe
- Represents 40% of agricultural activity and 170 billion euro
- Employs 4 million people
- Is central to a healthy diet
- Managing grassland
- Helps close cycles (reduced fertilizer, increased carbon sequestration)

- Is a major threat to the environment
  - 10% EU GHG emissions (with current accounting methods)
- Consumed in large quantities contributes unhealthy diet
- Driver of land use change (planted fodder)
How to make livestock more sustainable?

Two narratives shaping the livestock discourse
Sustainable intensification ⇔ Agroecology
How to make livestock more sustainable?

Sustainable intensification

- more efficient animals

\[
\frac{\text{ressources}}{\text{kg animal source food}} \downarrow
\]

Efficiency - relative performance

Assessment through Life Cycle Analysis (LCA)
How to make livestock more sustainable?

Sustainable intensification

• more efficient animals

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Efficiency - relative performance

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How to make livestock more sustainable?

**Agroecology**

- Integrate livestock in ecosystem processes (Dumont, 2012) in food system (van Zanten, 2019)
- Sufficency - Absolute performance
- Can be linked to planetary boundaries
How to make livestock more sustainable?

Agroecology

• Integrate livestock in ecosystem processes (Dumont, 2012) in food system (van Zanten, 2019)
• Sufficiency - Absolute performance
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No metrics why?

Levels of organisation relevant for livestock science

Examples of assessment methods

- Mass flow model (SOLm or CIFOS)
- Life Cycle Assessment (LCA)
Landscape: Why look beyond the farm?

- Ecological processes are generally not bound to the farm
- Account for spatial heterogeneity
- Account for possible interactions of farmers (feed and fodder, manure transfers)

=> Circularity and linkage to planetary boundaries
Levels of organisation relevant for livestock science

- **Examples of assessment methods**
  - Mass flow model (SOLm or CIFOS)
  - => to be developed (GeoSOL)
  - Life Cycle Assessment LCA

GeoSOL principle

SOL-m

Bottom-up mass-flow model
Model inputs and outputs, (all physical flows) related to individual agricultural activities based FAO STAT
GeoSOL principle

**SOL-m**
Bottom-up mass-flow model
Model inputs and outputs, (all physical flows) related to individual agricultural activities based FAO STAT OR aggregated from spatial data

Spatial allocation

Open access GIS layers

**Spatially explicit modeling**
Interactions; livestock - ecosystem processes
- Nitrogen
- Phosphorous
- Water
- (Carbon)
- (Biodiversity)
GeoSOL principle

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**Assessing planetary boundaries locally**
Linkage with carrying capacity aggregated to landscapes
- Soil nutrient balance
- Agricultural water balance

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What we plan to achieve?

- Assess the role of livestock for circularity
- Provide local carrying capacity related metrics for livestock
- Understand how mixed farming supports livestock production within planetary boundaries