The need for systems approach in assessing farming sustainability

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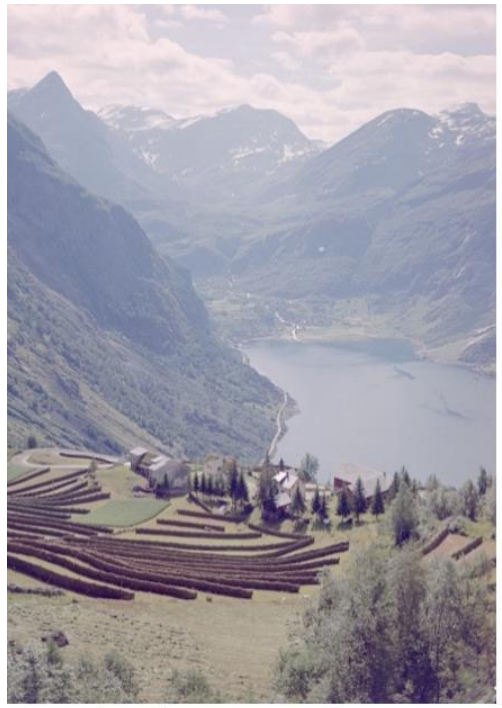


Terrestrial Animal Source Foods (TASF):
Livestock as villains and in policy making

Prevailing views

- Agriculture has large climate emissions and livestock is the main cause for this.
  - Livestock should thus be removed from agriculture.
  - By only growing plant food, climate emissions from food production will decrease.
  - Assuming that plants/crops are in essence climate neutral or low impact.
- New diets and dietary guidelines connects diet and agricultural production.
  - Red meat is claimed to be unhealthy and should be minimized.
  - And red meat production is harmful to the environment and the climate, do not eat it.
  - Because one should not eat red meat, it should not be produced either...
  - "..and by the way, red meat is unhealthy anyway".
- The claimed link from red meat to the sustainability of agriculture is never substantiated from a systems perspective.

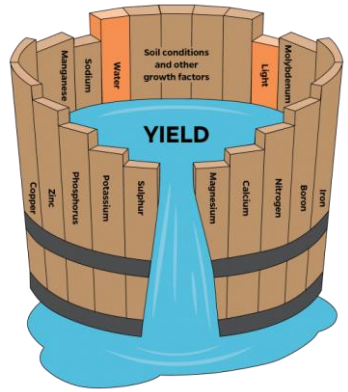
What is agriculture? – A system !!

- **Photosynthetic primary production**; Everything upwards in the system depends on it. Production and economy and ecosystem services;
- A challenge to **totally capture agriculture in calculations and models**
- **Sustainability is a measure of the long term survivability** of the system
- No change can be done to the whole system before **consequences have been assessed with proper models for the WHOLE system**

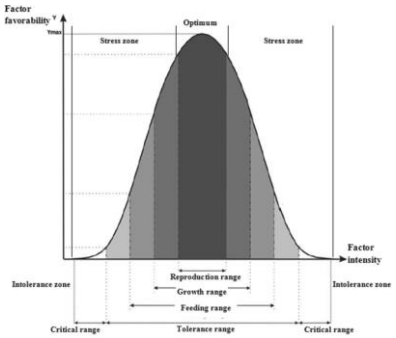
Methods matter – aligning methods with sustainability goals and the real system

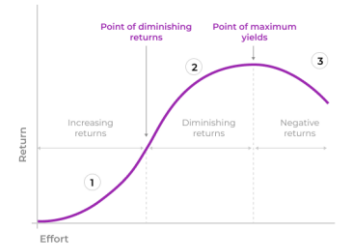
- Must be able to **define sustainability**
  - **Quantitative and operational** definition of sustainability
  - Setting **goals with numbers** and estimate gap between goal and state
  - Setting numerical **gaps**
- Must be able to do **systems assessment** and see the **feedbacks** of the system.
  - Involves advanced **system dynamics** modelling
  - Must be **mass- and energy-balance consistent**
- Social impacts are **as important as economical and physical aspects**
  - Democracy must prevail
  - Social disruptions involve huge risks

Basic principles of sustainability must include:



1. **Limits to growth** Liebig's Law of maximizing the harvest output to the limiting resource input for growth of plants. Grand scale sustainability: Stay within planetary limits for key natural resources.
2. **Ecological niche**. Ecological conditions envelope and conditions limits, (Shelford's Law of Tolerance). No environmental pollution over critical load to the environment that creates unacceptable disturbance to ecosystem status of function.
3. **Law of diminishing returns** is based on efficiencies towards thermodynamic maximums. No conversion is 100%, there is a loss.
4. **Economic sustainability**. Each farm unit must be economically profitable, and as a system be positive in the National accounts
5. **Social sustainability principles** Efficient institutions, without social disruptions, social trust, democracy





Systems analysis

- Holistic approach
- Complex relationships
- Casual pathways
- Dynamic processes
- Multidimensional out-come
- Simulate future scenarios

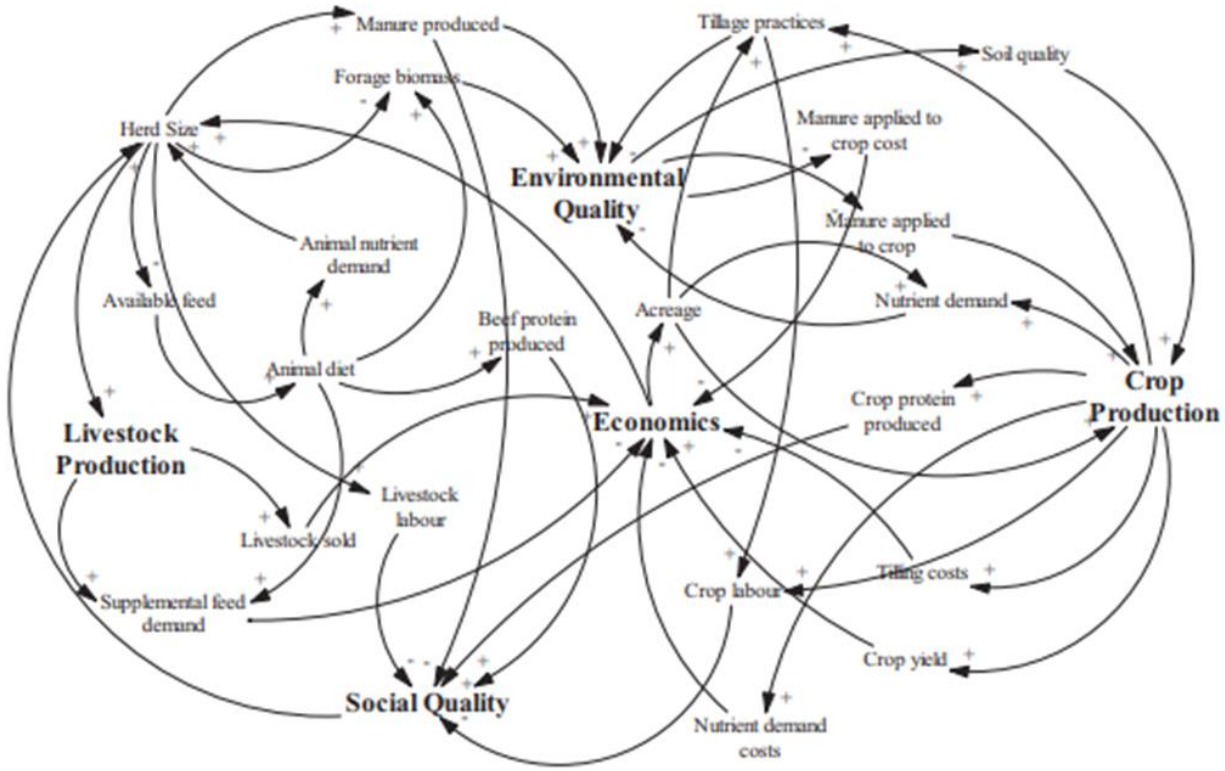
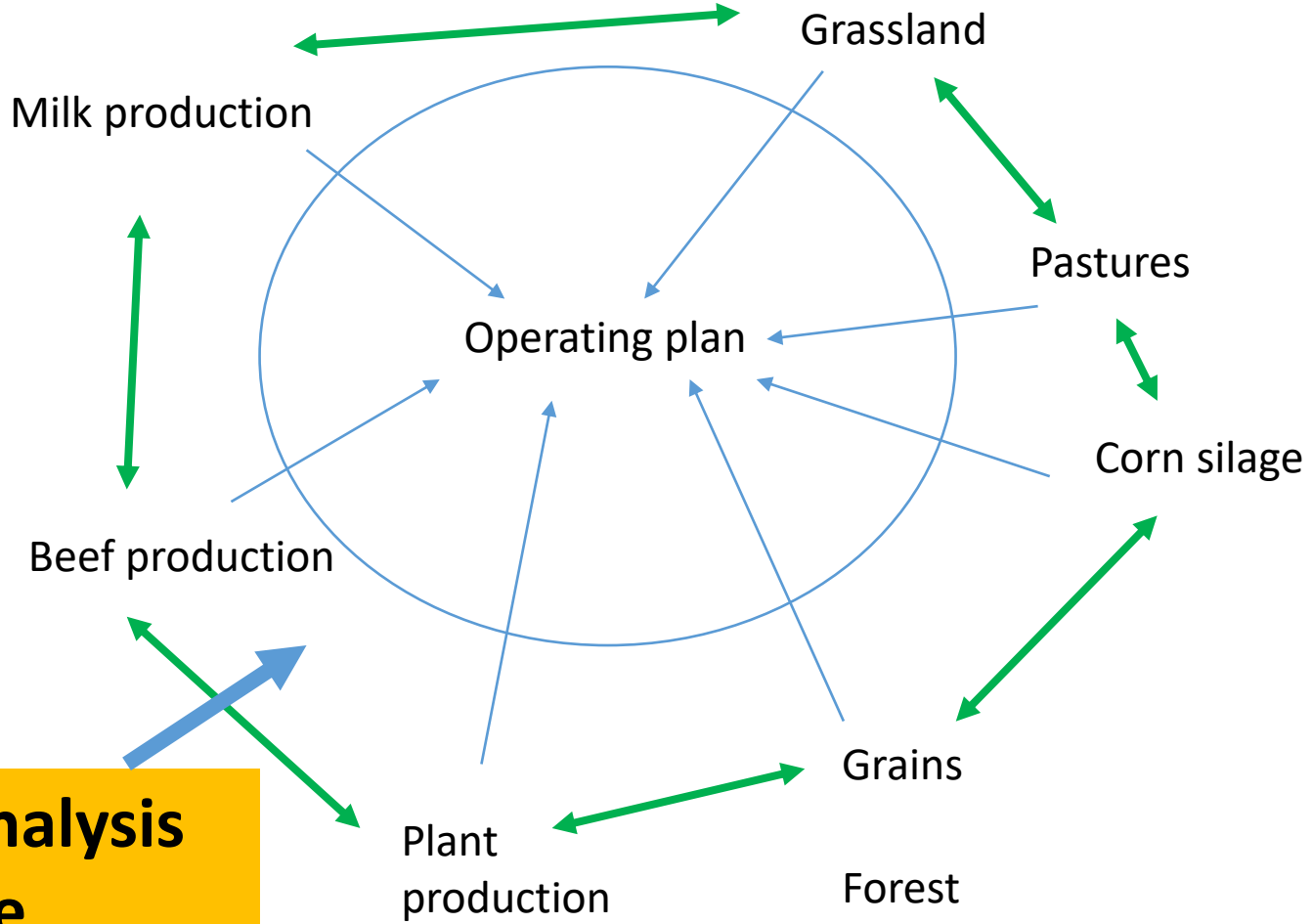


Fig. 4. CLD of production drivers (principle drivers are in larger bolded font). The positive (+) or negative (−) impact of a practice on a factor is indicat
arrow linking the two parameters, e.g., Animal Diet (+)→ Beef Protein Produced.

Simplifying system analysis: Contribution margin calculations and operating plan



System analysis in practice

Apply Liebigs law, Shelfords law of tolerance, law of diminishing returns, economy and social prinicples on all production branches and summarise them in the operating plan

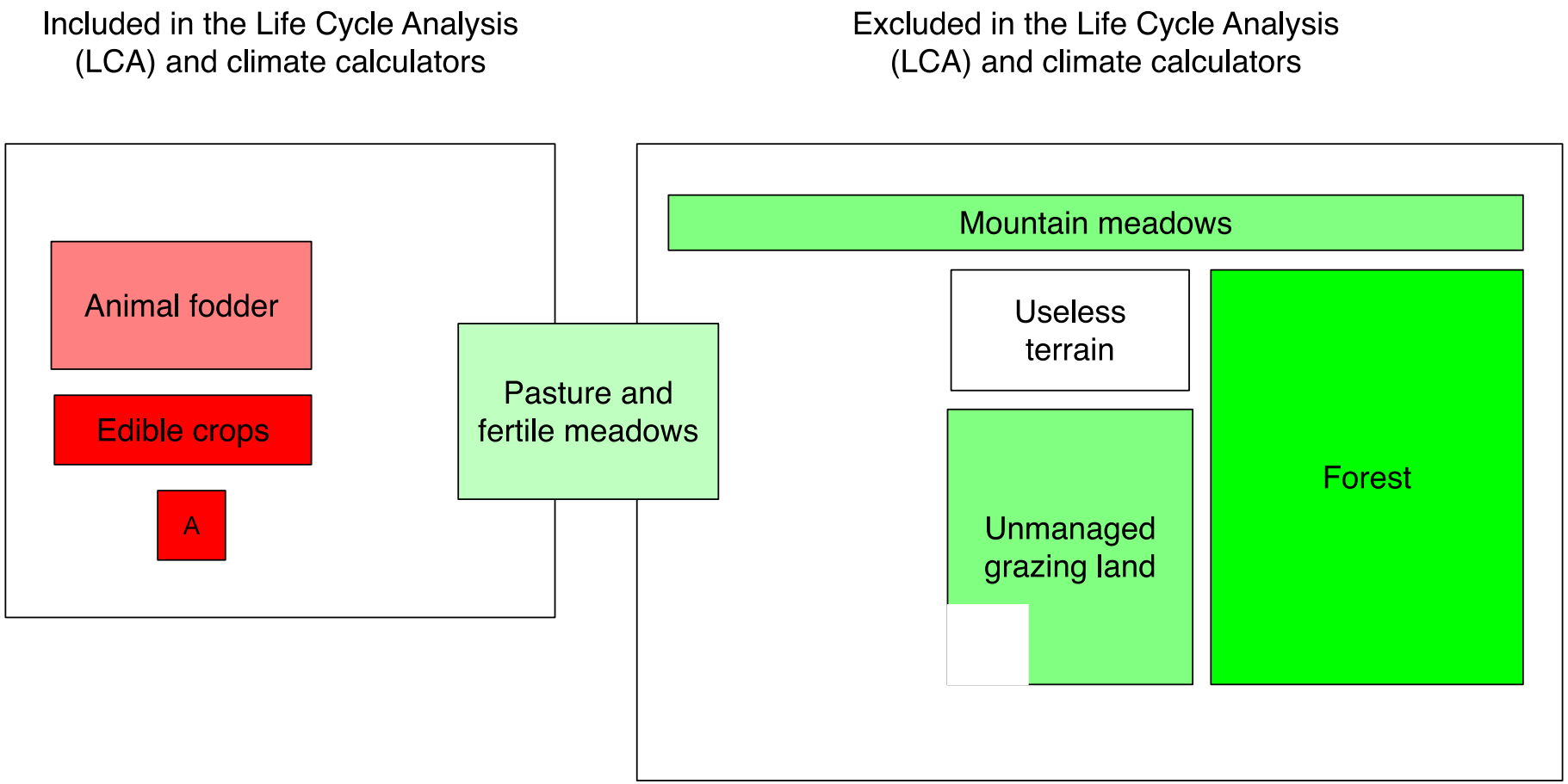
Examples:

- Climate – which crops are possible
- Plant nutrients, manure/fertilizer – excess/deficit
- Crop rotation, limits
- Social factors, available labour, social context
- Economy
- Climate footprint
- Carbon balance
- Soil health/Carbon sequestration
- Biodiversity

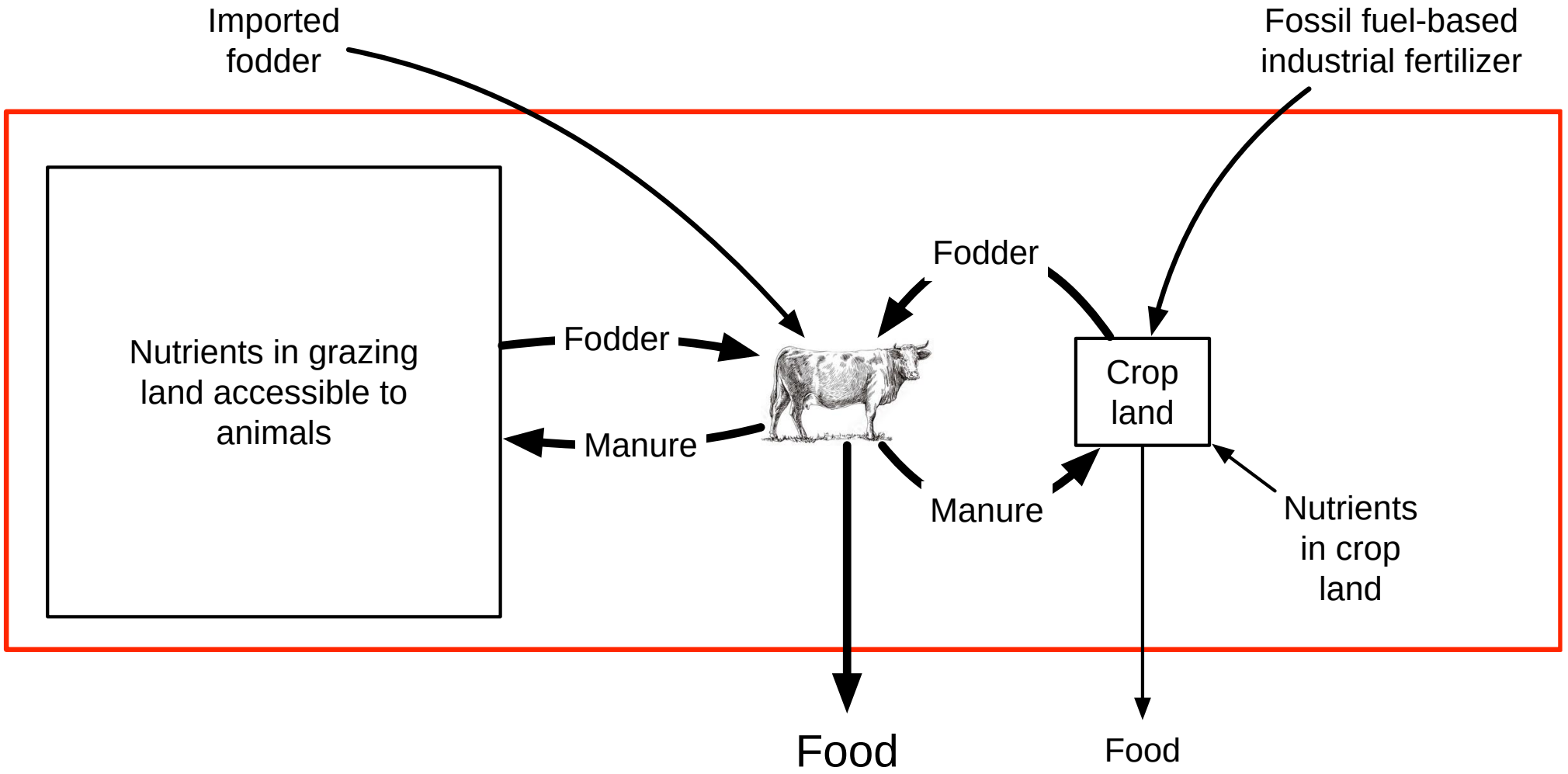
Nordic agriculture: diversity and integration

- Integrates animal, plants, land
- Diversity of farming systems in Norway:
  - A mixture of farms with different types of land areas
  - different flexibilities
  - different aspects of sustainability

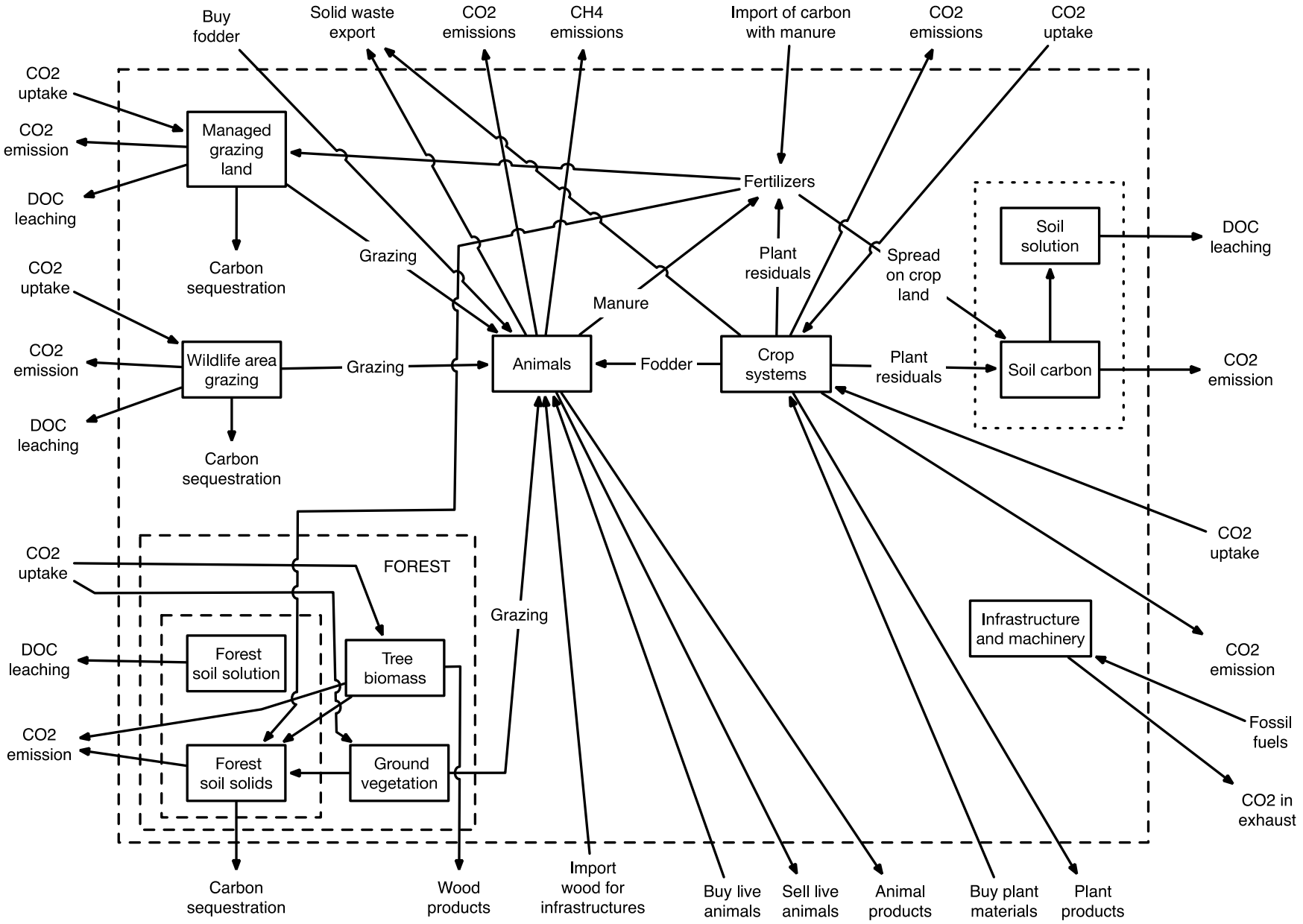
Present LCA studies and the «Climate calculators» based on the have a huge problem



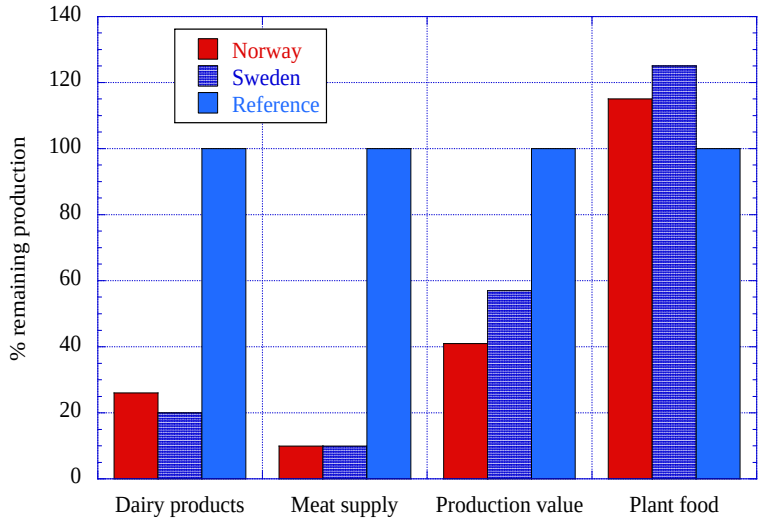
Nordic agriculture link animals and plants

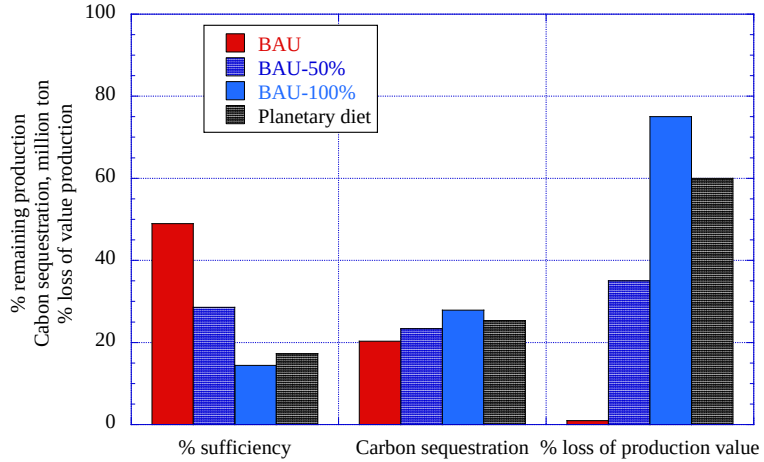


Complete carbon mass balances are needed



Scenarios on the impact of livestock reductions (50% - 85%-100%) on Norwegian and Swedish food production





1. 74-80% reduction of dairy cows and dairy
2. 90% reduction of beef, sheep, pig, reindeer
3. 80-70% primary food production decrease
4. 59-43% loss of ”gross production value” in agriculture
5. Self-sufficiency falls from 49% to 14% and 55 to 22

1. The reference is for setting the scale between 0 and 100%.
2. Self-sufficiency drops from about 49% to about 14% (in -100% livestock)
3. Carbon balance increased some
4. Production value losses are very substantial as compared to Business as Usual.
5. Farms are carbon sequestration producers. Nordic farms sequesters about 200 million C ton/year
6. Calculations show at present production, **Nordic farmers produce animal products that are sustainable with respect to carbon from a systems perspective**

Conclusions

1. **The reality:**
    1. Livestock is essential for food production and food security in the Nordics, and elsewhere.
2. **Flawed tool uses:**
    1. The previous ways of assessing food systems fail to capture the complexity of agriculture,
    2. Counting only cost and no benefits of livestock farming, failing to see the system
    3. Unsuitable for policy decisions
    4. Disregards self-sufficiency/food security
    5. Consequences: the protein supply for Nordic needs is directed to the world market - worse for the world's poor.
3. **Tool flaws:**
    1. LCA has no time dimension, nor systems analysis
    2. Poorly or not defined system boundaries and allocation
    3. Crucial impacts on topsoil and soil carbon, are disregarded
    4. All dynamics and feedbacks are ignored
4. **Way forward:**
    1. Systemic estimates of the farm are needed – allocation to products within farms is misleading and **utter** nonsense
    2. Use the "Sustainability Operating Plan”
    3. Get the system boundaries right

New report

Aspects of sustainability, Resilience food supply capabilities in Norwegian Agriculture and Food Systems

The role of animals combined with cr
and an assessment of the consequenc
the Norwegian food production system.

Thank You for your attention

A report compiled by

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Aspects of sustainability, Resilience food supply capabilities in Norwegian Agriculture and Food Systems - The role of animals combined with crops in the Norwegian food supply, and an assessment of the consequences of different potential changes in the Norwegian food production system

iversities in Belgium, Netherlands

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2023