How can sustainability of Norwegian sheep farming be improved?

NIBIO
NORWEGIAN INSTITUTE OF BIOECONOMY RESEARCH

L. Grøva[1], R. Bergslid[2], N. Elshani[1], O.Flaten[1], M. Koesling[1]. H. Steinshamn[1]

[1]NIBIO, Gunnars veg 6, 6630 Tingvoll, Norway; [2]NORSØK, Gunnars veg 6, 6630 Tingvoll

Background

Livestock production systems with ruminants are generally associated with high enteric methane emissions and thus a high carbon footprint, causing these systems to be challenged when it comes to what products to eat and wear in a sustainable future.

Sustainability is a multi-dimensional concept, encompassing both environmental, economic and social dimensions. Several tools aim to assess aspects of sustainability, and there is a need to consider all dimensions of sustainability.

The objectives of this study were to assess the sustainability of sheep farming in Norway as indicated by the protein efficiency, climate gas emission per produce, economic performance and assessments with the SMART-Farm tool, and to compare the results from the different sustainability assessments.

By this, we aim to provide new knowledge and insight on how the sustainability of sheep farming can be understood and thus improved with respect to food and fibre production. And how stakeholders in the value chain can enhance value creation based on this information in a wide sense.

Further, consumer perspectives on how they understand products, meat, and wool, from sheep farming are also to be assessed as part of the project.

Method

We assess the sustainability of Norwegian sheep farming through the following methods:

- The SMART-Farm tool (https://www.fibl.org/en/themes/smart-en)
- Life Cycle Assessment (LCA)
- Human edible protein ratio calculations
- Farm profitability assessments

The rationale for the selected methods to assess sustainability in sheep farming is:

SMART-Farm tool: The SMART-Farm tool was chosen to assess the sheep farms to include the different dimensions of sustainability: environmentally non-degrading, economically viable, and socially acceptable agricultural management strategies (FAO, 1994). Moreover, as the tool is a multi-criteria tool, it allowed for identification of trade-offs between these dimensions.

Life Cycle Assessment (LCA): This was used to calculate both climate gas emissions as CO_2-equivalents and carbon sequestration on rangeland. Emissions were calculated based on the emissions due to the production of inputs, feed production on farm, and emissions from enteric fermentation and manure, especially from storing and spreading. Also, emissions due to the use of tractors, machinery and buildings were included, taking into account their expected lifetime. The Global Warming Potential was calculated for a 100-year period based on the fourth assessment report from IPCC (2007) and the ISO standards 14040 and 14044. For the potential carbon sequestration on rangeland, modelling results for Nordic Countries from Chang et al. 2015 was used.

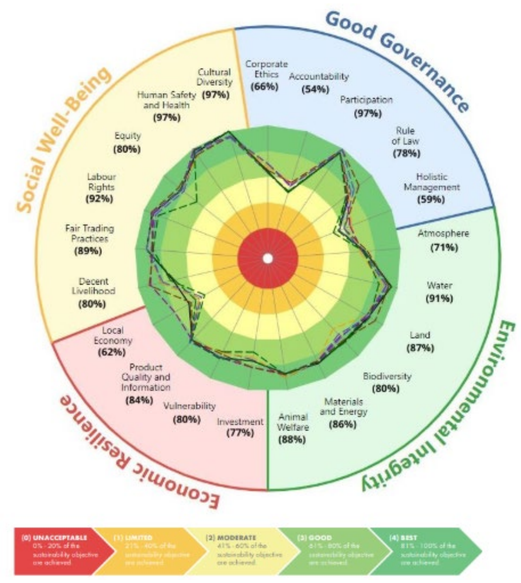
Human edible protein ratio: Animal edible protein output:human-edible protein input (kg/kg): Sheep convert non-edible protein from grassland and rangeland into high quality protein food. However, potential human-edible feeds are supplemented to improve the sheep's diet and production, and by doing so sheep compete with human population for limited area for cultivating cereals and pulses. High conversion efficiency of edible protein could be regarded as more sustainable than lower efficiency at the same protein output level.

Economics: Calculations for each output and cost item were performed per winter-fed sheep. We measured profitability as the profitability coefficient, calculated by dividing net farm income by the sum of interest claims on total value of farm assets and the opportunity cost of unpaid labor. Net farm income represents the return to all unpaid labor and management and to all the capital invested in the farm business.

The data was collected from eight sheep farms that participated in the Survey of Account Statistics for Agriculture and Forestry in the years 2018-2020, located in Mountain and Fjord regions, respectively.

Preliminary results

The SMART-Farm tool: The sheep farms score high on different sustainability dimensions when assessed through the SMART-Farm tool. This means that many management practices done on the sheep farms promote and support sustainability. However, the tool must be contextualized for Norwegian conditions to produce more precise results.



Life Cycle Assessment (LCA): The results of two farms with comparable emissions were merged, resulting in four groups presented. Rangeland is nearly sequestrating as much CO_2-equivalents as is emitted. It is important to find solutions to reduce carbon emissions and important to get reliable measurements to state if and how much carbon can be sequestered.

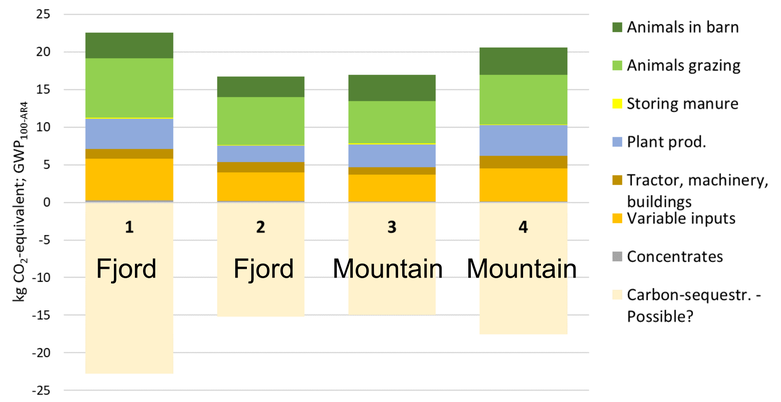


Figure 1 Emission of climate gases and modelled sequestration per kg meat

Human edible protein ratio: At similar edible-protein output, farms in the Mountain region used less edible food as feed and had as such better protein feed conversion efficiency.

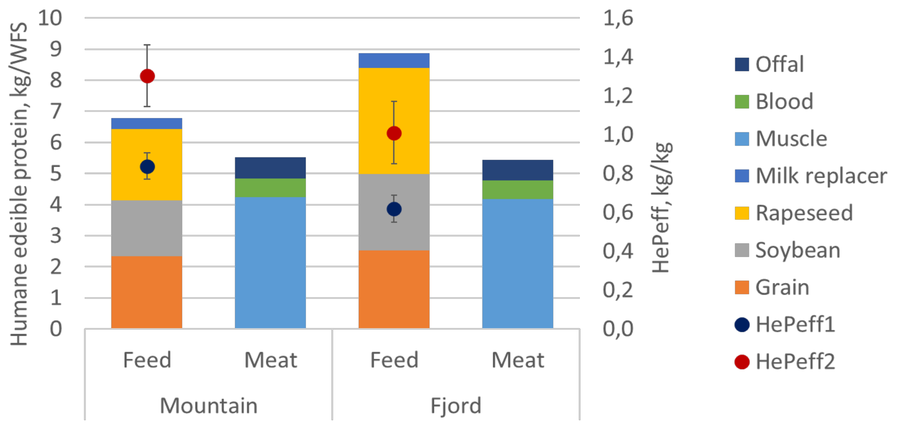


Figure 2 Human edible protein in feed and produced in meat per kg/winterfed sheep (WFS) and human edible protein in produce to edible protein in feed ratio (HePeff1 and HePeff2, with rape protein regarded as edible and non-edible, respectively)

Economics: Profitability in sheep farming was generally low. Larger flocks, on average, generated a higher profitability coefficient than smaller flocks. Profitability was higher in the Mountain region than in the Fjord region, associated with larger flocks in the mountain sample.

The work presented is conducted as part of the research project ***"Amazing grazing – sustainable meat and wool from Norwegian sheep farming systems".***
Funded by Forskningsmidler for jordbruk og matindustri (prnr 319396 Norwegian Research Council).