Summary of the NordPEF group tasks for 2020

Task 1.

Title
Harmonization of methods behind environmental footprint of feed- a report from a Nordic workshop
Authors
Hanne Møller (NORSUS), Troels Kristensen (AARHUS), Sanna Hietala (LUKE), Anna Woodhouse (NORSUS)
Summary
In the Nordic countries, there is an ongoing work to standardize and harmonize the carbon footprint and at the same time the product environmental footprint (PEF) calculation methods for raw feed materials and compound feeds has been approved. How can we further harmonize the ongoing work on feed carbon footprints? On the 25th of November 2020, an online workshop took place with approximately 50 attendees from the Nordic feed industry and other stakeholders. Four presentations with speakers from feed industry and advisory services from Denmark, Norway and Sweden covered topic as the GFLI database, the climate smart calculator in Norway and use of feed carbon footprints in Denmark and Sweden. There are major differences in how far and how the different feed producers and other stakeholders in the Nordic countries have come in using PEF or equivalent systems. However, it was a clear message that when consumers and other actors request environmental documentation, it puts pressure on the feed suppliers to establish a system. Data quality is crucial. PEF uses a Data Quality Rating (DQR), which includes a semi-quantitative assessment of the quality criteria of a dataset, including the proportion of primary and secondary data. The advantage of using secondary datasets is that there will be equal conditions for all suppliers in the same market. When a method opens for both secondary data and supplier data, it requires a review system, which approves data, or the source behind data in general, before they are used. However there seem to be a general agreement about that case (farm, region) specific data is needed to stimulate growers and feed industry to introduce mitigation in the production lines.
Conclusions
The NordPEF group invited the Nordic feed industry to the workshop in order to strengthen a Nordic dialog in relation to initiatives within use of climate documentation of feed and clarify if we can achieve harmonization by use of Product Environmental Footprint Category Rules (PEFCR) standards for feed. Among the participants, there was a general agreement of relevance of the topic and in some of the Nordic countries, there is ongoing effort to include carbon footprint of feed as part of climate calculators. It is important to be aware of that the aim of PEFCR for feed is to provide LCI data as input for livestock and not meant to be used for comparison between producers. As an intermediate product compound feed has different functions in nutrition of livestock. Thus, comparison of products can only be done if the functions and the nutritional quality and the target animal are the same. By providing openly available LCA databases for feed raw materials, feed LCA's are brought more easily accessible for companies to apply for own products. Yet, the databases should be transparent and uniform in methods, how the interpretation of PEFCRs are brought into results. Currently, the databases can rely on rather old data which can lead to outdated, misleading results. As the PEFCRs are used not only to provide product environmental information to consumers, but they are used by companies to improve products' environmental profile, the data quality and

harmonization of the data collection methods and interpretation of PEFCRs' should become more transparent.
Recommended further work for the NordPEF group
The aim of the workshop was to inform the feed industry and exchange information on ongoing feed carbon footprinting projects. The aim was fulfilled succesfully, for example has the Finnish feed industry started to adopting PEFCRfeed. The NordPEF group does not see any further work stemming from the workshop that is in line with the aims and purposes of the group.

Task 2.

Title
Emissions from manure management and application of organic and mineral fertilizer- comparisons of methods
Authors
Sanna Hietala (LUKE), Troels Kristensen (AU), Anna Woodhouse (NORSUS), Kirsi Usva (LUKE), Jouni Nousiainen (LUKE)
Summary
Current assessment methods for manure management and application of organic and mineral fertilizer (IPCC, NIR or national) applied in Nordic countries were reviewed and compared with PEF methodology. Differences were evaluated by applicability. The report was not exhaustive within this topic and descriptions were based on experiences that the participants of the group have as LCA practitioners. The methodology on how to account for manure emissions in the PEFCR red meat draft were the focus. The methodology for calculating manure emissions for pork and broiler production in Finland according to PEFCR red mat and national inventory methodology were described. A case study from Denmark evaluating manure management strategies effect on greenhouse gas emissions was presented. Anaerobic digestion has the potential to reduce carbon footprint of pork production. A case study evaluating greenhouse gas emissions from applying mineral and organic fertilizers conducted for Danish and Swedish conditions were described. It was found that there were no large differences when using the AU methods compared to the PEF method for direct and indirect N_2O emissions. There were however big differences in ammonia emissions for the AU compared to the PEF method. The AU method generated lower emissions based on the same input data compared to the PEF method. When estimating leaching of N, a comparison made between PEF feed and the Swedish methodology suggests that a very large difference in results can be expected depending on the method of calculation chosen. The PEF feed method results in many times higher leaching than if the value was selected from/calculated according to the Swedish method, up to 5-10 times higher N leakage for a single crop. There are also examples of the opposite relationship, where calculation according to PEF feed would result in half as high leaching. The difference would have been even larger for crops where fertilizer is not applied, such as field bean and pea. According to the PEF feed method, nitrogen leaching from these crops would be 0 kg, although in practice nitrogen leaching also occurs from these crops. The main differences appear to be at high fertilization applications (PEF overestimates the importance of fertilization), and for grassland crops (PEF does not reflect the effect of a perennial crop and evergreen soil). The PEF method is also unable to reflect local soil and climate conditions.
Conclusions

For the case study on manure emissions for finnish broiler and pork production, the methods used in NIR for manure management emissions had only small differences when compared to default IPCC methods. In other Nordic countries NIR methods give more options also for emission factors. Differences can be found also in determining the retention of nitrogen from feed, while feed ingredient N content estimated should be rather stable. For Finnish pork, the method for retention was based on Sevón-Aimonen (2002), which gave very similar result in comparison to IPCC 2006 for the presented example. The latest method in IPCC 2019 refinement resulted in a a slightly higher nitrogen excretion when compared to Finnish and IPCC 2006 methods for the given example. The Finnish method is based on data gained from Nordic swine breeds which are typically used in Finland. Thus, the N retention should be similar when compared to Nordic countries and the IPCC 2019 method is not describing the retention accurately for these breeds. In contrast to IPCC 2019 retention factors, the current typical breeds in Nordic can actually increase retention rate with growth when meat content is over 60%. When Nordic NIR methods were compared for excretion rate, large differences could be observed in nitrogen excretion rates especially for growing pigs. As each of the Nordic NIRs were applying national methods defined for the conditions in each country and excretion rates determined based on typical feed compositions, the observed differences can be actual differences in excretion rates. Yet, methodological differences in approach can be also partly explaining the variation.
For methane emissions from manure storage, there were more differences in methods between Nordic countries. Comparison of manure methane from similar breeding sows would give rather large differences between countries where similar Nordic conditions apply.
For the harmonization of manure emission assessment methods, a harmonized definition for Nordic conditions of the methane conversion factor, the amount of volatile solids together with N retention rates would be beneficial.

The Danish case study looking at manure management technologies showed that the combined effect of frequent removal from the stable and use of anaerobic digester in the slaughter pig unit was almost as effective as digester used in the whole chain. These effects will interact with production system, like type of housing, and efficiency, particularly feed efficiency and N excretion, as emission from manure is a major part of the total emission and directly linked to manure technologies.

Evaluating greenhouse gas emissions from applying mineral and organic fertilizers for Danish and Swedish conditions, it is reassuring that the N_2O emissions generated from the AU methodology and PEF showed similar results. Acidification potential results will differ between the two methodologies as the NH_3 emissions were twice as high for the PEF method compared to AU method. There is a need to investigate why this is to evaluate if the PEF method is overestimating emissions. Do the differences in nitrogen leakage due to difference in methodology have any impact on the environmental footprint? It only has a minor significance if only the carbon footprint is evaluated. Nitrogen leaching contributes to indirect N_2O emissions that have some impact on the carbon footprint, while phosphorus leaching does not contribute to any climate impact. However, if eutrophication is assessed, the method chosen has a great impact on the result. The main impact on eutrophication for environmental footprints of crops or feed materials is the leaching of nitrogen and phosphorus and can account for up to 90% of the eutrophication potential.

Recommended further work for the NordPEF group

Further work can be a case study comparing tier 1 and tier 2 methods for the Nordic countries.

Task 3.

Title
Biodiversity in LCA
Authors
Hanne Møller & Anna Woodhouse (NORSUS), Katri Joensuu (LUKE)
Summary
There are several methods developed for quantifying biodiversity impact in LCA, however most of them have limitations for example being restricted to certain locations, or global without meaningful results or restricted to only one taxonomy group. A method for assessing biodiversity in LCA should be applicable for farm level and up to a global scale, distinguish between different agricultural intensities, e.g., when assessing organic agricultural products using LCA, the omission of biodiversity is problematic, because organic systems are characterized by higher species richness at field level compared to the conventional systems. A biodiversity method for LCA inclusion should also have data available in existing data (databases etc.) and it should be possible to related to a functional unit. In this report several biodiversity methods for inclusion in LCA were described based on theif applicability on a global scale, inclusion of the effect of land management practices in the method, methods suitable for comparison between organic and conventional production and finally, a discussion of the lack of methods that can account for biodiversity in pastures and grasslands. he UNEP-SETAC Life Cycle Initiative (UNEP/SETAC, 2016) have recommended the biodiversity method by Chaudhary et al. (2015). The FAO guidelines for quantitative assessment of biodiversity in the livestock sector (FAO, 2020) have recommended the method by Chaudhary & Brooks (2018), which is an updated version the first mentioned method. The Chaudhary & Brooks (2018) appears so far to be the best method that meets the most important criteria for quantifying biodiversity in LCA: global applicable and associated characterisation factors that includes production intensity. A case study using the Chaudhaury and Brooks (2018) to assess the effect on biodiversity of steers and bulls in Sweden was presented. Bulls staying indoor their whole lifetime and steers grazing semi natural pastures for parts of the year. The results showed that the biodiversity method does not consider the evidence based positive impact grazing has on semi natural pastures. To only account for the indoor stable periods for the steers was deemed the most appropriate way of comparing the two production systems. When doing that, the biodiversity impact for the bull and steer systems were quite similar.
Conclusions
When choosing a biodiversity method, it is important to clarify the goal and scope of the study in question. Is the purpose of the study to get an overview of a global value chain, an assessment at the regional level between different types of grazing and roughage practice, or compare conventional and organic production? Based on the description of the methods in this report, it is clear that some methods are more suitable for a certain goal and scope than others. Currently, none of the mentioned methods can directly be taken into use in assessing the biodiversity impact of agricultural production in Northern European conditions. Knudsen et al. (2017) includes only Denmark and the southern part of Sweden of the Nordic region. The method of Meier et al. (2015) is only validated for use in Central Europe. The SALCA-BD method (Jeanneret et al. 2014) and the method proposed by Lindner et al. (2014) require additional expert evaluation for the definition of the calculation equations. The method proposed by Lindner et al. (2019) seems promising, but it contains a large number of different parameters and should first be tested in a case study to find out whether all the parameters are really needed and if the workload related to the data collection could be reduced by reducing the number of parameters.

If the scope is global or regional, the method by Chaudhary & Brooks (2018) is relatively easy to use because it includes the characterisation factors and it provides a good overview of the value chain. However, the method is not suitable for distinguishing between organic and conventional production or product systems at the local level. In this report we displayed a case study for beef production. For production systems where the feed is produced from feed crops, such as cereals, oilseeds and legumes, the method of Chaudhaury & Brooks (2018) is currently the best available method and can reflect where in the life cycle the largest impacts on biodiversity originates. It is important to note that Chaudhaury & Brooks (2018) is not taking into account the impact of land use on insects which may lead to an underestimation of the impacts in this model. No method to date can account for positive impacts on biodiversity in an optimal way e.g., when semi-natural areas are used for grazing.
Recommended further work
The AWG is deciding on recommendations on how to assess biodiversity which will be presented in February 2022. The NordPEF group think it is suitable to wait until this date until we recommend further work on biodiversity.