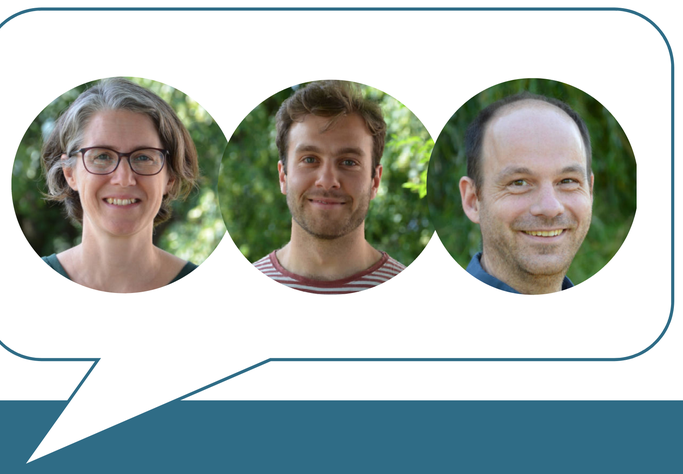

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FarmLCA: modelling implications of farm management changes towards agro-ecology

Why?

- Environmental impacts and potential trade-offs of **agro-ecological innovations** are currently not well captured in LCA models.
- Models miss **interlinkages of crops and livestock** and cannot assess consequences of management changes on farm (e.g. manure availability) for mixed livestock and arable farms.
- A **new modelling tool** was developed and tested on a **Scottish beef farm** converting to a **feed-no-food scenario.**

FarmLCA model

- Combined **cradle-to-farm gate LCA** and **farm system model**
- **Emission models** for crops and livestock, incl. soil organic carbon, N and P leaching etc. (Table 1)
- **Crop-livestock interactions**: Implications on **manure and feed availability**
- Link to **life cycle inventory databases**
- **Plausibility checks** for fertilisation and feeding
- **Environmental impacts** for farm, plot, food product
- Implemented in MS **Excel**

Case study: Scottish feed-no-food beef

- **Per kg beef,** the feed-no-food scenario (Fig.1; B) had **5% higher climate impacts** than the baseline (A), due to increased methane emissions per kg (slower growth), although impacts of off-farm feed decreased.
- **Freshwater eutrophication** and **land use** were **reduced by over 10%** in the feed-no-food scenario, due to omitting off-farm feed.
- Model was able to display **environmental trade-offs** and implications on **manure and feed availability.**
- **Outlook**: Improved feed-no-food scenario will be assessed, better using synergies between crops and lifestock to improve environmental performance.

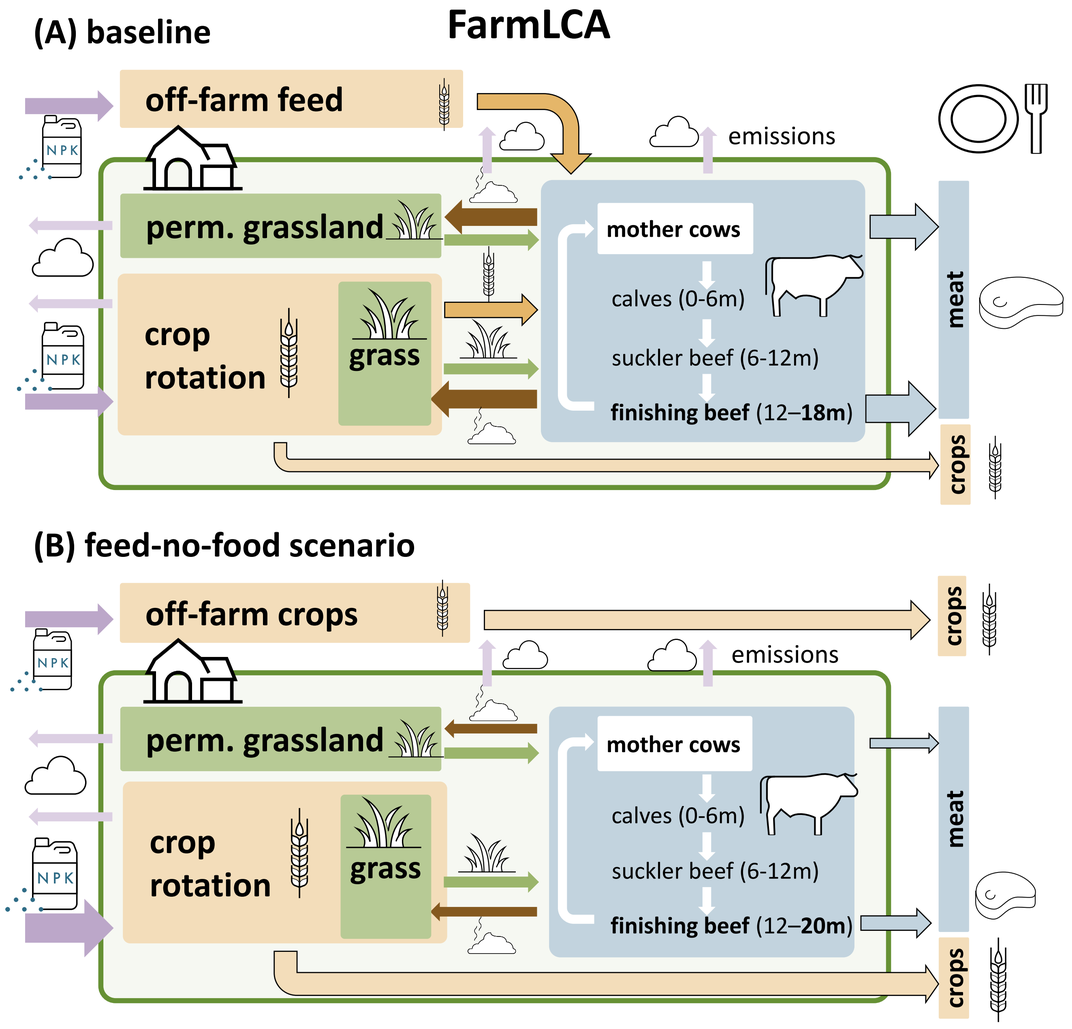

Fig. 1: Moving towards **feed-no-food beef** production on a typical **Scottish farm.** The FarmLCA allows to **model implications** in 1) **manure** and **feed availability,** 2) **meat** and **crop output,** 3) **emissions** from crops and livestock, 4) required **external inputs** and 5) overall **environmental impacts** (cradle-to-farm gate LCA).

Table 1: Emission models implemented in FarmLCA

Production	Emission	Method
Crop field emissions	N_2O	IPCC 2019 (Tier 1 & 2)
	CO_2	IPCC 2019 (Tier 2)
	NO_x	EMEP/EEA 2023 (Tier 1)
	NH_3	EMEP/EEA 2023 (Tier 2)
	NO_3	SQCB-NO3
	PO_4, P	SALCA-Phosphorus
Manure management	CH_4	IPCC 2019 (Tier 2 & 3)
	N_2O	IPCC 2019 (Tier 3)
	NH_3	EMEP/EEA 2023 (Tier 2)
Enteric fermentation	CH_4	IPCC 2019 (Tier 2 & 3)

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