New Zealand GHG inventory: Case Study for Dataman Project

Reason for inclusion

- Agriculture is New Zealand's most important source of greenhouse gas (GHG) emissions (47%), with emissions from manure management (direct deposition and effluent management) being significant contributors. The degree of contribution from agriculture makes New Zealand unique among its Annex 1 neighbours.
- We have access to the New Zealand inventory structure, through contacts with the MPI inventory team (Joel Gibbs) and related project work on improvements to the methodology used within the National Inventory Manure Management (led by Jiafa Luo; AgResearch).

Describe current inventory method for accounting for GHG emissions from MM

A summary of current methodology used to estimate the N_2O emissions from manure management systems in New Zealand is reported in Fig. 1. Emissions for key livestock classes (dairy cattle, beef cattle, sheep and deer) are based on a Tier 2 methodology. Estimates of livestock metabolisable (ME) energy requirements (MEreq), from animal production data and population characteristics, and ME content of diet to estimate dry matter intake (DMI) are multiplied by nitrogen (N) content of diet to estimate N excretion. All pastures have a 'fixed' monthly national average ME and single fixed N content value. Excreta is partitioned into dung and urine based on the N content of the diet.

Country specific emission factors are used to estimate the direct and indirect N_2O emissions from dung and urine deposition, and from effluent applied to land. Default IPCC emission factors are used for estimating CH_4 and indirect N_2O emission from stored farm dairy effluent.

Case studies, summarising, for each country, the ability of the current inventory to capture manure emissions accurately, and recommendations for improvements

The New Zealand inventory structure is currently relatively simple for manure management systems. The current structure is shown in Fig. 2.

As part of a recent project for MPI, a revised model framework (Figs. 3 and 4) has been developed (Luo et al. 2019). Below are the key points from the project's executive summary:

"The revision takes into account the activity data, type and amount of manure generated, and the management conditions, in order to calculate GHG emissions from managed manure. This was based on outcomes from a review of the published and unpublished NZ and international literature and a workshop of national and international manure management experts. A possible future structure for MMS to account for inclusion of improved emission factors (EFs) and potential mitigation methods is proposed (Fig. 3 and 4).

Knowledge and data gaps that require further investigation to increase the accuracy of the accounting of GHG emissions from manure management in the NZ GHG inventory have been identified. These are summarised below:

1. Derive EFs for ammonia (NH_3), N_2O and CH_4 for populating new manure management frameworks. It is recognised that the Dataman project will be a valuable source of information.
2. Revise the methane conversion factor (MCF) value used for farm dairy effluent. The NZ GHG inventory calculation method currently assumes FDE ponds align with the IPCC 'anaerobic lagoon', however, Prof. Sven Sommer suggested this should be re-assessed, as the associated MCF value of 0.74 is too high for NZ manure. IPCC manure category 'liquid manure' may be more suitable. We recommend this issue requires a more thorough assessment. Specifically, the MCF should be measured under local environmental conditions in order to represent the variety of specific NZ storage facilities.

3. Develop a spreadsheet based on the proposed manure management (MM) GHG framework (Figs 3 and 4) to provide a simple method for evaluating the influence of activity data and EFs on GHG emissions from MMSs".

Continued work for the inventory team at MPI will be aligned with the work being undertaken in Dataman.

References

Luo J, van der Weerden T, Saggar S, de Klein C, Rollo M, Longhurst B. (2019). Refining New Zealand's GHG inventory methodology: manure management – Final. Report for MPI. Pp. 76.

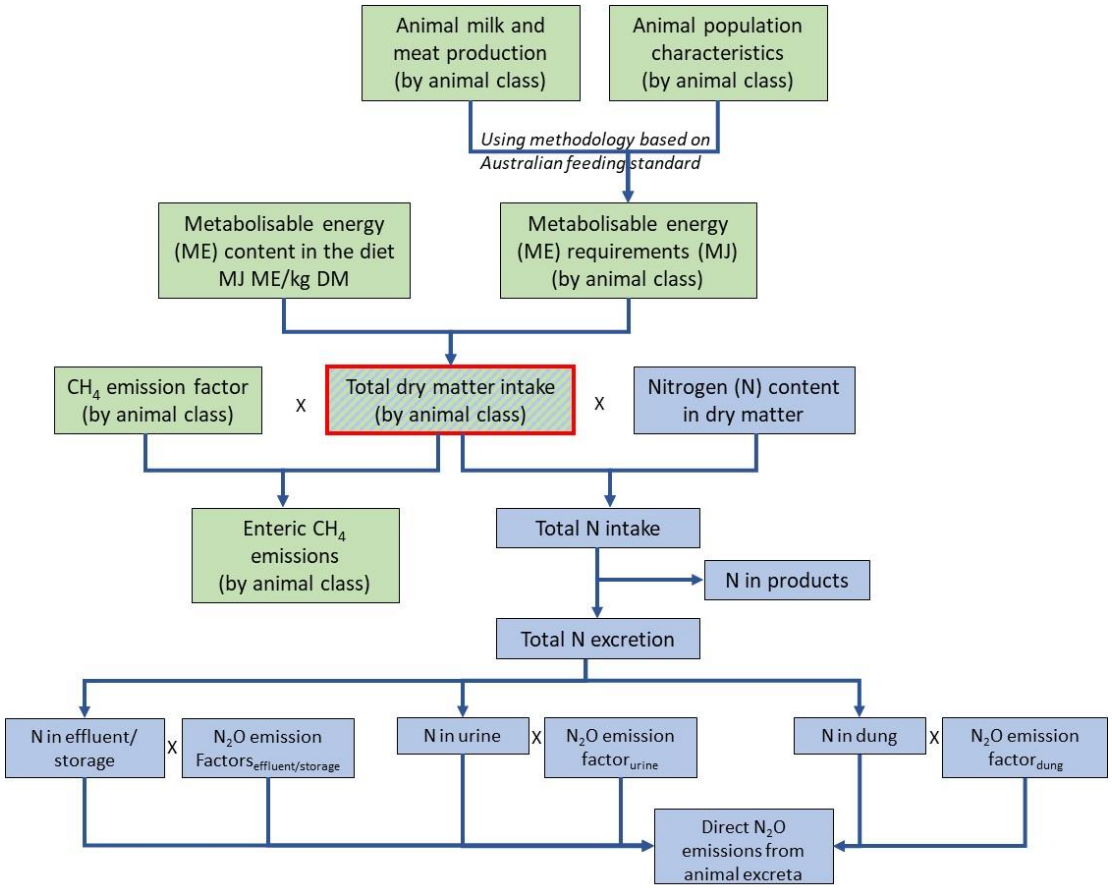

Fig. 1: General principles of GHG emissions from agriculture in New Zealand.

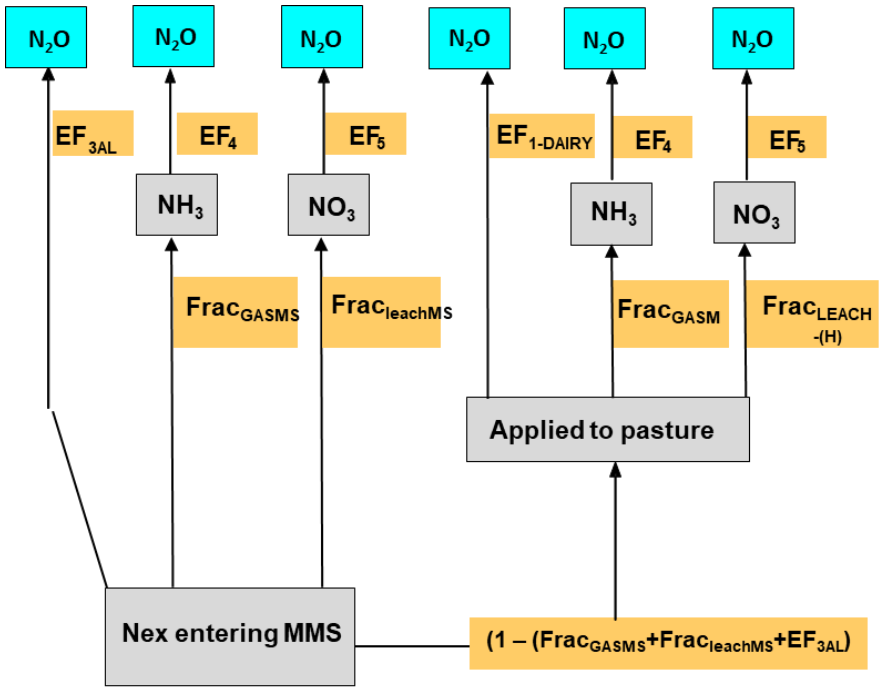

Fig. 2: Current framework for calculating N_2O emissions from MMSs (Manure Management Systems).

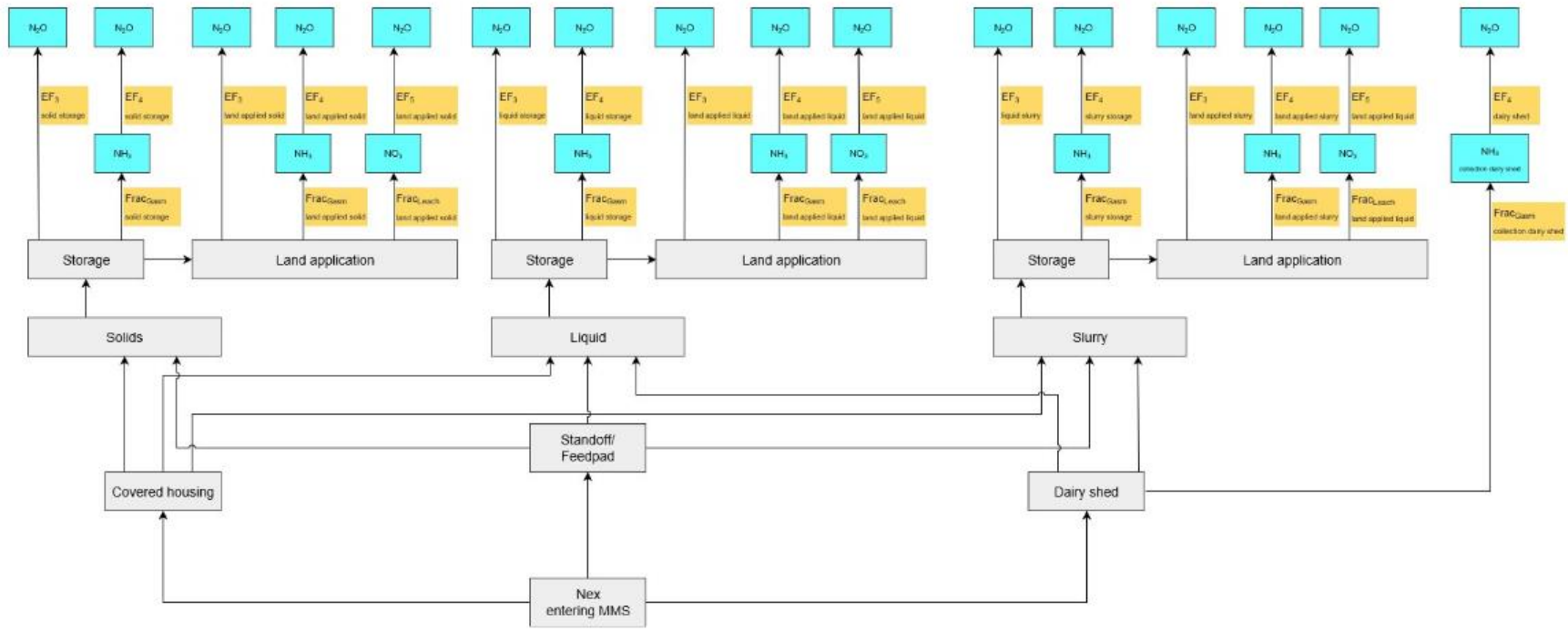

Fig. 3: Proposed framework for calculating N_2O emissions from MMSs (Manure Management Systems).

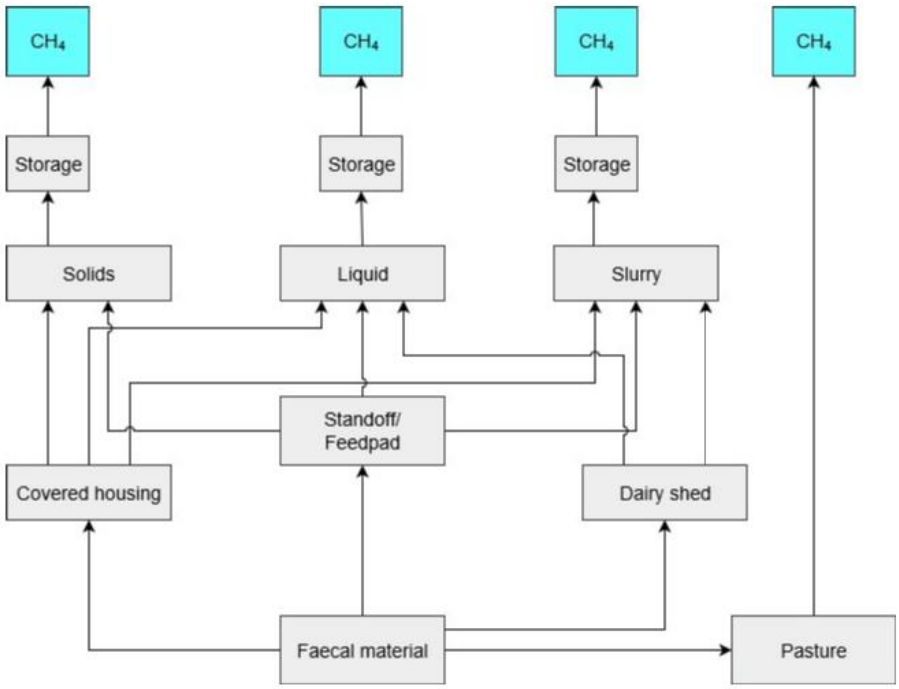

Fig. 4: Proposed framework for calculating CH_4 emissions from MMSs (Manure Management Systems).