Chilean GHG inventory – Manure management systems

Dataman Project

Reason for inclusion

The interest of Chilean inventory for manure management can be summarized into 3 points, which are describe as follow:

- We have access to Chilean inventory structure by Marta Alfaro and Francisco Salazar, whom are working in this project.

- Agriculture is the second sector supplying greater greenhouse gas (GHG) emissions (10.6%), after energy sector, which supply 78% of total GHG emissions. Emissions from manure management are the third most important category of Agriculture, supplying 17% of the sector, after enteric fermentation (40%) and agricultural soils (38%).

- Chilean inventory of manure management includes the Nitrous oxide (N_2O) and methane (CH_4), which are the interest for DATAMAN project, including NH3 emissions. N_2O emissions from manure management are calculate using a combination of Tiers (1 and 2) and emissions factor (default and country-specific), including direct emissions from storage systems, and indirect emissions from manure management system, urine and dung. On the other hand, CH_4 emissions from manure management are

Describe current inventory method for accounting for GHG emissions from MM (separate diagrams and table)

A summary of current methodology used to estimate the N_2O emissions from manure management systems in Chile is reported in Figure 1. Briefly, animal population is calculated using the Agriculture and Forest Survey of 1997 and 2007 (CENSO), and Biennial report of ODEPA. Animal population from 2007 to 2019 are extrapolated from a combination between data supplied for CENSO surveys and ODEPA reports, using a Tier 2 approach. Nitrogen

excretion rate of animals is calculated using the IPCC equation, which includes the animal body weight. Body weight is calculated according to Expert judgement.

Once Nitrogen excretion rate per animal is calculated, animals are classified in different Manure management systems, according to Expert Judgments. The main manure management are piles storage and lagoons under aerobic and anaerobic conditions. N_2O emissions from these systems are calculated using TIER 2 methodology and country-specific emission factors. All of these manure systems are considered as direct emissions.

Indirect emissions of N_2O comes from 2 categories: 1) Manure management systems (via NH_3 volatilization and NOx emissions) and 2) Direct deposition of urine and dung. All of indirect emissions are calculated using TIER 1 methodology and default Emission Factors.

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

The analysis of Chilean inventory for manure management systems showed six potential improvements in its structure, which are showed in the Figure 1.

The first potential improvement is the Animal population estimation, which consider a TIER 2 methodology. However, the estimation of total number of animals is extrapolated from the Agriculture survey in 2007, suggesting a bias in the current number of animals and total GHG emissions.

The second improvement point is the N excretion rate estimation, which include the body weight of animal according to Expert Judgment. In this way, it is possible that the amount of N excretion could be under or overestimated, indicative of bias in the GHG reported.

The third improvement point is the classification of manure management systems. Currently, the N excretion is classified into several type of manure management according to Expert Judgments. Under this situation, Chilean inventory could be under or overestimating the amount of GHG emitted by manure management systems. Therefore, the selection of mitigation strategies for the most important manure management system may not be accurate.

The fourth and fifth improvement points are the estimation of N_2O emission following the land application of manure and direct deposition of urine and dung using the TIER 1 methodology. Livestock systems, especially dairy and beef cattle are pasture grazing-based systems, suggesting an important effect on total N_2O emissions from manure management. Therefore, it should be estimated using a TIER 2 methodology and country-specific emission. Considering the importance of grazing system in Chilean farm, the use of TIER 1 and default emissions factors for urine and dung N_2O emissions could not be the best way.

The sixth potential improvement in the inventory structure is the estimation of indirect emissions of N_2O using a TIER 1 methodology. It considers the NH_3 as indirect source of N_2O emissions, however, NH_3 should be consider as a principal gas such as CH_4 and N_2O.
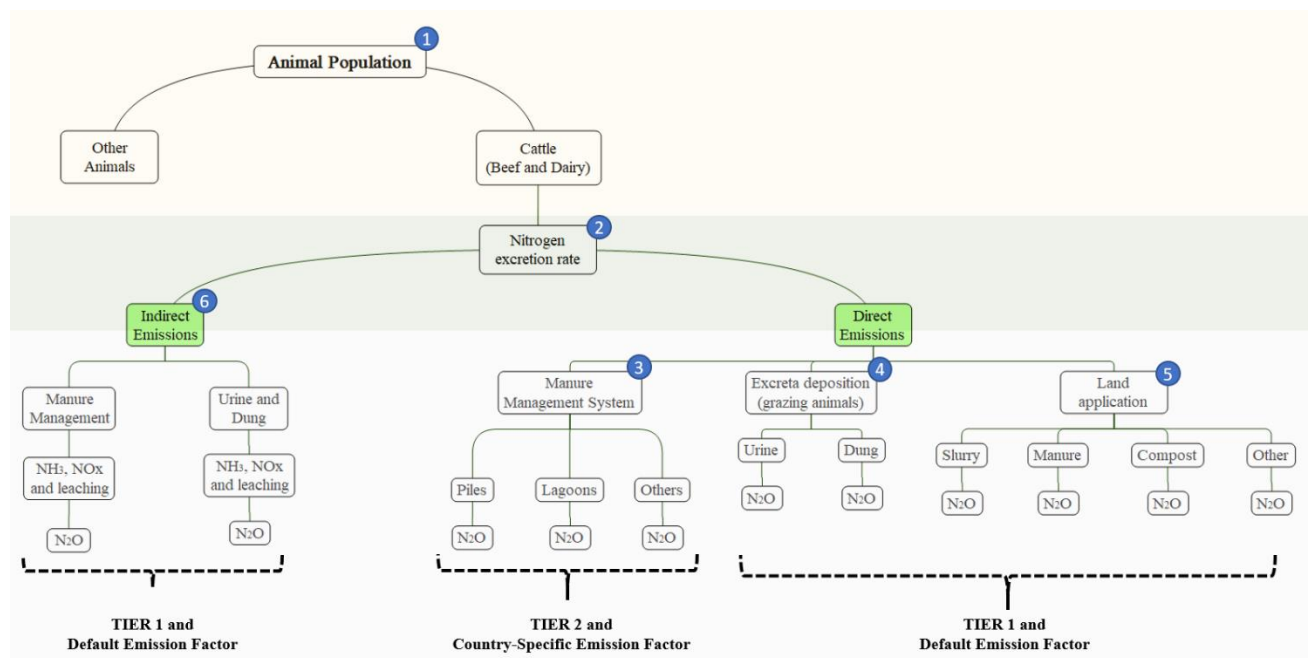
Figure 1. Chilean inventory of nitrous oxide emissions from manure management systems. Numbers 1 to 6 show potential inventory improvements. Adapted from third biennial report of climate change, 2018.