

Comparison of models used for the calculation of national ammonia emissions from agriculture in Europe

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Background and objectives

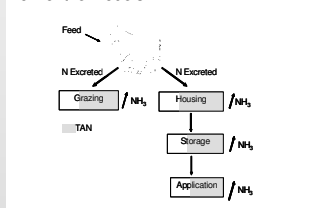
Within the framework of the Gothenburg Protocol and policy implementation accurate calculations and inventories of total national ammonia (NH₃) emissions are required. To allow a coordinated implementation of the protocol, different national inventories should be comparable; at present they are not.

A core group of emission inventory experts has therefore inaugurated the EAGER network (European Agricultural Gaseous Emissions Inventory Researchers Network), with the aims of achieving a detailed overview of the present best available inventory techniques, compiling and harmonizing the available knowledge on emission factors (EF) and initiating a new generation of NH₃ emission inventories. As a first step in summarizing the available knowledge, the objective was to determine the degree to which results obtained with six different N-flow models currently used for NH₃ emission calculations agree, and to evaluate any larger disagreements.

The approach

Six N-flow models (Fig. 1, Tab. 1) used to calculate NH₃ emissions from agriculture for inventories and policy implementation in different European countries were compared using standard activity data sets. Three different levels of model standardizations were used to calculate NH₃ emissions for a dairy cow scenario (Tab. 2).

Fig. 1: Schematic representation of the N flow of the models.



Tab. 1: Models used for the scenario calculations.

Model	Country	Objectives of the model
DYNAMO	Switzerland	Estimation of the magnitude of NH ₃ losses at the farm and national level; national emission inventory, evaluation of abatement potential
DanAm	Denmark	Estimation of the magnitude of NH ₃ losses at the national level; national emission inventory
GAS-EM	Germany	Estimation of NH ₃ and other N losses at the national level; national emission inventory
MAM	Netherlands	Manure policy analyses and estimation of NH ₃ emissions at the farm and national level
FARMMIN	Netherlands	Ex-ante evaluation of the effect of management on profitability and nutrient losses.
NARSES	United Kingdom	Estimation of the magnitude, spatial distribution and time course of agricultural NH ₃ emissions at the national level; national emission inventory, calculation of cost curves

Tab. 2: Different levels of model standardizations used for the model comparisons

Scenario	Nitrogen excretion [kg N yr ⁻¹]	Emission factors
FF	Fixed*	Fixed
FN	Fixed	National**
NN	National	National

* Same value used in all models
 ** Model-specific values used

Results

Fig. 2: Results obtained for the FF scenario. (standardized N excretion rates and standardized EFs)

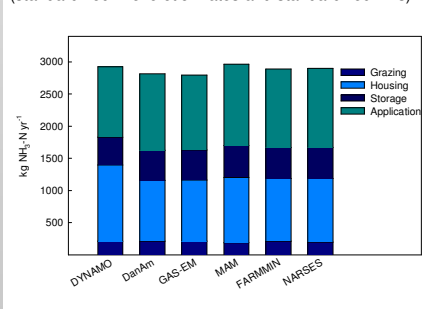


Fig. 3: Results obtained for the FN scenario. (standardized N excretion rates and national EFs)

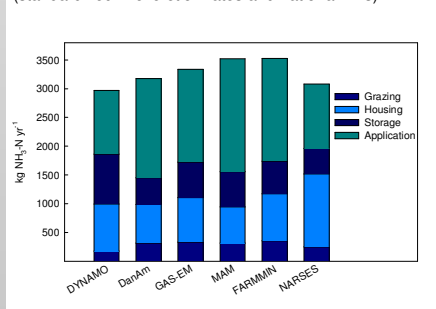
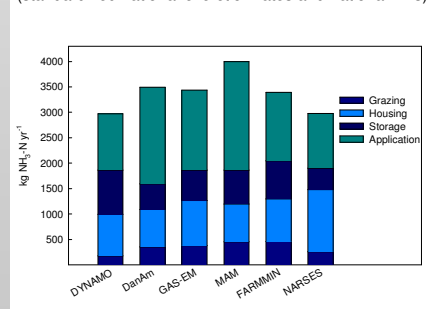


Fig. 4: Results obtained for the NN scenario. (standardized national excretion rates and national EFs)



Conclusions

- × Very similar estimates of the NH₃ emissions were obtained for the FF scenario indicating that the underlying N flows of the different models are highly comparable.
- × Differences were more pronounced when the emissions were calculated with national emission factors and/or national N excretion rates (FN and NN scenarios).
- × The variation in the calculated emissions for the FN and NN scenarios was primarily the result of the distinct national emission factors and N excretion rates which reflect the specific livestock and manure management systems and the specific climatic conditions of the countries.