The German Experience

GAS-EM – comprehensive treatment of emissions and the N_2 problems in manure management

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Modelling of animal excretions in GAS-EM

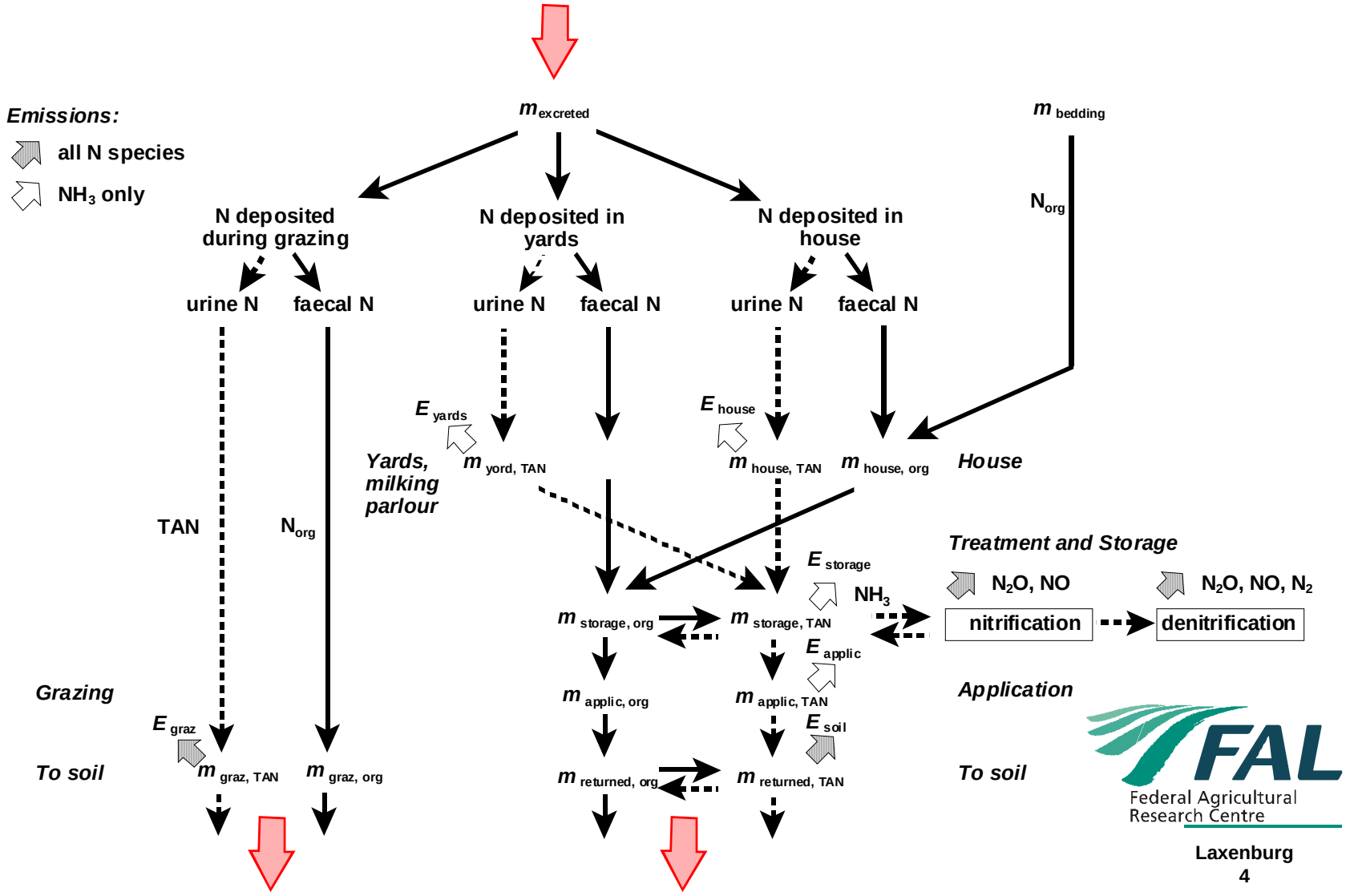
- Modelling in principle according to IPCC using a mass balance approach reflecting energy and nutrient requirements as a function of animal performance and actual feed composition
- Modelling results in different N excretion rates (faecal and renal) for the relevant animal subcategories and each spatial unit (Federal State, district) and each year
- We are confident that the results obtained reflect the German reality (comparison with measured data).

Modelling of the subsequent N mass flow

- according to Dämmgen and Hutchings (2007) (or the new Guidebook chapter) chapter using
- national emission factors for NH_3 as often as possible
- EMEP/CORINAIR partial emission factors for NH_3 and NO
- IPCC emission factors for N_2O

Structure of GAS-EM

The mass flow approach for mammals including all nitrogen species



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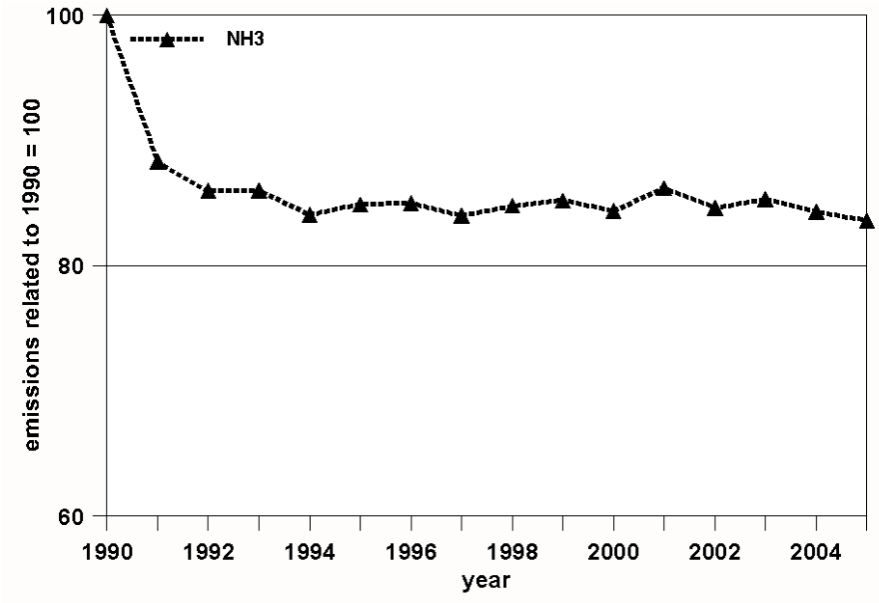
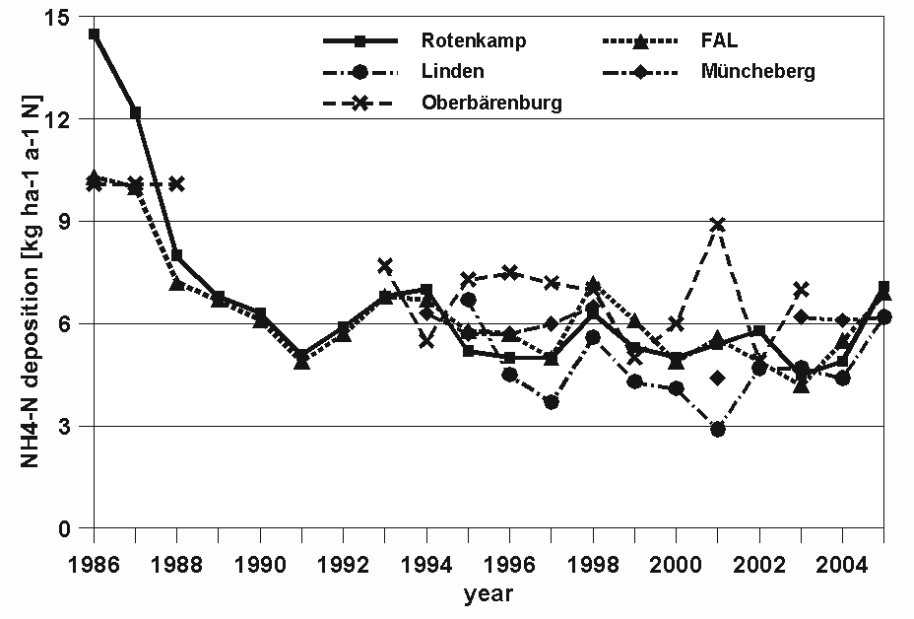
External Evidence?

The emission pattern must be similar to the deposition pattern.





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Treatment of N_2O in the mass flow

- There is no emission factor for N_2O from houses, as these emissions are considered negligible according to IPCC(2006), Chapter 10.5 (absence of oxidized N) (accepted)
- N_2O emission factors relate to N excreted.

  We calculate N_2O emissions according to IPCC (differentiation between various storage types) and subtract the amount of N emitted from the TAN pool "TAN after housing".

Problems: the amounts of N_2O

The basic problem

- N_2O emissions are related to the N input. In principle they should be related to N turnover rather than to N inputs.
- For the application of mineral fertilizer we know:

  "The German sites show no correlation between applied N and emitted N-N_2O…" (Jungkunst and Freibauer, 2005).

  "N_2O emissions decrease in Europe with increasing N application to cereals" (Kasimir Klemedtsson and Klemedtsson, 2002).

- What about manure N?

Problems: the amounts of N_2 and NO

Treatment of N_2 in the mass flow

- Where there's N_2O there is N_2.

- Where there's a will there is a way.

Attempts have been made to relate NO and N_2 emissions to N_2O emissions. A constant ratio is assumed for liquid and solid animal manures

$N_2O : NO : N_2 = 1 : 0.1 : 3$

(suggested by Jarvis und Pain, 1994)

Treatment of N_2 in the mass flow

- The treatment of N_2O, NO and N_2 according to IPCC and Jarvis and Pain is satisfactory as long as there are (nearly) no N_2O emissions.

  This holds true for liquid slurry without a natural crust only!

- For solid systems in particular, the N_2O emission factor and the derived factors for N_2 and NO are (very) doubtful.

Problems: immobilization and mineralization

In solid systems, TAN is immobilized when (appropriate?) bedding material is used in the house

- Question: how are Kirchmann and Witter (1989) to be interpreted?
- The (present) German assumption:

  If enough straw is supplied, then a constant fraction of TAN is immobilized (40 %).

  A variable fraction could also be calculated as a function of the amount of straw added.

Problems: immobilization and mineralization

However:

Solid manure is mineralized during storage.

- Question: can the dynamics of FYM degradation be reproduced in a model?

- The (present) German calculations assume comparatively high loss rates for NH_3 from solid manure stores.
  Hence, FYM is degraded. N_2O (and N_2) might be emitted simultaneously.

Problems: immobilization and mineralization

In liquid systems, TAN is immobilized and N_{org} is mineralized.

- Statement:

  Apart from the fact that these processes take place, little is known about conditions and dynamics.

- The (present) German calculations assume that

  10 % of the TAN present at the beginning of storage are immobilized and

  10 % of the N_{org} present at the beginning of storage are mineralized (expert judgement Döhler).

Solutions

(1) Ban solid systems!

(2) Retire!

(3) Keep EAGER eager!

Initiate, perform and evaluate adequate measurements!

Johan's Question

What are the difficulties and the suggestions for implementing integrated nitrogen policies?

Difficulties:

(1) In Germany, there is hardly any (or: no effective) communication between the Ministries of the Environment and Agriculture with respect to integrated nitrogen.

Johan's Question

What are the difficulties and the suggestions for implementing integrated nitrogen policies?

Difficulties:

(2) In Germany, the number of people in the Ministry of Agriculture who know about integrated nitrogen policies does not exceed 2.

Johan's Question

What are the difficulties and the suggestions for implementing integrated nitrogen policies?

Difficulties:

(3) In Germany, the basic education in science fails to inform people about the fact that there are problems which are not linear (i.e. more complicated than: if A, then B).

This includes policy makers.

Johan's Question

What are the difficulties and the suggestions for implementing integrated nitrogen policies?

Difficulties:

(4) In Germany, reduction of the emissions of reactive nitrogen would result in a "threat" to the quality of life:

No politician who wants to be re-elected will seriously talk about changes in the human diet (less protein: less meat, less sausage, less cheese, …) or individual mobility.

Johan's Question

What are the difficulties and the suggestions for implementing integrated nitrogen policies?

Suggestions:

Within the Ministry:

(1) replace at least some of the lawyers by knowledgeable people,

(2) accept that facts may be as important as sectoral interests

Johan's Question

What are the difficulties and the suggestions for implementing integrated nitrogen policies?

Suggestions:

Within the society:

(3) Arise public awareness of the fact that the current (mis)use of nitrogen in Central Europe will definitely affect peoples' lifestyle and the potential lifestyle of their children.