Samfundsperspektiv – effekt af gylleforsuring på udledning af ammoniak, lattergas, metan osv. fra mark og lager

Workshop: Scenarie for fordoblet anvendelse af gylleforsuring i Danmark

Mandag den 18. september kl. 11.30 til 16:00

Hos Danske Maskinstationer og Enrepanører (DM&E), Porschevej 3, 7100 Vejle

dNmark research alliance

Baggrund

LandbrugsAvis

20. JULI 2017

Danmark har bl.a. nedbragt ammoniakfordampningen med bedre udstyr til gylleudbringning.

Danmark stemte nej men skal alligevel reducere ammoniak

Selv om Miljø- og Fødevareministeren stemte nej i Bruxelles, skal Danmark alligevel reducere ammoniakudledningen mere end noget andet EU-land.

Af Frederik Thalbitzer
lft@landbrugsmedierne.dk
tlf. 33 39 47 41

Danmark skal reducere udledningen af ammoniak, selv om ministeren stemte nej i EU.

Det er en straf for at have været ambitiøse, var Esben Lunde Larsens lidt bitre kommentar mandag.

For mandag godkendte ministerrådet trods dansk modstand nemlig at følge den protokol, der handler om, hvor meget de forskellige lande skal mindske udledningen af en række forskellige stoffer, bl.a. ammoniak.

Det betyder, at Danmark skal reducere udledningen af ammoniak med 24 pct. fra 2005 til 2020. Det er det suverænt højeste krav i EU, hvor landene i snit skal reducere med seks procent. Kravet er også betydeligt højere for Danmark end for nabolande som Sverige, der kan nøjes med 15 procent, og Tyskland, der kan nøjes med 5 pct. Danmark har ellers allerede fra 2005-2011 reduceret ammoniakudledningen med 11 procent, og det er markant mere end både Tyskland og Sverige.

»Vi skal arbejde for at mindske luftforureningen internationalt, men det er ganske enkelt ikke rimeligt, at Danmark skal reducere ammoniak med 24 pct. i 2020. I Danmark har vi længe haft høje krav til bl.a. dmændene, som mindsker ngen af ammoniak.

»Regeringen er forpligtet til at føre ammoniakreduktionen ud i livet, så vores nej i dag ændrer ikke på, at vi er loyale over for EUs mål.«

Miljø- og fødevareminister Esben Lunde Larsen (V).

Når vi så skal finde 24 pct. mere, er ammoniakmålene en straf for at have været ambitiøse. Fordelingen bør være mere fair, så den danske konkurrenceevne ikke forringes,« siger miljø- og fødevareminister Esben Lunde Larsen (V).

Nej og ja

Efter at ministerrådet nu har sagt god for Gøteborg-protokollen, skal den godkendes af de enkelte medlemslande. For fortsat at være loyal over for EUs ambitioner for at mindske luftforureningen agter regeringen - selv om ministeren stemte nej i ministerrådet - at godkende protokollen på Danmarks vegne.

Forpligtelserne i den reviderede Gøteborg-protokol, som den kaldes, skal i forvejen implementeres i dansk lov gennem NEC-direktivet, som blev vedtaget i EU i december 2016.

Danmarks egen skyld

De høje krav til Danmark har været debateret i årevis, men det er ikke lykkedes regeringen at få lempet kravene. Det er den tidligere regering med Ida Auken - dengang SF, nu radikal - som miljøminister, der selv sagde til EU, at Danmark kan reducere udledningen af ammoniak med 24 pct. På samme måde bliver andre lande holdt fast på deres tilbagemeldinger, f.eks. skal Frankring, der i 2005-2011 øgede ammoniakudledningen med tre pct. kun reducere med fire procent frem mod 2020.

Reduktionskrav

Så meget skal Danmark reducere udledningen fra 2005 til 2020:

- NOx: 56 procent
- VOC: 35 procent
- SO2: 35 procent
- NH3 (ammoniak): 24 procent

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LRTAP Long-range Transboundary Air Pollution

Task Force on Reactive Nitrogen

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Welcome to the TFRN website
This is the website of theTask Force on Reactive Nitrogen (TFRN) under the Working Group on Strategies and Review of the UNECE Convention on Long-range Transboundary Air Pollution

TFRN is led by Denmark.

The Co-Chairs are Mark Sutton (United Kingdom), Tommy Dalgaard (Denmark) and Claudia Marques-dos-Santos Cordovil (Portugal).

The Task Force holds plenary meetings at least once a year, see below for details on the past and future TFRN meetings.

Several Expert Panels have been set up by the TFRN, the Expert Panel on Mitigation of Agricultural Nitrogen (EPMAN) the Expert Panel on Nitrogen Budgets (EPNB), the Expert Panel on Nitrogen and Food (EPNF) and the Expert Panel on Nitrogen in countries of Eastern Europe Central Caucasus and Asia (EPN-EECCA). These panels can meet more often than the TFRN, work on specific issues and provide input to TFRN.

TFRN-12

TFRN-12 will be held in Aarhus Denmark, 29th & 30th June, 2017. Please visit the TFRN-12 page for further details.

Sidebar nav

- TFRN-12 Registration
- Bibliography
- N in the News
- TFRN-10

UNECE for TFRN

You can return to the Convention's web page for TFRN here

UNECE Ammonia Guidance Document

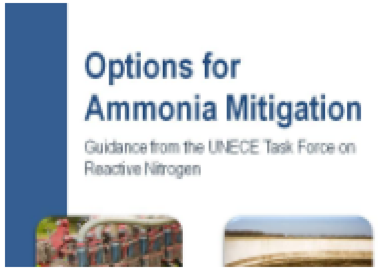


Figure 8: Ammonia emissions (thousand tonnes) in Denmark, Finland, Norway and Sweden during 1990–2012

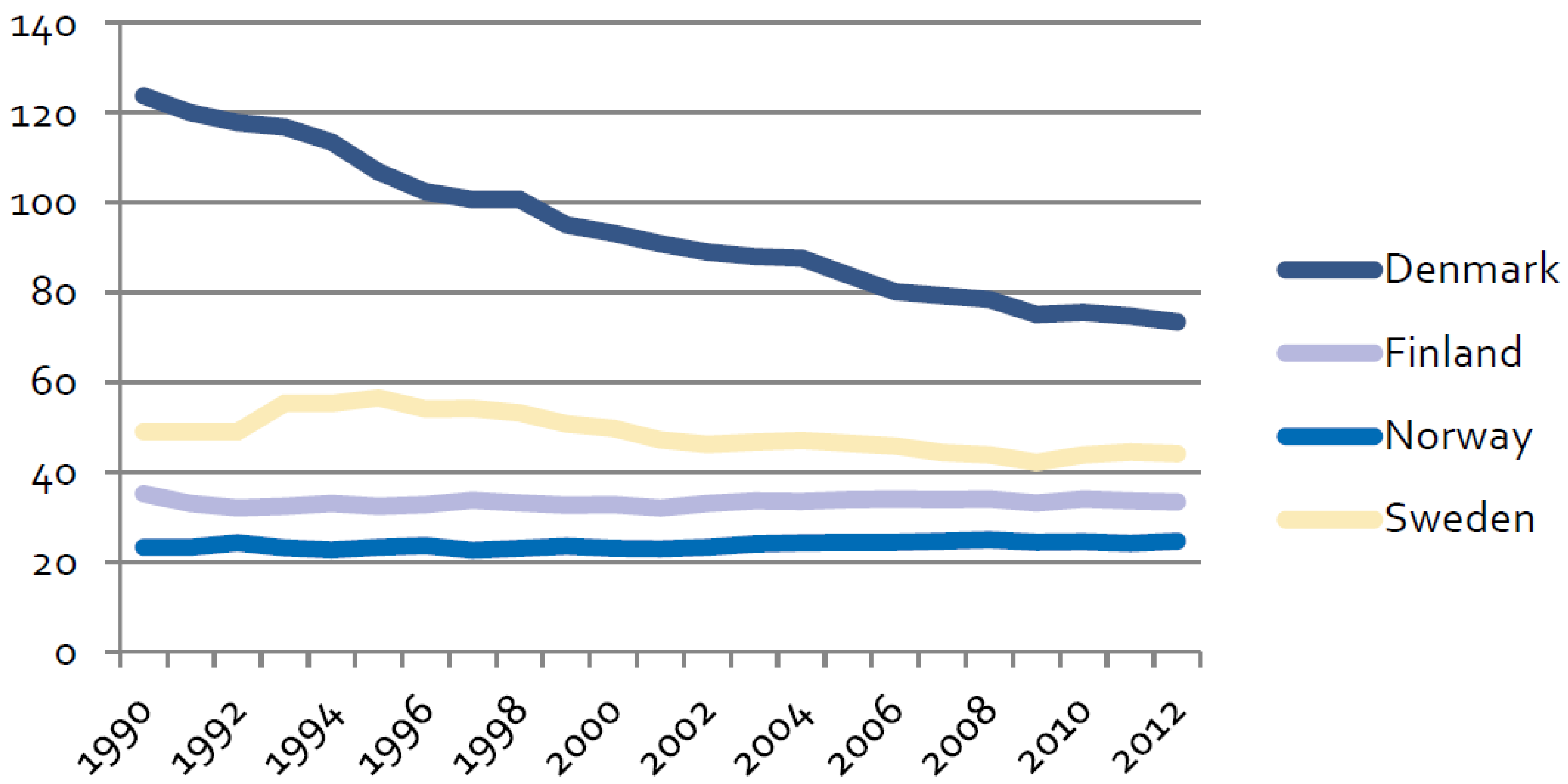


Figure 9: Nitrous oxide emissions (thousand tonnes) from agriculture in Denmark, Finland, Norway and Sweden during 1990–2012

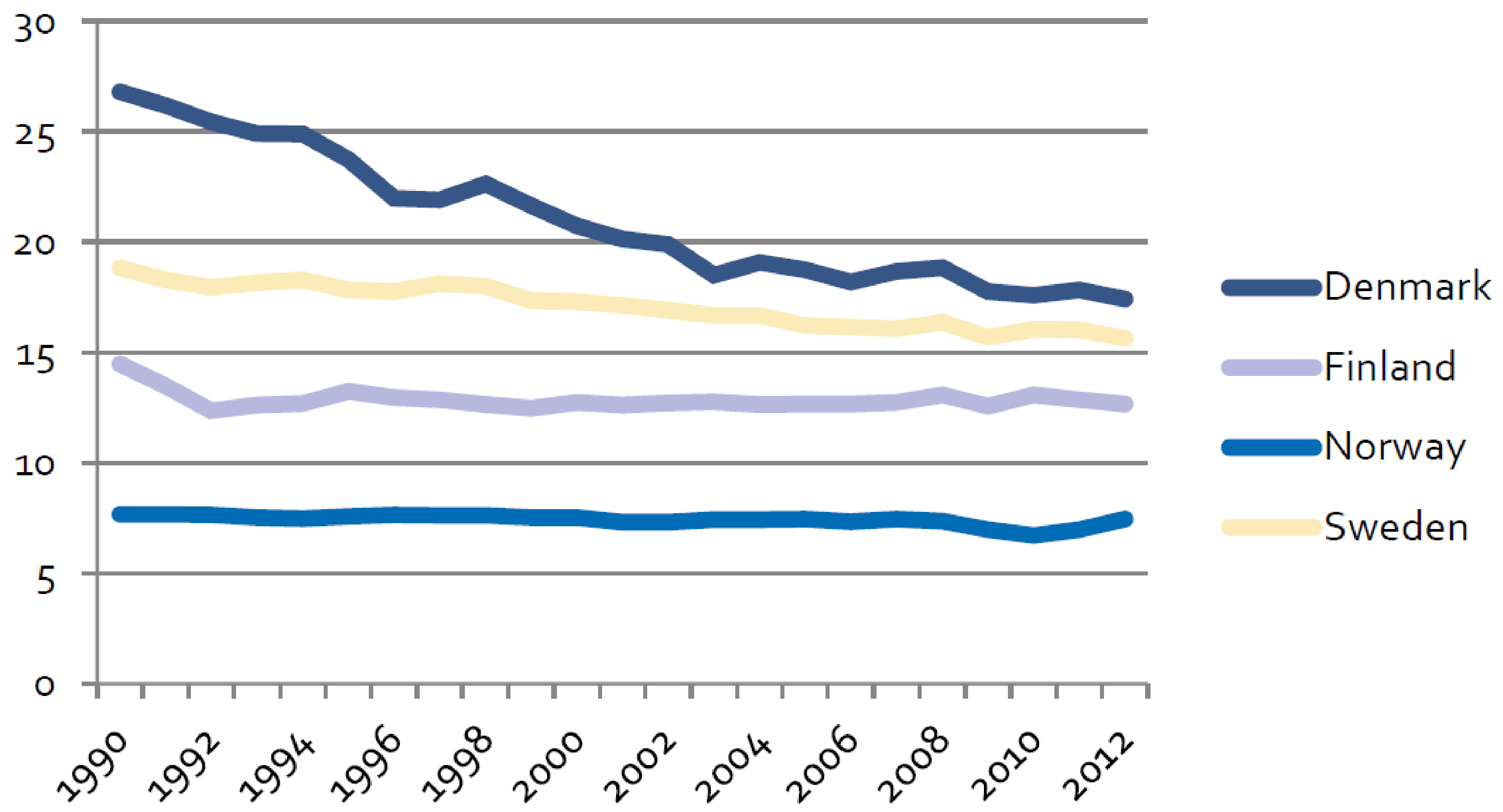


Figure 6: Ammonia emissions (thousand tonnes) in Denmark, Finland, Norway and Sweden during 201

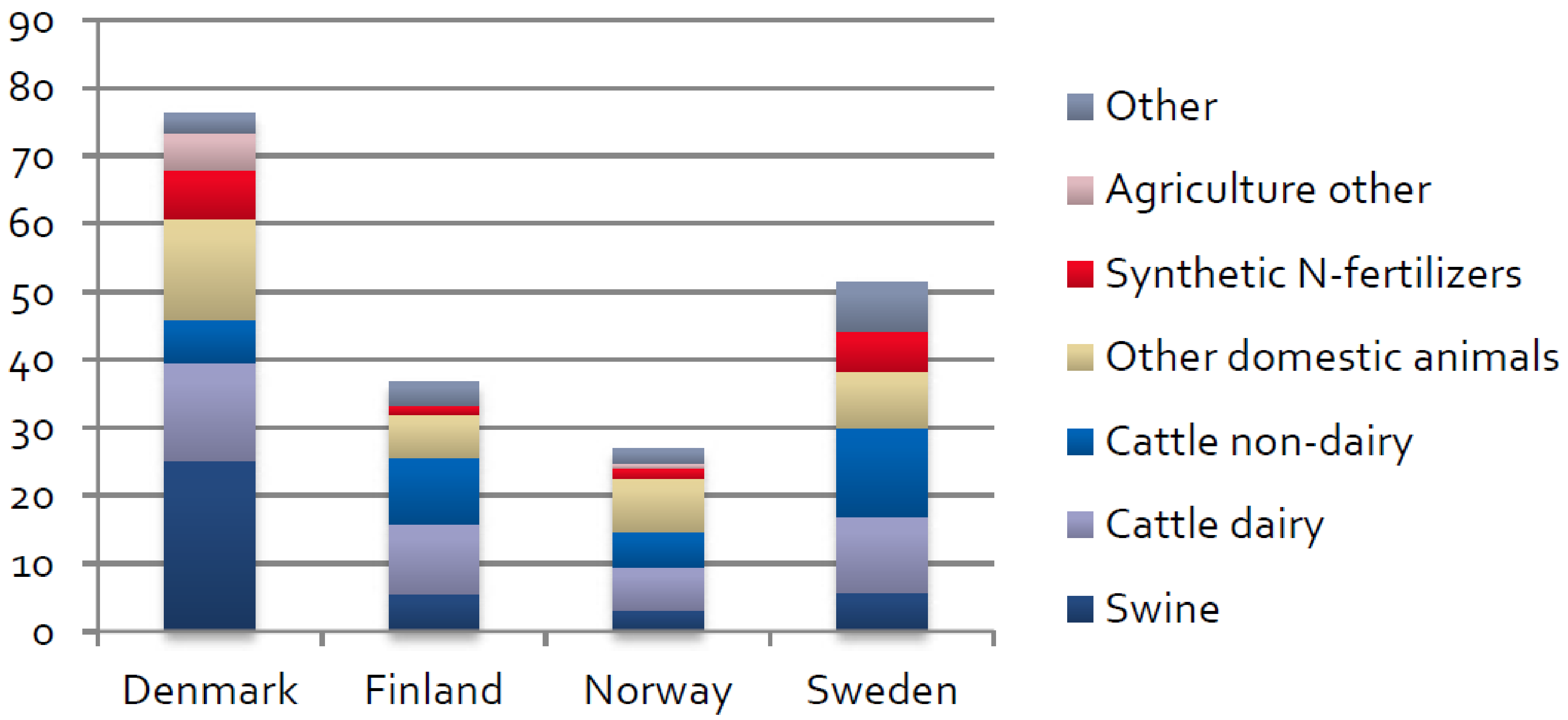
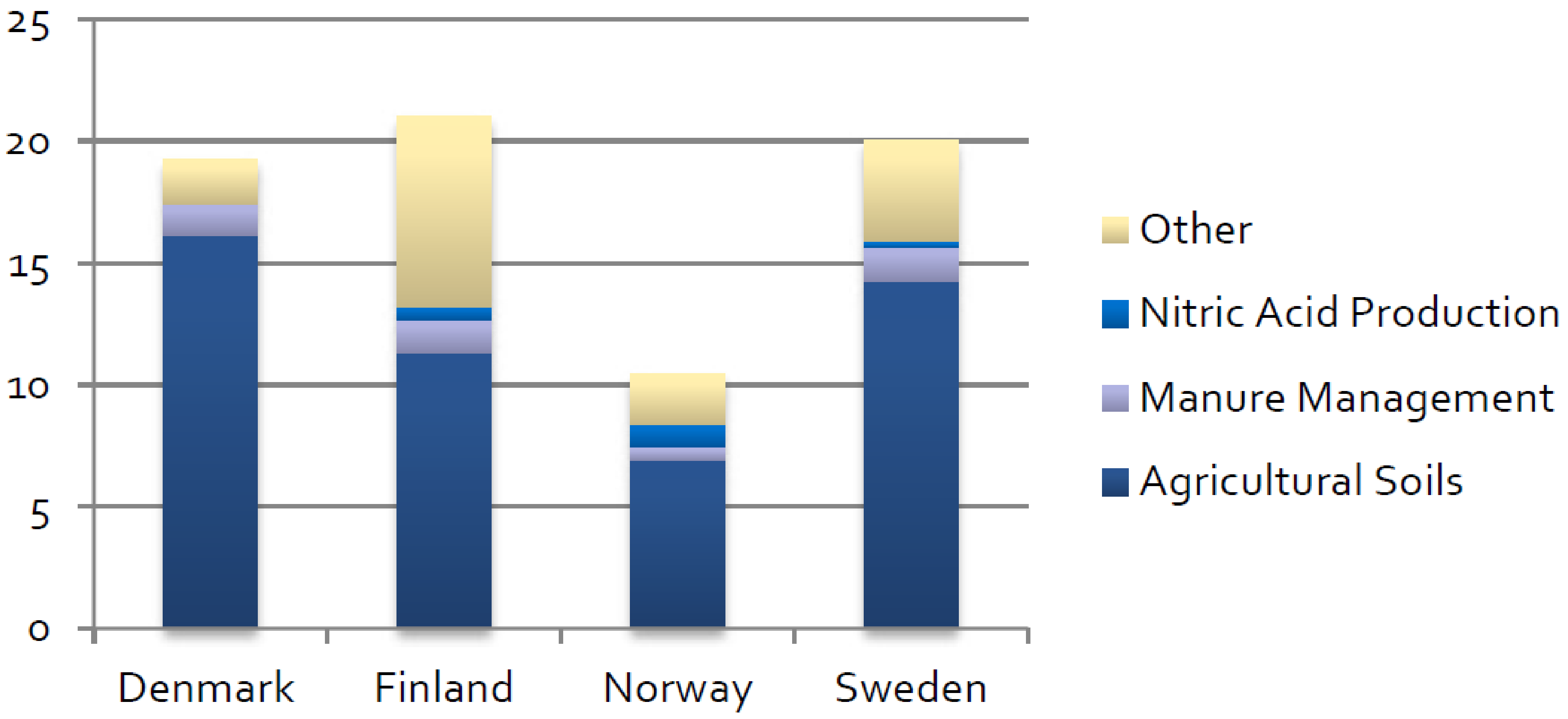


Figure 7: Nitrous oxide emissions (thousand tonnes) in Denmark, Finland, Norway and Sweden during 2012



UN-TFRN

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Task Force on Reactive N | NECDAmmoniaMethane_

www.clrtap-tfrn.org/sites/clrtap-tfrn.org/files/documents/NECDAmmoniaMethane_UN-TFRN2015_0513%20combi.pdf

Methane and Ammonia Air Pollution

Policy Brief prepared by the UNECE Task Force on Reactive Nitrogen[1]. May 2015.

There are significant interactions between ammonia and methane emissions from agriculture. Overall, measures to reduce these gases go hand-in-hand through links to sector activity. While some measures offer synergistic benefits, there is an ongoing need to optimize practices in order to minimize trade-offs between the two gases. These interactions highlight the opportunity to further develop synergies when including both ammonia and methane the revised EU National Emissions Ceilings Directive (NECD).

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[1] This briefing has been prepared by the following authors: Tommy Dalgaard[a], Jørgen E Olesen[a], Tom Misselbrook[b], Cameron Gourley[c], Etienne Mathias[d], Juerg Heldstab[e], Alexander Baklanov[f], Claudia M d S Cordovil[g], and Mark Sutton[g] . (Affiliations: [a], Aarhus University, Denmark; [b], Rothamstead Research, North Wyke, UK; [c], Agriculture Research and Development Division, Ellinbank Centre, Department of Economic Development, Jobs, Transport and Resources, Ellinbank, Victoria 3821, Australia; [d], Centre Interprofessionnel Technique d'Etudes de la Pollution Atmosphérique (CITEPA), Paris; e, INFRAS, Zürich, Switzlerand; f, World Meteorological Organisation, Geneva, Switzerland; g, Instituto Superior de Agronomia (ISA), University of Lisbon, Portugal; [h], Centre for Ecology & Hydrology, Edinburgh Research Station, UK.)

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Table 1. Sources for emissions of methane (EEA 2014) and Ammonia (EUROSTAT 2011) in the EU.

Source of emission	Methane	Ammonia
Agriculture	50%	93%
- Livestock	37%	
- and livestock manure	12%	69%
- Other	1%	24%
Waste (household, sewage, garden)	31%	-
Energy industry and other sectors	19%	7%

Interactions between ammonia and methane emission mitigation

- Most ammonia emissions in Europe and around half of the methane emissions result from agricultural activities (see Table 1). In the case of methane, waste and energy sectors are also major sources.
- Agricultural ammonia emissions arise predominantly from livestock manure management and nitrogen fertiliser use. By contrast, methane emissions arise mainly from enteric fermentation in ruminant livestock, with manure management as a secondary source. Rice production also gives rise to both methane and ammonia emissions, although this is only a small source of methane emission in the European Union.
- Although there is no direct causal relationship between ammonia and methane emissions, the feed intake and the level of activity in the livestock and crop sectors affects the emission of both gases, as do specific management practices.
- Increases in the efficiency of animal production are likely to be associated with lower emission intensities for both ammonia and methane. For example, increasing the productive lifetime of a dairy cow will result in fewer replacement animals being required and therefore a lower overall ammonia and methane emission from the whole dairy system (i.e., cows and replacement animals) per litre of milk produced.

DNMARK forskningsalliancen

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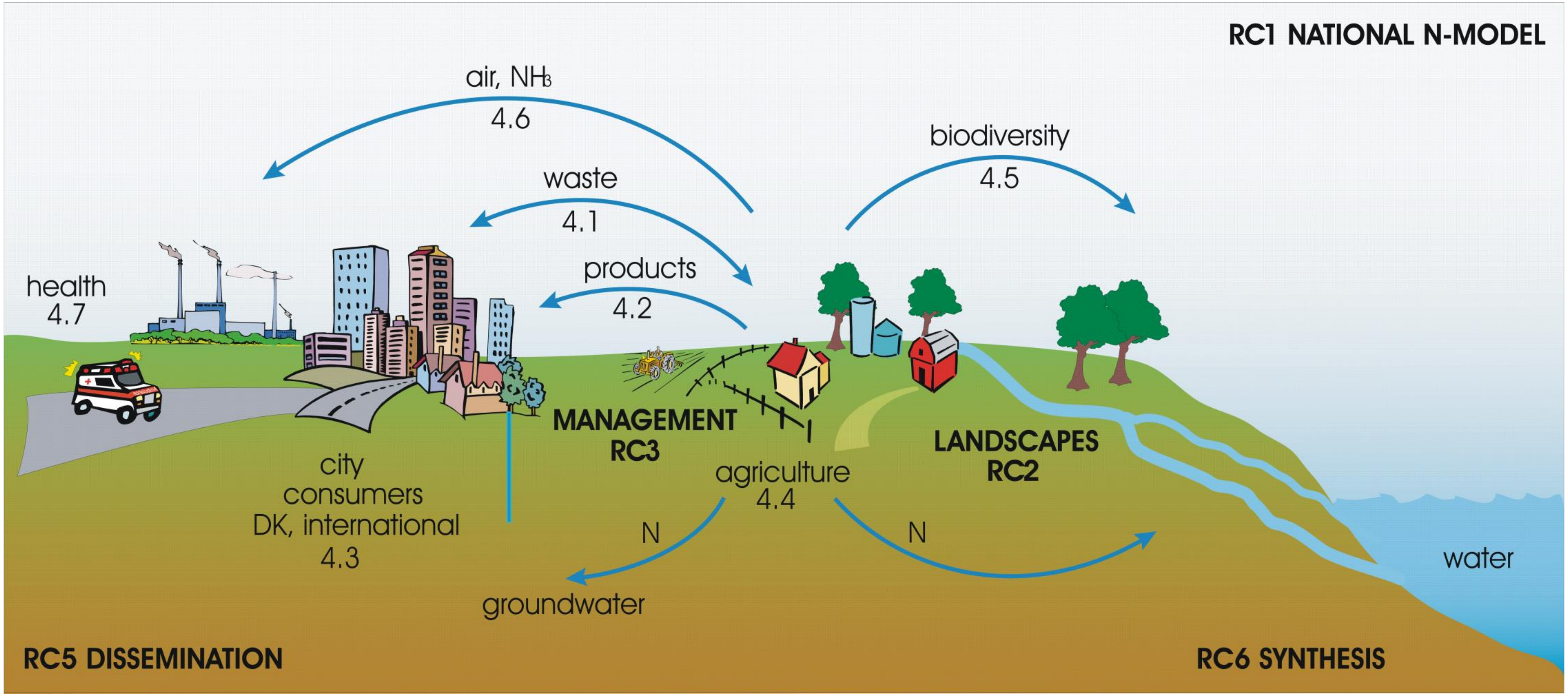
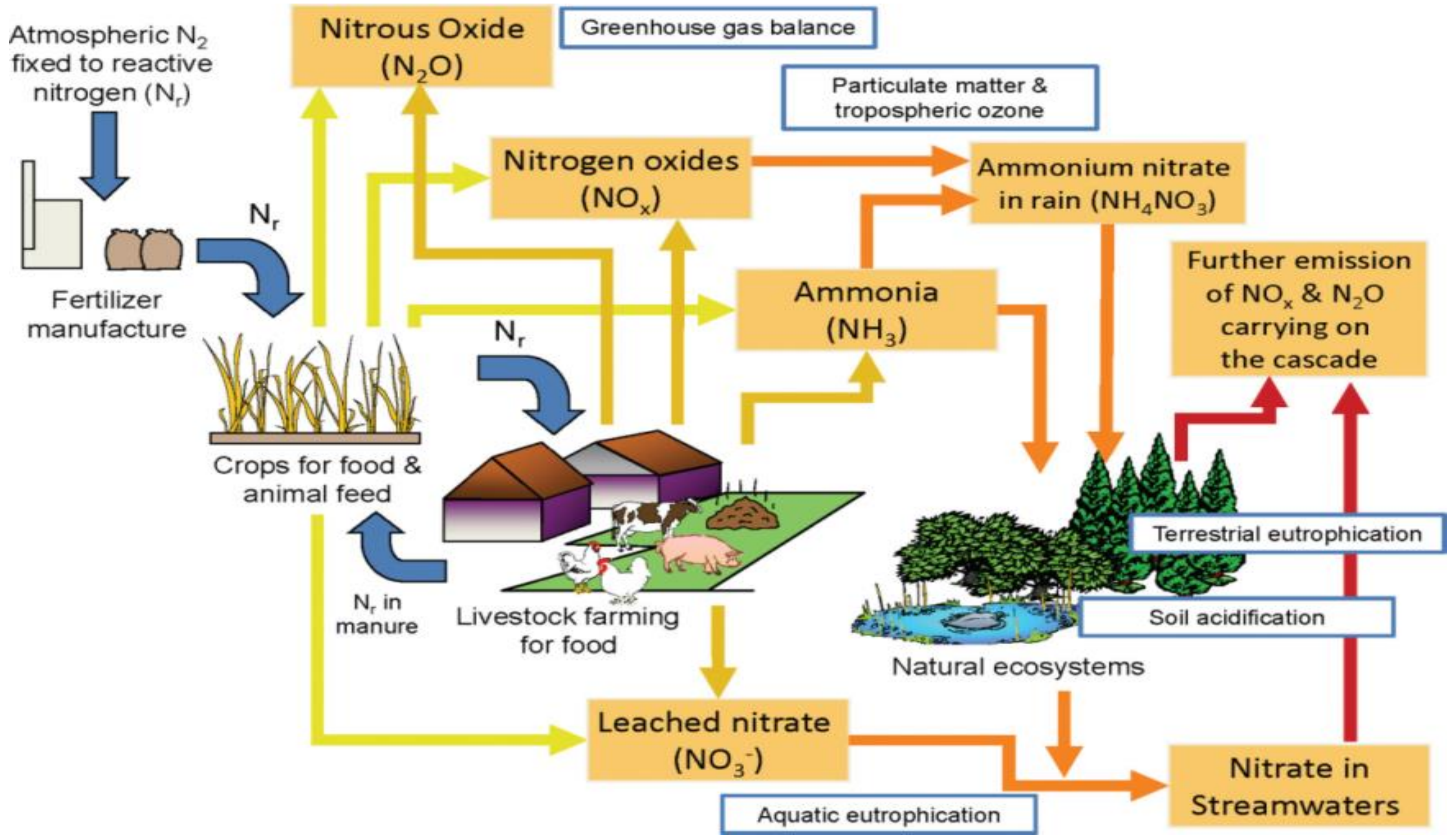
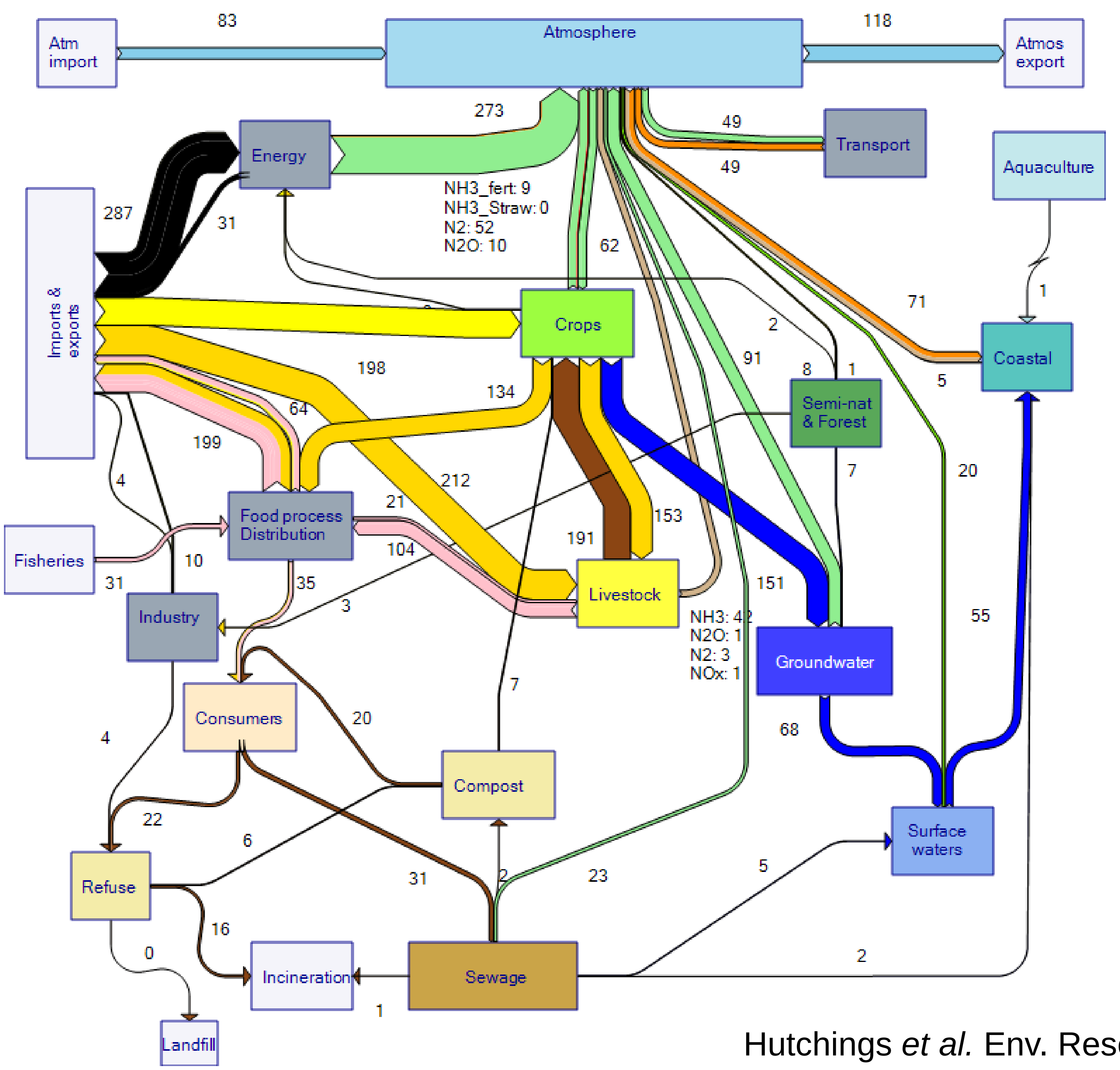
Research components:



N-kaskaden i landbruget





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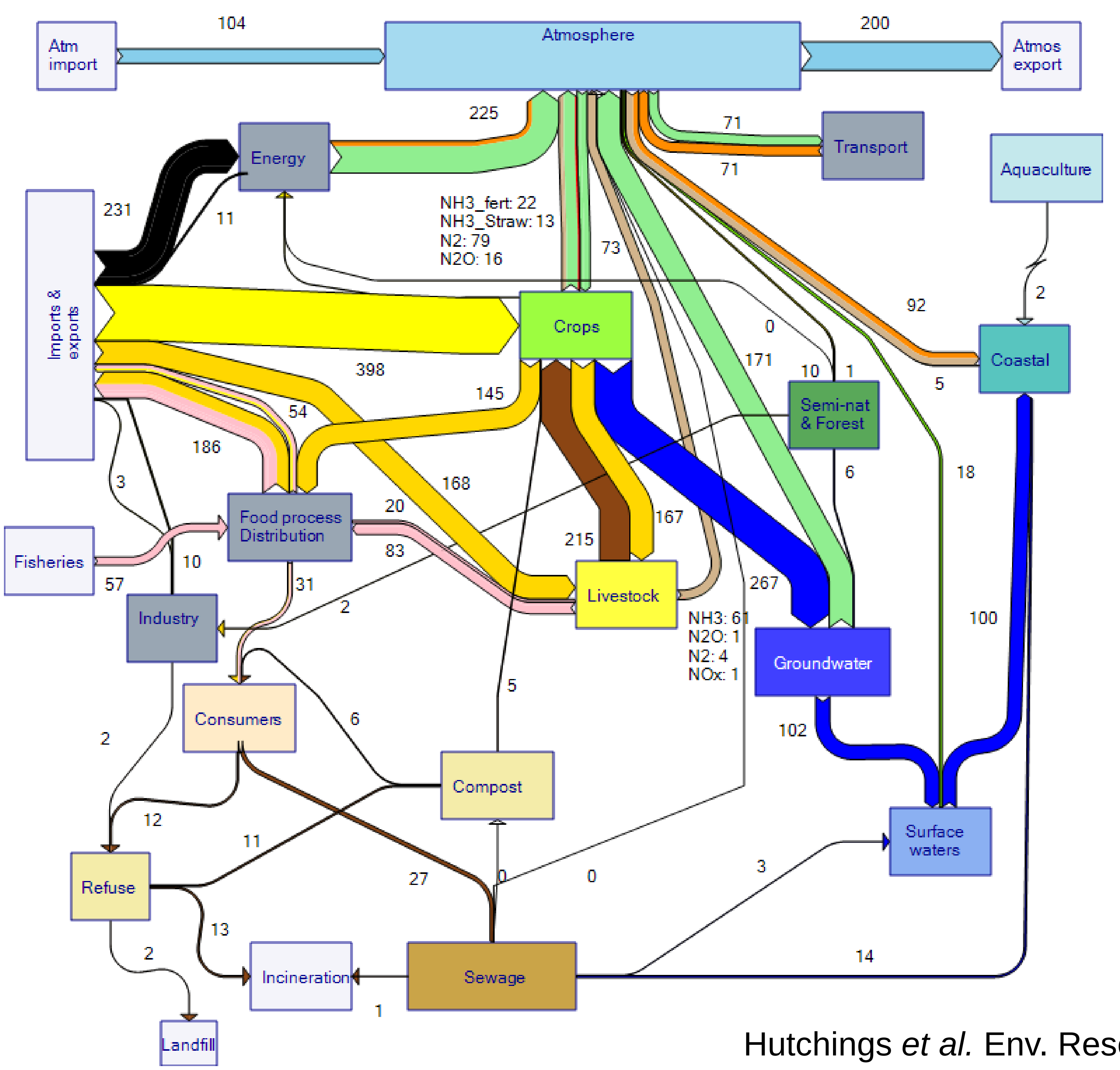
2010

kt N år^{-1}

dNmark research alliance

Hutchings *et al.* Env. Research Letters 9 (2014)



1990

kt N yr^{-1}

Hutchings *et al.* Env. Research Letters 9 (2014)

Løsningsscenarier

3 typer af løsningscenarier

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1. **Geografisk målretning:** *Målrettede tiltag baseret på lokal tilpasset management og planlægning*
2. **Teknologi:** *Nye produktionskæder med en mere effektiv N udnyttelse og recirkulering*
3. **Ændret forbrug:** *Nye forbrugsmønstre der medfører ændret ressourceanvendelse og kvælstofkredsløb*

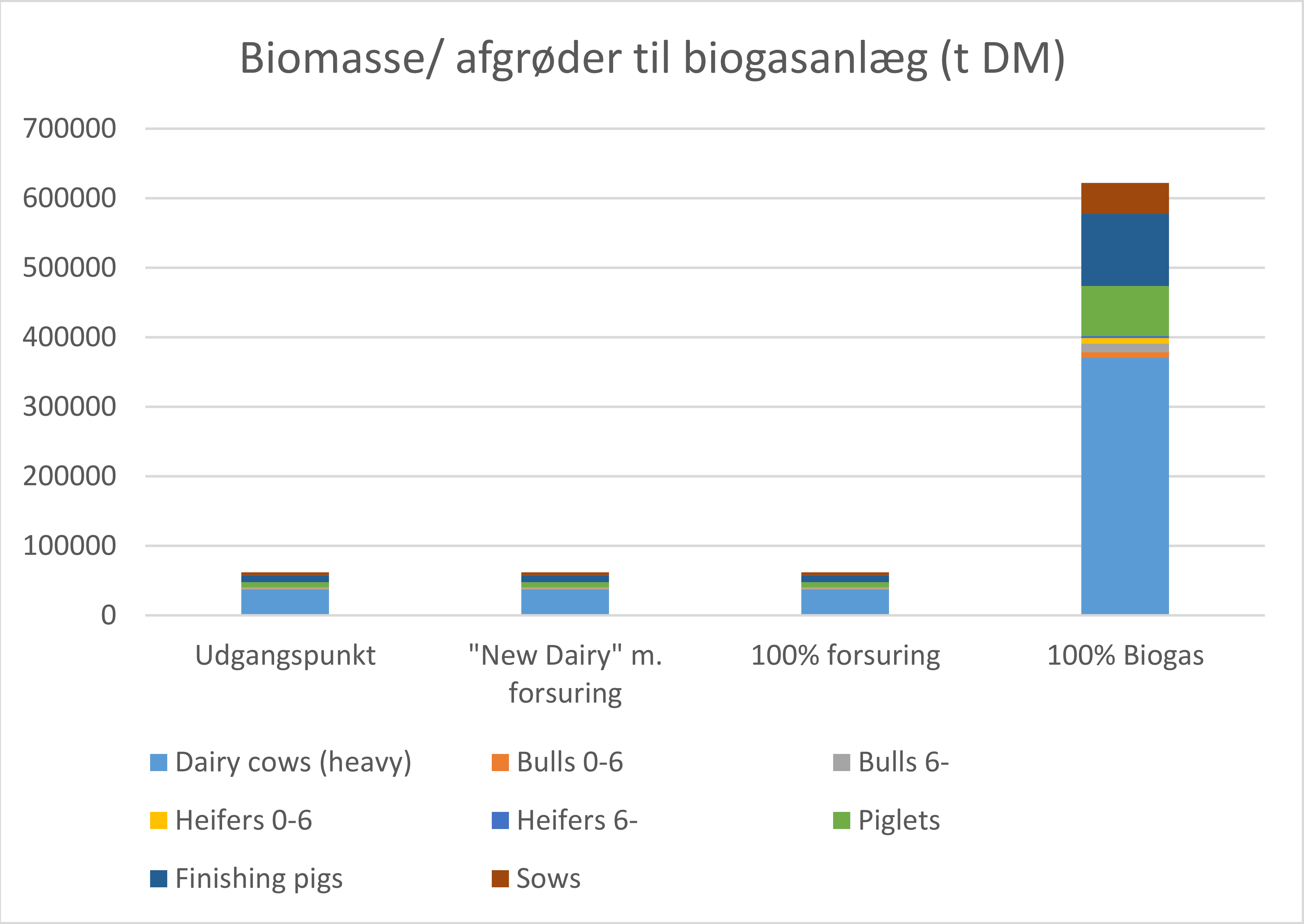
Eksempler teknologi-scenarier

- **100% udnyttelse af husdyrgødning til biogas (pånær ved afgræsning)**
  - Med optimal tilsætning af plantebiomasse
- **100% stald-forsuring (på nær ved afgræsning)**
  - I hele kvægbruget
  - I hele husdyrproduktionen

Teknologi: ”New production chains with a more efficient use and recycling of N”

- **Anaerobic digestion (biogas) of livestock manure**
  - Added biomass in maize and grass silage
  - Enhanced N utilisation efficiency of applied manure (lower N leaching)
- **Acidification of livestock slurry (cattle and all)**
  - Reduces ammonia volatilization from livestock houses, manure storage and application
- **Green biorefining**
  - Import of soybean for supplying proteins to the intensive livestock production is replaced by proteins produced from grassland (enhancing grassland with lower N leaching)

	Emissions reductions (% change)			Applied N in field (% change)		
	NO_3	NH_3	N_2O	Fertilizer	Manure	Total
Biogas	-11.4	7.3	-12.6	-21.0	12.4	1.3
Acidification (cattle)	0.3	-18.3	-0.7	-4.7	2.0	-0.2
Acidification (all)	0.6	-49.1	-0.4	-18.9	8.9	-0.3



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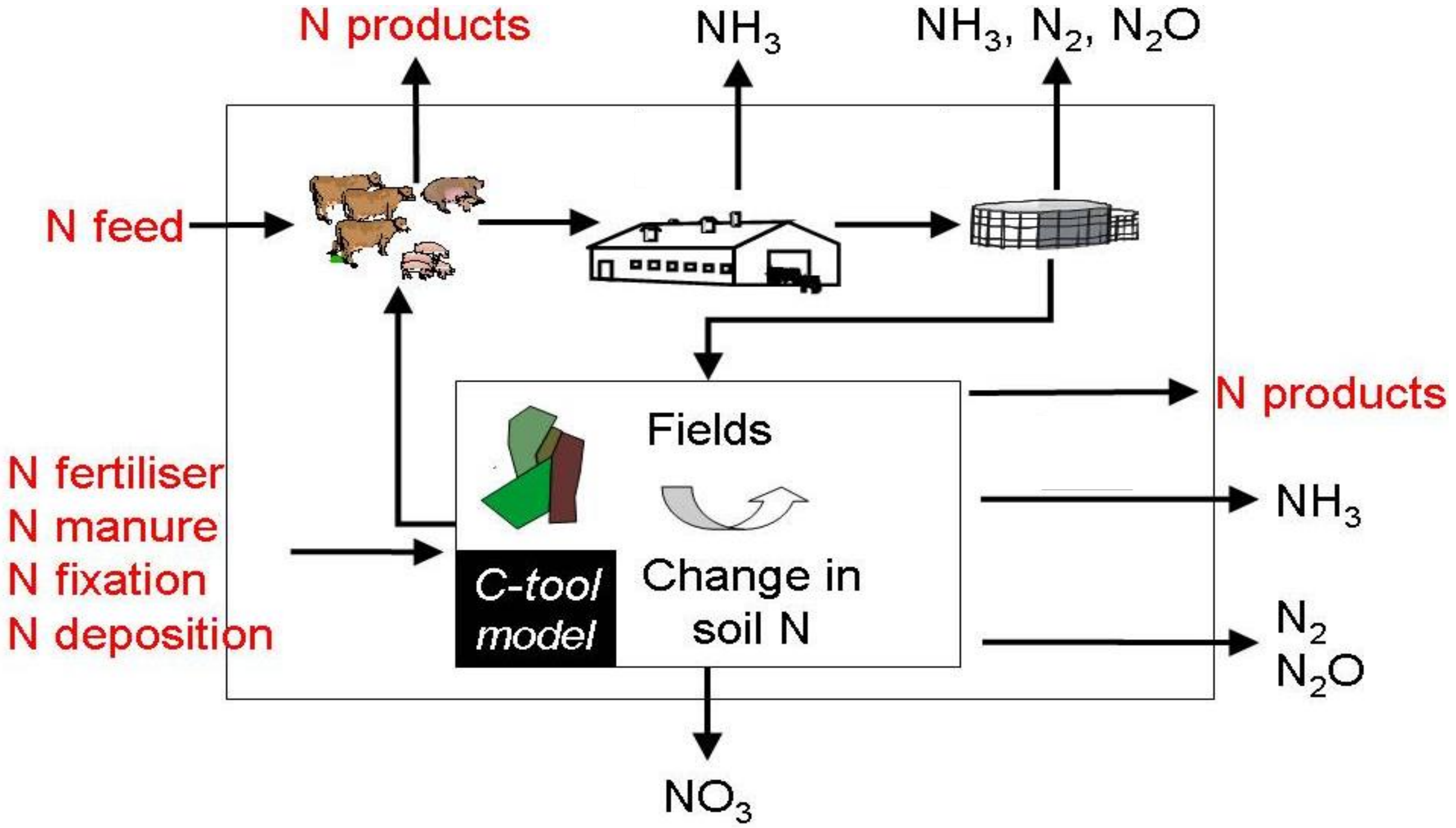
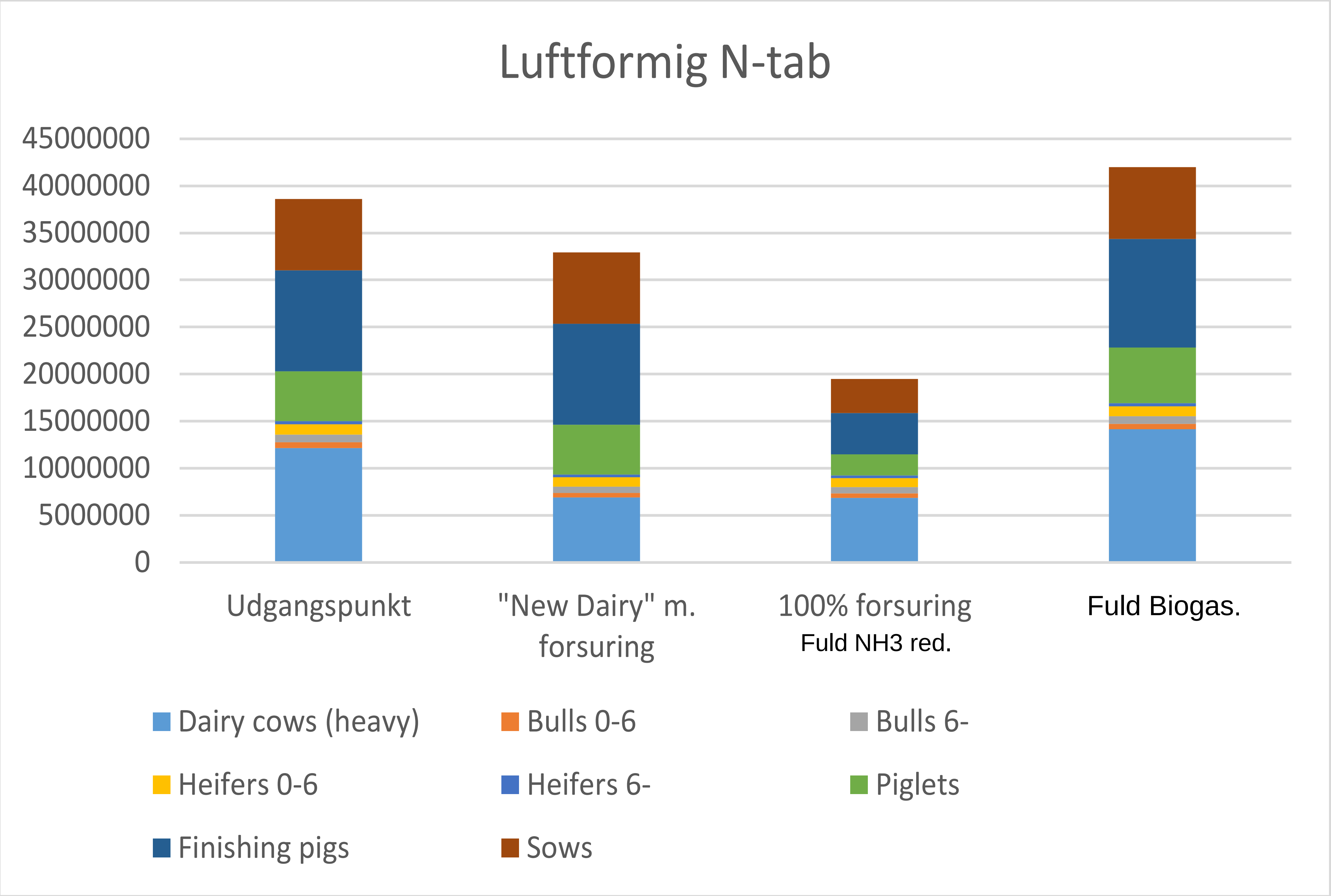
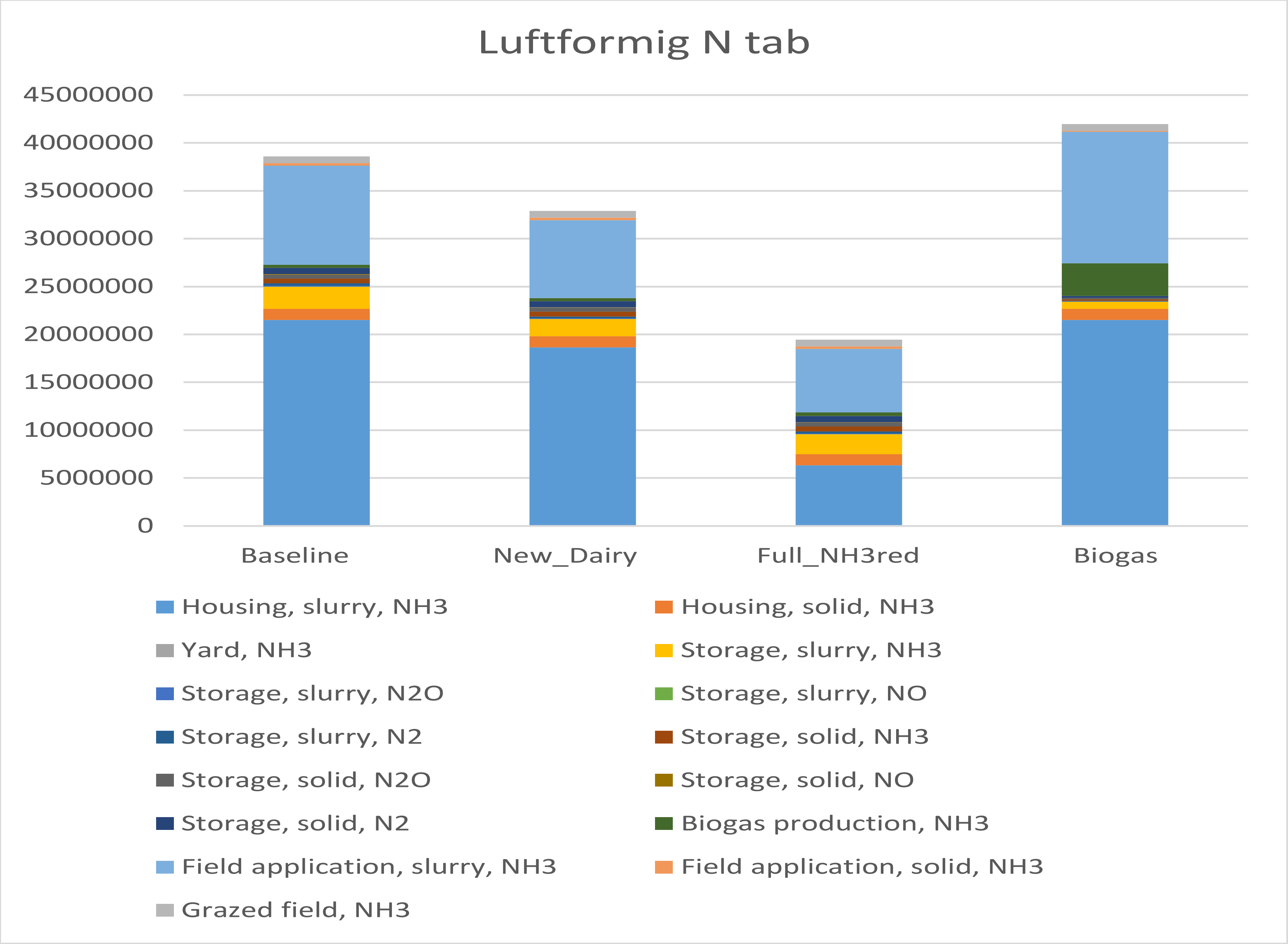
N tab fra landbrug til luft og vand




Luftformig N-tab
45000000
40000000
35000000
30000000
25000000
20000000
15000000
10000000
5000000
0
Udgangspunkt
"New Dairy" m. forsuring
100% forsuring
Fuld NH3 red.
Fuld Biogas.
Dairy cows (heavy)
Bulls 0-6
Bulls 6-
Heifers 0-6
Heifers 6-
Piglets
Finishing pigs
Sows



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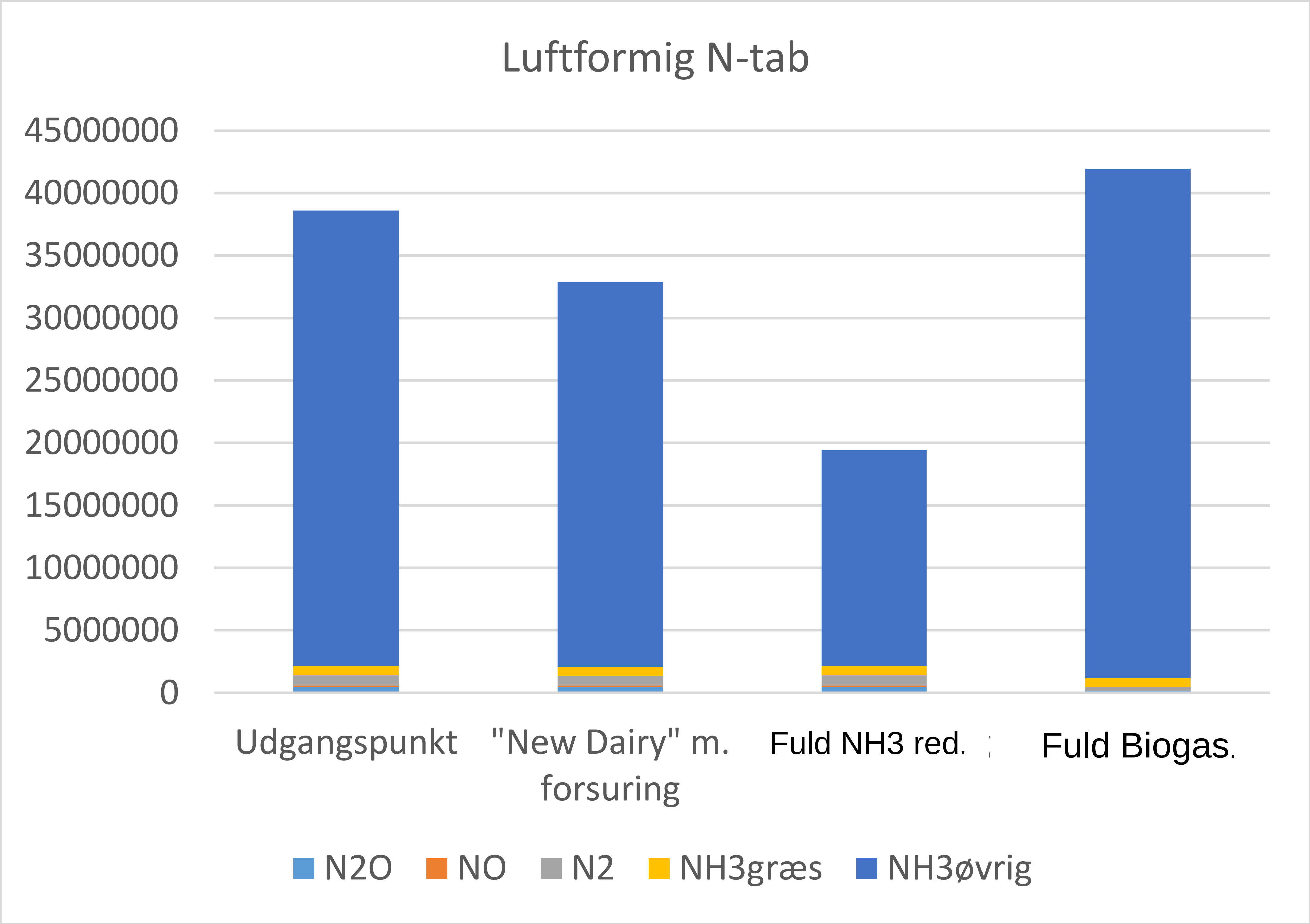
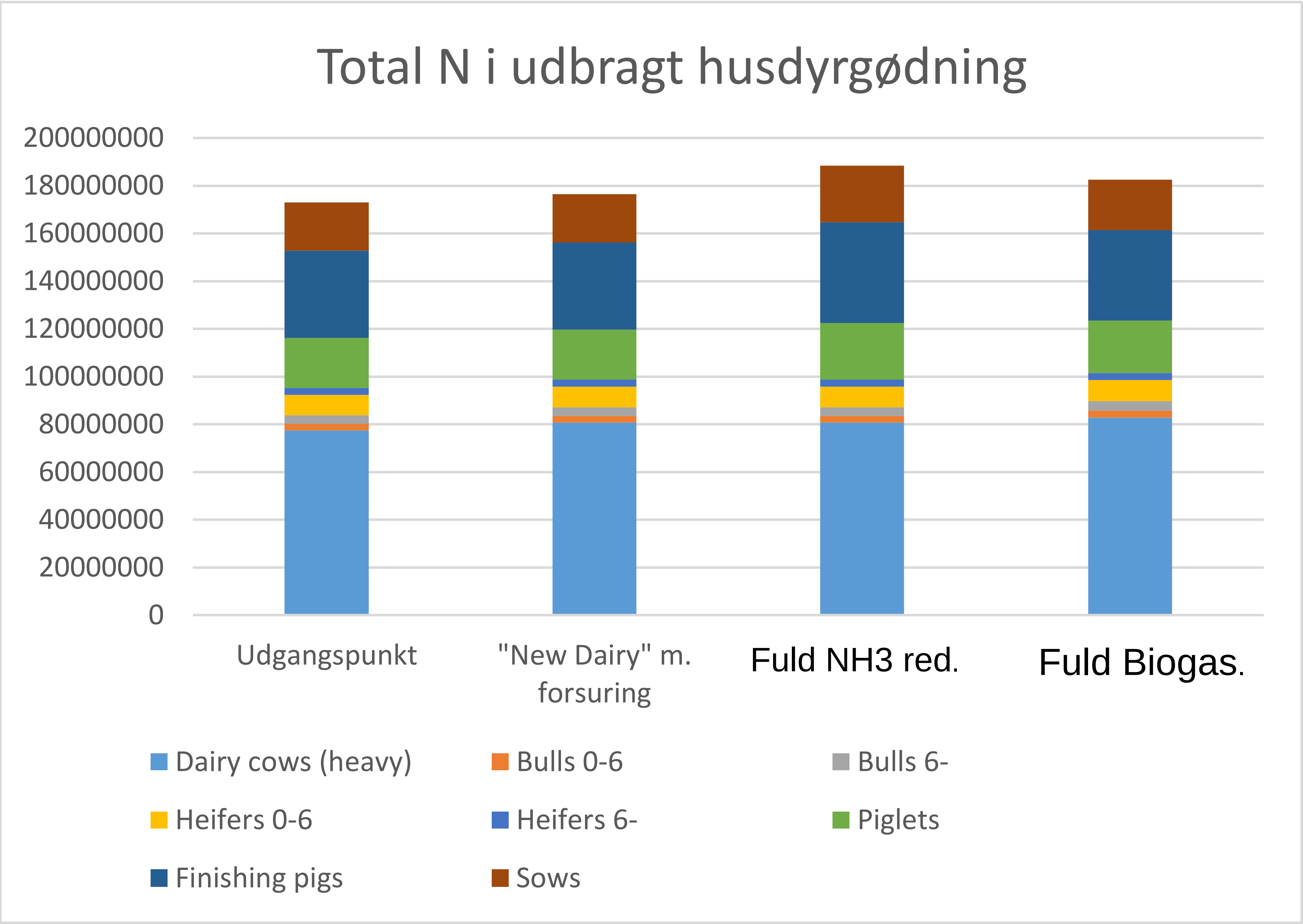

Luftformig N-tab
45000000
40000000
35000000
30000000
25000000
20000000
15000000
10000000
5000000
0
Udgangspunkt
"New Dairy" m. forsuring
Fuld NH3 red.
Fuld Biogas.
N2O
NO
N2
NH3græs
NH3øvrig



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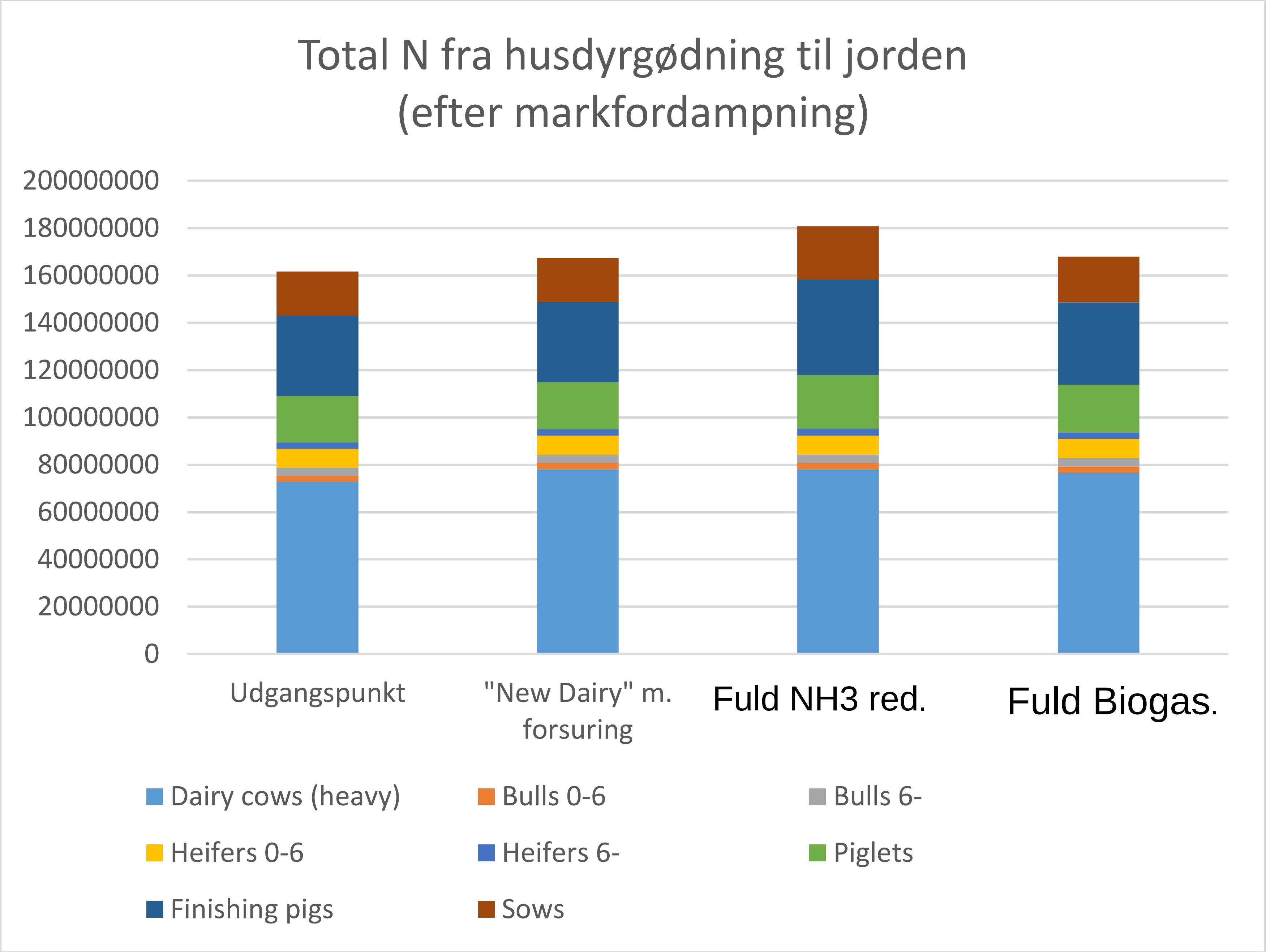
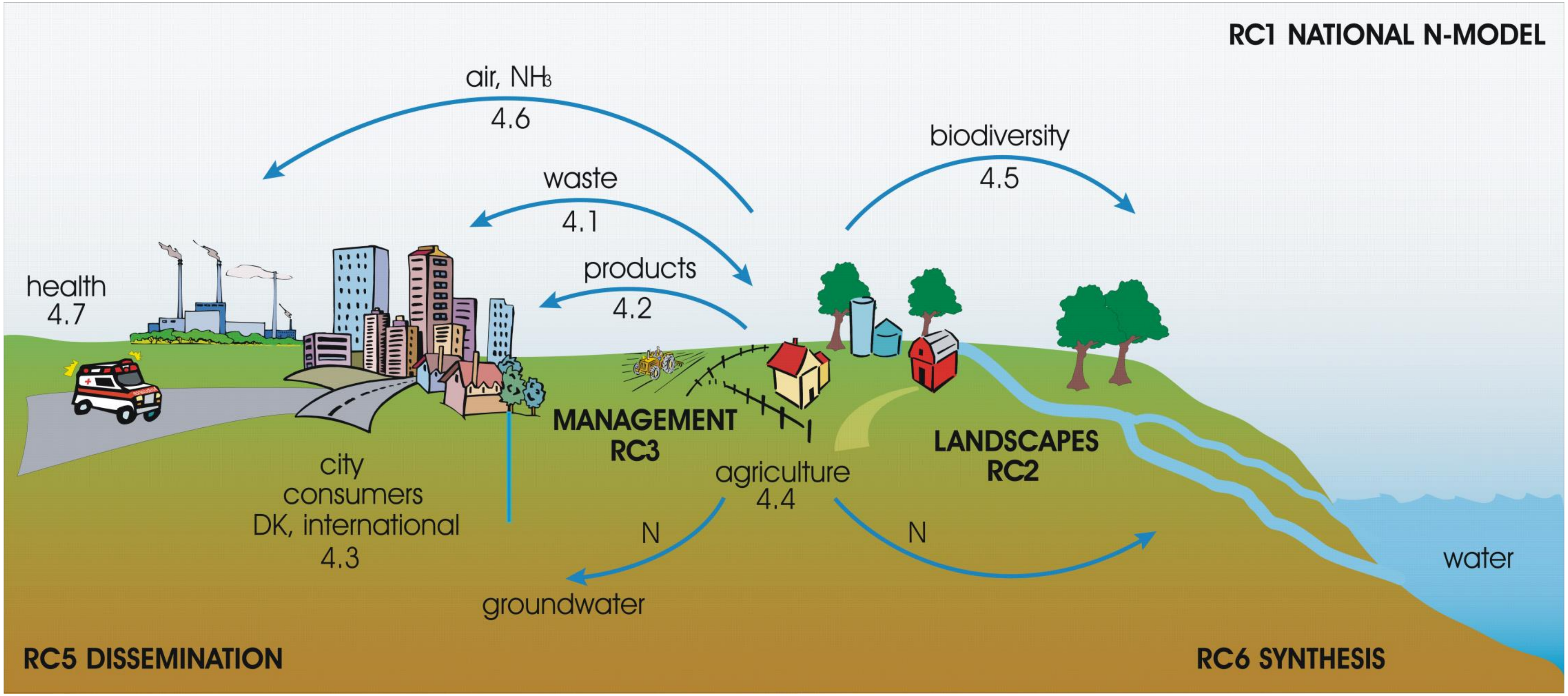

Total N fra husdyrgødning til jorden
(efter markfordampning)
200000000
180000000
160000000
140000000
120000000
100000000
80000000
60000000
40000000
20000000
0
Udgangspunkt
"New Dairy" m. forsuring
Fuld NH3 red.
Fuld Biogas.
Dairy cows (heavy)
Bulls 0-6
Bulls 6-
Heifers 0-6
Heifers 6-
Piglets
Finishing pigs
Sows

DNMARK forskningsalliancen

Research components:



Fact sheets

- The dNmark landscape model – a tool for dialog-based Nitrogen management
- The TargetEconN framework – a cost-minimization model for Nitrogen management
- How does long-term urban and agricultural waste application affect Nitrogen availability, crop uptake efficiency and soil fertility?
- Farmer perceptions and use of organic waste products as fertilisers – a survey study of potential benefits and barriers in Denmark
- Targeted land conversion – a Danish case study on nitrogen reduction
- Spatially targeted strategy – a method for nitrogen load reduction from agriculture
- The Danish nitrogen footprint - Applying nitrogen footprints and using policy scenarios to change consumption behavior
- Local landscape scenarios – addressing targeted nitrogen regulation

Research briefs

- Nitrate in Danish drinking water
- Meat consumption affects N-use – and meat narratives affect Danish self-identity and society
- Ammonia, ammonium and the risk of asthma – A nationwide study in preschool
- European attitudes to water pricing: Internalizing environmental and resource costs

http://sustainablenconference.dnmark.org/

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INNOVATIVE SOLUTIONS FOR SUSTAINABLE MANAGEMENT OF NITROGEN

International Conference at Aarhus University
Denmark, June 26-28, 2017

dNmark

Conference theme

We have gathered some photos from the welcome reception Sunday and from the visit at the Climate Planet.

More photos from start of conference (Lars Kruse, AU-foto)

130 participants from 27 countries joined the conference, see group photo.

Available presentations (this page will be continously updated)

We are happy to announce the International Conference at Aarhus University, June 26-28, 2017, on "Innovative solutions for sustainable management of Nitrogen".

Sustainable management of nitrogen (N) is a key issue for the bio-economy, environmental protection, and human well-being. Innovative, research based solutions are at the nexus of sustainability and new N management approaches are therefore called for, and is the background for the dNmark Research Alliance to invite to this international conference.

The conference will focus on solutions at different scales and places in the N management chain, and participants are invited to submit abstracts to the conference proceedings, and potential special issue papers. In addition to the conference, a full day of excursions are offered to showcases for sustainable N management in Denmark. In addition to the conference, the UN-ECE Task Force on Reactive Nitrogen TFRN-12 workshop is hosted June 29-30. This event is described at the TFRN-12 homepage.

About the conference »

- Conference theme
- Invited speakers
- Presentations
- Scientific committee
- Task Force meeting on Reactive Nitrogen

Conference sessions »

- S1: New technologies
- S2: Local solutions
- S3: Health impacts
- S4: Nitrogen abatement policies
- S5: Sustainable consumption
- S6: N monitoring

Program »

- Program for conference and excursion

About DNMARK »

DNMARK is a multidisciplinary research alliance proposing new ideas to optimise the use of nitrogen. The aim is to improve resource efficiency and public health, and at the same time reduce climatic and environmental impact.

Behind the alliance are Danish and foreign universities and several partners from the business world including agribusinesses and related companies as well as public authorities and interest groups. See more info at the DNMARK website.

See also brochure about the alliance (Danish version here)

DNMARK is funded by a five-year grant from the Strategic Research Council, which per april 2014 became The Danish Innovation

Forsuring /New Dairy

New Dairy

There appears to be limited scope to improve the feed composition of dairy cattle, as the protein concentration in feed is similar to that considered the target by MST (MST teknolologiblade). Most other cattle categories are grazed for a significant proportion of the year, so optimising feed is not practical. The only measure for reducing NH_3 emissions from the whole management system on cattle farms is in-house acidification. This is assumed to lead to a 50% reduction in NH_3 emissions (MST teknolologiblade). We assume 100% implementation here.

Full NH_3 reduction

Emissions from pig production are significant. In this scenario, air scrubbers are assumed to be installed in pig housing (NH_3 reduction 88%, MST) and tank/field acidification (NH_3 reduction 40%, MST) for field-applied pig slurry. In both cases, we assume 100% implementation.

Biogas

1.1 Biogas

The scenario assumes 70% of manure will be treated in an anaerobic digester.

Degradation of organic matter in pig and cattle slurry during digestion is assumed to be 65% and 40% respectively. The is based on Bo values of 330 and 200 nL/100g VS (Kafle and Chen, 2016) and an assumed 55% CH_4 in biogas. Note that lower values for cattle slurry are possible (Amon *et al.*, 2007).

It is assumed that it is economically necessary to increase the gas production by adding additional feedstock to the reactor. A wide variation of additions can be found in the literature, both in terms of the material added and its composition. Here we choose to relate the feedstock addition to the amount of slurry dry matter. We chose a relatively conservative amount, as there is a political desire to minimize the extent to which energy production competes with livestock production.

For supplementary feedstocks, the following composition data and mixture was used.

Supplementary feedstock	Dry matter in fresh matter (kg/kg)	N concentration (kg/(kg fresh matter))	N concentration (kg/(kg dry matter))	Degradation %	% contribution
Municipal organic waste	0.4	0.0068	0.017	50	0
Green waste (grass, etc.)	0.15	0.0046	0.030666667	50	0
Food waste (food processing	0.2	0.0051	0.0255	80	0
Maize silage	0.35	0.0046	0.013142857	75	40
Grass silage	0.35	0.0094	0.026857143	50	40
Straw	0.86	0.0051	0.005930233	70	20
Slaughterhouse waste	0.33	0.01287	0.039	80	0
Other	0.3	0.009	0.03	50	0

Values for the degradation of crop products was obtained from (Dandikas *et al.*, 2014) and (Hjorth *et al.*, 2011).

3 skalaer for løsninger

AARHUS UNIVERSITET

- **Lokalområder (landskabs skala)**

  2 eksempler (geografisk målretning):
  - Hagens Møllebæk (Skive)
  - Henne Mølle Å / Fidde Strøm (Varde)
- **Hoved-vandoplande (regional skala)**

  1 eksempel (geografisk målretning):
  - Limfjorden
- **Danmark (national skala)**

  3 eksempler:
  - Forsuring og biogas (Ny teknologi)
  - N fodaftryk (ændret forbrug)