

# Modelstudie naar de effecten van brongerichte landbouwmaatregelen op de stikstofdepositie in Natura 2000-gebieden

## *Effects of agricultural measures on deposition in Natura 2000 sites*

26 april 2016, Hans Kros

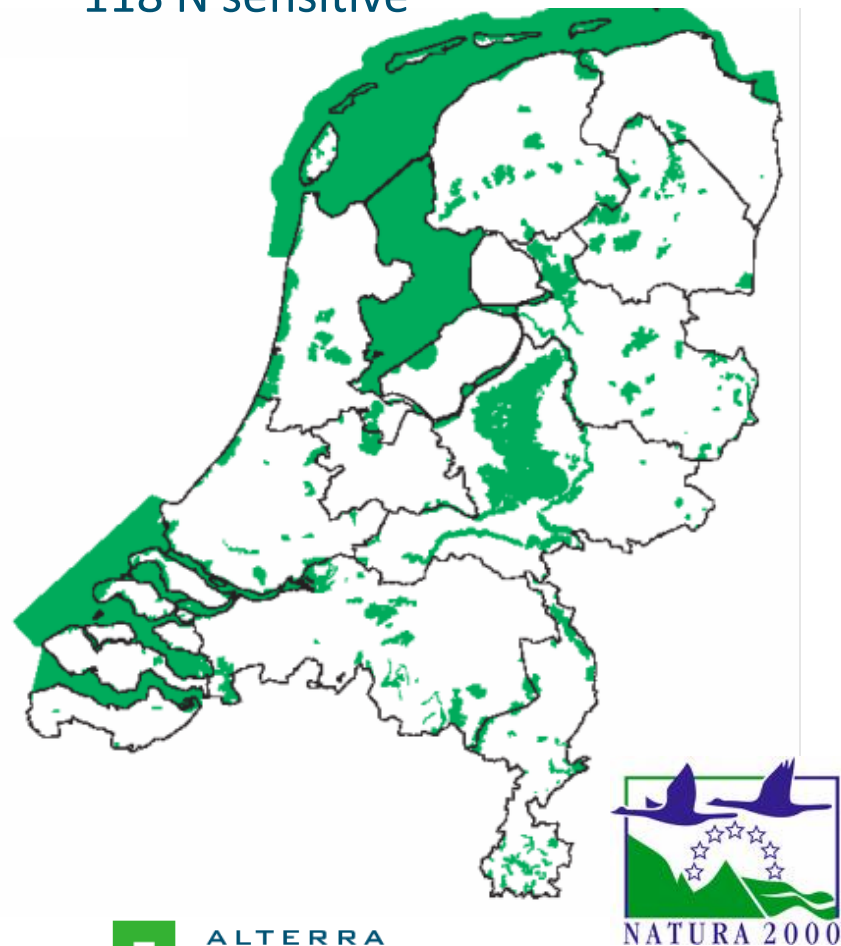


# N 2000 sites and N related policy questions

162 sites

~ 1.1 M ha (10% of land area)

118 N sensitive



- Which additional measures could be used to mitigate ammonia emission in spatial zones surrounding the Natura 2000 sites?
- What are most promising measures in relation to its associated costs?
- What are the growth potentials for farms in the neighbourhood of Nature 2000 sites?

---

# Background/Aim

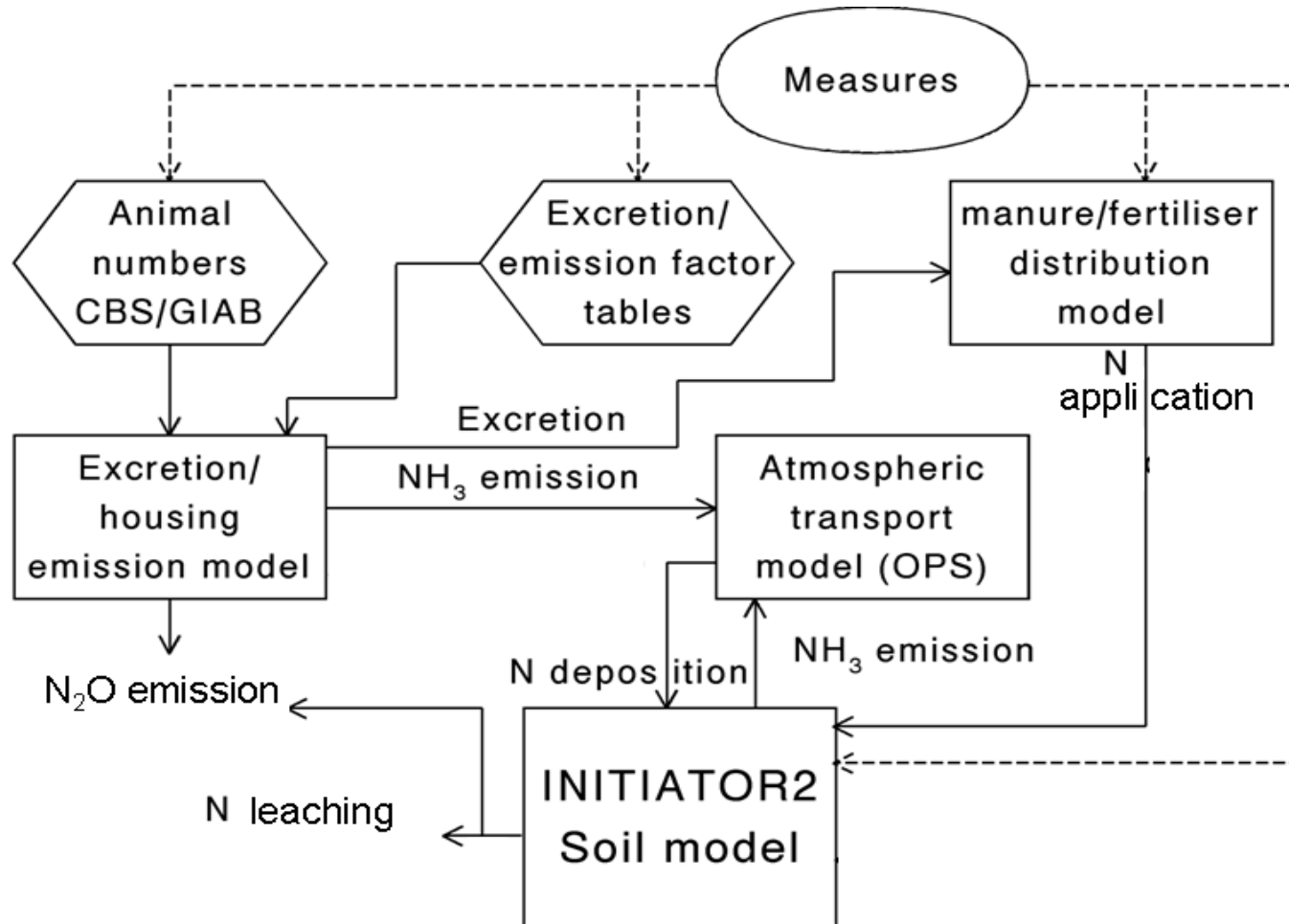
## Background

- The provinces in the Netherlands are responsible for the protection plans for Natura 2000 sites
- To protect Natura 2000 sites against ammonia deposition and exceedances of CLN, regionally specific measures are needed

## Aim

- To quantify the effects of a set of agricultural measures on the reduction in N deposition and CLN exceedance on Natura 2000 sites at landscape scale
- To identify the most cost effective measures on reducing  $\text{NH}_3$  emission and the resulting N deposition on Natura 2000 sites

# INITIATOR: A tool for integrated environmental analyse for agriculture



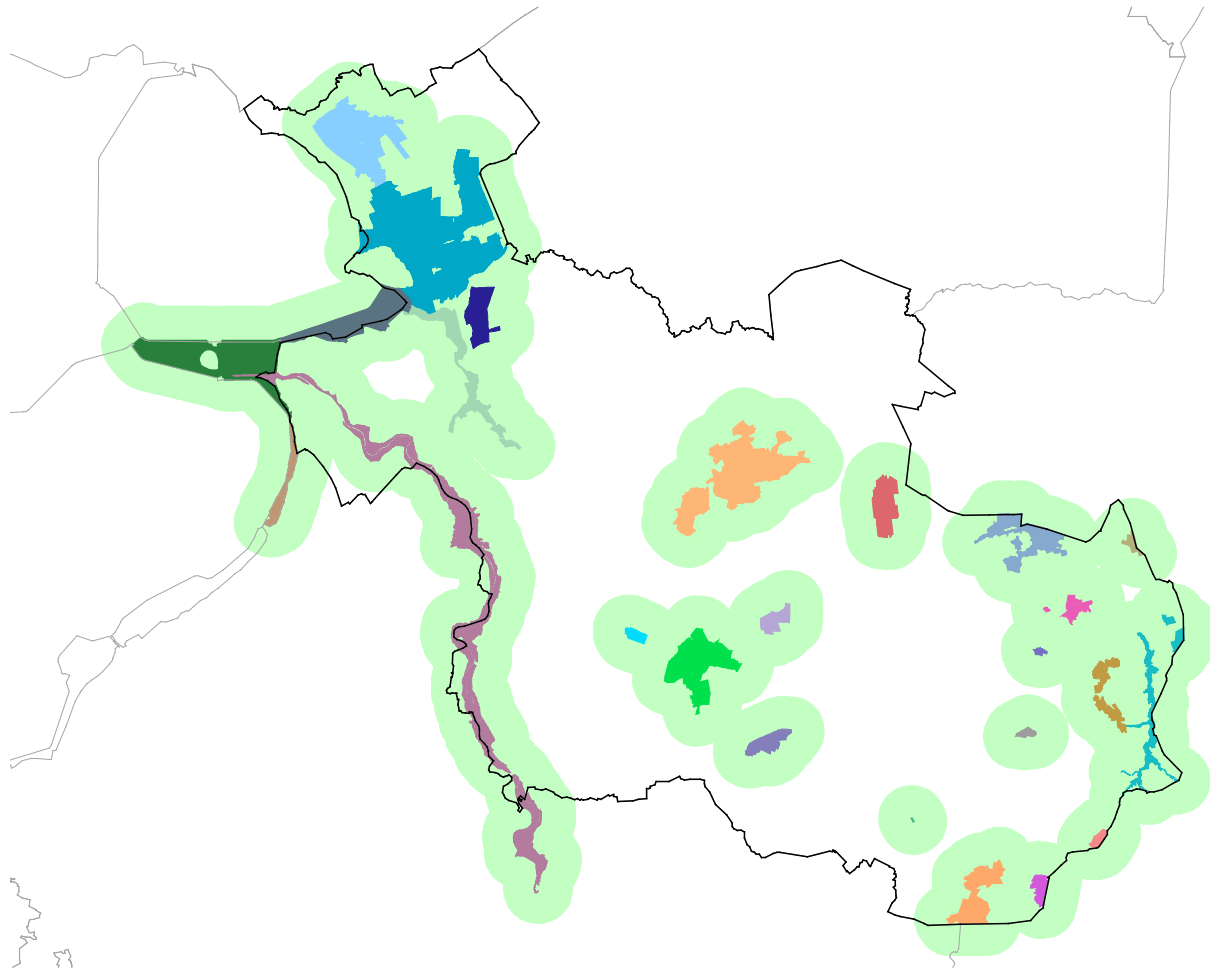
---

# INITIATOR: tool for integrated environmental evaluations for agriculture

---

- Integration in INITIATOR implies:
  - Different N inputs and outputs
  - Interaction with other substances (GHG, C, P, BC, metals)
  - Different spatial scales (landscape, province, country)
- INITIATOR calculates:
  - Emission of ammonia to the atmosphere <-> NEC
  - N deposition in nature <-> critical N deposition

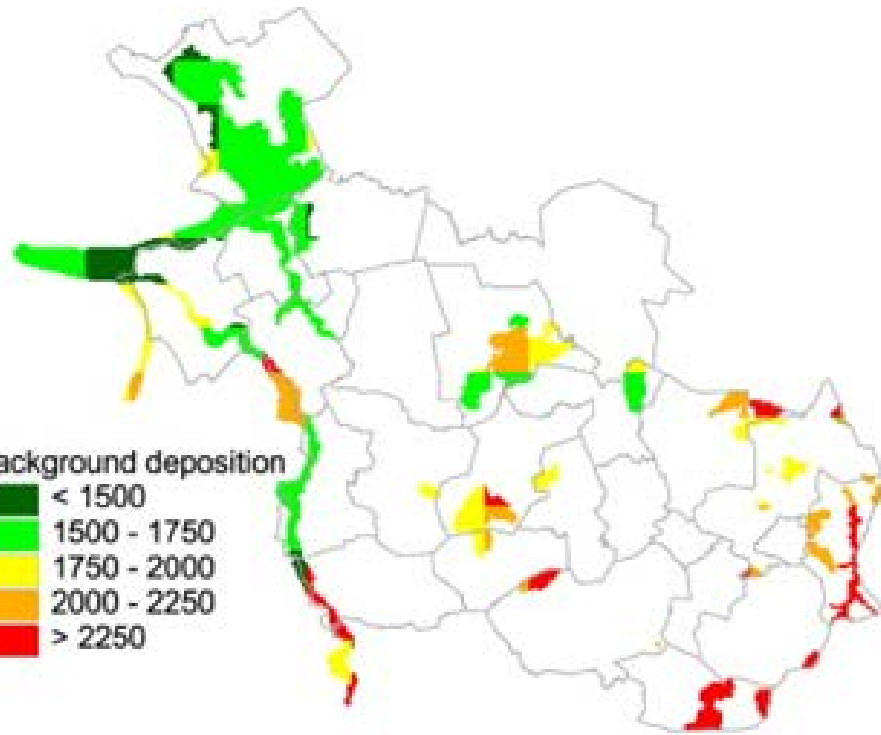
# Spatial zones surrounding Natura 2000 sites



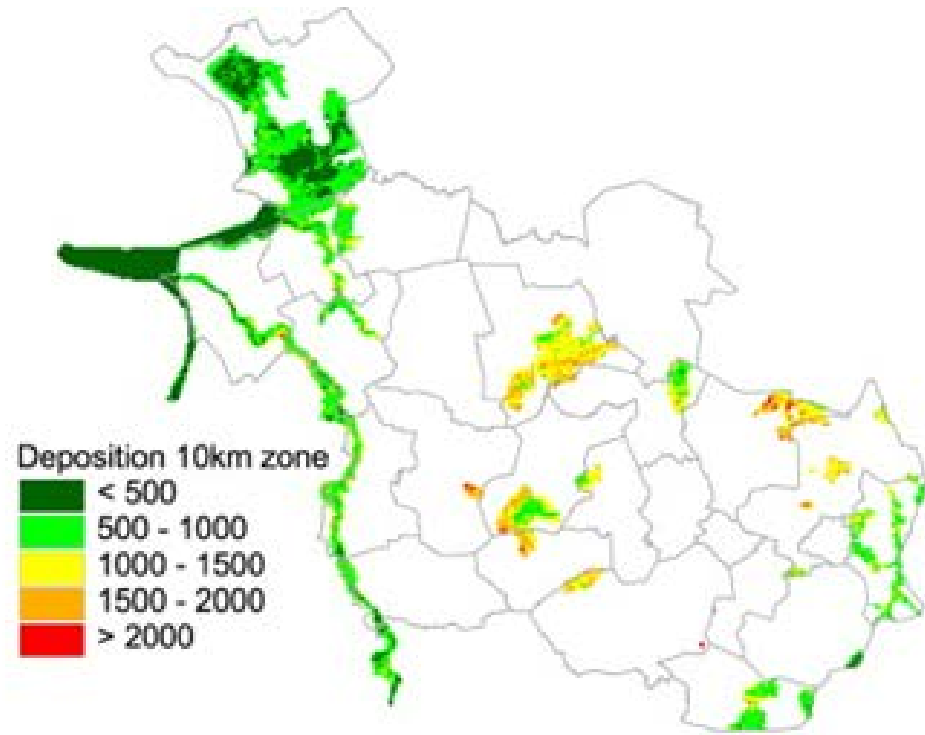
10 km zone surrounding Natura 2000 sites  
in the province Overijssel (light green)



# Contribution of local emissions to total N deposition



Background



Contribution from the 10km zone



# Origin N deposition in N2000 sites

Emission of N source	N Deposition (mol ha <sup>-1</sup> yr <sup>-1</sup> )	Contribution (%)
<b>NH<sub>3</sub> from housing systems within the 10 km zone around Natura 2000 sites</b>		
<b>Cattle</b>	<b>254</b>	<b>11</b>
<b>Pigs and poultry</b>	<b>212</b>	<b>10</b>
<b>Other cattle</b>	<b>21</b>	<b>1</b>
<b>NH<sub>3</sub> from land application</b>	<b>293<sup>e</sup></b>	<b>13</b>
<b>NH<sub>3</sub> from outside the 10 km zone, but in NL<sup>a</sup></b>	<b>495</b>	<b>22</b>
<b>NH<sub>3</sub> from sources abroad<sup>b</sup></b>	<b>368</b>	<b>16</b>
<b>NO<sub>x</sub> from Overijssel<sup>c</sup></b>	<b>90</b>	<b>4</b>
<b>NO<sub>x</sub> from outside Overijssel<sup>d</sup></b>	<b>506</b>	<b>23</b>
<b>Total</b>	<b>2240</b>	<b>100</b>

<sup>a</sup> Denotes to the NH<sub>3</sub> deposition due to agricultural sources outside the 10 km zone but within the Netherlands.

<sup>b</sup> Denotes NH<sub>3</sub> emission from all sources (agricultural and non-agricultural) outside the Netherlands and all non-agricultural sources within the Netherlands.

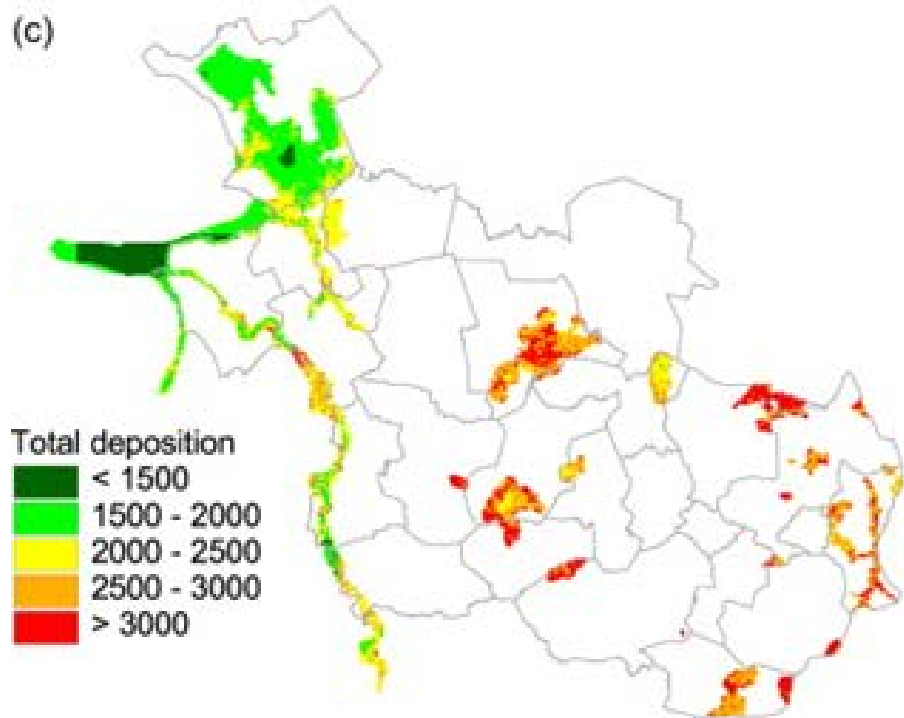
<sup>c</sup> Denotes NO<sub>x</sub> emission from all sources in Overijssel

<sup>d</sup> Denotes NO<sub>x</sub> emission from all sources outside Overijssel, including sources abroad

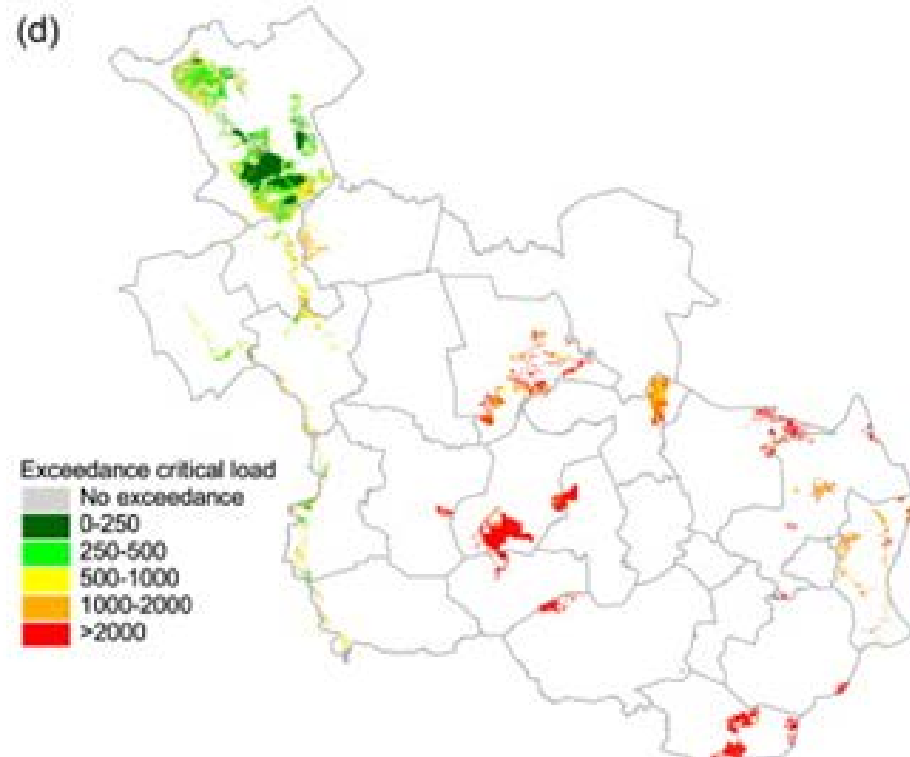
<sup>e</sup> 69% of this value is caused by manure application, 16% by grazing and 15% by fertilizer



# Total N deposition and CL exceedances



Total N deposition



Exceedances of critical N load

# Evaluated measures

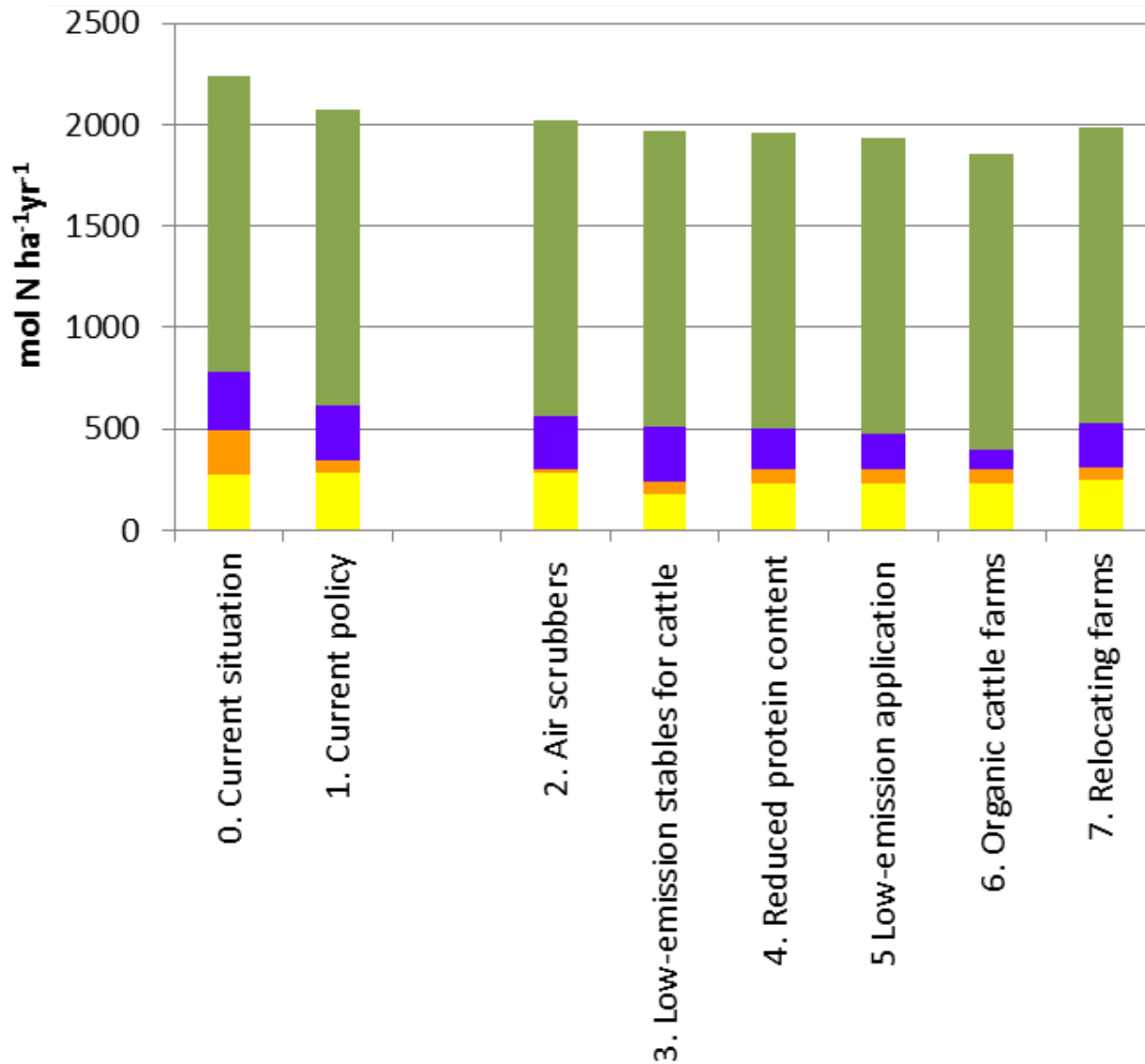
Measure	Description	Parameterisation
1	<b>Current policy</b>	Full implementation of the low emission housing systems according to the National policy <sup>a</sup> and the European IPPC <sup>b</sup> for pigs and poultry farms. Furthermore, small farm (< 40 LSU <sup>c</sup> ) were closed and the animals were transferred to larger farms (> 70 LSU).
2	<b>Air scrubbers</b>	Reduction of NH <sub>3</sub> emission from stables and manure storages by 70% compared to current practice stables. This measure is implemented for all farms within the 10 km zone.
3	<b>Low-emission stables for cattle</b>	Reduction of NH <sub>3</sub> emission from stables and manure storages by 40% compared to current stables.
4	<b>Reduced protein feed cattle Reduced N manure and fertilizer application</b>	Reducing the N excretion factor by 18%. Reducing the mineral N content in manure by 25% Reducing N application on grassland to new N use requirements
5	<b>Low-emission application</b>	Only sod incorporation
6	<b>Organic cattle farms</b>	No fertilizer application for all cattle farms in the 10 km zone. This measure is combined with measure 4 and 5.
7	<b>Relocating farms</b>	Implemented by a complete stop of all agricultural activities at these farms.

<sup>a</sup> The Ammonia and Livestock Farming Regulation for intensive animal husbandry (VROM, 2005)

<sup>b</sup> The Integrated Pollution Prevention and Control – EC Directive 96/61/EC (EC, 1996).

<sup>c</sup> Live Stock Units

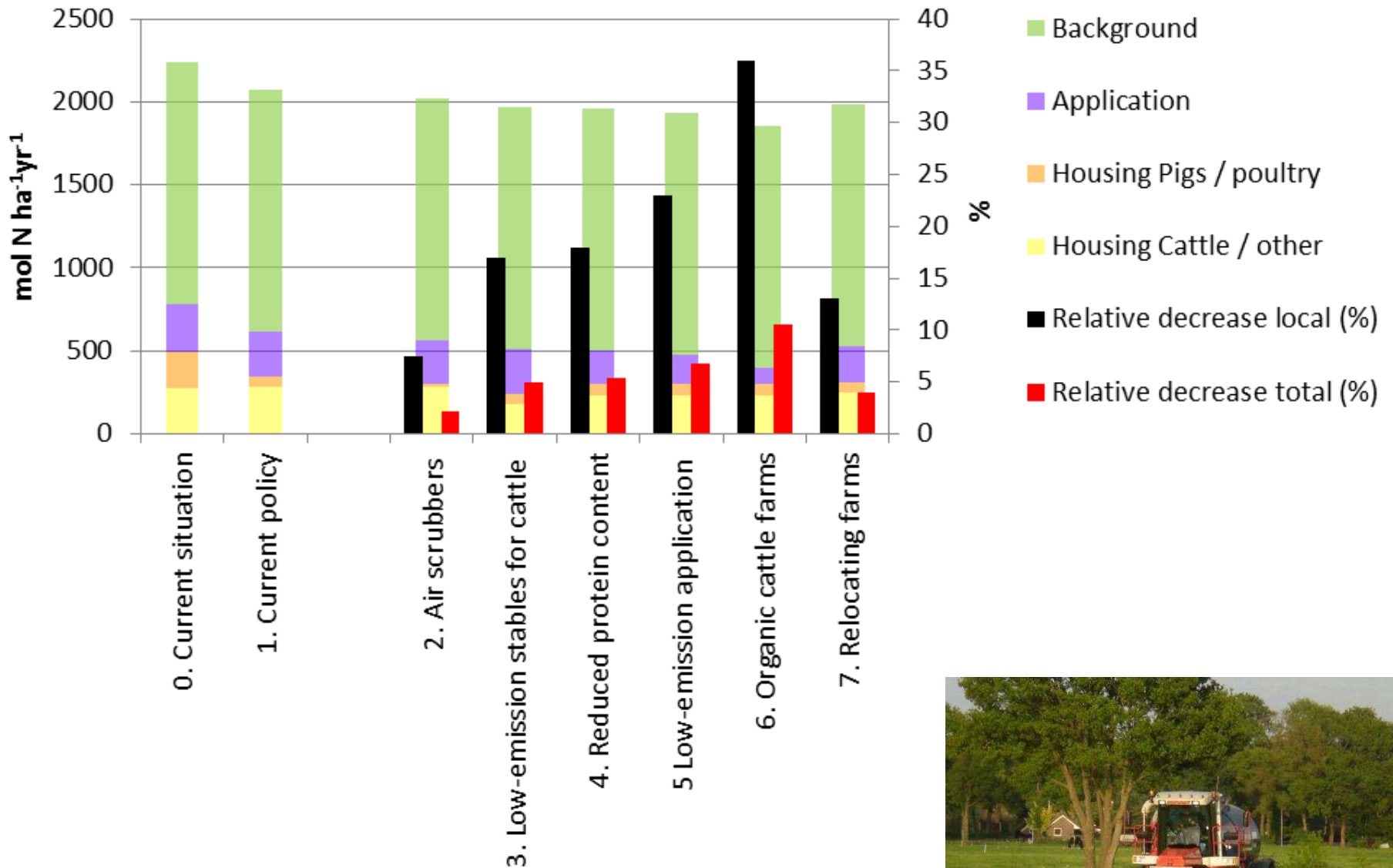
# Effect of measures



- Background
- Application
- Housing Pigs / poultry
- Housing Cattle / other



# Effect of measures



# Effect of measures on CLN exceedance and the average accumulated of CLN (AAE)

Measures	Effect	
	Area exceeding CLN (%)	AAE <sup>1)</sup> (mol ha <sup>-1</sup> yr <sup>-1</sup> ) <sup>2)</sup>
<b>0. Current situation</b>	<b>93</b>	<b>1189</b>
<b>1. Current policy</b>	<b>93</b>	<b>1007</b>
<b>2. Air scrubbers</b>	<b>92</b>	<b>960 (-4.7)</b>
<b>3. Low-emission stables for cattle</b>	<b>91</b>	<b>908 (-9.8)</b>
<b>4. Reduced protein content</b>	<b>91</b>	<b>911 (-9.5)</b>
<b>5 Low-emission application</b>	<b>87</b>	<b>889 (-11.7)</b>
<b>6. Organic cattle farms</b>	<b>84</b>	<b>828 (-17.8)</b>
<b>7. Relocating farms</b>	<b>92</b>	<b>951 (-5.6)</b>

1) Average Accumulated Exceedance  
2) Values in bracket denotes the relative change compared to the current situation (in %)

# Cost efficiency of ammonia measures

Measures	Cost efficiency (million € per mol reduction in NH <sub>3</sub> deposition per ha)
2. Air scrubbers	1.22
3. Low-emission stables for cattle	0.34
4. Reduced protein content	0.19
5. Low-emission application	0.07
6. Organic cattle farms	0.27
7. Relocating farms	8.28



---

# Conclusions

---

- For the province of Overijssel only 35% of the N deposition in the Natura 2000 sites was due to agricultural  $\text{NH}_3$  emissions from the 10 km zone around the Natura 2000 sites
- Evaluated measures at landscape scale have a rather small contribution to protecting Natura 2000 areas against elevated N deposition levels
- Organic farming has the largest effect; Low-emission application the highest cost efficiency
- A reduction of less than 20% in total N deposition could be achieved by all these measures
- Do no focus on the CL exceedance as such, but gap closure leading to a more balanced approach



# Thank you

Thanks to:

Jan Cees Voogd

Edo Gies

Further reading:

- <http://dx.doi.org/10.1016/j.envsci.2012.09.005>
- <http://library.wur.nl/WebQuery/wurpubs/418953>

