

# The use of a Fertiliser Allocation Model for the evaluation of the impact of farm practices and policy measures on fertiliser use, nitrate residues and nitrate leaching

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# Fertiliser Allocation Model: Background

ArcNEMO: Nutrient emission model: quantification of nitrogen and phosphorus losses from agriculture to surface water  
(D'Heygere et al., 2015)

→ ability to calculate a large range of (policy) measures concerning fertilisation

Spatially distributed model; resolution 50m x 50m

Processes in unsaturated zone of the soil profile: soil balance model for mineral N and P:

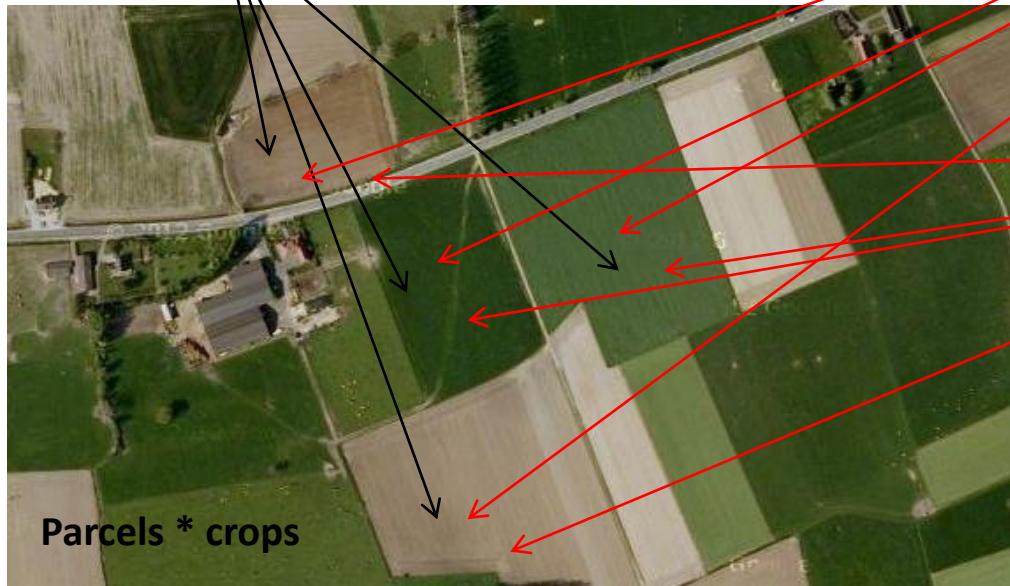
input	output
atmospheric deposition	crop uptake
mineralisation	denitrification
erosion	erosion
fertilisation	drainage
	leaching

Input data available in Flanders concerning fertilisation, at parcel level?

# Fertiliser Allocation Model: Background



Total use of N and P<sub>2</sub>O<sub>5</sub> from animal manure



Total use of N and P<sub>2</sub>O<sub>5</sub> from mineral fertilisers

# Fertiliser Allocation Model: Objective

estimation of  
the applied amount of N and P from animal and mineral fertilisers  
on each agricultural parcel,  
per fertiliser type:

- animal manure (animal origin, liquid or solid manure,...)
- mineral fertilisers

based on available information from the Flemish authorities (Flemish Land Agency)  
by simulating the reasoning and practices adopted by Flemish farmers to fertilise their  
land.

# Use of the Fertiliser Allocation Model (BAM) for scenario analysis

Scenario 0: reference scenario: actual fertilisation standards, actual cropping practices

Scenario 9: providing a winter cover crop on each parcel (mustard or grass)

→ fertilisation standards of parcels ↑

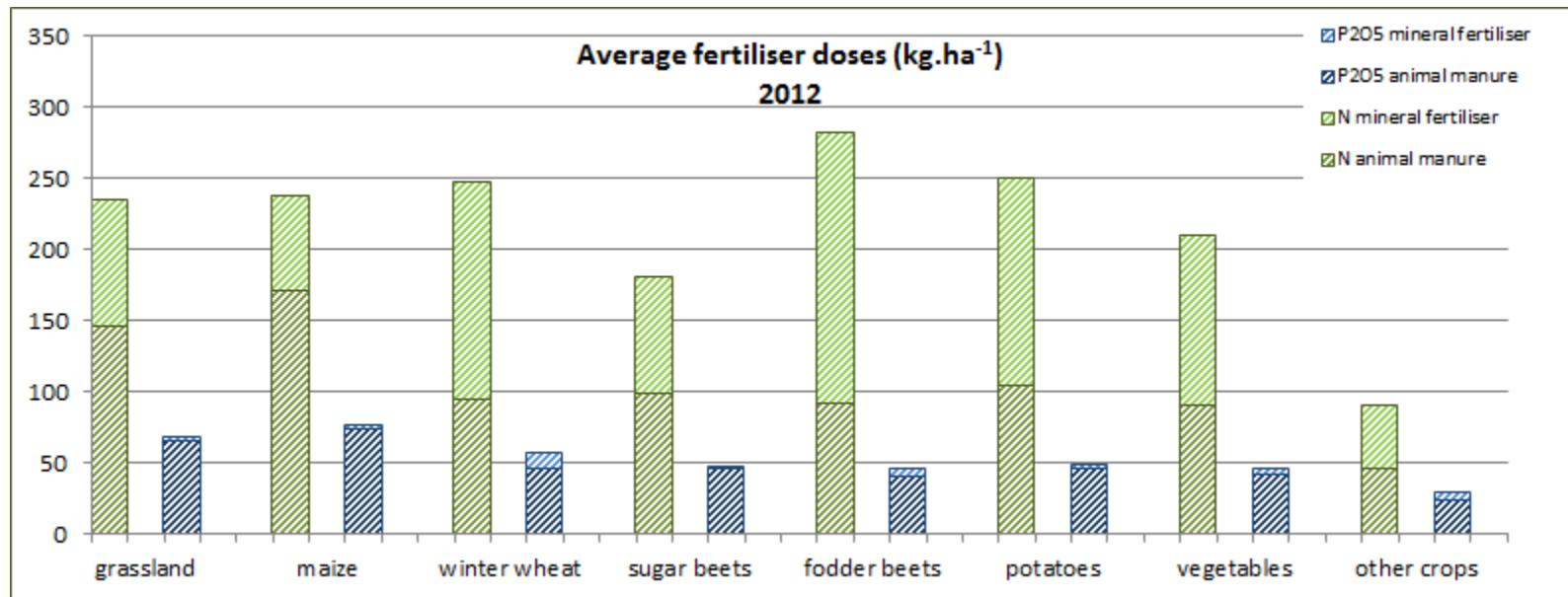
Scenario 11: application of fertilisation standards at farm level (not at parcel level)

- permission to fertilise more on some parcels if compensated by less on others; fertiliser allocation capacity at farm level must be respected.
- drastic change of the allocation of available fertilisers to the parcels

$$\text{fertiliser allocation capacity} = \sum_{\text{parcels}} (\text{fertilisation standard} * \text{surface})$$

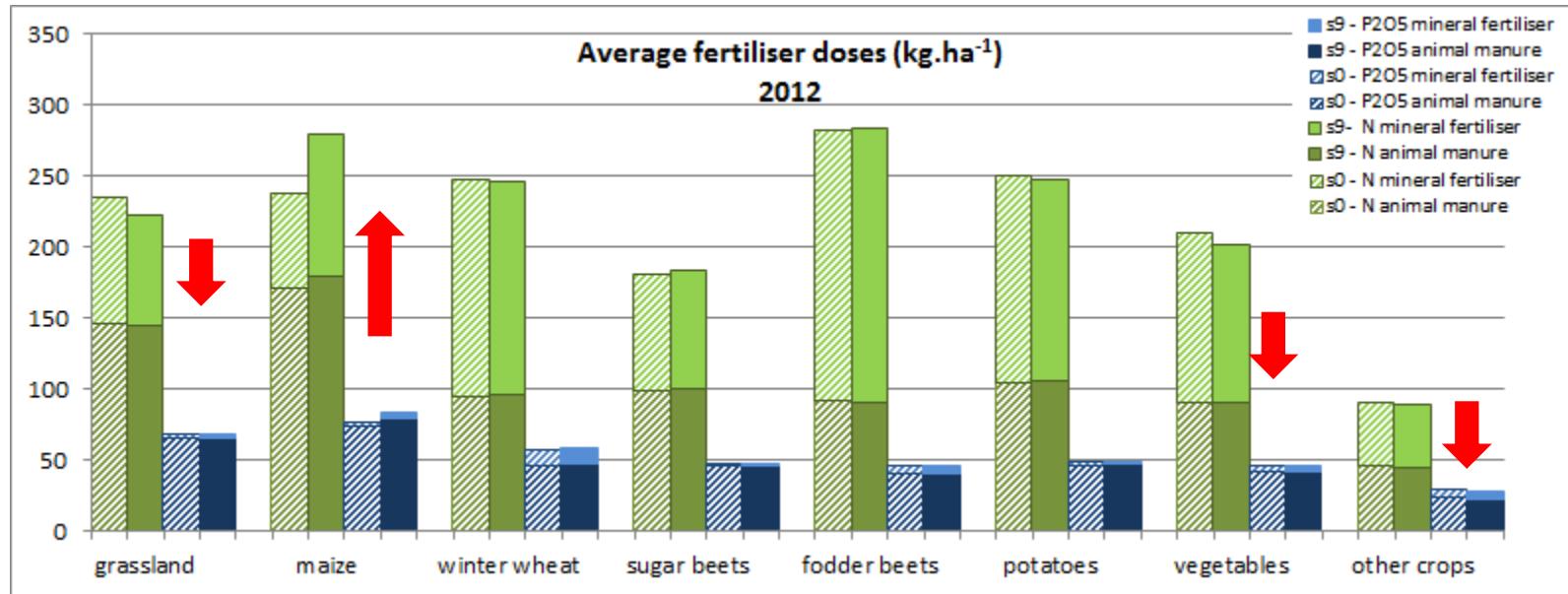
# Reference scenario (s0): actual situation (actual fertilisation standards and cropping practices)

Average calculated fertilisation doses per crop (Flanders):



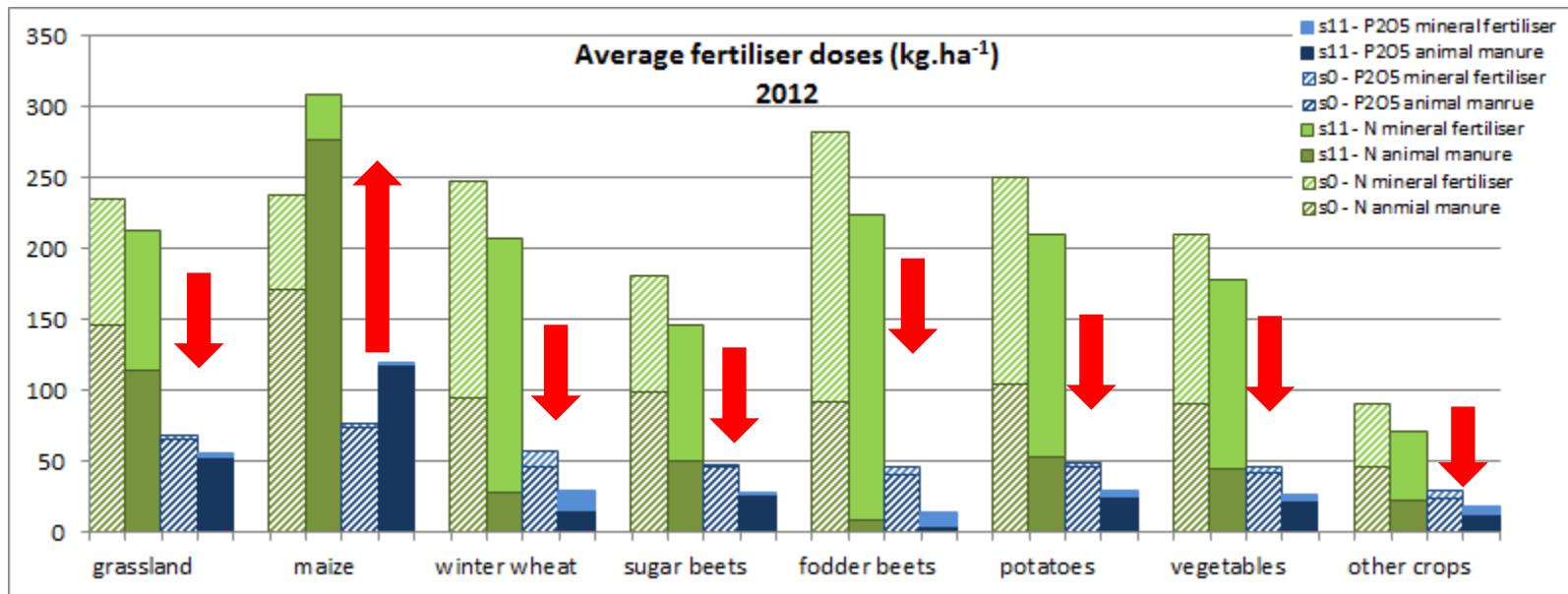
# Scenario Winter cover crop (s9): winter cover crop on each parcel (catch crops mustard or grass)

Average calculated fertilisation doses per crop (Flanders):

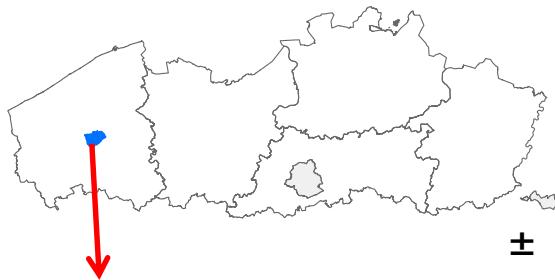


# Scenario Farm level fertilisation (s11): application of fertilisation standards on farm level (not on parcel level)

Average calculated fertilisation doses per crop (Flanders):



# Example farm1: mixed farm with mainly maize and grassland

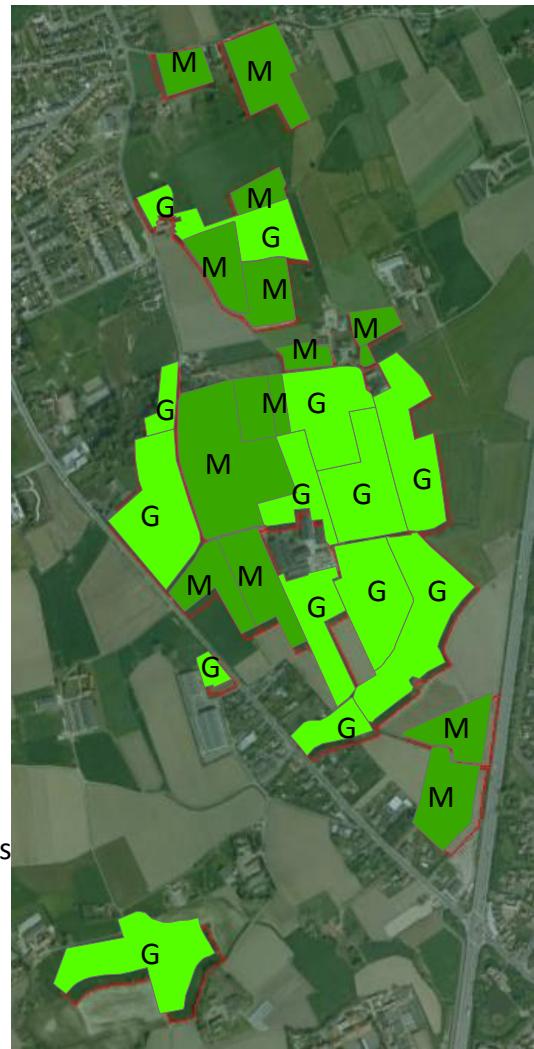


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sandy loam region (West-Flanders)  
grassland (34 ha)  
maize (25 ha)  
pigs (2661)  
cattle (292)

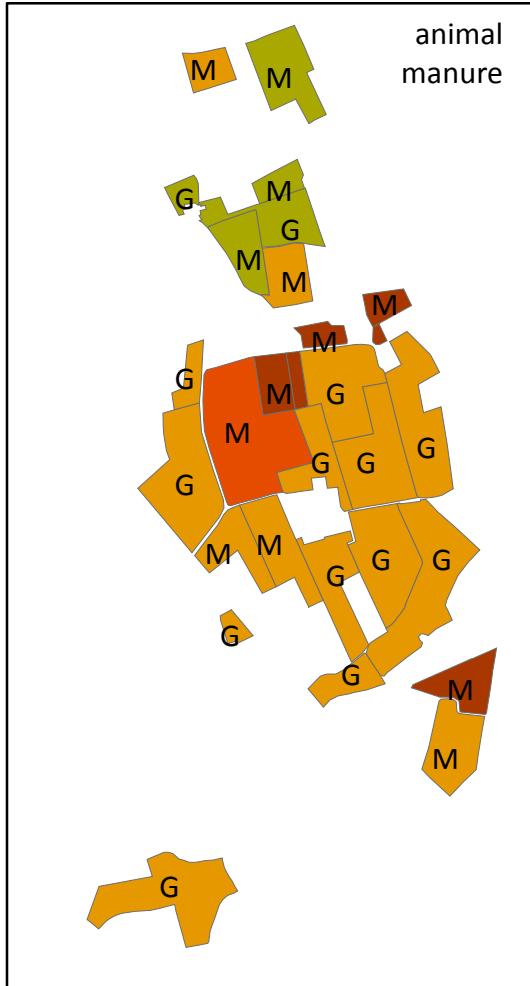
total N fertiliser use:

- 13 400 kg N from animal manure
- 6 800 kg N from mineral fertilisers

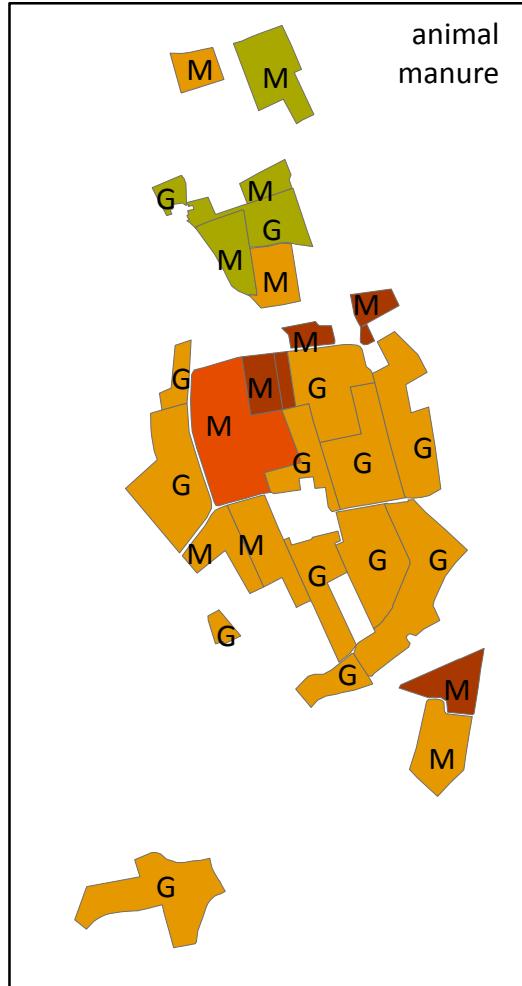


# Farm1 (maize & grassland): calculated N fertilisation in different scenario's

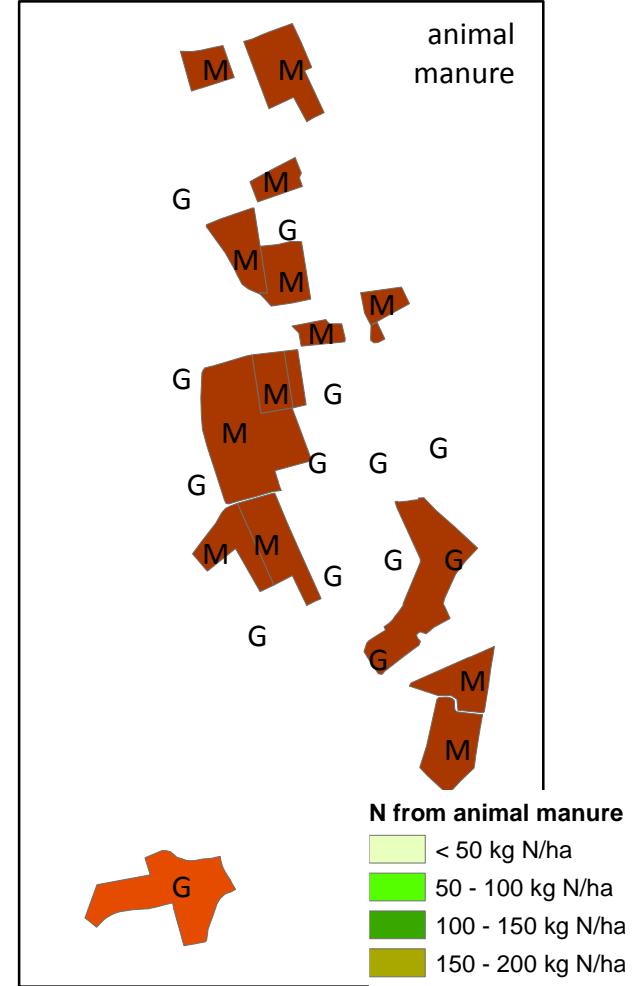
s0 - ref. scenario



s9 - winter cover



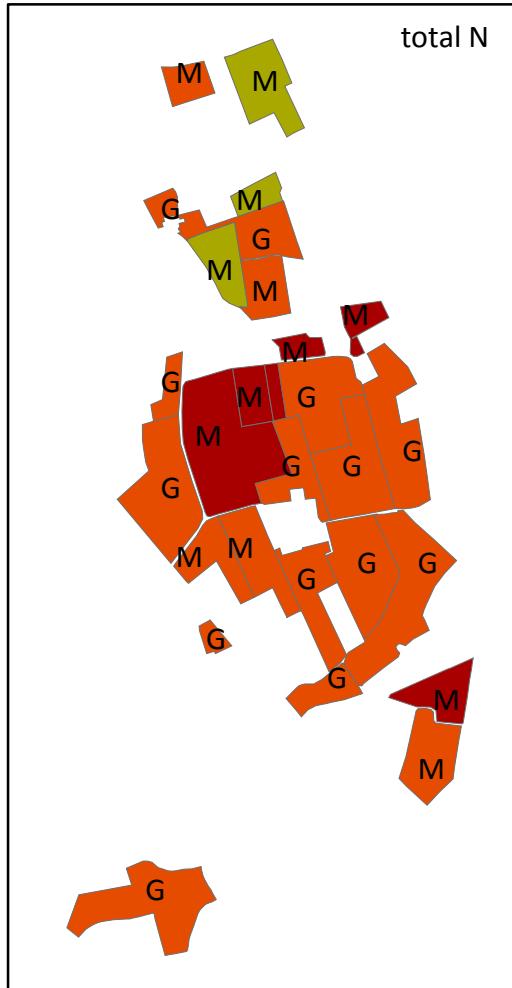
s11 - farm level



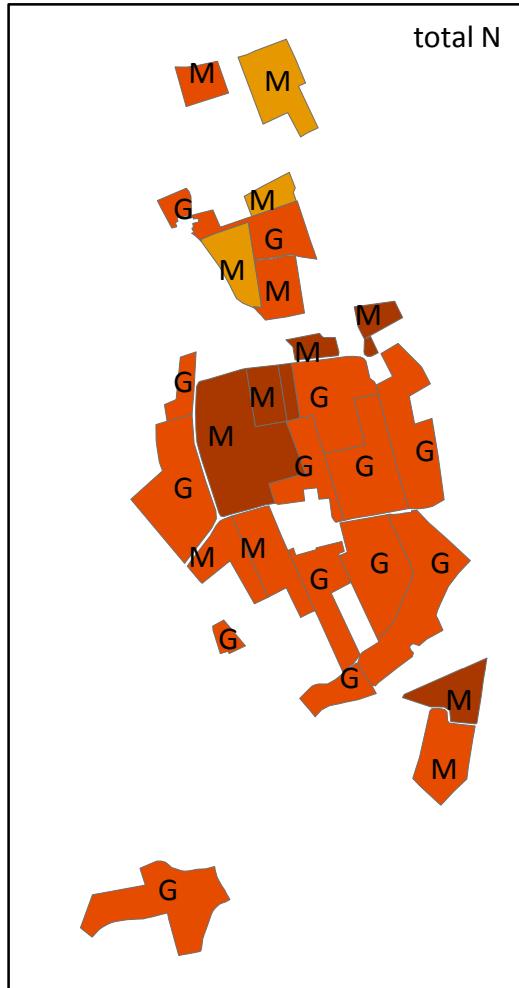
N from animal manure
< 50 kg N/ha
50 - 100 kg N/ha
100 - 150 kg N/ha
150 - 200 kg N/ha
200 - 250 kg N/ha
250 - 300 kg N/ha
> 300 kg N/ha

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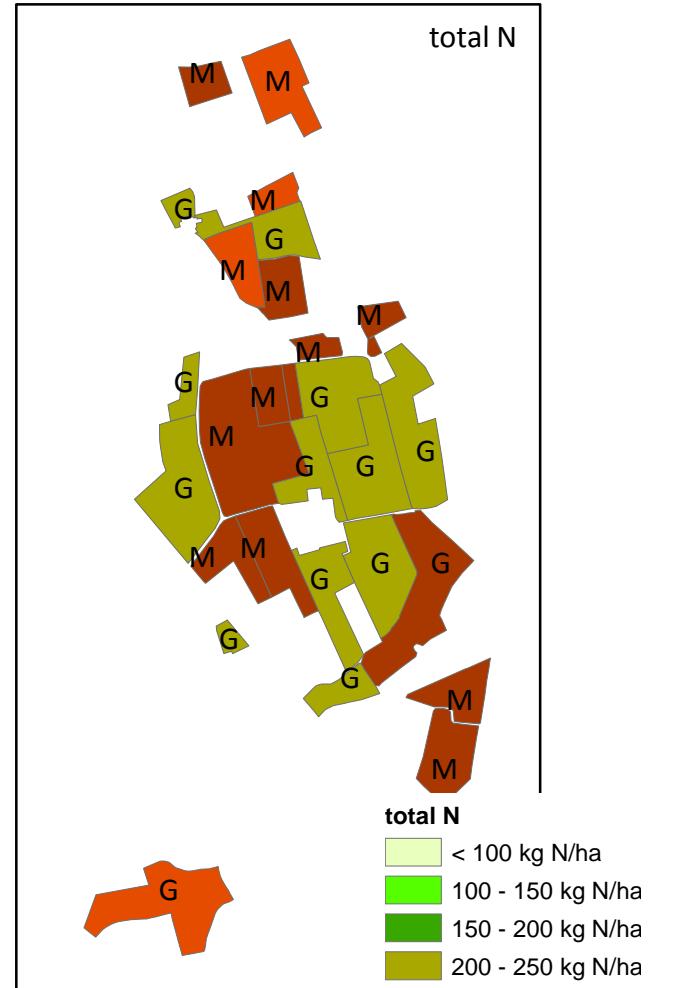
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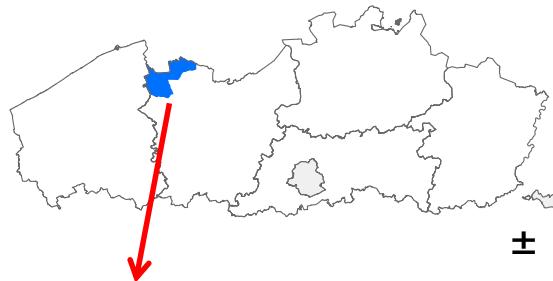


s11 - farm level



total N
< 100 kg N/ha
100 - 150 kg N/ha
150 - 200 kg N/ha
200 - 250 kg N/ha
250 - 300 kg N/ha
300 - 350 kg N/ha
> 350 kg N/ha

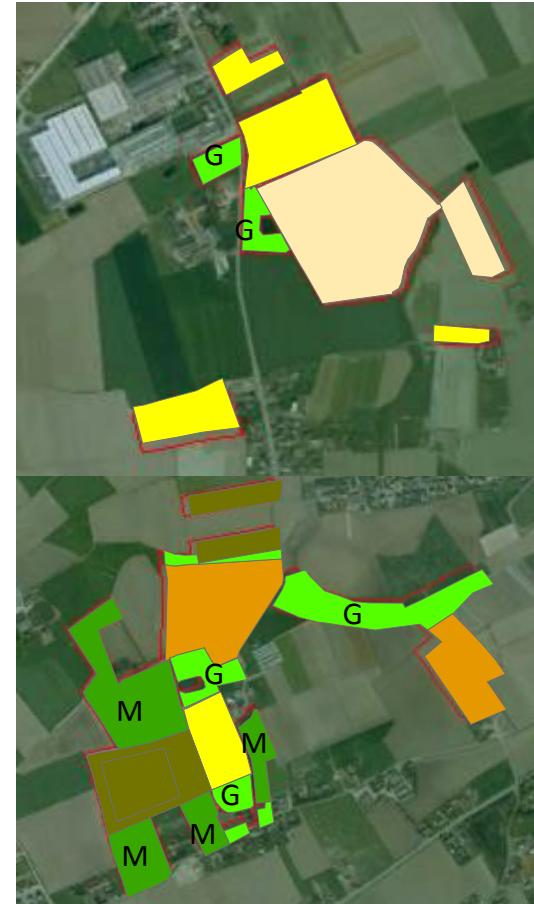
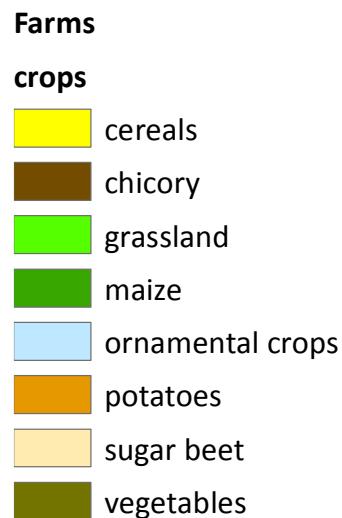
# Example farm2: arable farm with different crops



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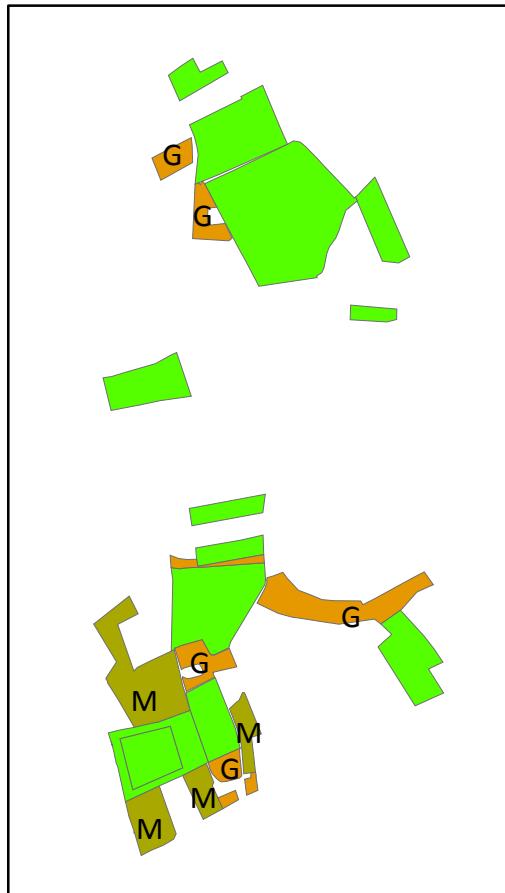
sandy loam region (East-Flanders)  
grassland (2 ha)  
maize (5 ha)  
vegetables (5 ha)  
chicory (3 ha)  
potatoes (2 ha)  
trees and ornamental crops (1 ha)  
no animals  
total N fertiliser use:

- 2 700 kg N from animal manure
- 900 kg N from mineral fertilisers

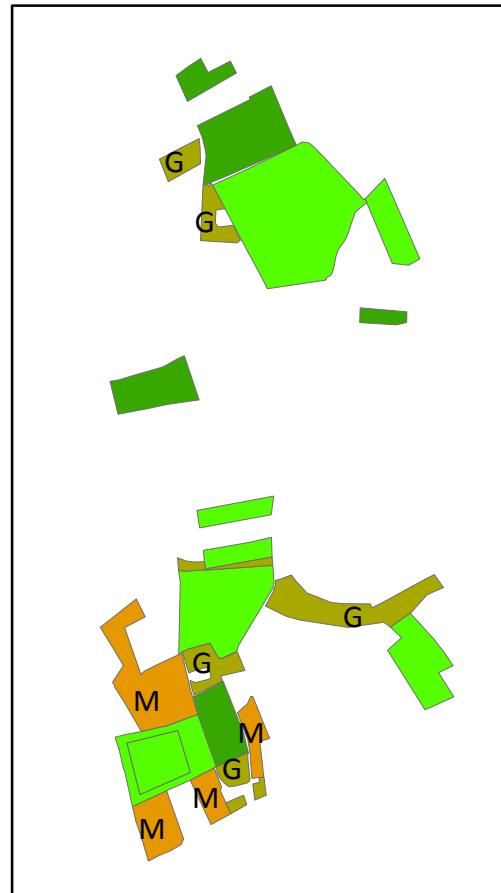


# Farm2 (arable crops): calculated N fertilisation in different scenario's

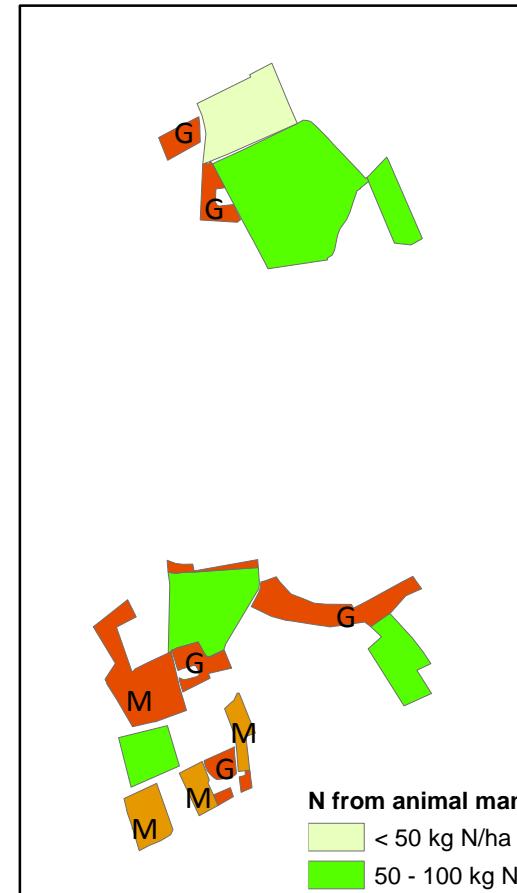
s0 - ref. scenario



s9 - winter cover



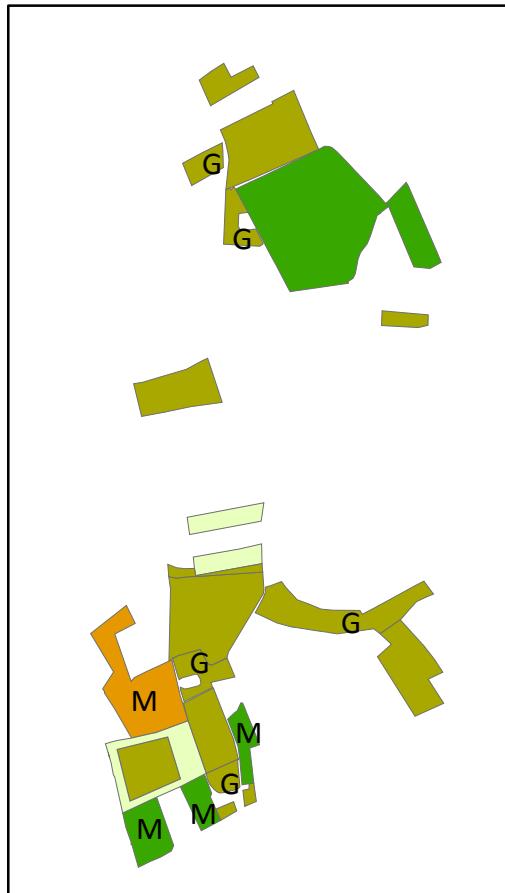
s11 - farm level



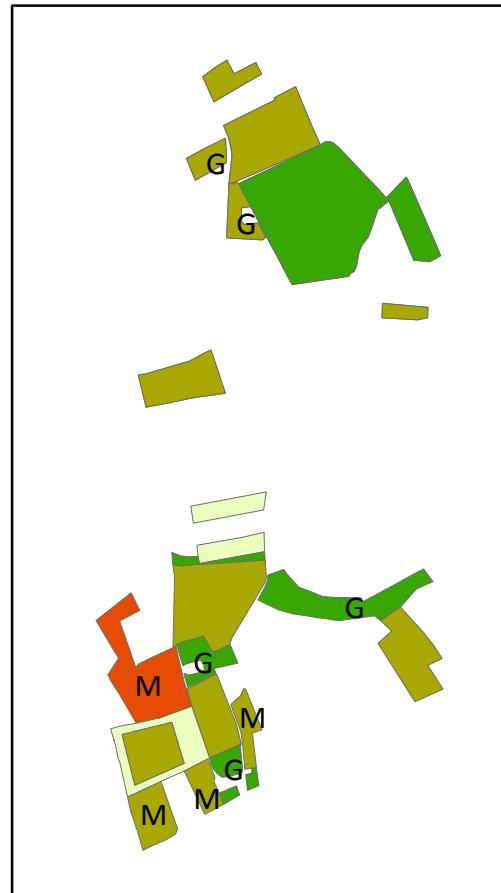
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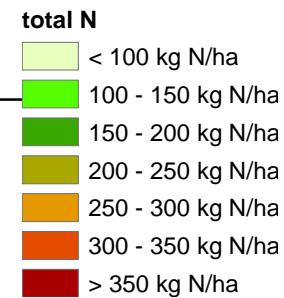
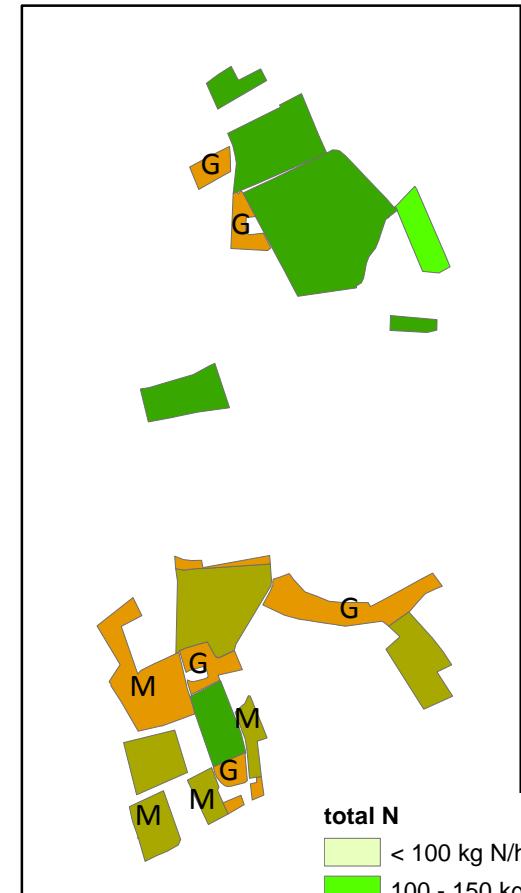
s0 - ref. scenario



s9 - winter cover



s11 - farm level



# Conclusions

- The fertiliser allocation model is able to calculate realistic fertiliser doses per parcel at farm and region level.
- Doses are calculated per fertiliser type → modeling of plant uptake, mineralisation, leaching, etc. in ArcNEMO.
- The model simulates the reasoning and practices adopted by Flemish farmers to fertilise their land.
- Therefore it can be used to simulate scenarios in order to estimate the effect of policy measures on fertilisation at parcel level.

# Acknowledgement

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thank you for your attention