

A comparison of disaggregated nitrogen budgets for Danish agriculture using Europe-wide and national approaches

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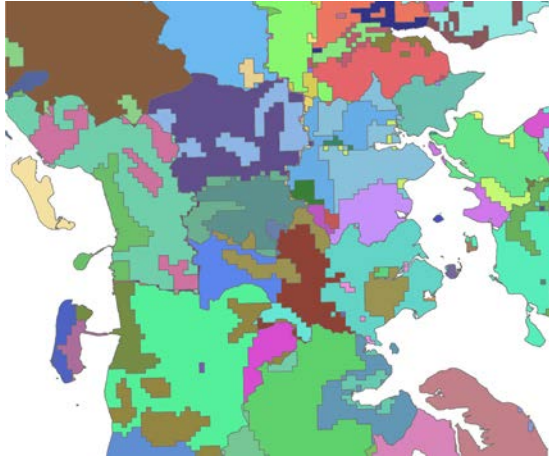
Objectives

- Inter-comparison of disaggregated agricultural N budgets for Denmark based on (the new) INTEGRATOR with 1 × 1 km livestock data and manure distribution, using:
 - Generic (EU-wide) data
 - Detailed Danish data
- Here: Focus on NH_3 emission and N leaching in 2010

INTEGRATOR-EU MODEL

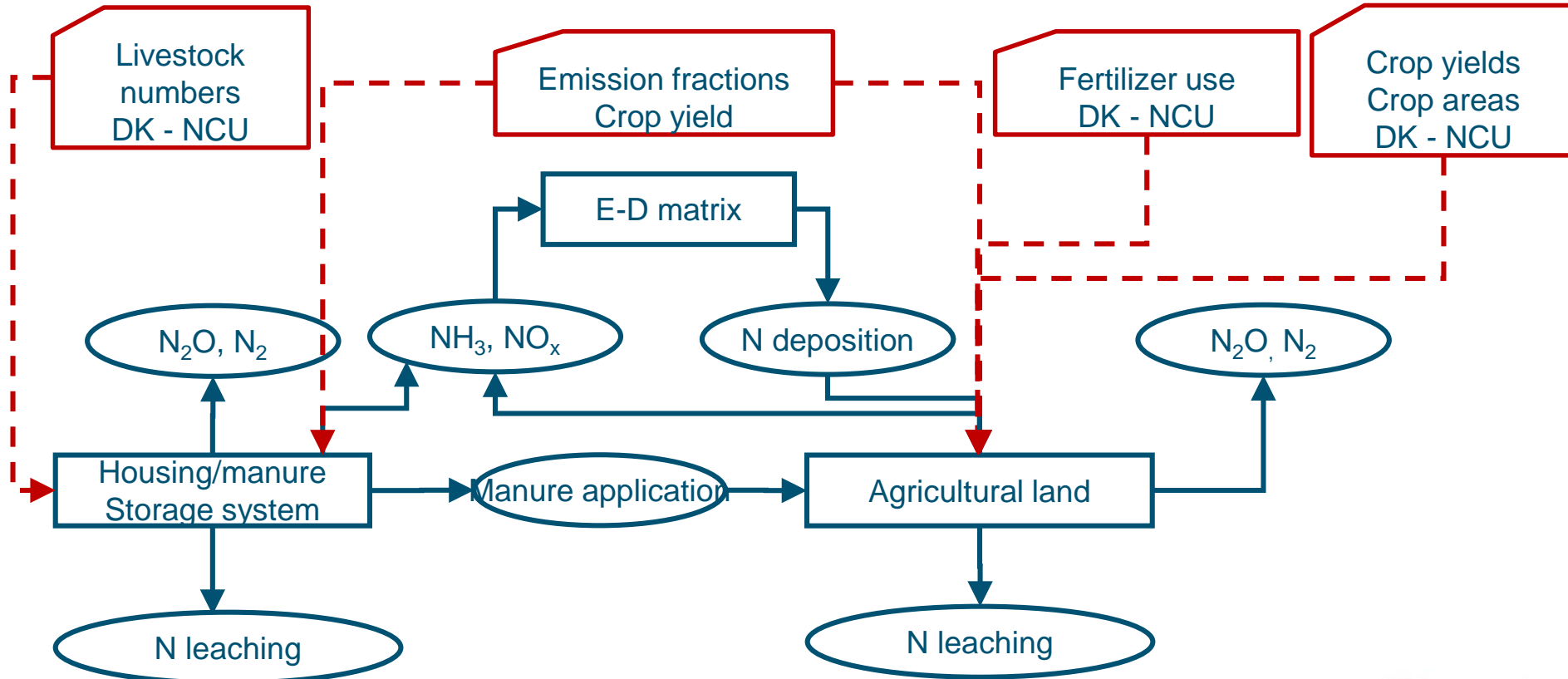
- An integrated tool for the European scale to:
 - Predict past, current and future N (NH_3 , NO_x , NO_3), P and GHG (CO_2 , N_2O , CH_4) losses in response to:
 - Changes in land cover and land management
 - While including interactions between agricultural and non-agricultural systems by gaseous N emissions and related N deposition
- Spatial levels:
 - NCU level: ~ 50,000 N Calculation Units
 - Europe: 27 Member States (countries)
- Focus of this study:
 - Agricultural soils only, limited to N for the year 2010

INTEGRATOR-DK: Adaptation of NCU boundaries



- NCU: Polygons of clusters of 1 km x 1 km pixels. NCU is unique combination of soil type, climate, slope and NUTS3
- Remapped to avoid NCUs crossing municipal boundaries
- From 107 to 605 NCUs

INTEGRATOR-DK: linking with Danish data



Results – ammonia emission and nitrate leaching

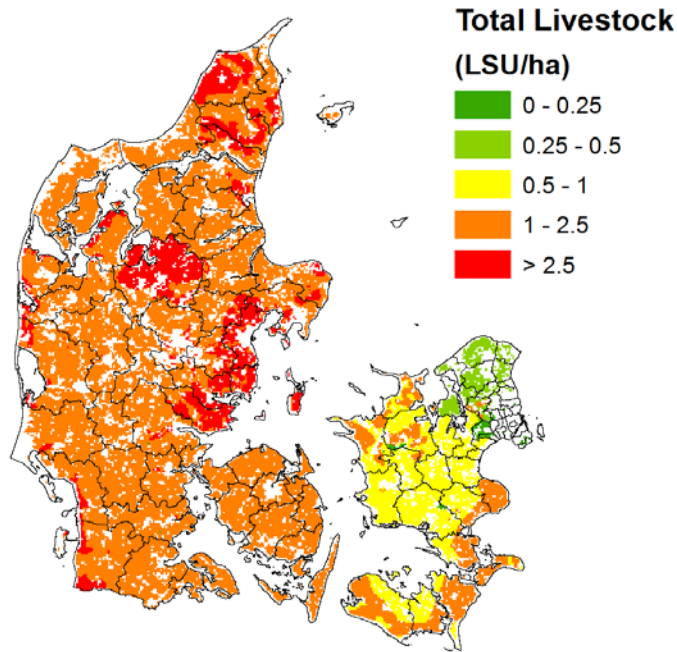
- Comparison of INTEGRATOR-EU and INTEGRATOR-DK
 - Effect of higher spatial resolution input data
- Comparison of INTEGRATOR-DK and Danish model results
 - (Mainly) effect of model used

Comparison with national DK budgets 2010

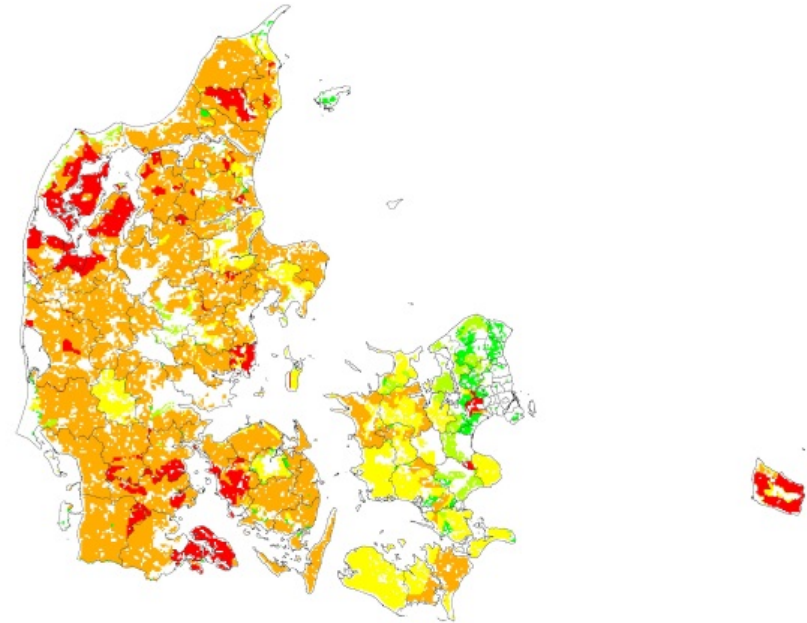
Source	N budget for Denmark (kton N yr ⁻¹)		
	Int-EU	Int-DK	Bal-DK ¹⁾
	2010	2010	2010
Manure excretion	240	251	238
Fertilizer	197	197	198
N biosolids	4	3	7
Deposition	28	35	21
Fixation	13	21	41
Mineralisation	52	48	77
Total input	534	556	580
Uptake	323	283	302
Emission NH ₃	56	61	51
Emission N ₂ O	5	6	11
Emission NO _x	3	2	11
Emission N ₂	74	106	54
Leaching + runoff	74	98	151
Total output	534	556	580

¹⁾ Based on Hutchings et al (2014)

Total livestock numbers (LSU) in 2010

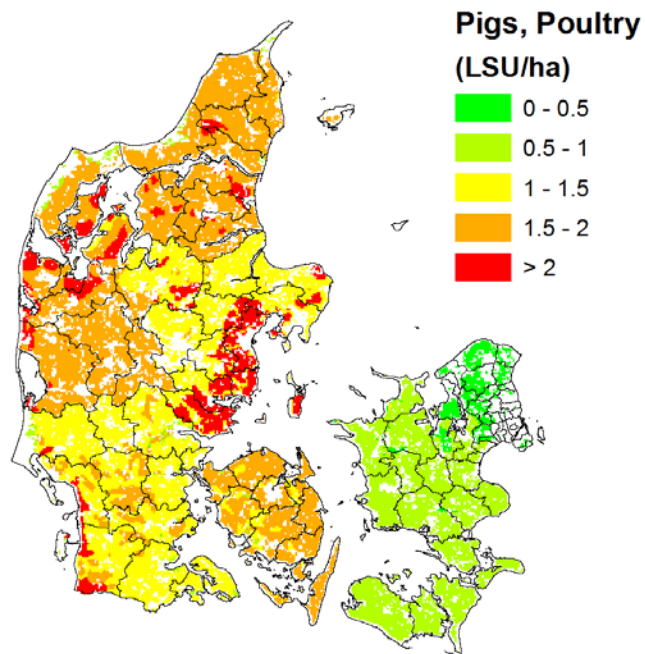


INTEGRATOR-EU

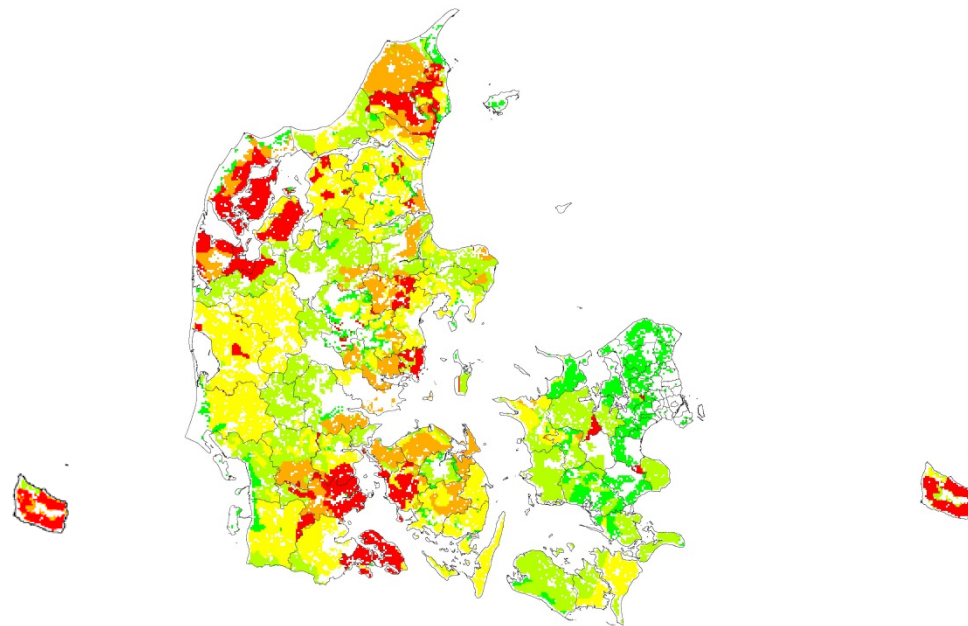


INTEGRATOR-DK

Livestock numbers (LSU) pigs and poultry in 2010

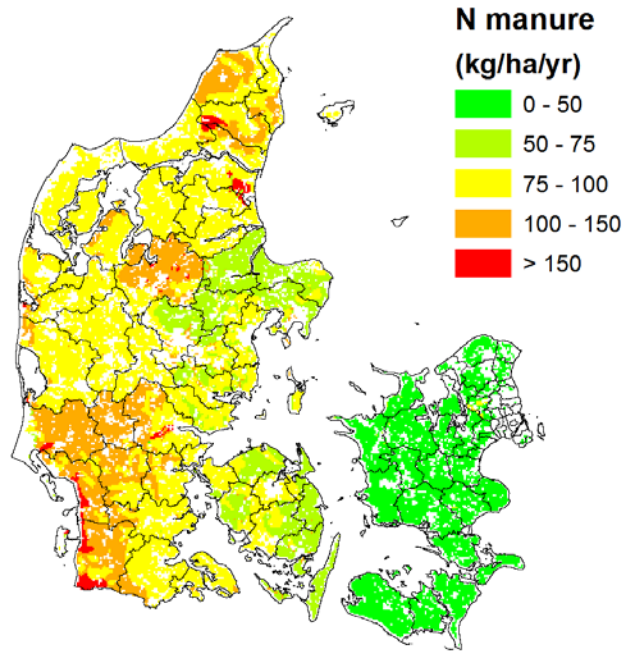


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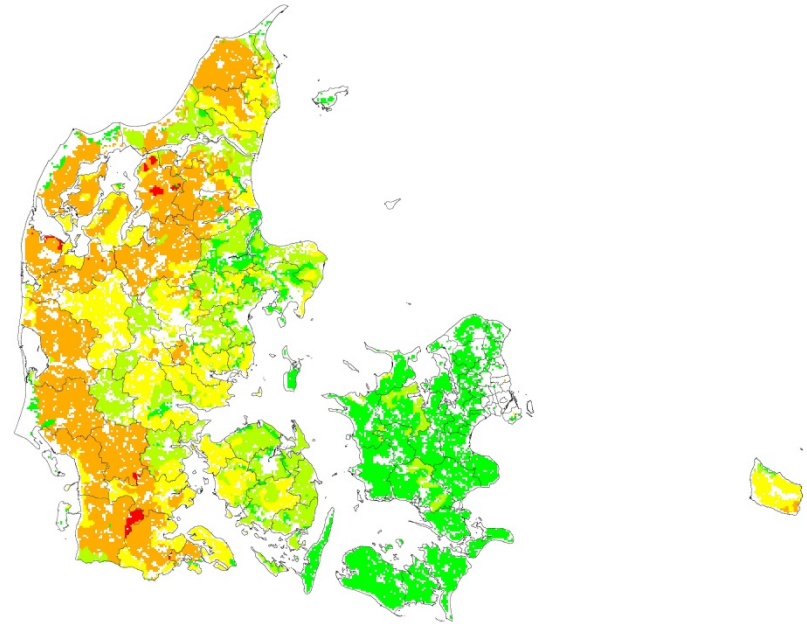


INTEGRATOR-DK

N animal manure input 2010

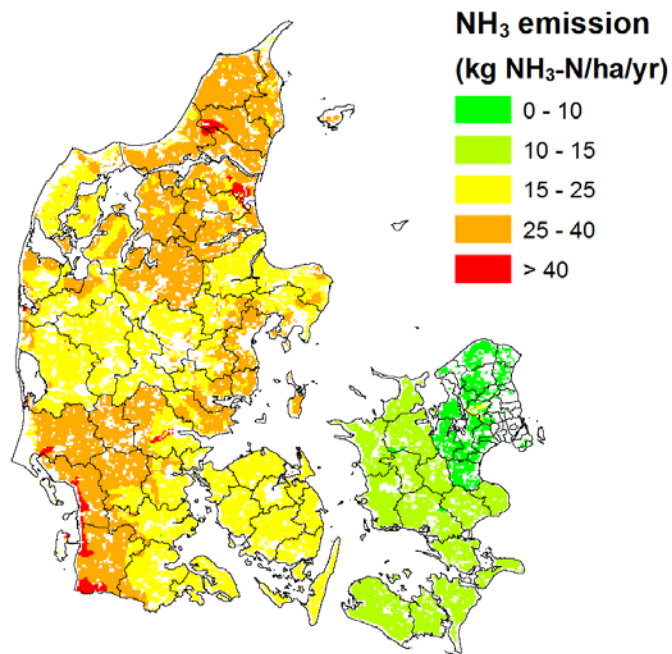


INTEGRATOR-EU

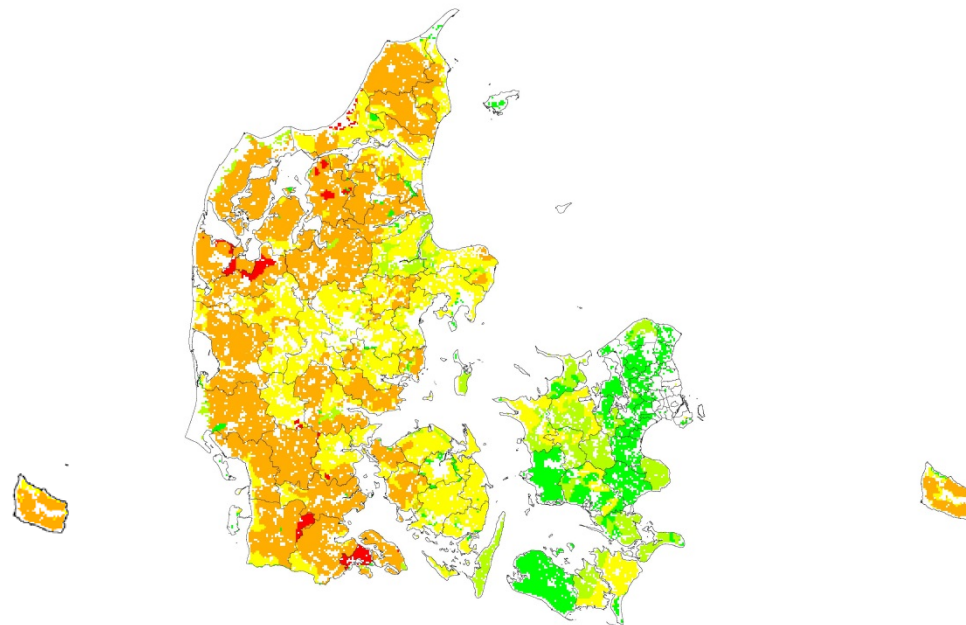


INTEGRATOR-DK

Total agricultural ammonia emission 2010

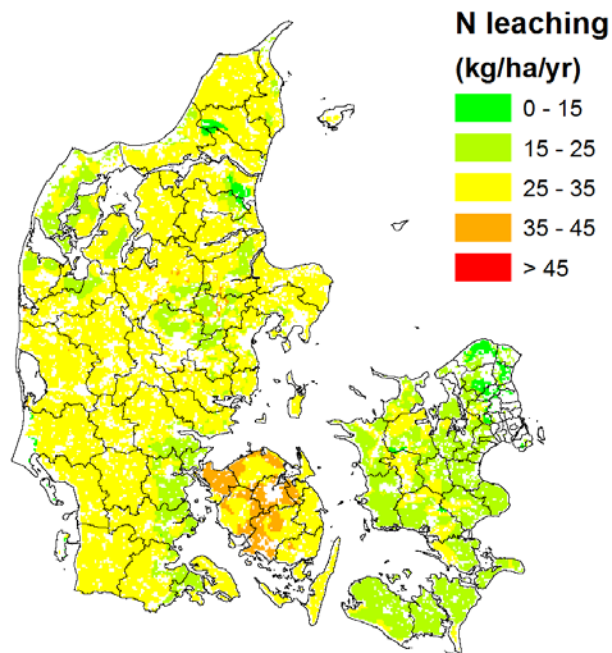


INTEGRATOR-EU

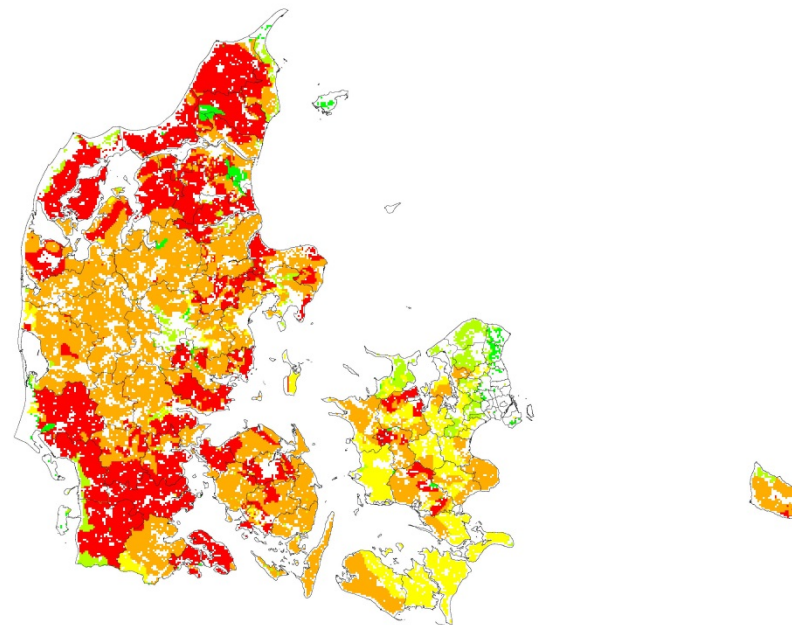


INTEGRATOR-DK

N leaching and runoff 2010

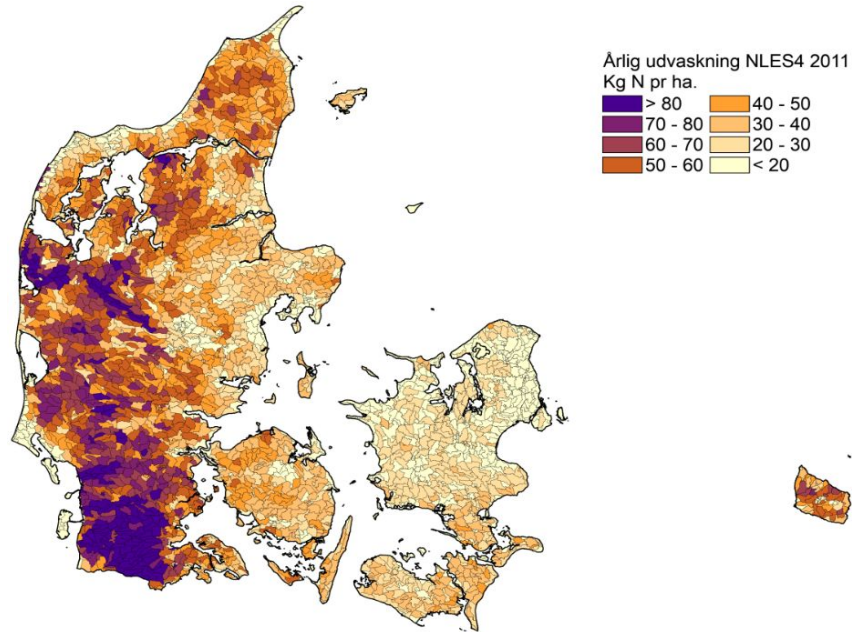


INTEGRATOR-EU

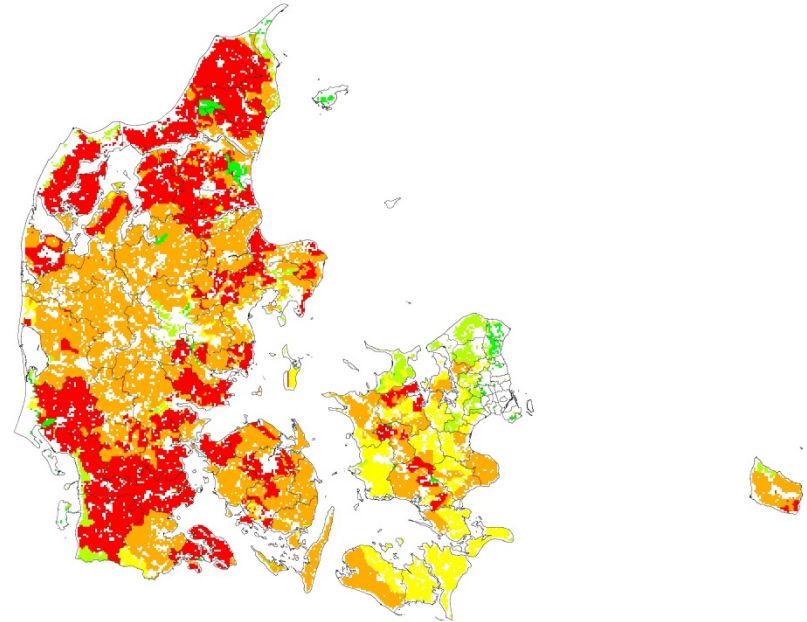


INTEGRATOR-DK

Comparison with observation based N leaching



NLES4 – 2011 from N model report



INTEGRATOR-DK 2010

Conclusions

- Large differences between Integrator-EU and DK in the spatial distribution of NH_3 emission and N leaching, due to differences in livestock distribution
- Large differences between both Integrator versions and DK estimates in N leaching at national scale, due to higher crop offtake and denitrification in Integrator
- The incorporation of detailed national data rather than less detailed European data does not necessarily result in more reliable national N budgets
- There is clearly a need for collection of high resolution data from all Member States , esp. in view of livestock numbers and denitrification

Thank you!

