Land Use and Landscape Management

Theme 4 workshop reporting for TFRN-12
Aarhus University, 28 June 2017

RE: ***Joint DG ENV & TFRN workshop: Towards joined-up nitrogen guidance for food, air, water and climate co-benefits.***

Brussels, October 11th and 12th, 2016.

European Commission

LRTAP Long-range Transboundary Air Pollution

dNmark research alliance

Participants

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Sarah	Faulkner	National Farmers Union	United Kingdom
Simon	Buckle	OECD	France
Penny	Johnes	University of Bristol	United Kingdom
Sergiy	Medinets	ONU	Ukraine
Hélène	Simonin	EDA	Belgium
Tommy	Dalgaard	Aarhus University	Denmark
Michael	Kuegler	VLK+EUFRAS(European Forum of Rural Advisory Services)	Belgium
Tanja	Schmadl	European Region Tyrol - South Tyrol - Trentino - Brussels Office	Austria
Ute-Maria	Skiba	NERC- Centre fro Ecology and Hydrology	United Kingdom
Patrick	Durand	INRA	France
Bert	Baumann	RIVM	Netherlands
Lidia Maria	Sas Paszt	Research Institute of Horticulture	Poland
Keith	Smith	University of Edinburgh	United Kingdom
Clare	Howard	CEH	United Kingdom
Mark	Sutton	CEH	United Kingdom
Klaus	Butterbach-Bahl	KIT/ILRI	Germany

Preliminary list of land use and landscape management measures

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Geographically targetted land use change:

- *Set aside*
- *Integrated Buffer Zones (Riparian Buffer Strips)*
- *Biodiversity buffer strips around fields*
- *Hedgerows and afforestation*
- *Changed crop rotation/ perennial crops (for e.g. permanent grasslands)*
- *Agroforestry*
- *Wetlands and watercourse restoration*
- *Constructed mini-wetlands……*

Geographically targeted management:

- *Soil tillage and conservation (for e.g. no till on organic soils)*
- *Drainage and controlled drainage*
- *Grassland management*
- *Placement of livestock production*
- *Manure (re)distribution, fertigation etc.*
- *Placement of biogas plants and bio-refineries for biomass redistribution……*

From the Theme 4 background document

Top-10 landscape measure candidates

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- **Agroforestry**
  - Livestock agroforestry
  - Agroforestry/ alley cropping
- **Buffer zones**
  - Riparian buffer strips (harvested)
  - Riparian buffer strips (non-harvested)
  - Biodiversity buffer strips / set-aside land
- **Tree planting**
  - Planting trees on steep slopes and marginal land
  - Hedgerows
  - Afforestation
- **Wetlands (harvested/non-harvested, restored/constructed)**
- **Landscape planning (spatial)**
  - Regional, spatial integration of livestock and crop farming
  - Soil quality based differentiation of land use, zoning
  - Spatially targeted mitigation measures to the most sensitive/responsive sites .....
- **Landscape management (spatio-temporal)**
  - Permanent grassland and grassland management
  - Fertigation etc.
  - Constrained outdoor grazing livestock production (and increased N tax!!?) .....

Revised assessment categories

- **Water quality**
- **Air pollution**
- **GHG**
- **NUE**
- **Other issues… iLUC etc.**

Practice	Water quality¤	Air Pollution	GHG emissions	NUE, surplus and output §	Notes (incl. indicators suggested) £
	• Nitrate • Ammonia • Total N ¤¤	• Total NH3 emissions • Ammonia concentrations*** • NOx emissions from soils** • N'PM2,5 concentrations	• Nitrous oxide • Carbon dioxide # • N2 ## • Methane ###	• Efficiency • Surplus • Output	
Riparian buffer strips	--NO3 -+totalN +NH3 +org N	No link	++N2O +-CH4 --CO2 if used for bioenergy/hay…	+efficiency if harvested	**produce bioenergy crops/hay grass in the buffer strip to be able to remove biomass N** **co-benefit: reduce erosion (sediment)** **resource person: Penny, Patrick**

Guidance checklist for implementation of landscape scale measures

Relevance of the different nitrogen forms for the landscape scale measure implementation:

- **Water quality**
  - Nitrate
  - Ammonia
  - Total N… Organic compounds…
- **Air pollution**
  - Total ammonia emissions and concentration
  - Nitrous oxide, NOx …
  - N'PM2,5
- **GHG**
  - Nitrous oxide
  - Free nitrogen
  - Relation to other greenhouse gasses
- **NUE**
- **Other issues… iLUC etc**

Summary of next steps

- Review measure tables:
- Discuss top-down versus bottum-up approaches
- Elaborate recommendations for the further work on land use and landscape scale management measures:
- AOB?

Table 1. Landscape management impact on Nitrogen losses (first draft synthesis for discussion)

a) Geographically targeted Land use

Practice	Leaching/runoff	Ammonia volatilization	Nitrous oxide emissions	Notes
Set-aside grassland				
Riparian buffer strips	↓	↓	↓ ↑	N2O mitigation rate depends on

b) Geographically targeted management

Practice	Leaching/runoff	Ammonia volatilization	Nitrous oxide emissions	Notes
Types of soil				

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3. Summary and conclusions

Based on the European Nitrogen Assessment, and for further development, the following key points in relation to nitrogen flows and fate in rural landscapes have summarized (Cellier *et al.* 2011): "

Nature of the problem:

- The transfer of nitrogen by either farm management activities or natural processes

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Additional points to discuss

- **Mixing agricultural and non agricultural (or extensively managed) land uses dilutes the concentrations of nitrogen in air and water, which may be of interest for adverse effects (or regulation compliance…) based on concentrations, and not on fluxes.**
- **In a landscape, you have generally several farms, and you can sometimes take advantage of the complementary and/or collaboration between farms to better close the nitrogen cycle. The obvious example is the mixing of livestock farms and crops farms (this was the main subject of the FP7 CANTOGETHER program http://www.wur.nl/en/show/cantogether.htm), but there are other examples.**

Additional studies to include

- **A modeling study on mitigation of N_2O emissions and NO_3 leaching at different agricultural sites across Europe using LandscapeDNDC** Molina-Herrera et al. Biogeosciences, 10, 119–133, 2013 www.biogeosciences.net/10/119/2013/

- **Estimation of nitrogen budgets for contrasting catchments at the landscape scale http://www.biogeosciences.net/10/119/2013/bg-10-119-2013.pdf**
- **Heterogeneity of atmospheric ammonia at the landscape scale and consequences for environmental impact assessment http://ac.els-cdn.com/S0269749113002157/1-s2.0-S0269749113002157-main.pdf?_tid=8d247716-8bcf-11e6-91d1-00000aab0f6b&acdnat=1475763602_fa7ea83f86ac35ff70fba00feb3bb3f2**
- **Catchment land use effects on fluxes and concentrations of organic and inorganic nitrogen in streams http://ac.els-cdn.com/S0167880914004733/1-s2.0-S0167880914004733-main.pdf?_tid=be94ae92-8bcf-11e6-b4a2-00000aab0f02&acdnat=1475763685_7d776822a8e6ede73983a812a3fc7a5b**