
Increasing nutrient efficiency – potentials and limitations

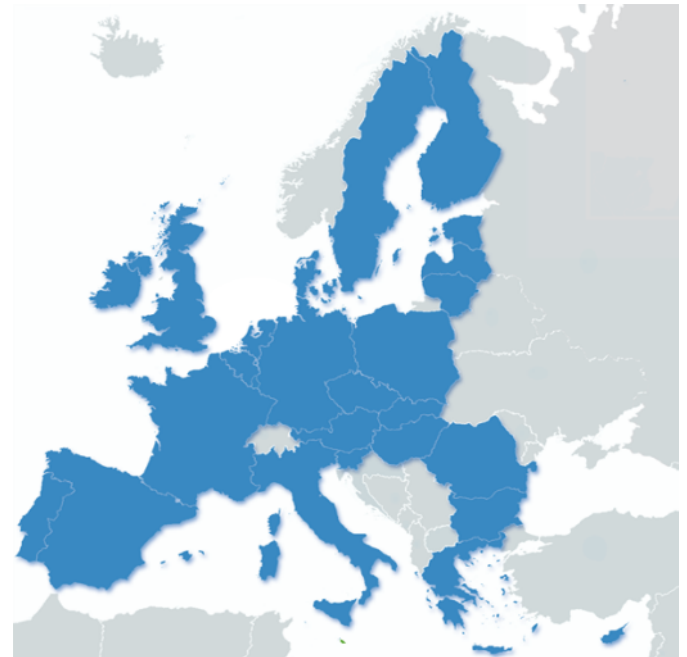
Case study: European Union

Gerard Velthof

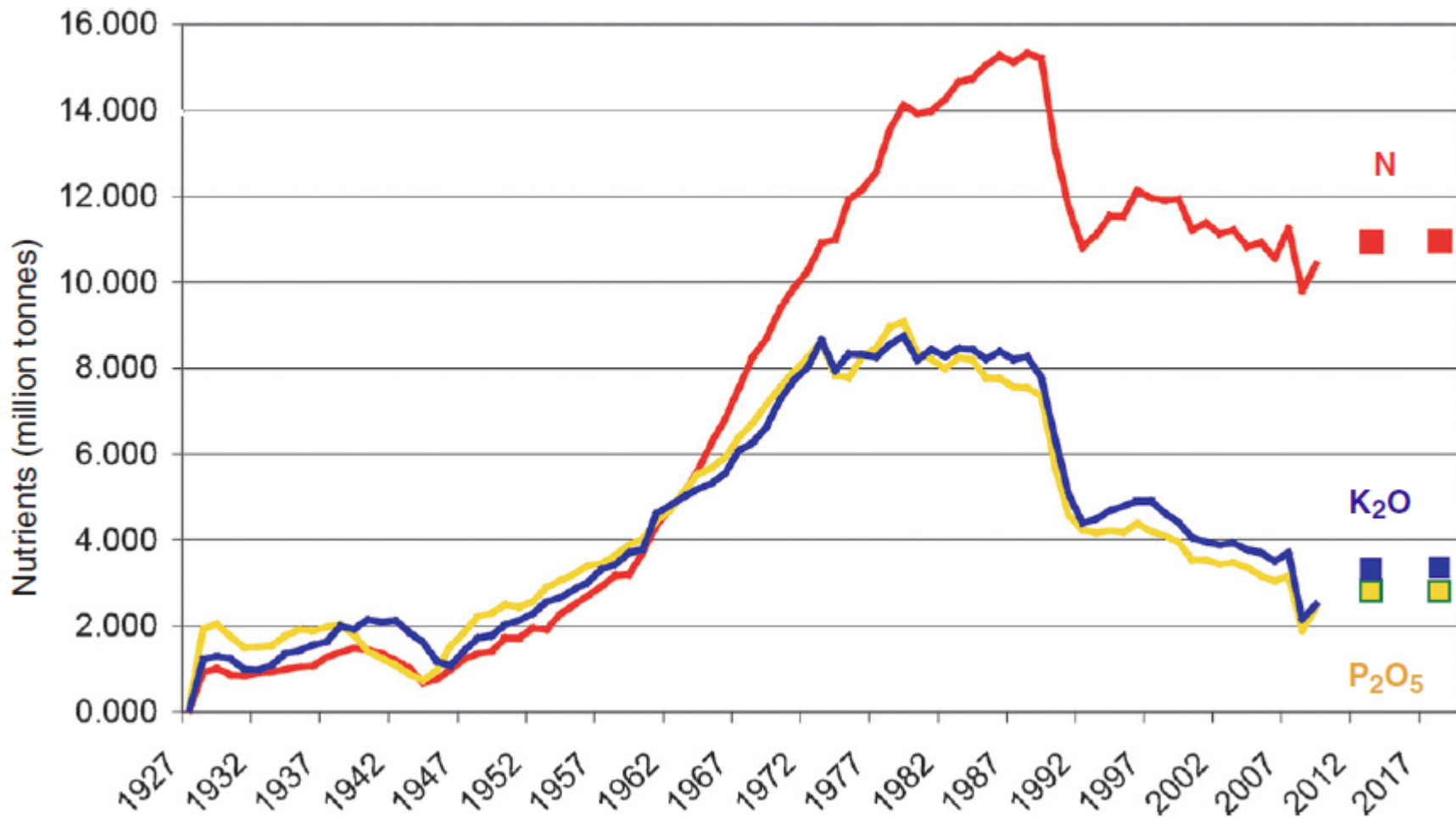


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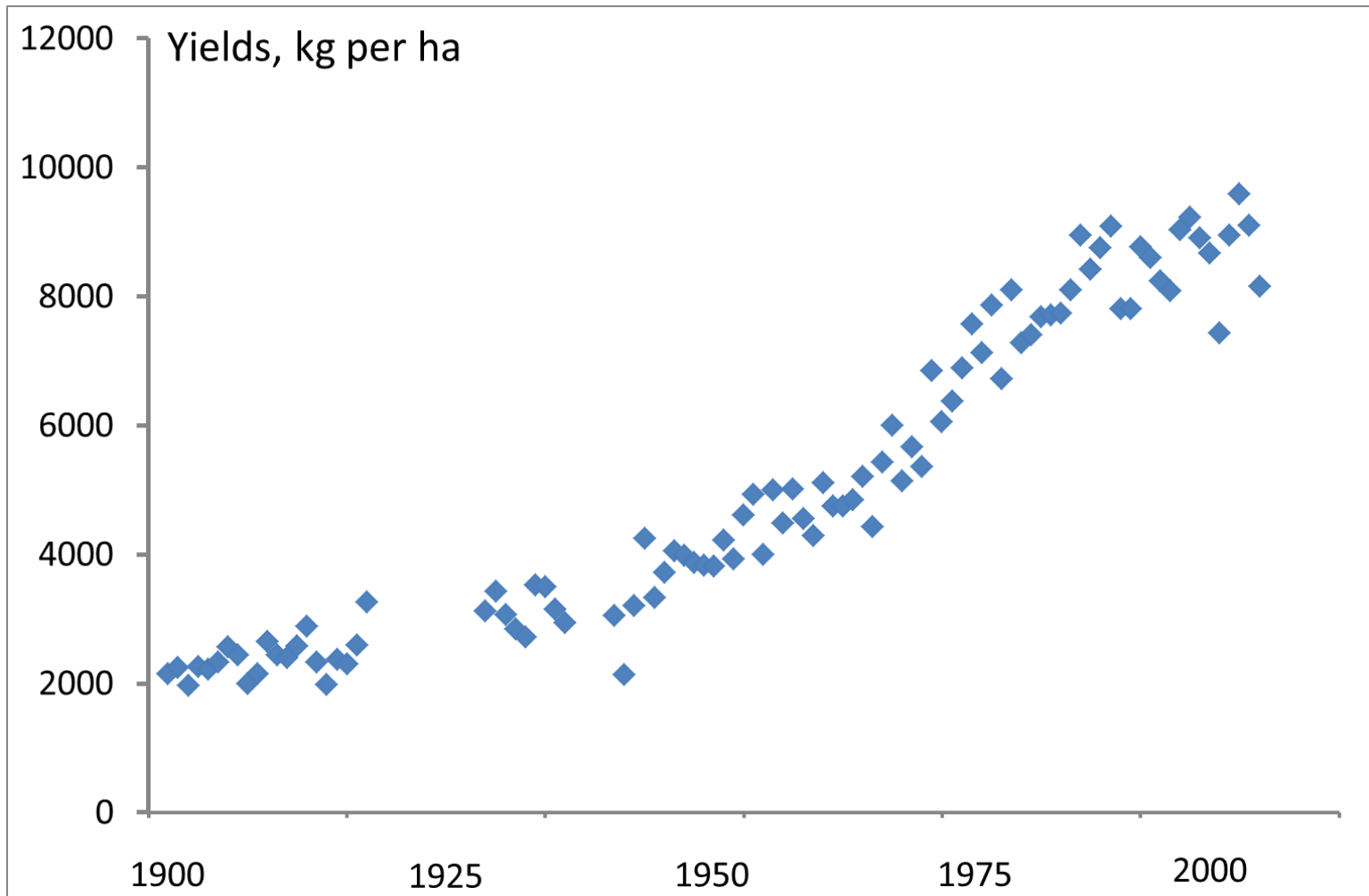
- Trends in N and P use in European Union
- N and P balances and emissions
- Strategies to improve nutrient use efficiency
 - Crop production
 - Animal production
 - Increase value of waste
 - Dietary changes
- Conclusions



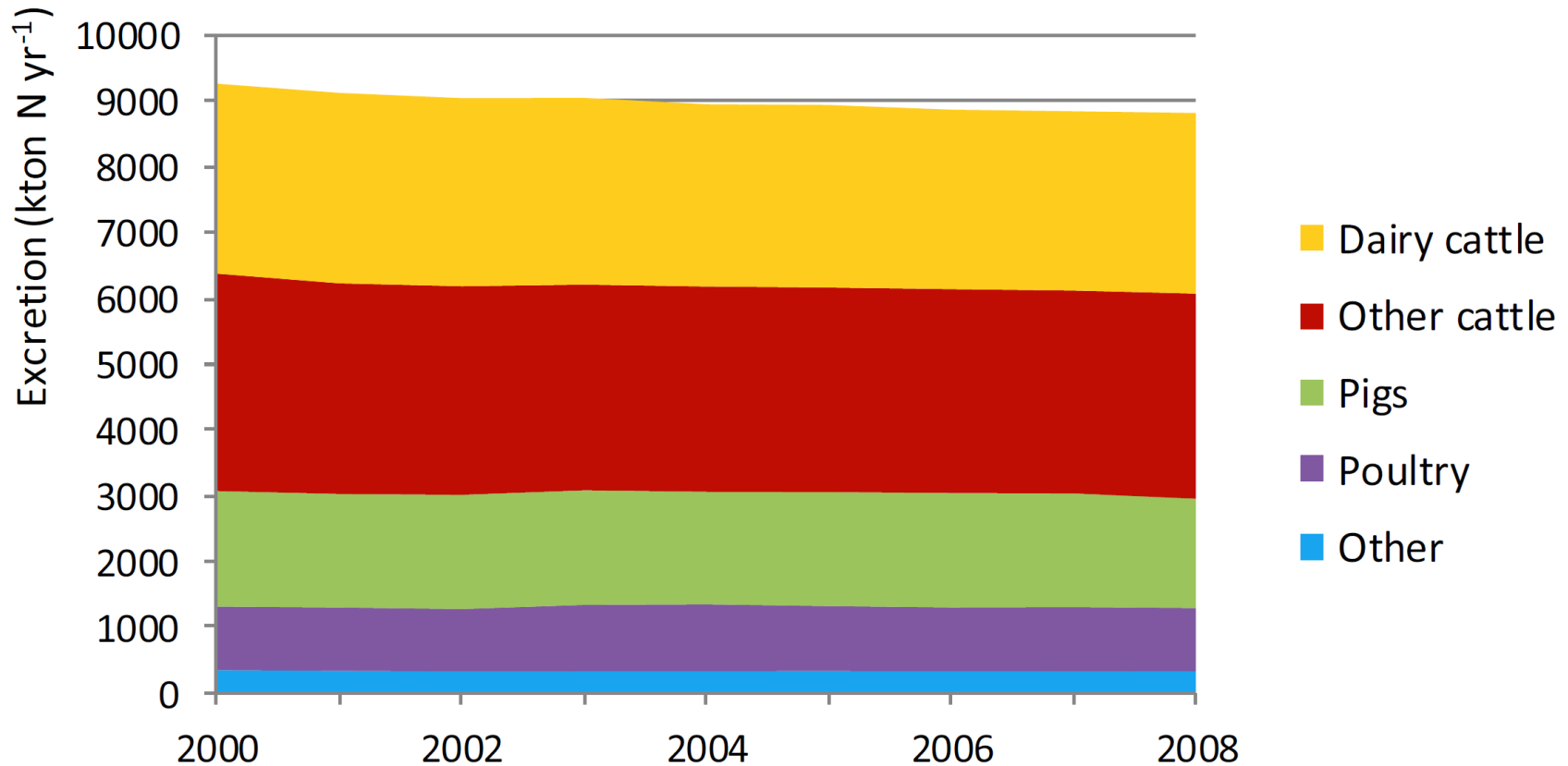
Mineral fertilizer use in EU-27



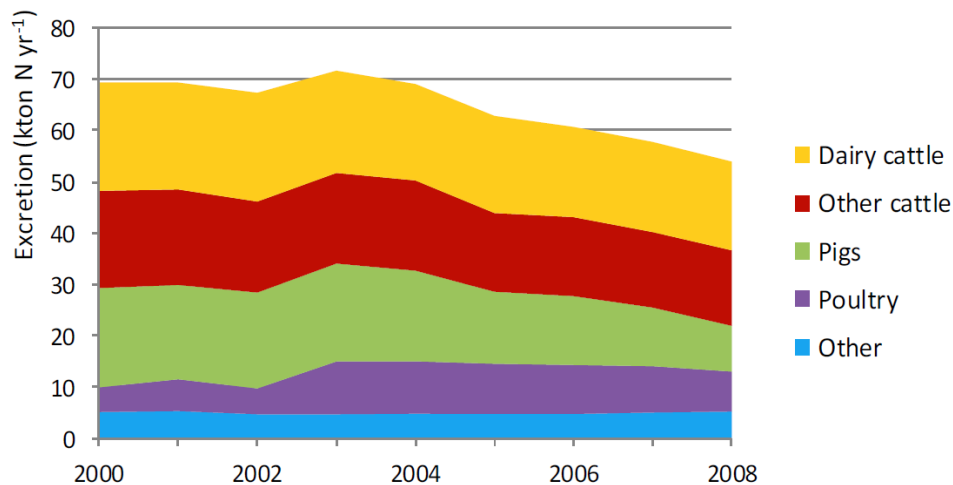
Wheat yields in the Netherlands



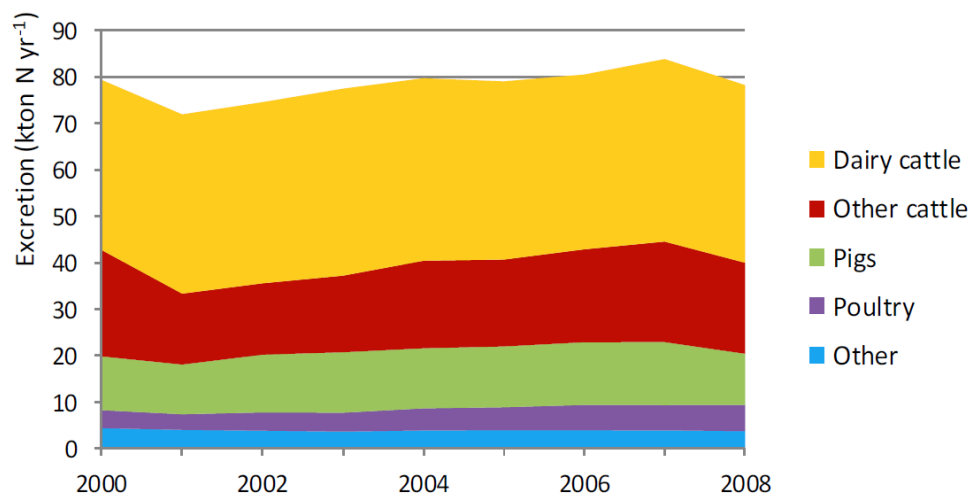
Manure production in EU-27



Differences in trends between countries

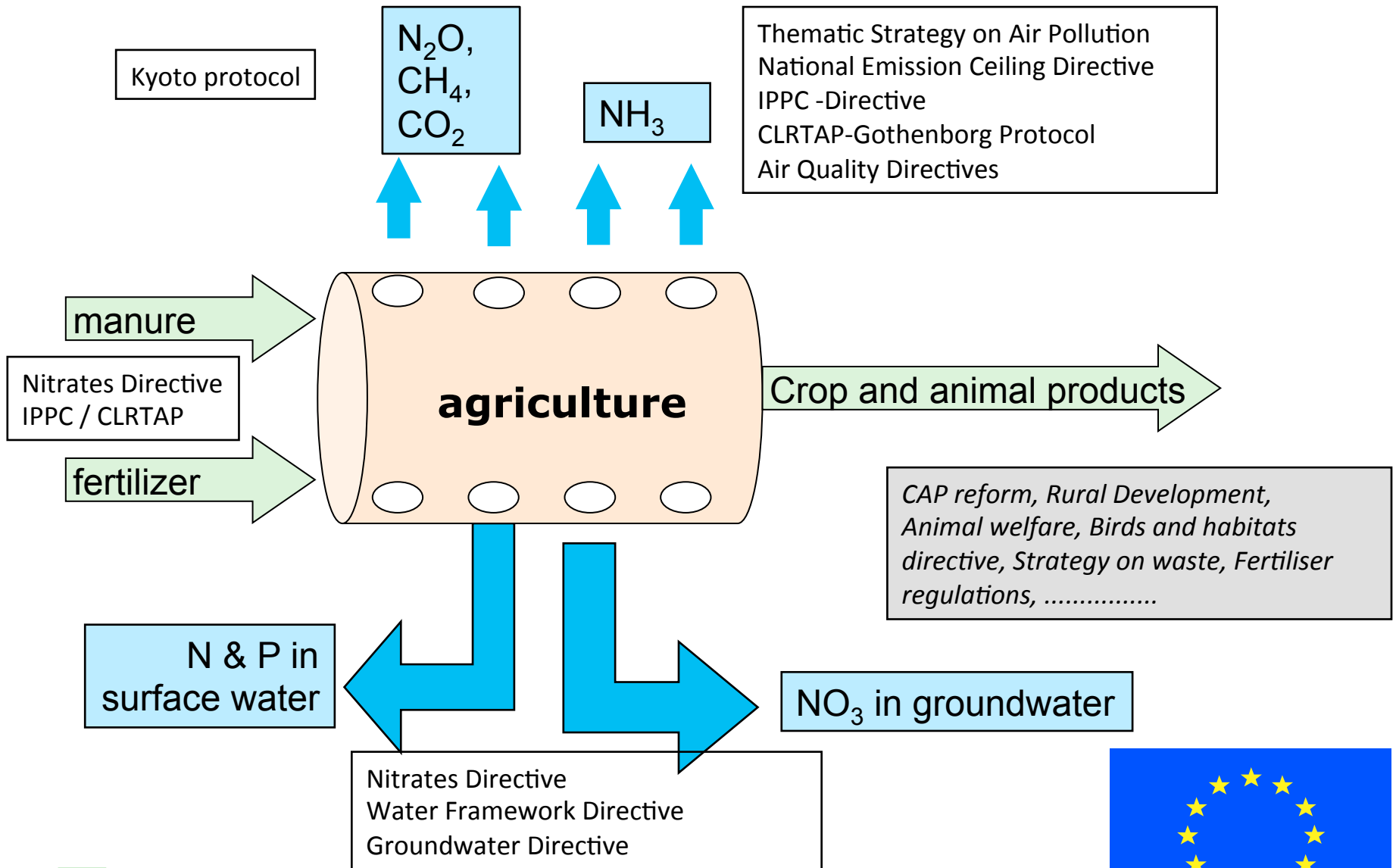


Slovakia



Lithuania

EU policies affecting N and P use



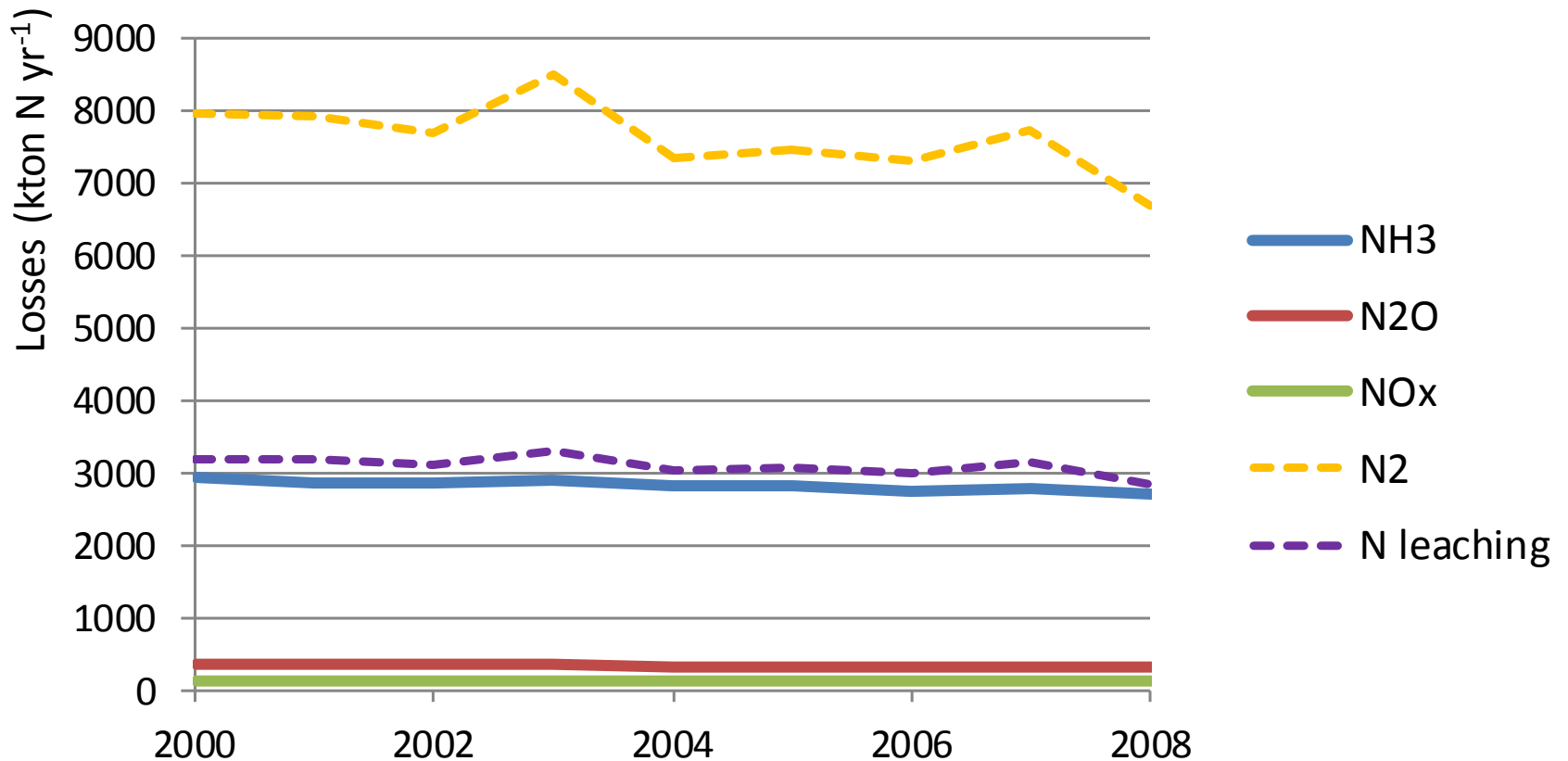
Change N balance between 2002 and 2008

Member state	Change in N balance, kg N/ha
Hungary	-38
Belgium	-31
Malta	-27
Netherlands	-27
Portugal	-24
Slovenia	-24
United Kingdom	-24
Denmark	-16
Slovakia	-15
Greece	-14
Ireland	-12
Luxembourg	-10
Bulgaria	-9
Austria	-9
Germany	-8
France	-6
Latvia	-6
Finland	-6
Spain	-5
Italy	-1

Member state	Change in N balance, kg N/ha
Czech Republic	2
Lithuania	3
Sweden	3
Estonia	4
Cyprus	8
Romania	8
Poland	16

Gross N balance, Eurostat

Trends in N losses in EU-27 in period 2000-2008



Regional differences in N losses

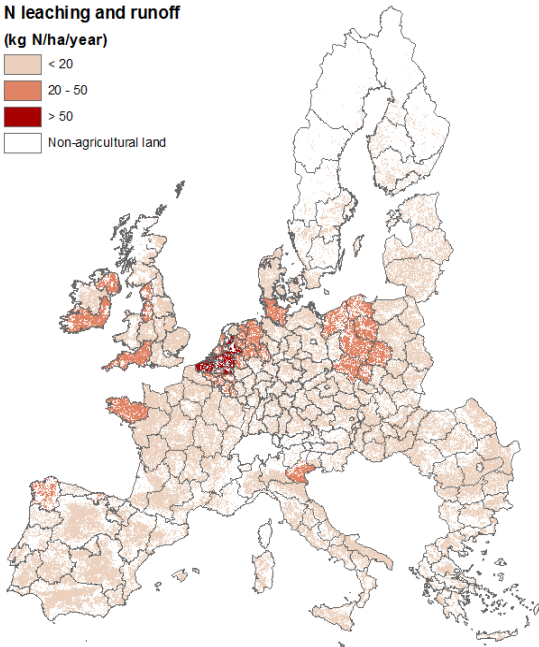
Nitrate leaching

Ammonia

Nitrous oxide

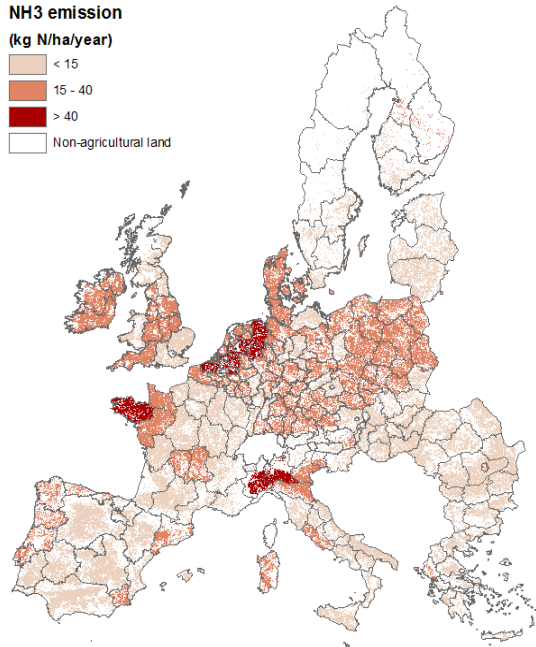
N leaching and runoff
(kg N/ha/year)

- < 20
- 20 - 50
- > 50
- Non-agricultural land



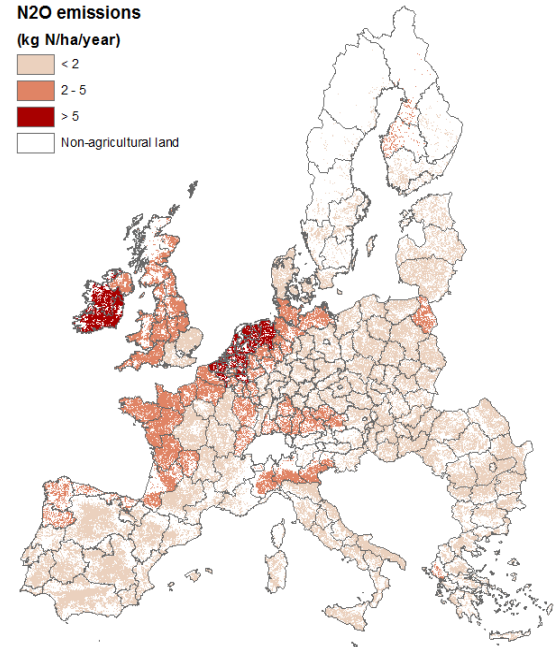
NH3 emission
(kg N/ha/year)

- < 15
- 15 - 40
- > 40
- Non-agricultural land



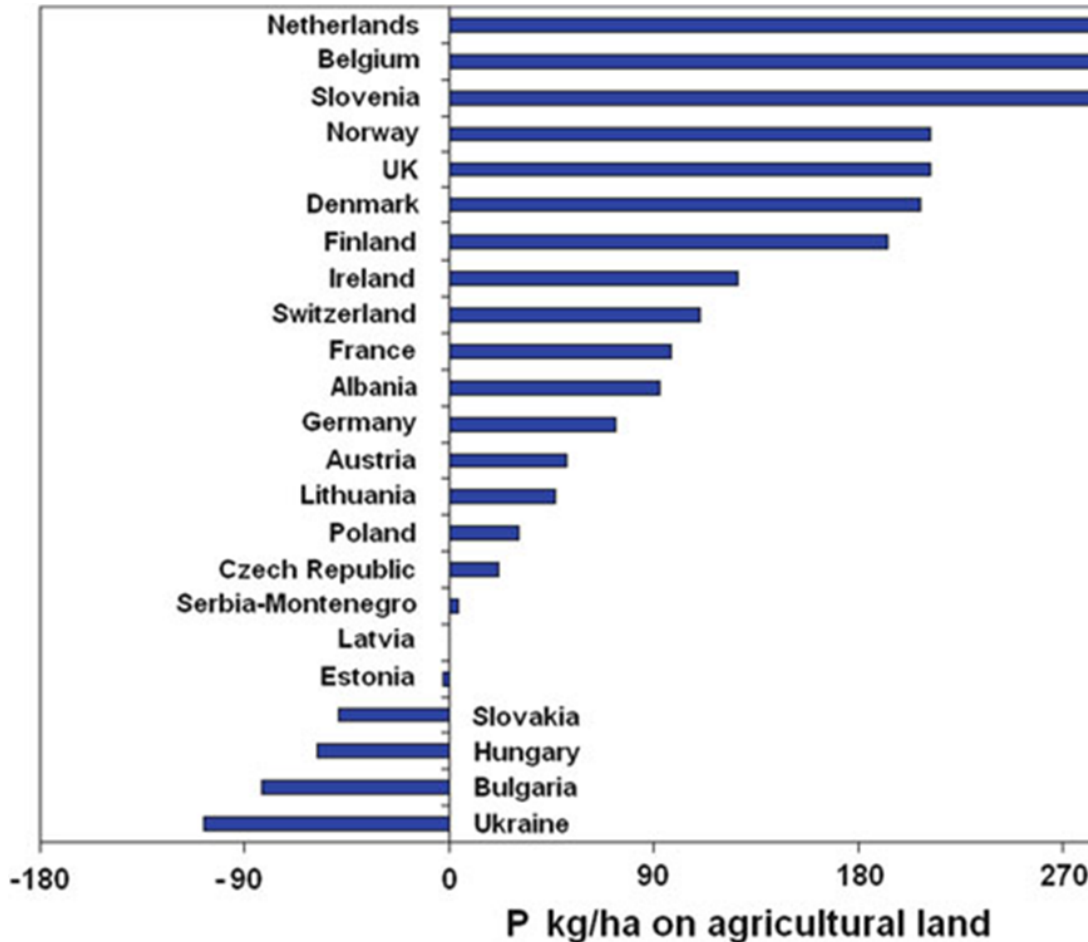
N2O emissions
(kg N/ha/year)

- < 2
- 2 - 5
- > 5
- Non-agricultural land



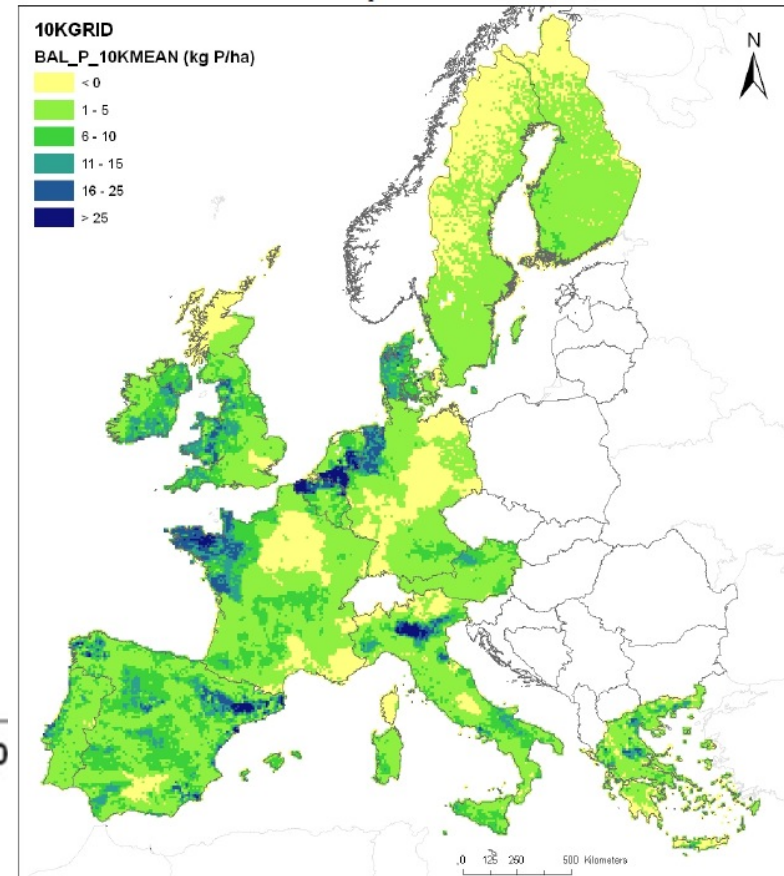
Agronomic P balances in the EU

Grizzetti & Aloe
2007



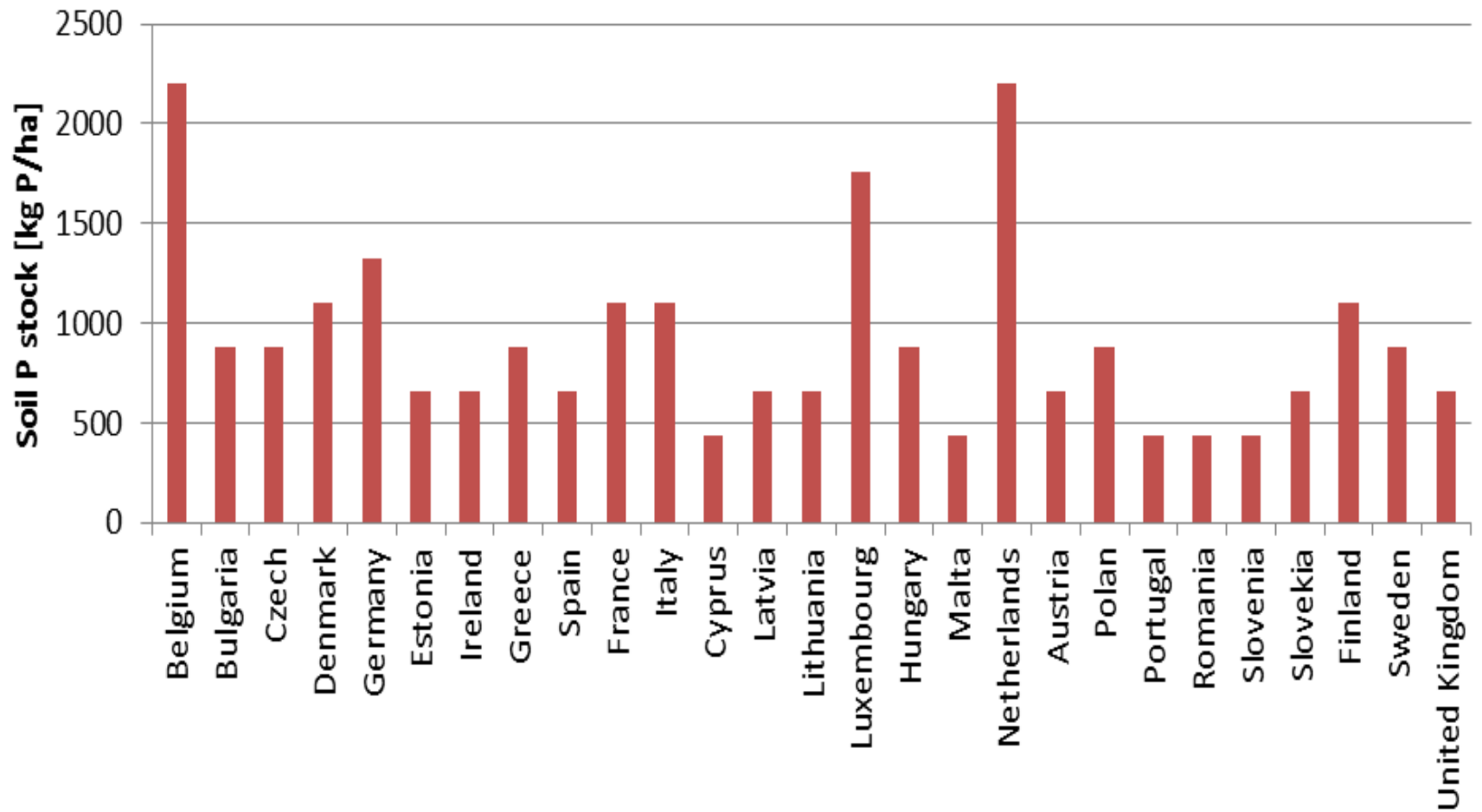
Estimated cumulative P balances [kg P/ha] of EU countries, 1991–2005

Csathó & Radimszky 2012

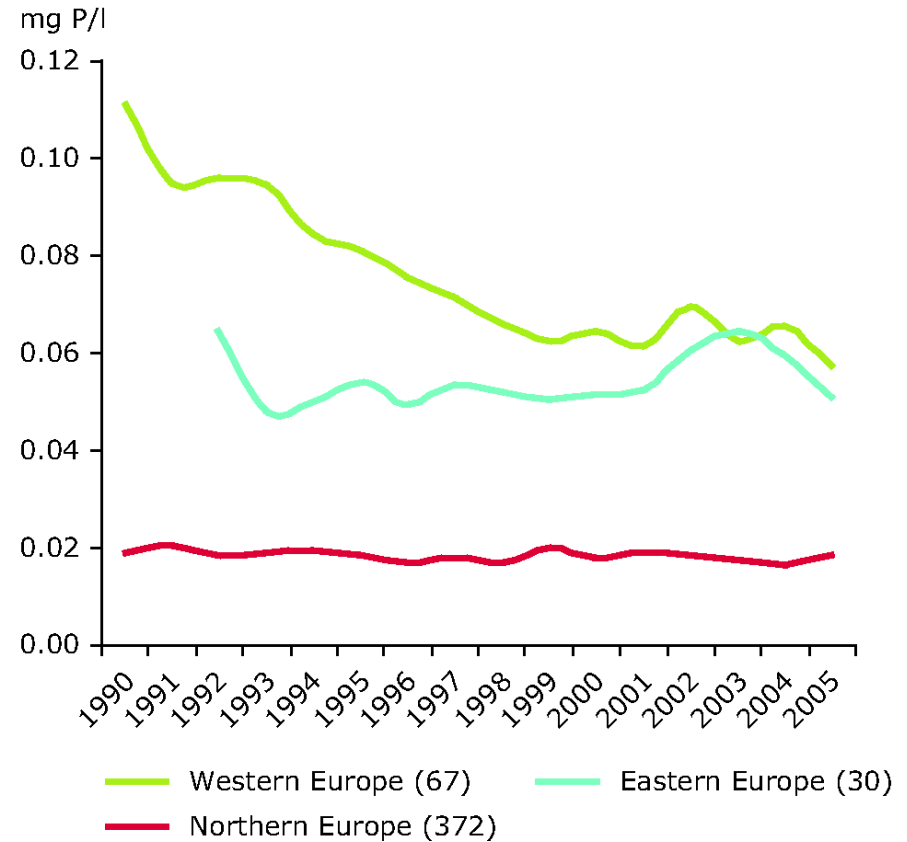
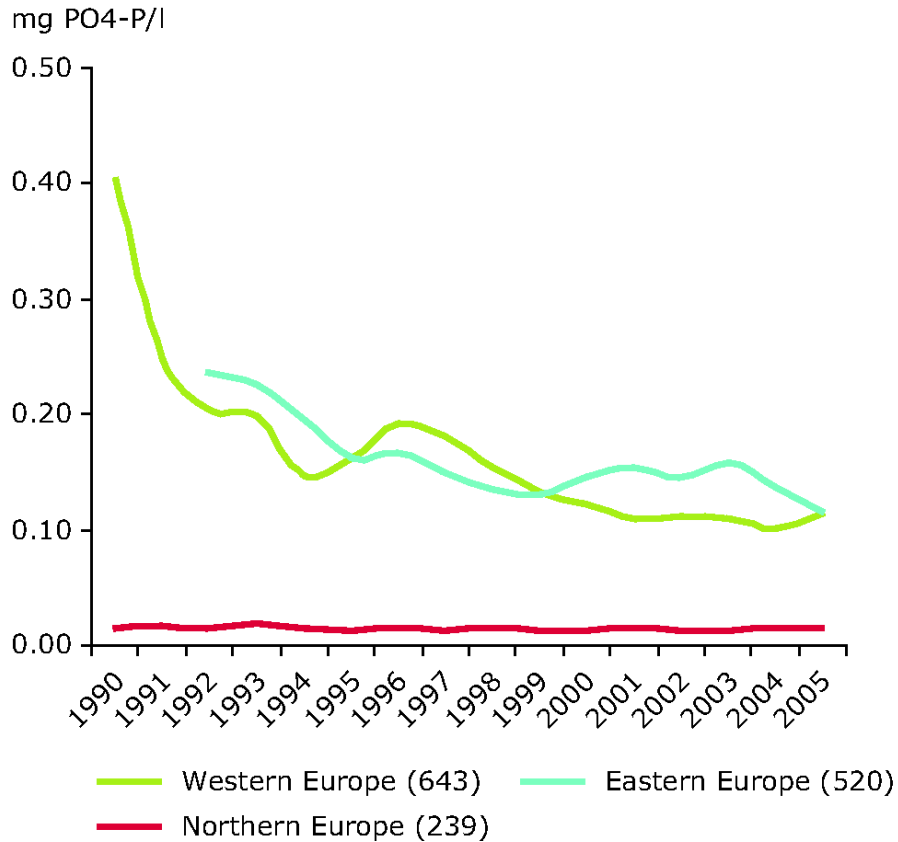


Annual regional agricultural P balances [kg P/ha] for EU-15 in 2000

Calculated P stock in the soil



P concentrations in rivers and lakes in EU regions, period 1990 - 2005



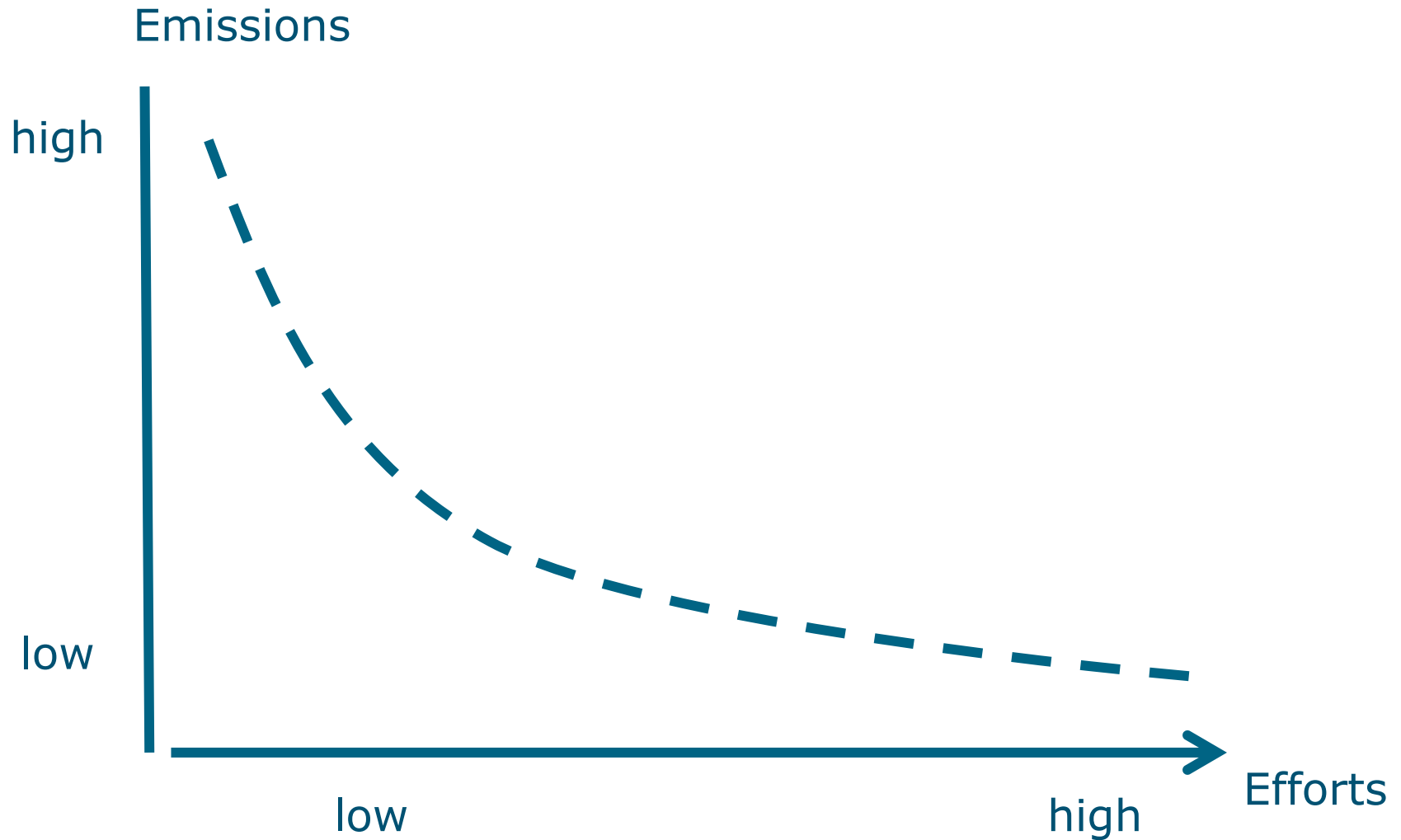
Strategies to improve nutrient use efficiency (NUE)

Increasing NUE in crop production

- Plant breeding and crop rotation
- Soil and water management
- Emission mitigation
- Weed, pest, and disease management
- Nutrient management
 - Right type of N and P
 - Right time of application
 - Right method
 - Right place of application

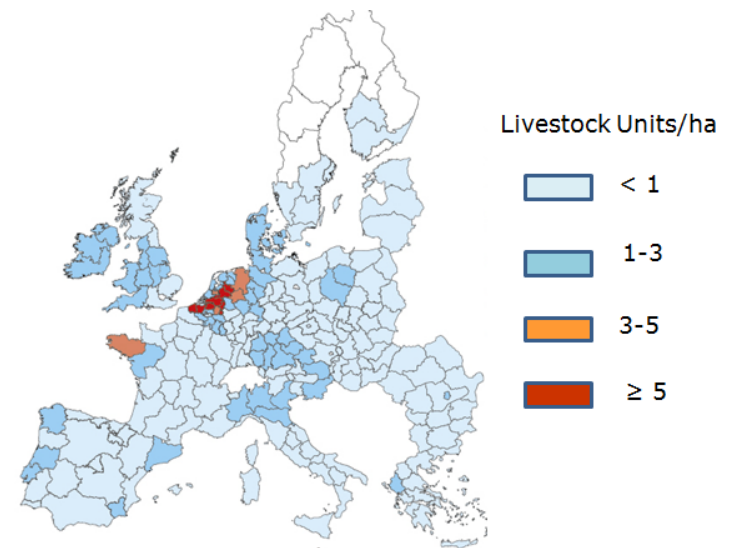


Efforts to reduce emissions



Increasing NUE in animal production

- Animal feeding; low protein and P content
- Animal breeding
- Animal housing and health
- Nutrient management
- Emission mitigation strategy
- Spatial planning



All livestock (2005)

Ammonia abatement techniques

- Decrease N inputs in fertilizers and feed
- Low emission animal housing systems
- Low emission manure storage techniques
- Low emission manure spreading techniques
- Limiting NH_3 emission from mineral N fertilizers (urea)

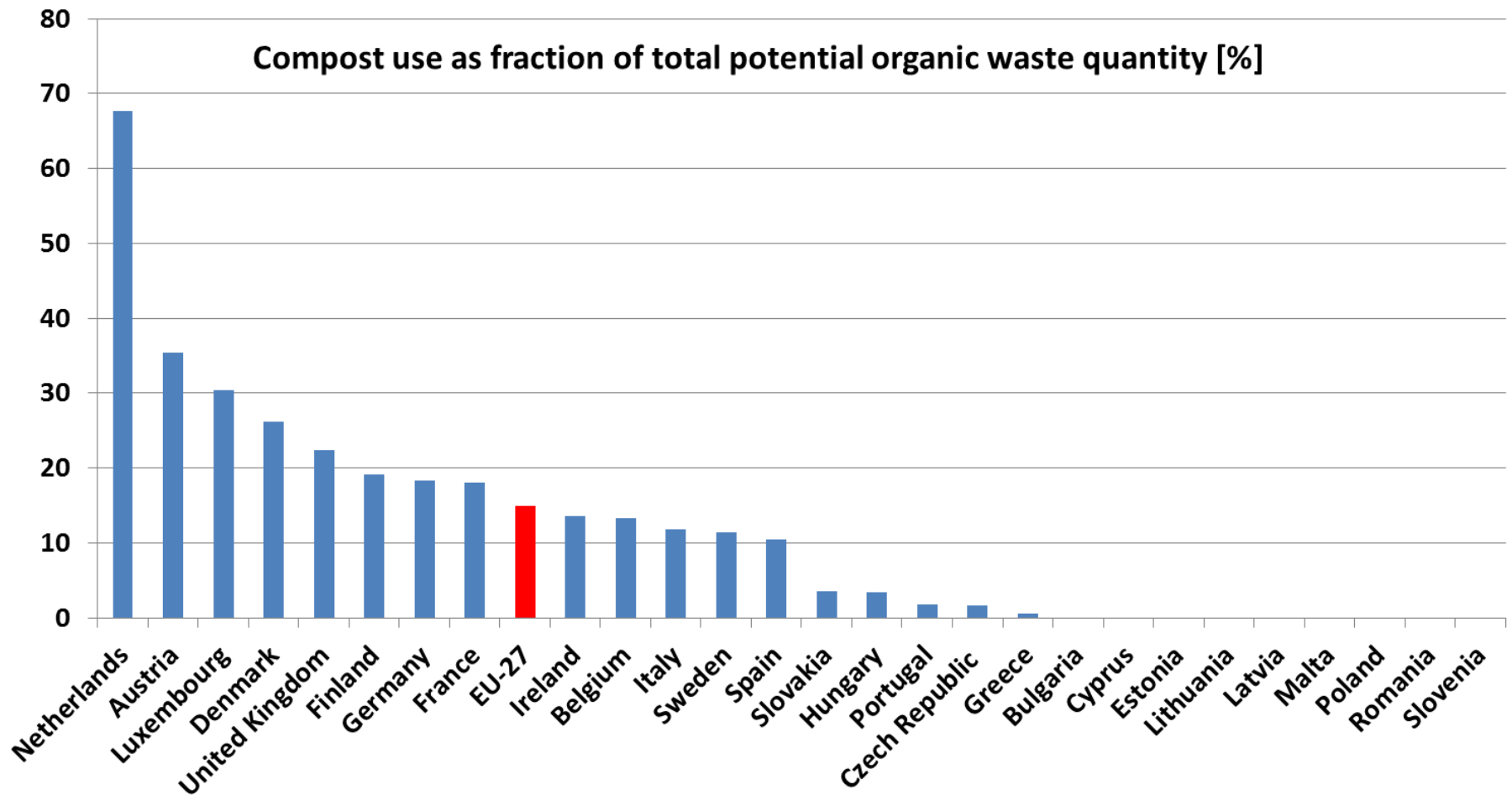


Increasing the value of manure and wastes

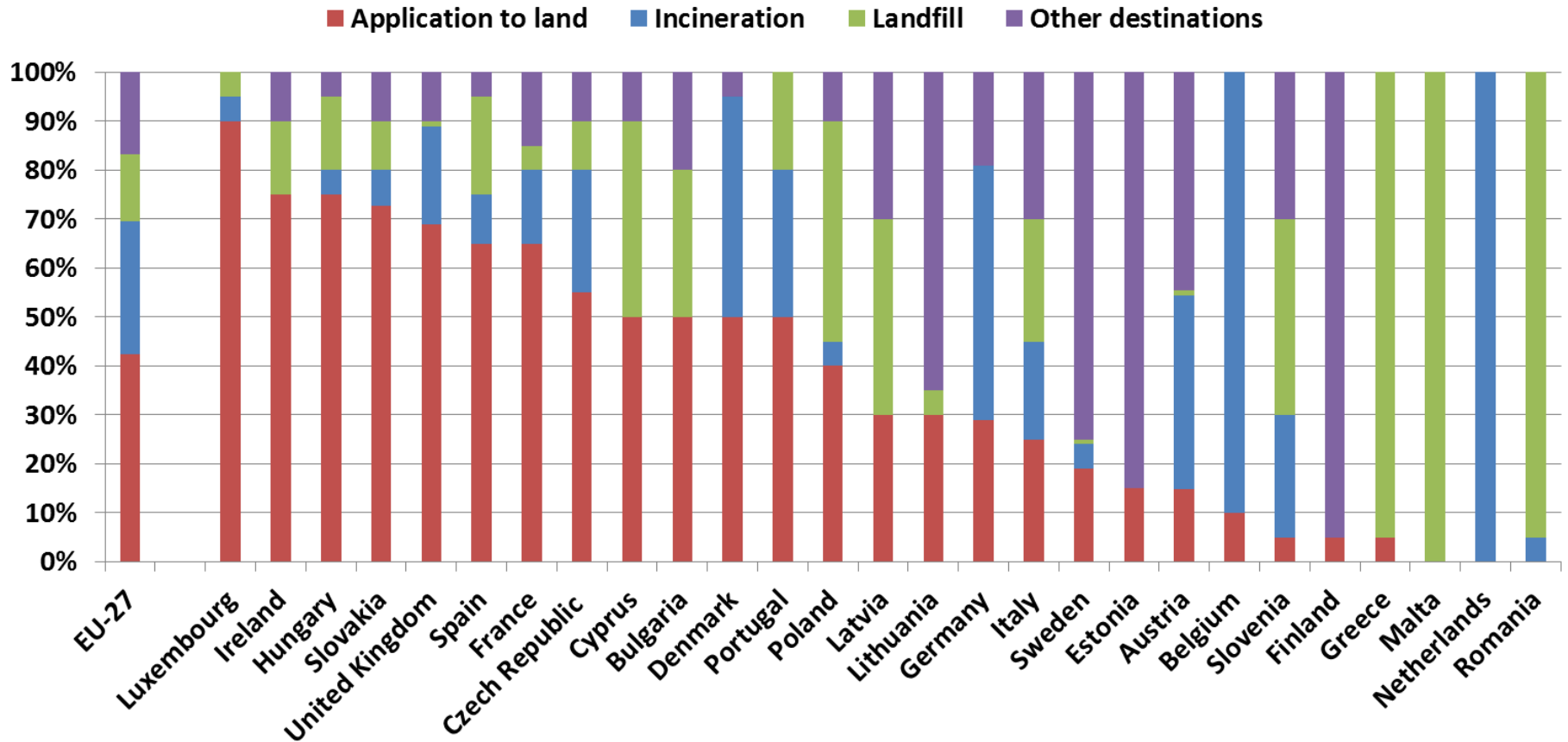
- Recycling
- Collection and storage
- Time of application
- Method of application
- Processing
- Emission mitigation strategies



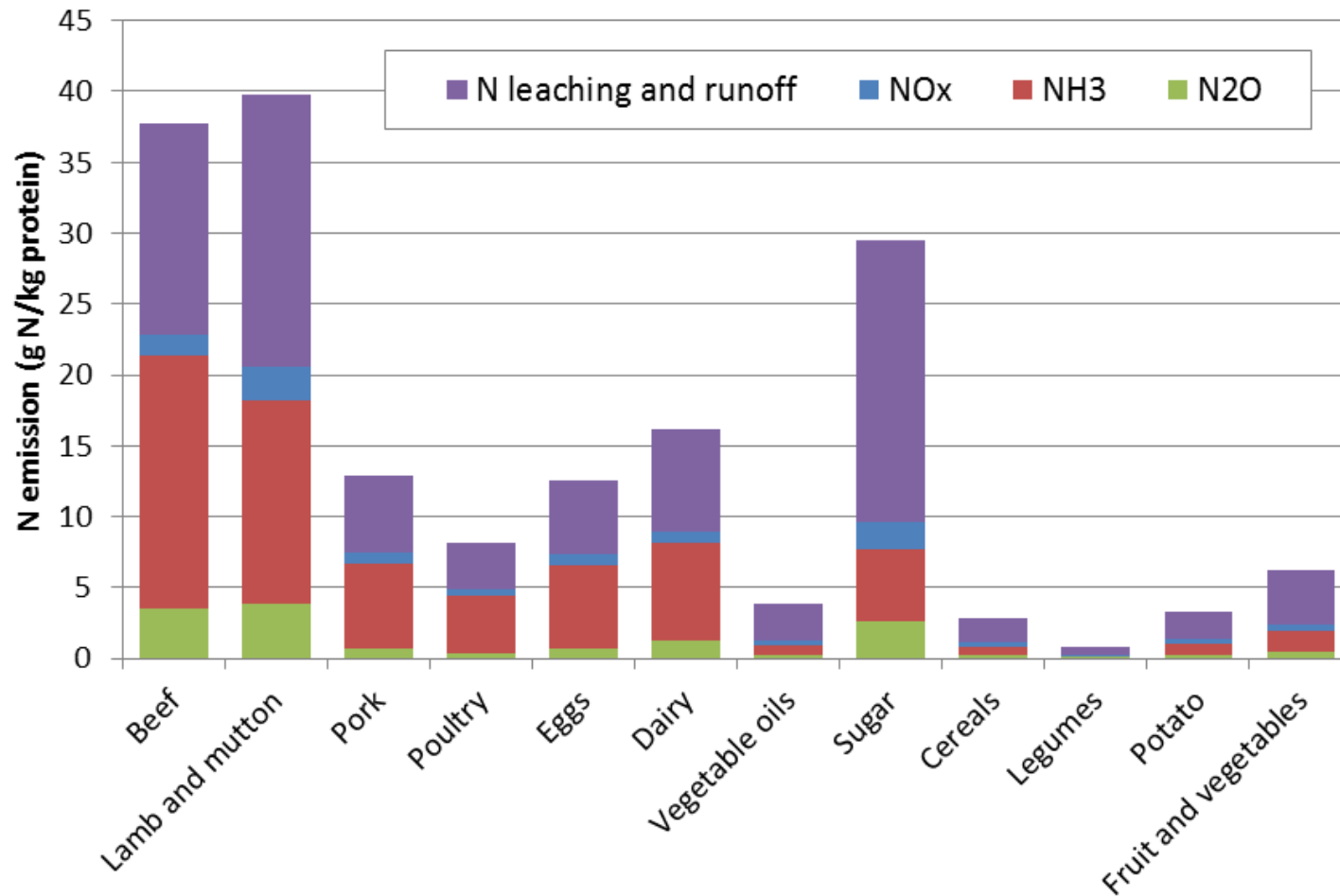
Reuse of organic waste in EU-27 in 2005



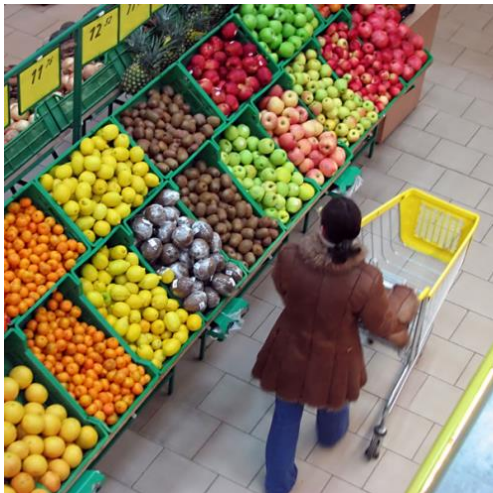
Use of sludge in EU-27 in 2010



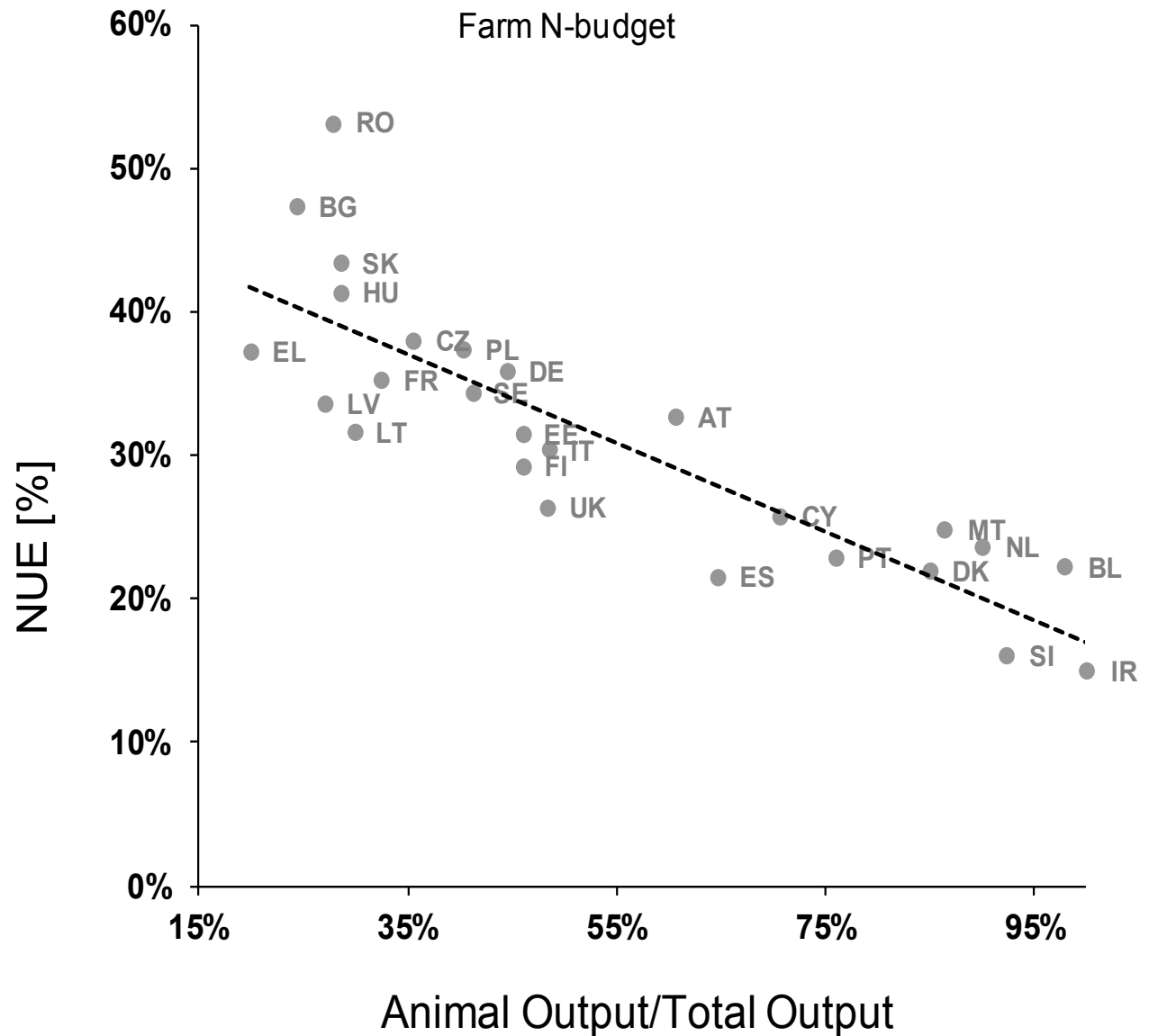
Dietary changes: N footprint food



Nitrogen Use efficiency in EU countries



Leip et al., 2011



Conclusions

- N and P inputs by fertilized and manure decreased in EU
 - emissions decreased, but further decreases needed
- Fate of surplus
 - N: loss to atmosphere and water
 - P: accumulation in soil and loss to water
- Strategies to improve NUE
 - management of crop production
 - management of livestock systems
 - recycling and proper use of wastes
 - dietary changes affect N emissions

Thank you



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For quality of life