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science for global insight

Nitrogen budget: a tool to validate information on nitrogen fluxes

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Overview

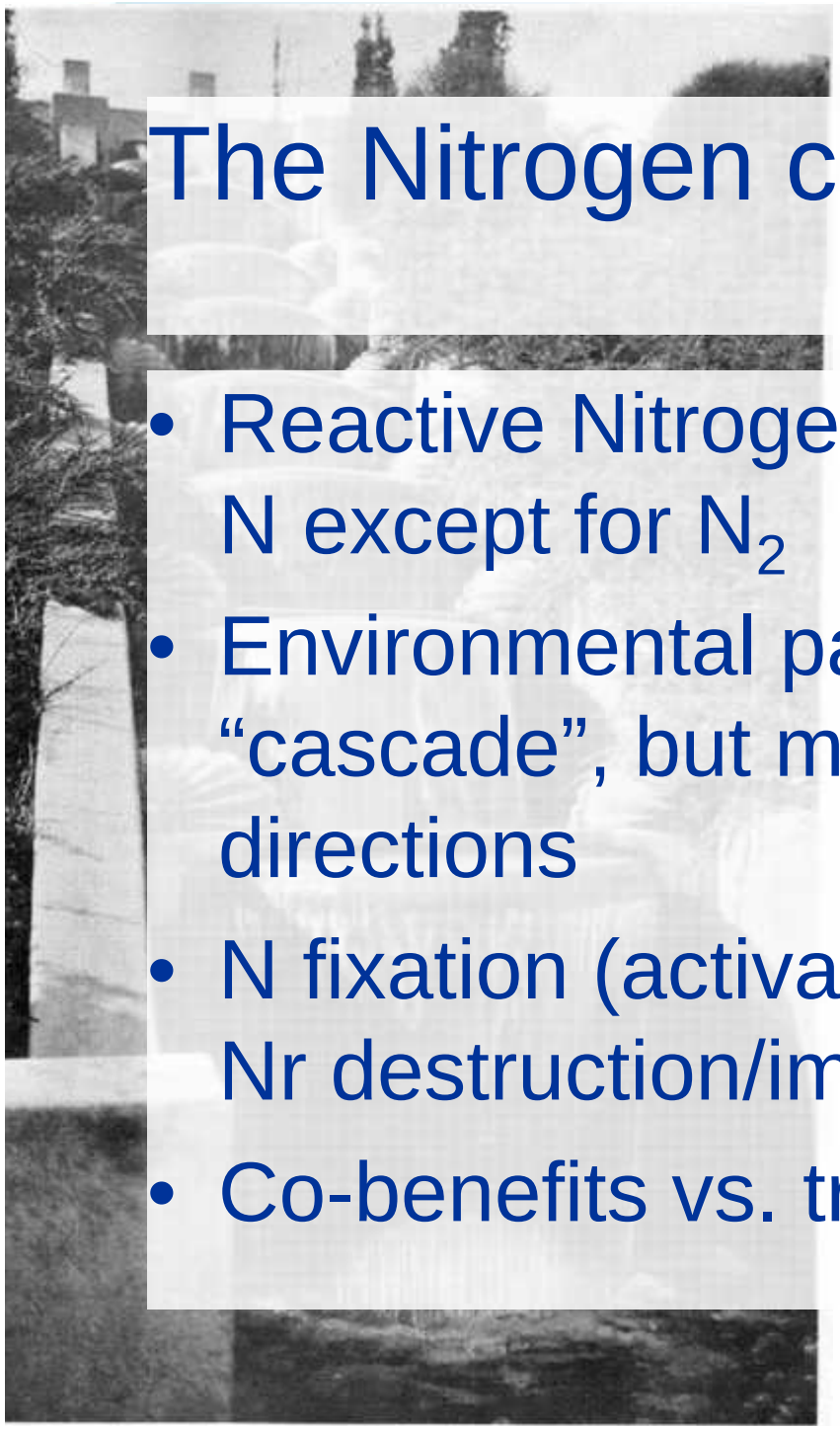
- The N cycle/cascade:
  from Material Flow Analysis
  to National Nitrogen Budgets

- Policy needs:
  Multiple frameworks, interlinked approaches

- Implementation:
  data comparability, common database

Cascade

- mass consistency
- multiple pools
- flows between pools



The Nitrogen cascade

- Reactive Nitrogen (Nr) covers all forms of N except for N_2
- Environmental path of Nr is a short "cascade", but may take multiple directions
- N fixation (activation) as source, Nr destruction/immobilization as sink
- Co-benefits vs. tradeoffs in measures

Choice of budget level

Global:
planetary boundaries

- Continental:
  limited interaction

- Individual country:
  Trade and transport become dominant
  vs.: legislative frameworks require data

Problem-oriented legislation

- *National* for direct national impacts
- *EU directives* to be implemented as national law (European Union specific)
- *International agreements* to be ratified into national legislation

→requires national level data collection

→impacts on the same economic sectors

→interferes with other relevant regulation

Guidance Document on National Nitrogen Budgets

United Nations ECE/EB.AIR/119

Economic and Social Council

Distr.: General
17 June 2013

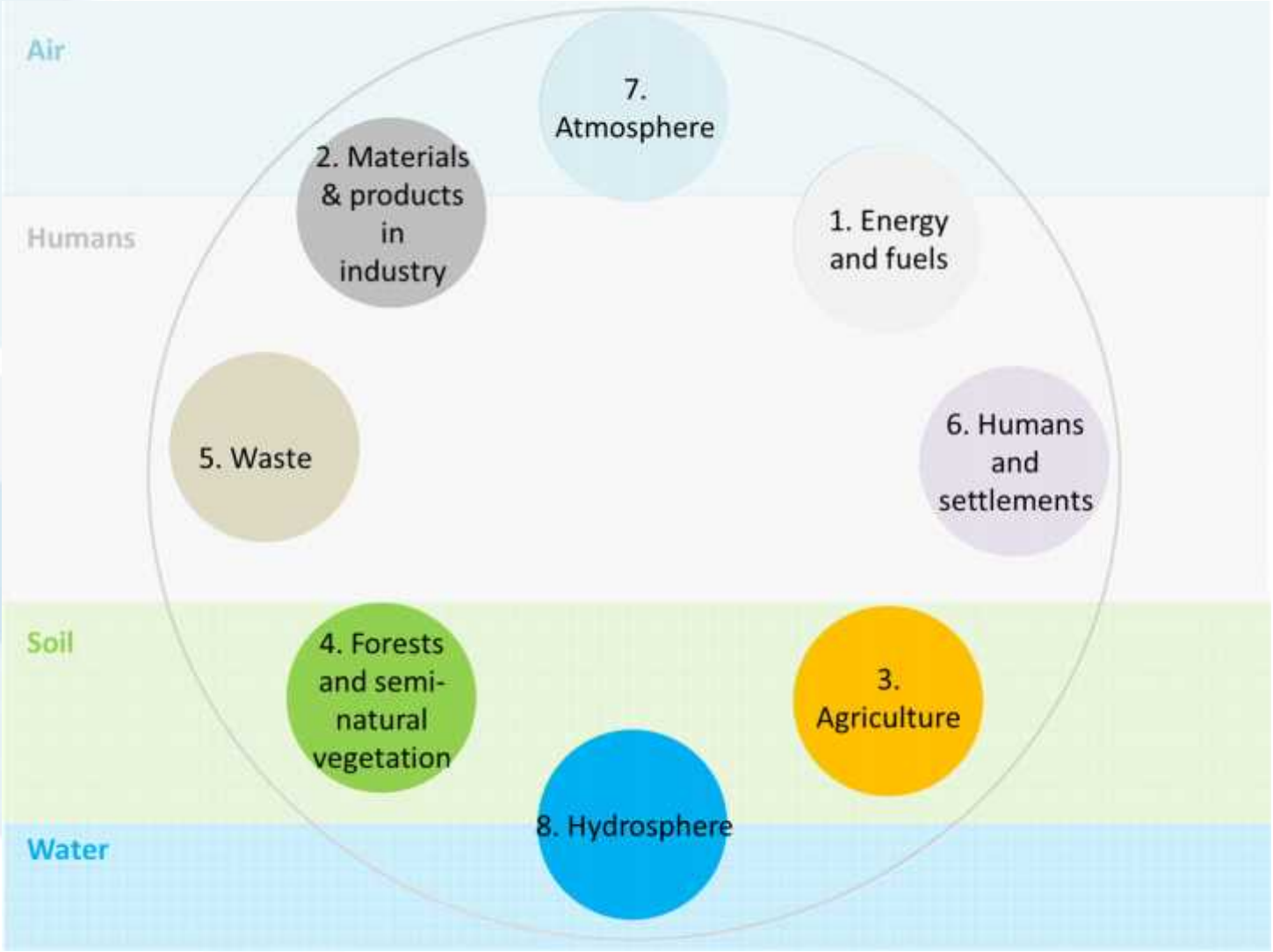
Original: English

Economic Commission for Europe

Executive Body for the Convention on Long-range Transboundary Air Pollution

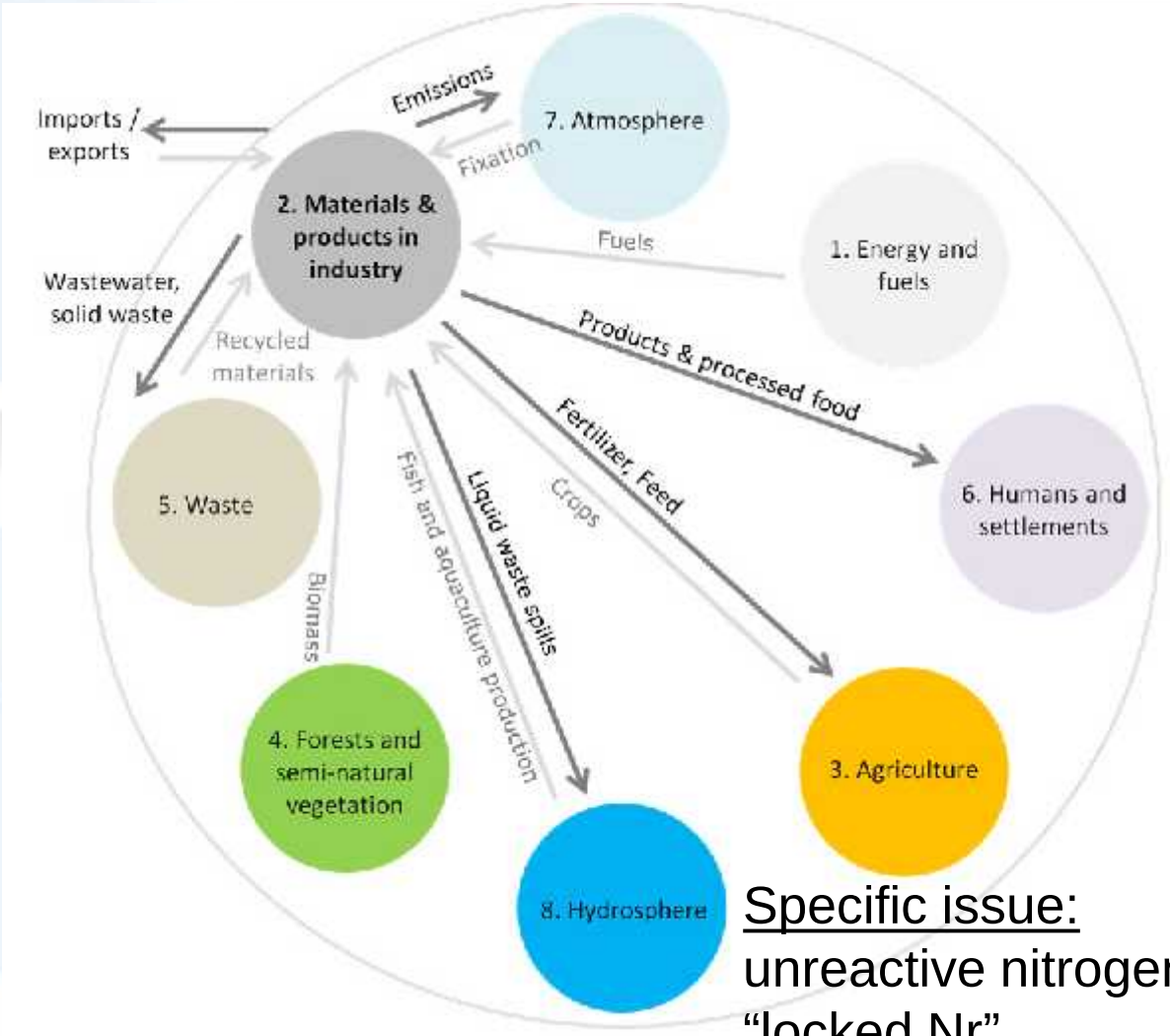
Guidance document on national nitrogen budgets

National Nitrogen Budgets



http://www.clrtap-tfrn.org/epnb

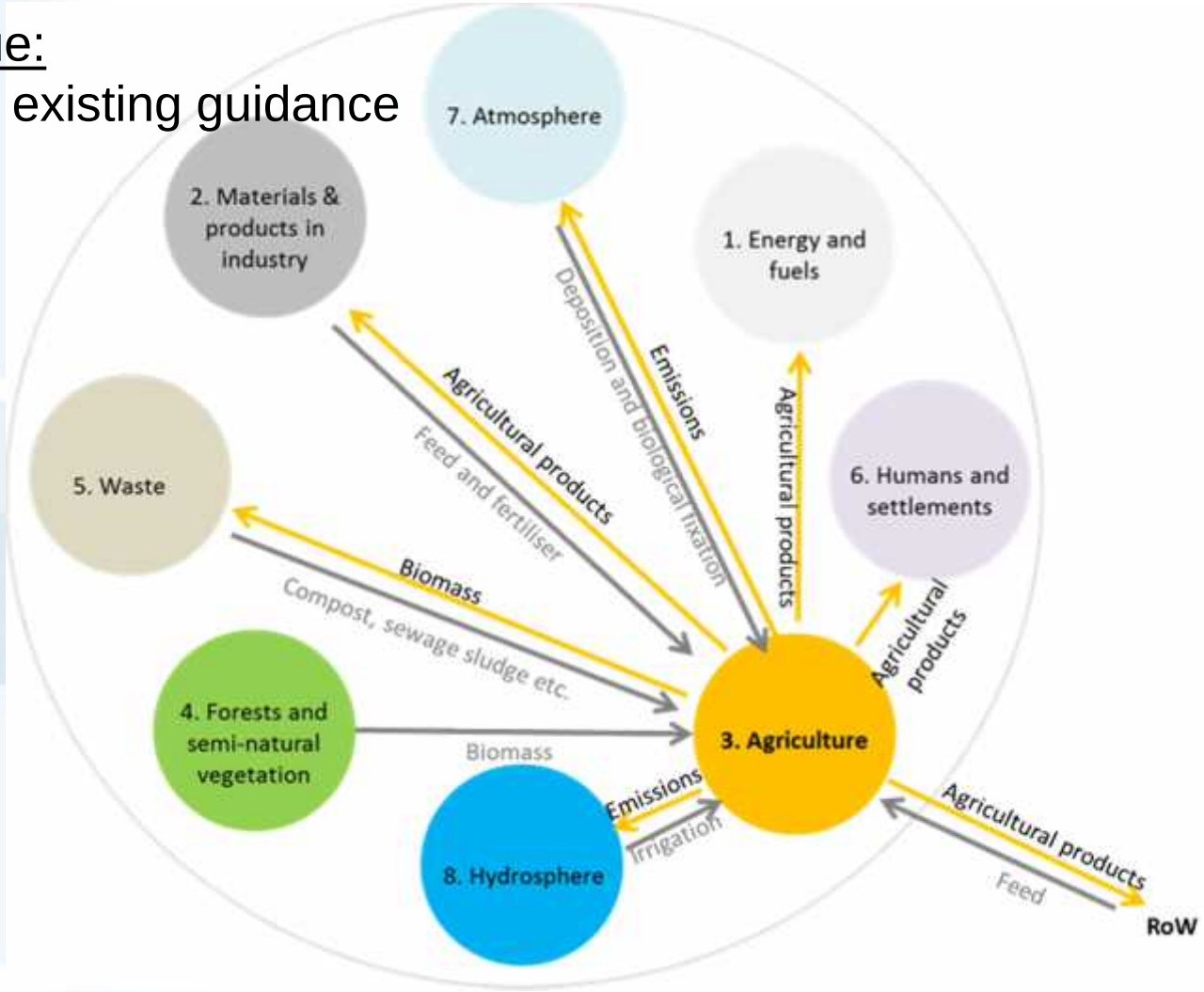
Pool “Materials”



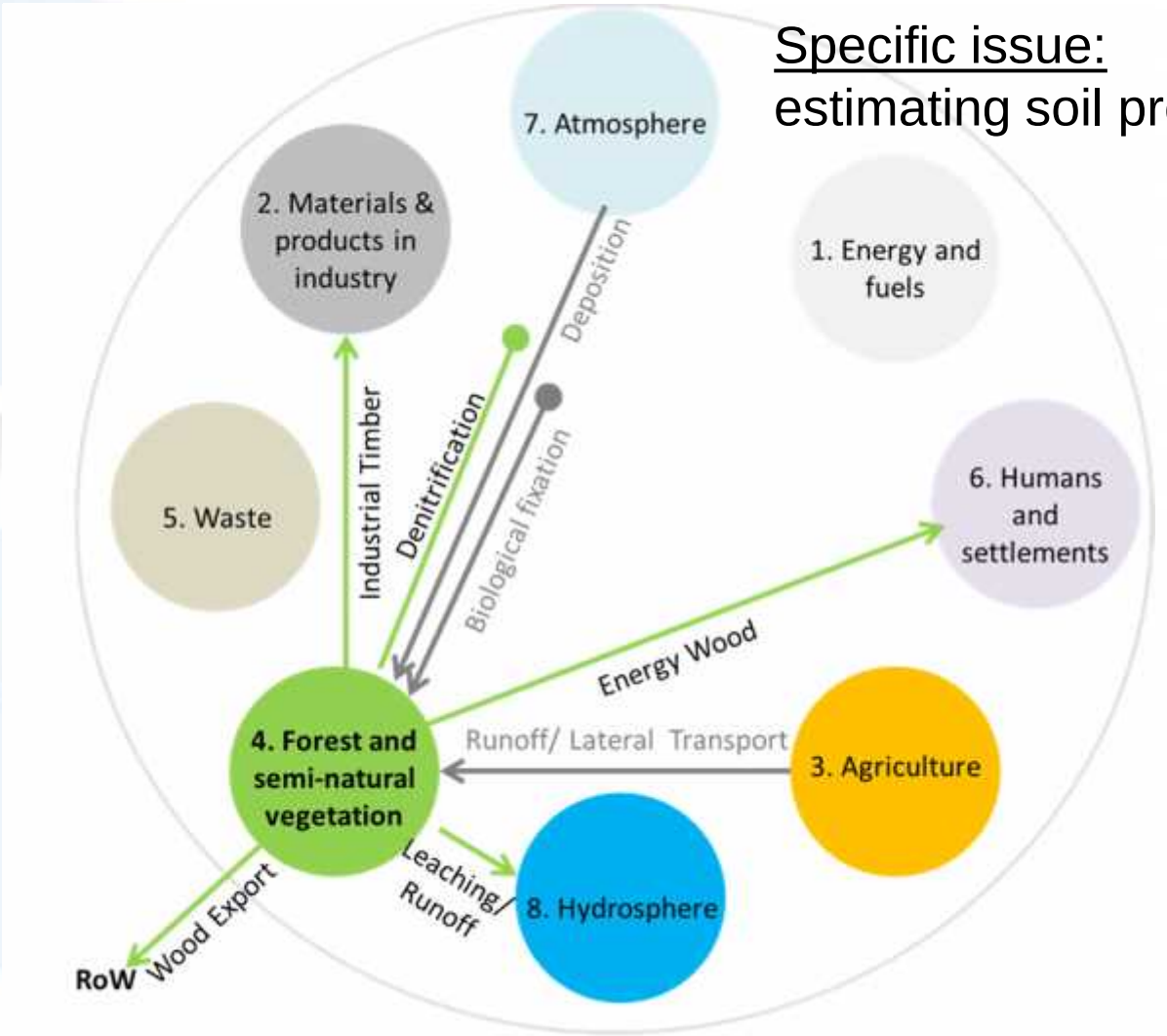
<u>Specific issue:</u>
unreactive nitrogen compounds, “locked Nr”

Pool “Agriculture”

<u>Specific issue:</u>
harmonizing existing guidance

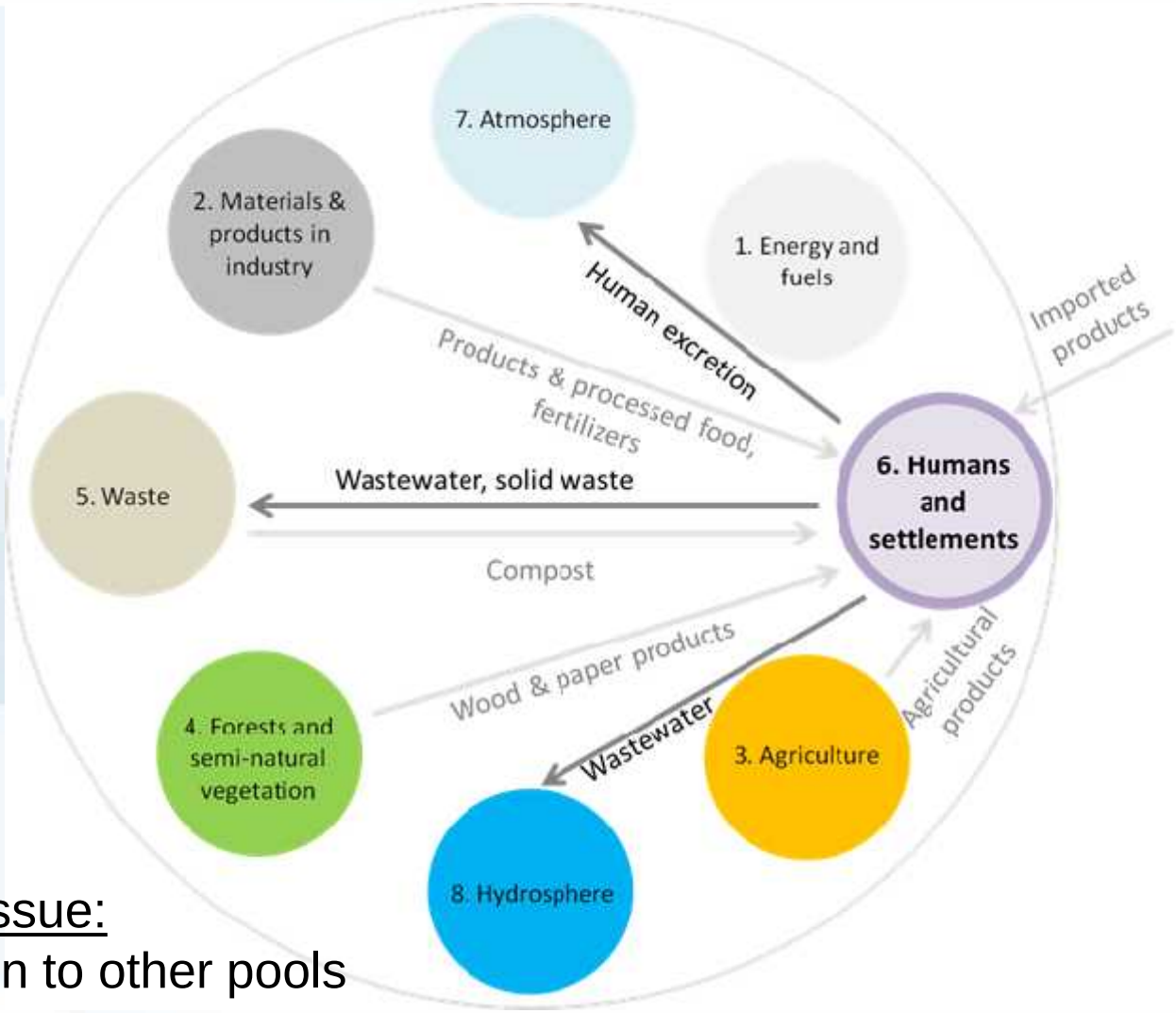


Pool “Forests/semi-natural veg.”



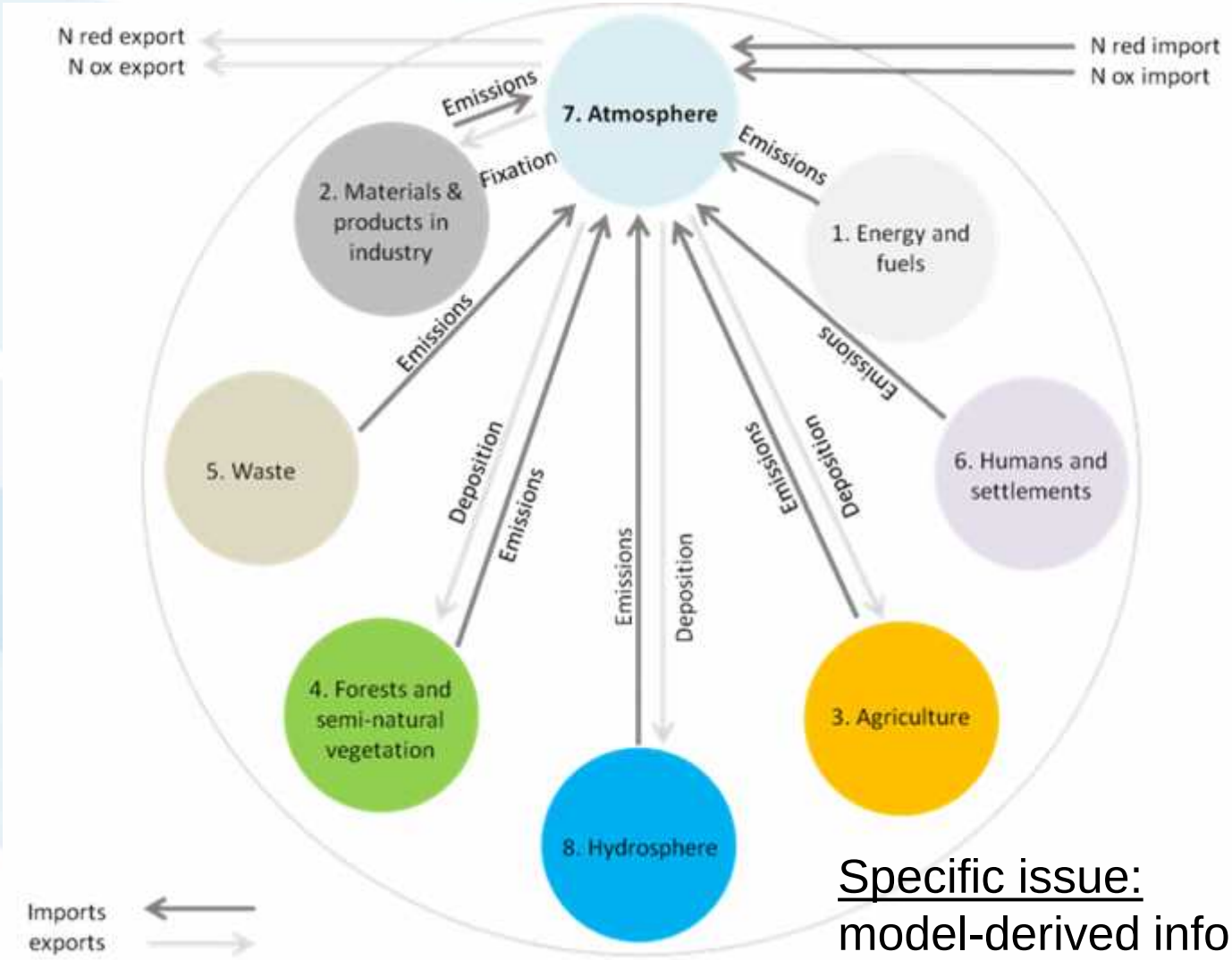
Specific issue:
estimating soil processes

Pool “Humans and settlements”



Specific issue:
delineation to other pools

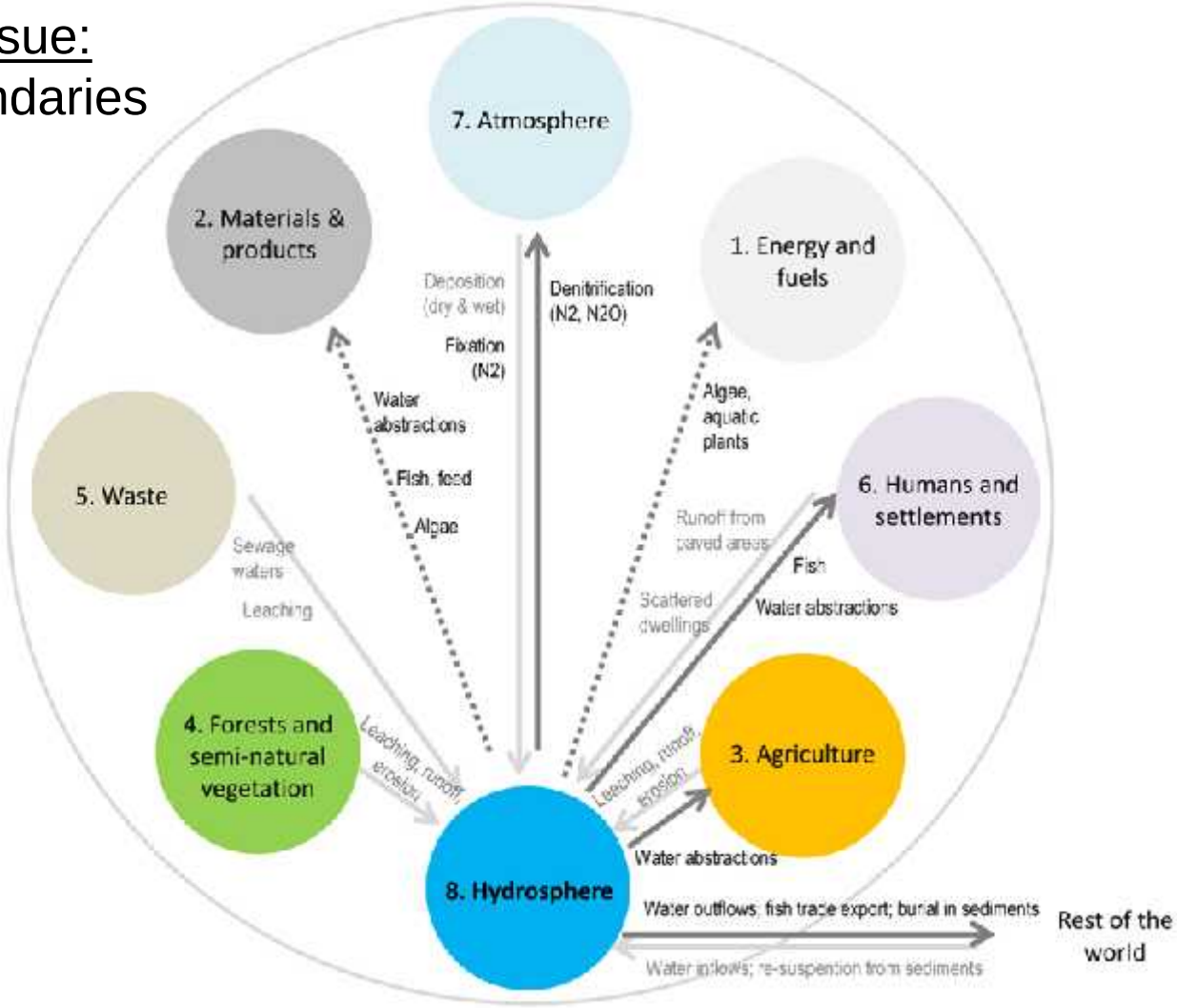
Pool “Atmosphere”



Specific issue:
model-derived information
Reduced vs. oxidized N

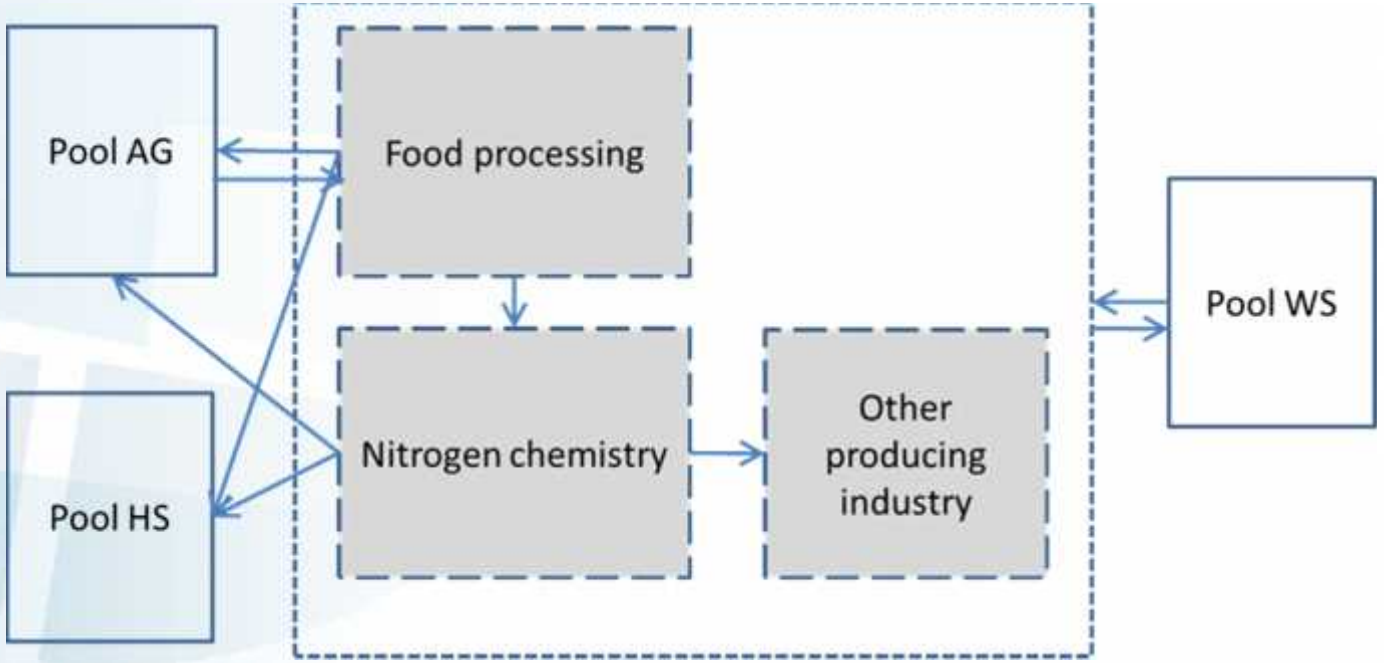
Pool “Hydrosphere”

<u>Specific issue:</u>
outer boundaries



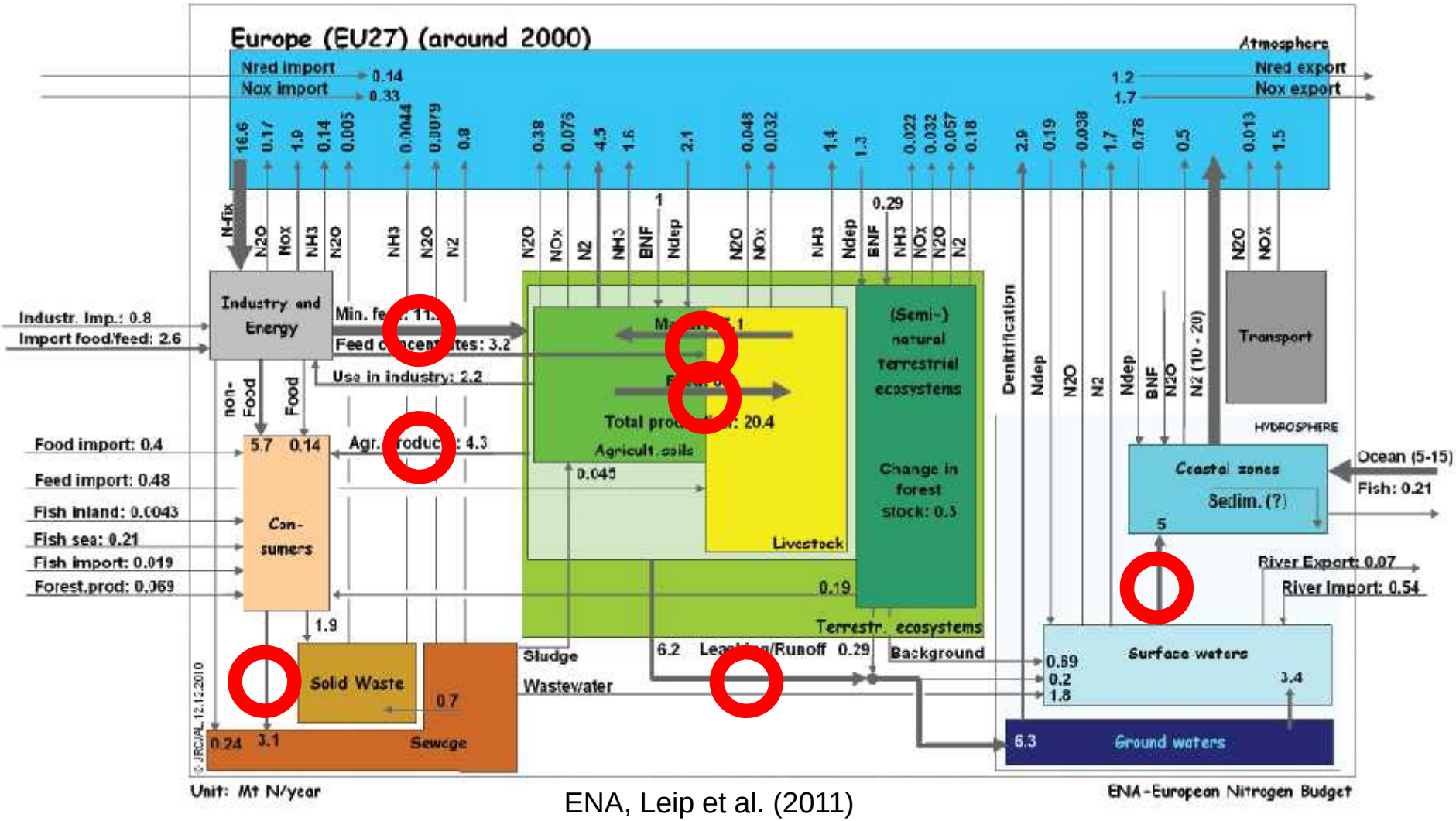
Substructure of pools

e.g., “Materials and products in industry”



$Pool_{ex}$	$Pool_{in}$	Flow	Process	MP sub-pools involved
MP	EF			
MP	AG	MPAG	Fertilizers, Feed for farm animals	MP.FP; MP.CI
MP	FS	MPFS	Fertilizers	MP.CI
MP	WS	MPWS	Waste	MP.FP; MP.CI; MP.OP
MP	HS	MPHS	Food and food products	MP.FP; MP.CI; MP.OP

Top-down budgets



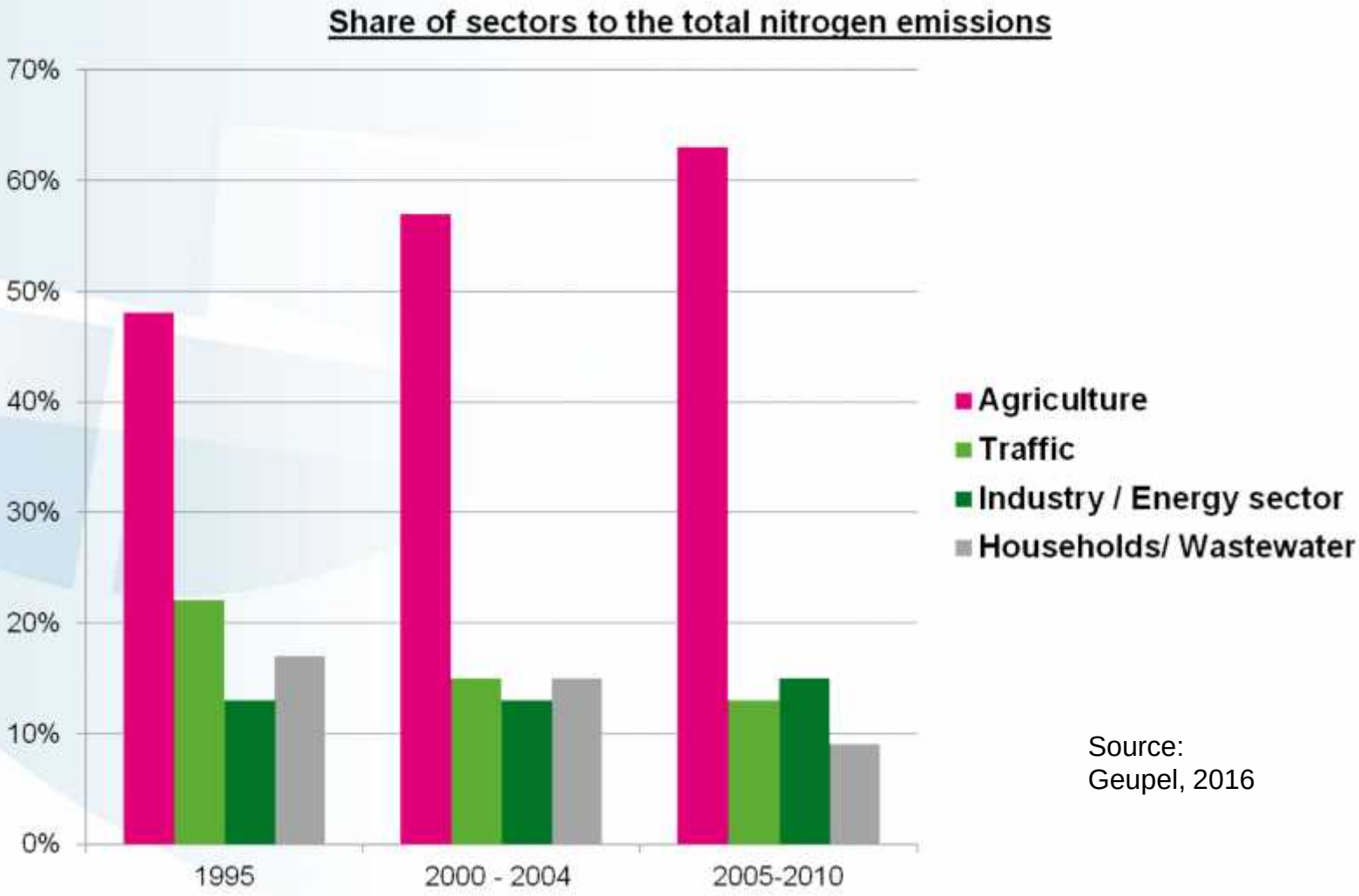
ENA, Leip et al. (2011)

Lessons learned from N-budgets

- Switzerland
- Germany
- Canada
- Denmark

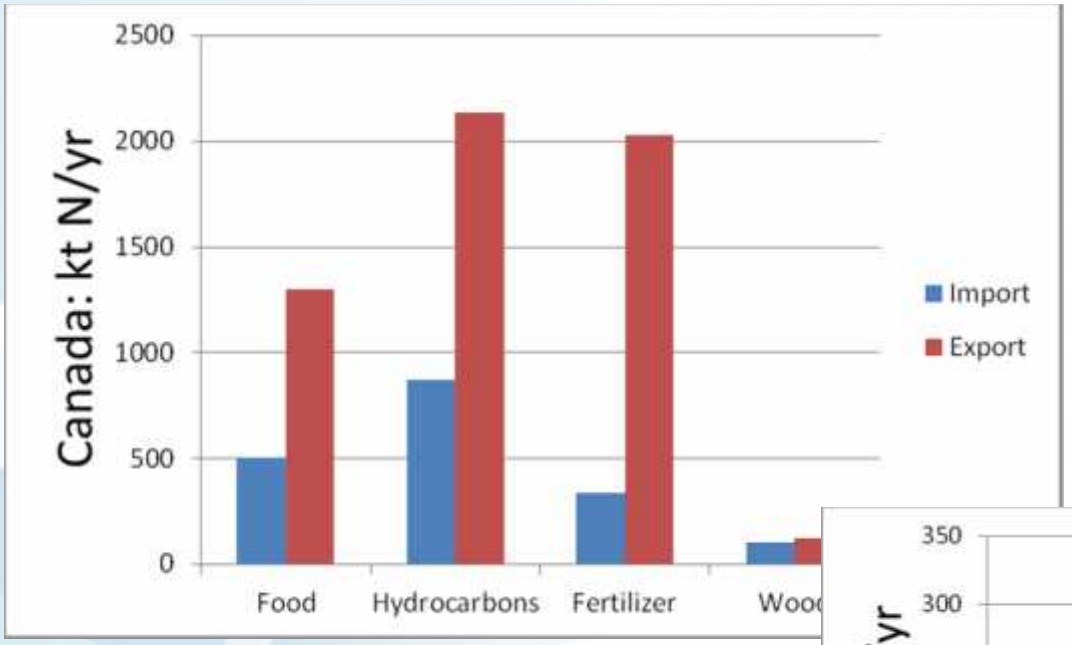
- Further (partial) activities, with limited documentation also from other countries

Time trends (here: Germany)



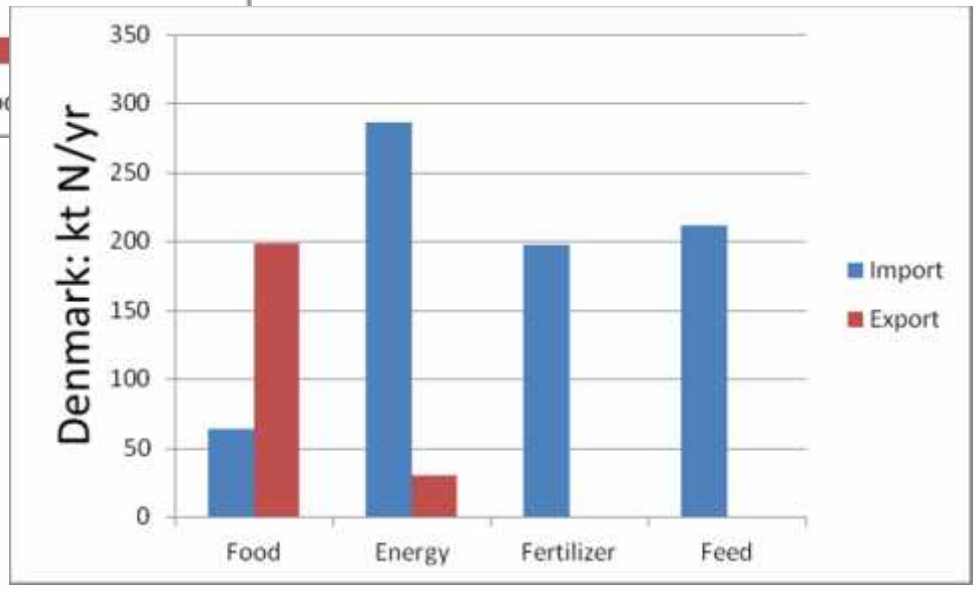
Source:
Geupel, 2016

Import/Export

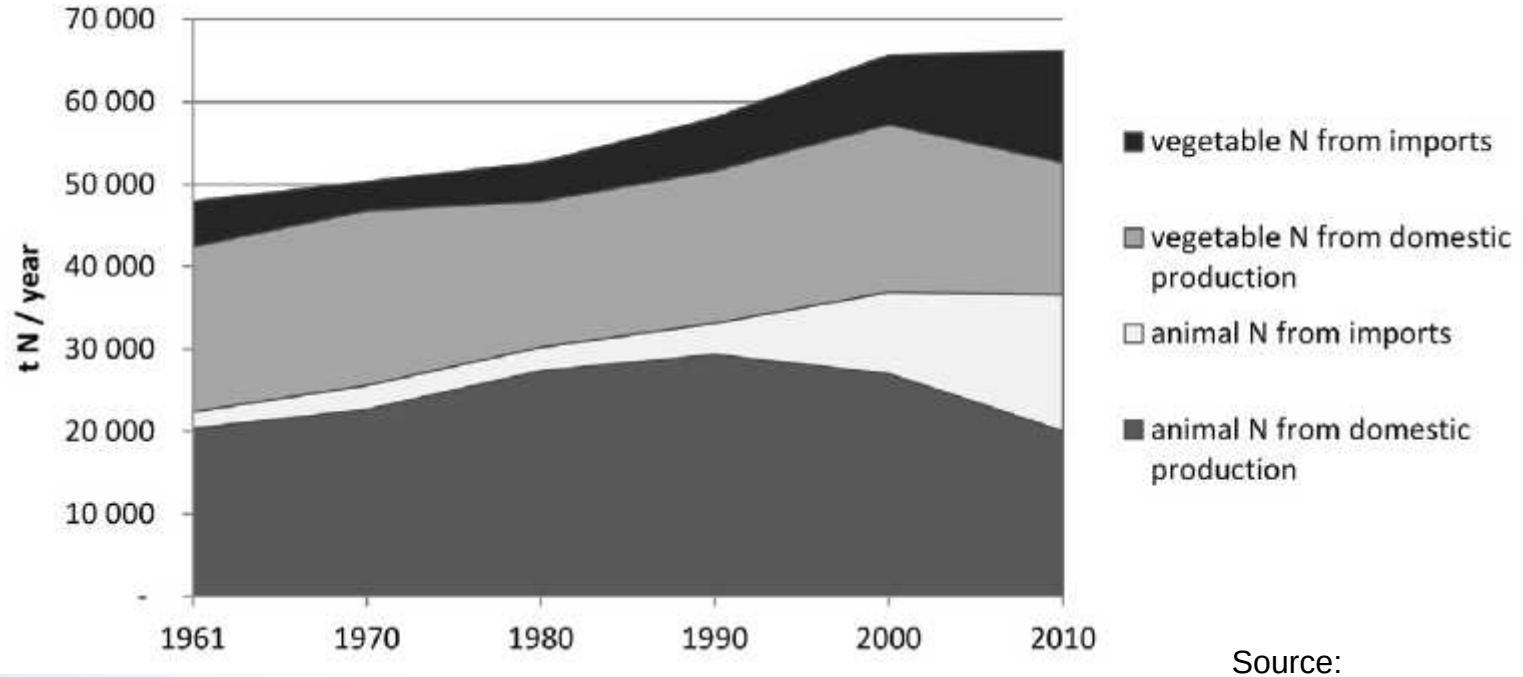


Data:
Clair et al., 2014

Data:
Hutchings et al., 2014

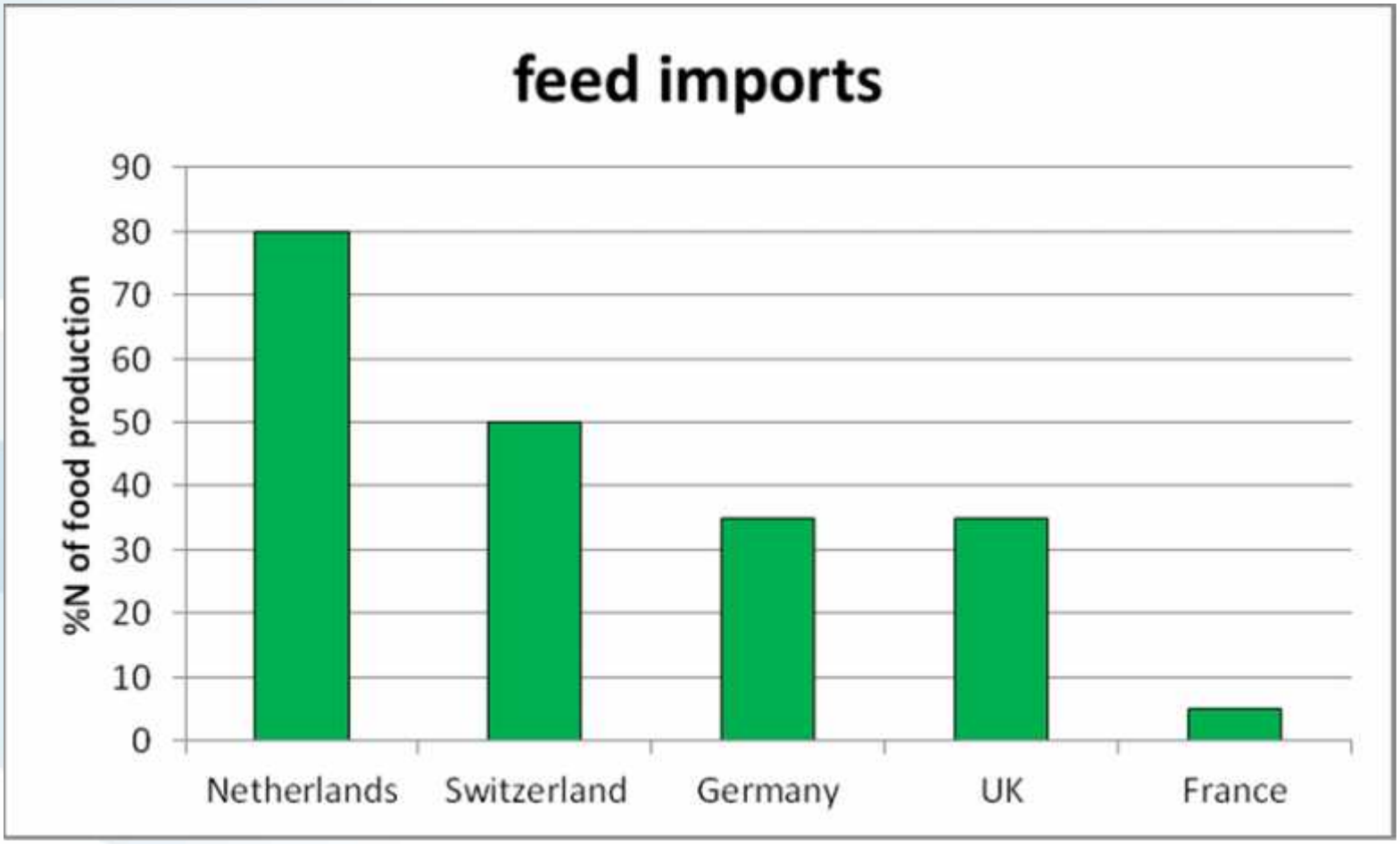


Partial balances: Austria



Source:
Pierer et al., 2015

Comparisons between countries



Data: Leip et al., 2011

Strengths / shortcomings

+ Observed discrepancies help to understand processes
+ Improved plausibility checks (benchmarking in time, similar country, …)
+ Policy target can be monitored

– Proper system boundaries and interfaces between pools needed
– To be explored: different data availability

Policy impacts, future applications

- N budgets appear in EU legislation

  "Member States ***may*** establish a national nitrogen budget"
- Extension to more countries will further allow meaningful comparisons
- Practice feedback welcome and needed – it is expected to improve usability

http://www.clrtap-tfrn.org/epnb