

For our Environment

Umwelt   
Bundesamt

Joint OECD / TFRN Nitrogen Workshop

# National Nitrogen Budget Germany

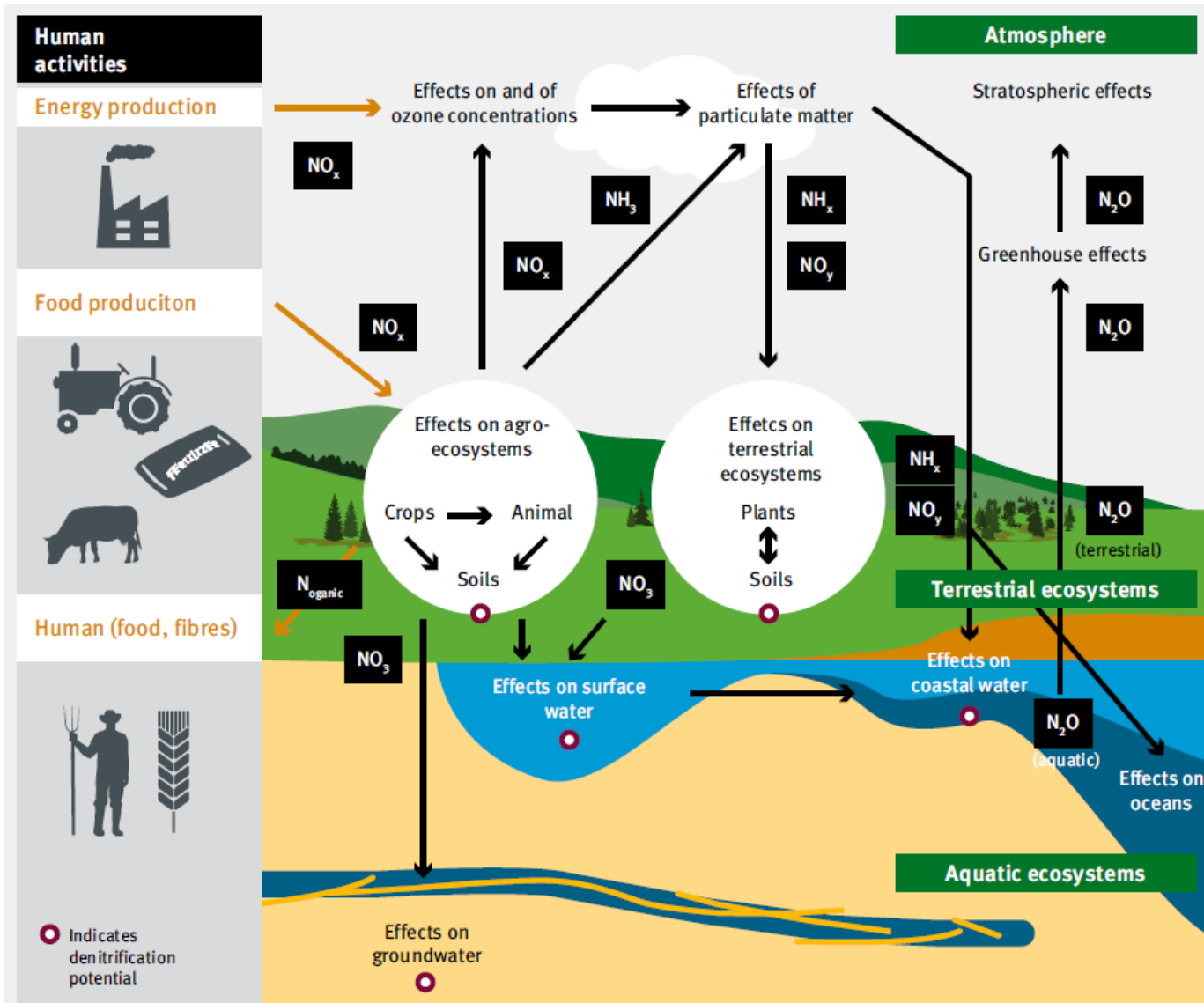
## A tool for policy making

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Section II 4.3

Air Quality and Terrestrial Ecosystems

## Objective: Quantification of the nitrogen cycle



after Galloway et al., 2003

## Background

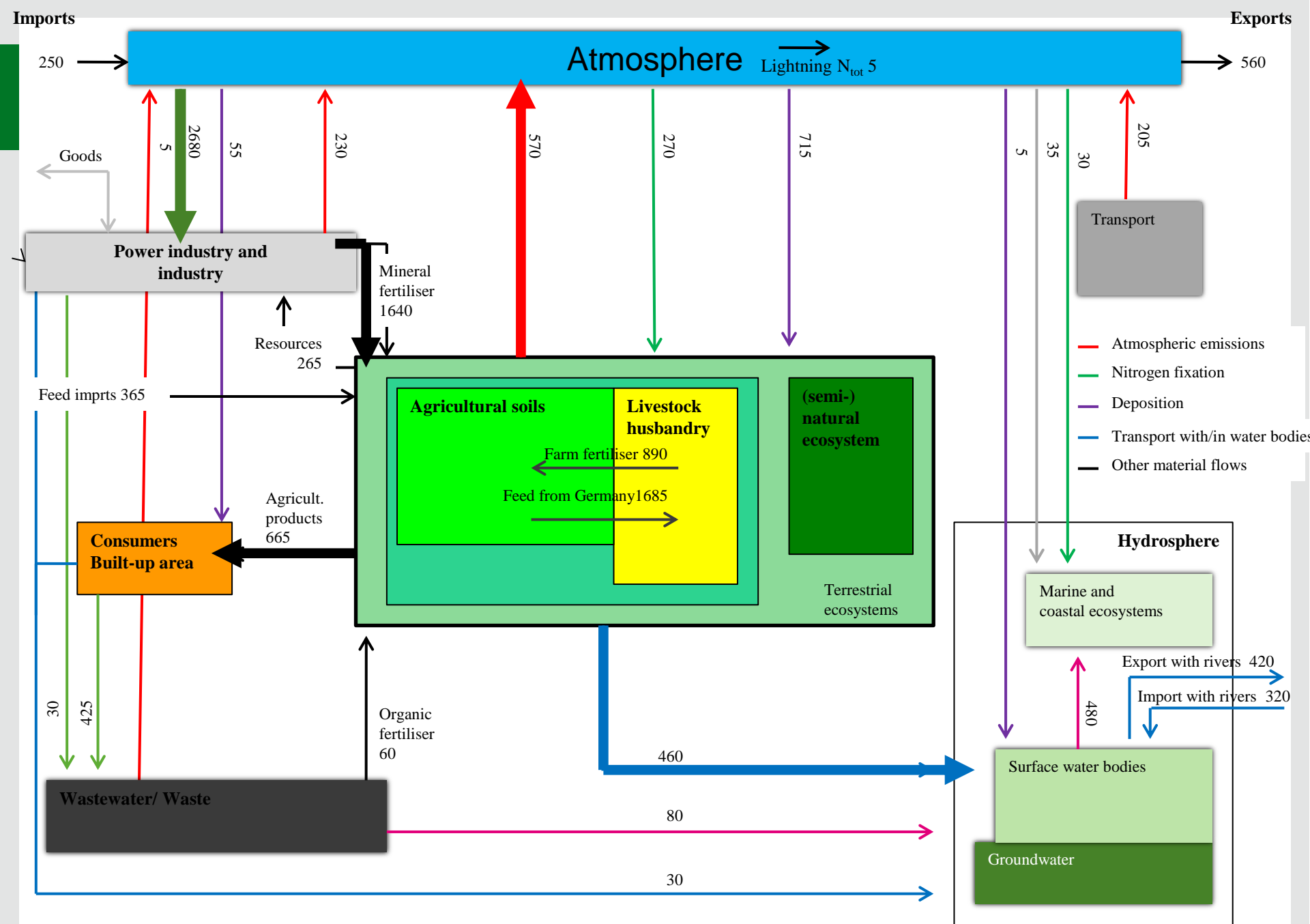
- Policy support
  - Where are the main flows?
  - Who are the main polluters?
  - Where are the most promising intervention points?
- Part of our agency's recommendations to go for an integrated approach.
- Application of a national method
- First approach in 2009 (data from 2000-2004)
- Second approach in 2015 (data from 2005-2010)
- Exchange of experiences with EPNB
- No application of EPNB Guidelines yet

## Methods and system boundaries

- Pools, entity that stores, releases or receives nitrogen
  1. Industry and Energy
  2. Transport
  3. Agriculture
  4. Natural and semi-natural ecosystems
  5. Waste and wastewater
  6. Atmosphere
  7. Hydrosphere
  8. Urban system
- Review work – basically no own calculations
- Focus on fluxes between pools
- International exchange with products incomplete
- Values  $> 1 \text{ Gg N yr}^{-1}$
- Where data are available, average values are given for 2008-2010.
- Otherwise the single value between 2005 and 2010 is taken

## Data collection

Type of flow in N-cycle	N-amount (Gg yr <sup>-1</sup> )	Ref. period	Source of data
<b>Industry and Energy</b>			
<ul style="list-style-type: none"> <li>➤ Industrial statistics</li> <li>➤ Emission inventories (CLRTAP, IPCC)</li> </ul>			
<b>Transport</b>			
<ul style="list-style-type: none"> <li>➤ Emission inventories (CLRTAP, IPCC)</li> </ul>			
<b>Agriculture</b>			
<ul style="list-style-type: none"> <li>➤ Agricultural statistics</li> <li>➤ Emission inventories (CLRTAP, IPCC)</li> </ul>			
<b>Natural and semi-natural ecosystems</b>			
<ul style="list-style-type: none"> <li>➤ Research data</li> </ul>			
<b>Wastewater</b>			
<ul style="list-style-type: none"> <li>➤ Research data</li> <li>➤ Wastewater statistics</li> </ul>			
<b>Atmosphere</b>			
<ul style="list-style-type: none"> <li>➤ EMEP-data</li> <li>➤ National deposition data</li> </ul>			
<b>Hydrosphere</b>			
<ul style="list-style-type: none"> <li>➤ Research data</li> </ul>			



## Inputs and Outputs

### Rate of input of reactive nitrogen into the environment (in 1000 Gg N yr<sup>-1</sup>)

	Global	Europe	Germany
Biological N-fixing	58.0 (14.0 %)	0.3 (1.5 %)	0.1 (2.0 %)
Lightning	5.0 (1.0 %)		
N-fixing in oceans	140.0 (34.0 %)	0.5 (2.5 %)	
Sub-total	203.0 (49.0 %)	0.8 (4.0 %)	0.1 (2.0 %)
Haber-Bosch	120.0 (29 %)	16.6 (74 %)	2.7 (74 %)
Biological N-fixing in farming	60.0 (15 %)	1.0 (4 %)	0.2 (6 %)
Fodder imports		0.5 (2 %)	0.4 (10%)
Combustion processes	30.0 (7 %)	3.7 (16 %)	0.4 (10 %)
Sub-total	210.0 (51 %)	21.8 (96 %)	3.6 (98 %)
Total	413.0 (100 %)	22.6 (100 %)	3.7 (100 %)
Area-related [ kg ha <sup>-1</sup> ]	8	53	103

Global: Fowler et al. (2013), Europe: Sutton et al. (2011), Germany: this study

## The key flows of reactive nitrogen in Germany

**Proportions of the main N-compounds and emitting groups in the mean annual emissions affecting air and surface waters in the current budget period**

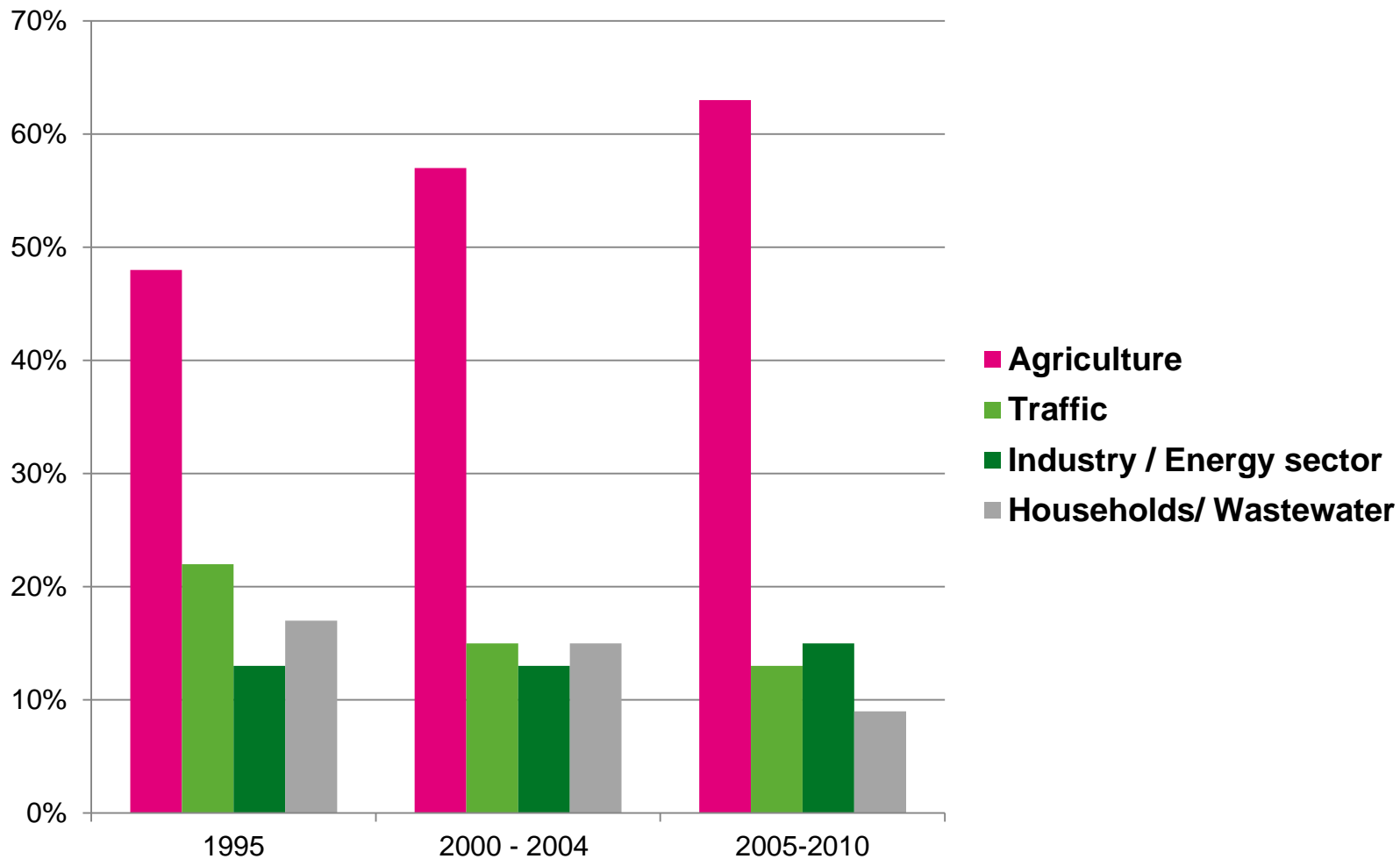
	Air			Water	Total [Gg N yr <sup>-1</sup> ]	%
	NO <sub>x</sub>	NH <sub>3</sub>	N <sub>2</sub> O	NO <sub>3</sub> <sup>-</sup> /NH <sub>4</sub> <sup>+</sup>		
Agriculture	33	435	88	424	980	63
Traffic	192	13	2		207	13
Industry/ Energy sector	166	15	27	10	218	14
Households/ Wastewater treatment plants/ Surface run-off*	21	1	6	135	163	10
<b>Total</b> [Gg N yr <sup>-1</sup> ]	412	464	123	569	1568	100
<b>%</b>	26	30	8	36	100	

\* Includes urban systems and the entire surface run-off, because currently no distinction can be made between agricultural and other areas. The atmospheric emissions include small domestic combustion units.



## Trends of key flows

Share of sectors to the total nitrogen emissions



## Use in policy support



Report to the public and to the Federal Ministry for the Environment

Published in January 2015

Policy support with the aim to convince policy makers of the need to go for an integrated approach

Main messages

- Negative impacts of the intensified nitrogen cycle
- Needs for action and policy strategies
- Germany's nitrogen cycle
- Measures and recommendations for action

Successful !

Since last year the Federal Ministry for the Environment has started the elaboration of a national nitrogen strategy.

→ Third update of the national nitrogen budget with application of the EPNB Guidelines planned.

[umweltbundesamt.de/en/publikationen/reactive-nitrogen-in-germany](http://umweltbundesamt.de/en/publikationen/reactive-nitrogen-in-germany)

# Thank you for your attention!

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[umweltbundesamt.de/en/topics/air](https://umweltbundesamt.de/en/topics/air)

## Inputs and Outputs

<b>Quantified Input 4200 Gg N yr<sup>-1</sup></b>	<b>Quantified Output 3550 Gg N yr<sup>-1</sup></b>
2700 industrial fixation	900 coastal ecosystems
370 feed import	560 transboundary atmosphere
440 emission fossil fuel burning	340 wastewater treatment
275 biological fixation	750 denitrification agri. surpluses
570 transboundary import	1000 industrial products

## The key flows of reactive nitrogen in Germany

