

General overview on the purpose and advantages of nutrient bookkeeping for modern farming and environment protection

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Structure

1. Purpose of nutrient accounting in agriculture
2. Concepts, uncertainties, methodological variations
3. Nutrient balances versus fertilisation plans
4. Discussion

Nutrient balances in agriculture: background

- N and P surplus important agri-environmental indicator
- ‚Pressure indicator‘ for potential losses into the environment = potential pollution
 - Surface & groundwater, marine environment (NO_3 , P)
 - Gaseous emissions (NH_3 , N_2O)
 - Habitats sensitive to nutrient inputs (N, P)
 - Impacts: water pollution, eutrophication, acidification, PM (particulate matter), climate (greenhouse gases)
- Resource efficiency: high energy input (mineral N), non-renewable, scarce resource (P)
- N and P are major nutrients, a key for crop productivity

Nutrient balances in agriculture:

Legal basis and international agreements

EU directives related to N (and P) emission

- Water Framework Directive (WFD, 2000/60/EC)
- Marine strategie Framework Dir. (MFD, 2008/56/EG)
- Nitrates Directive (ND, 91/676/EEC)
- Groundwater Directive (GWD, 2006/118/EC)
- National Emission Ceilings Dir. (NEC, 2001/81/EC)
- Fauna Flora Habitats Directive (FFH, 92/43/EEC)

International agreements

- International Marine Protection (PARCOM / HELCOM)
- Convention on Long-range Transboundary Air Pollution
- Kyoto protocol

Nutrient balances and “accounting” in agriculture:

Purpose

National and regional level: Nutrient balances

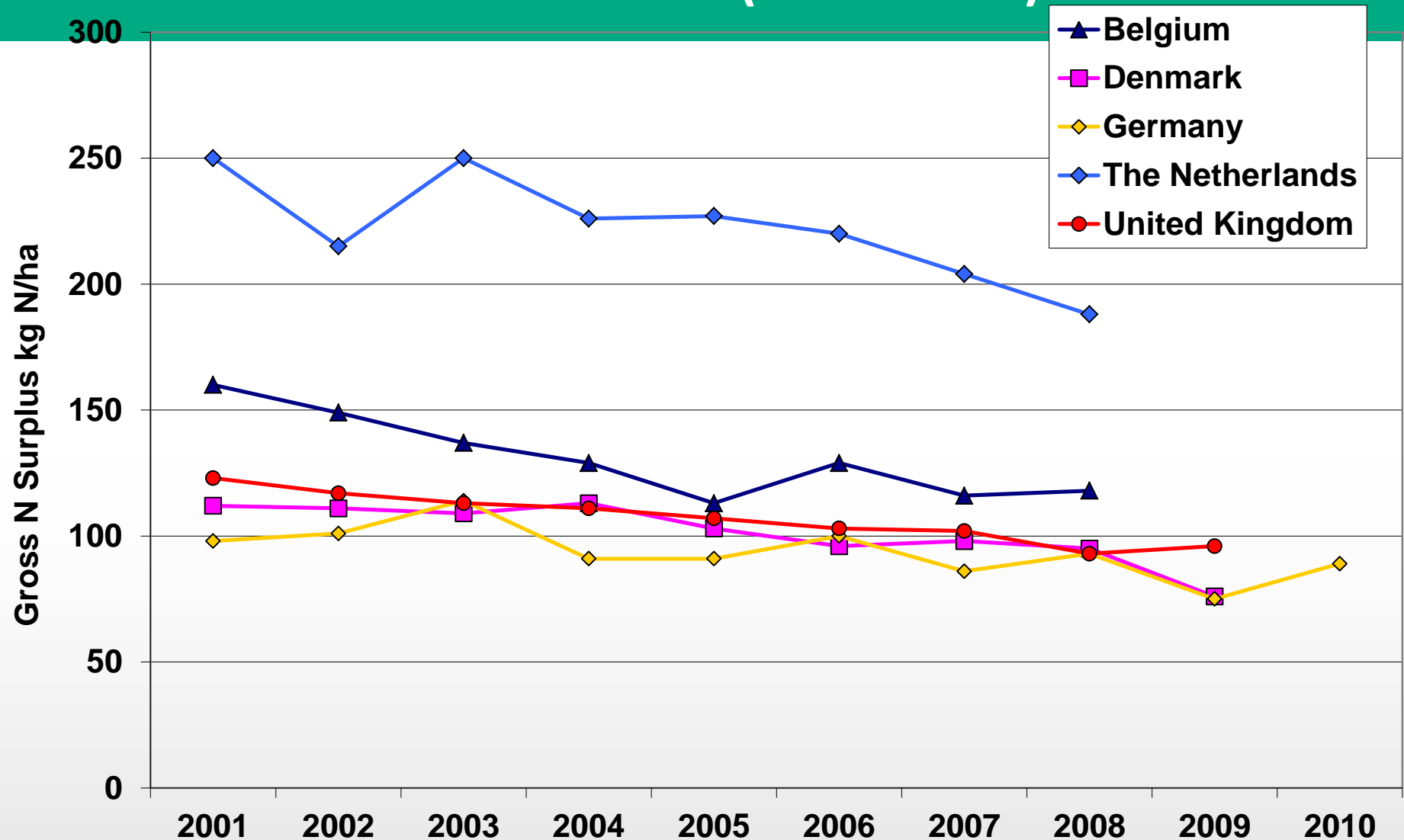
- Environmental observation
- International environmental reporting (national or regional level, e.g. OECD national N surface balance)
- Basis for modeling of water pollution
- Input for ranking of water bodies according to WFD

Farm and field level: Nutrient accounting

- Nutrient management at farm level (*balances vs. plans*)
- Basis for technical advice, benchmarking
- Legal thresholds, mandatory rules

Example 1: National balances

EUROSTAT Gross N balance (2001-2010)



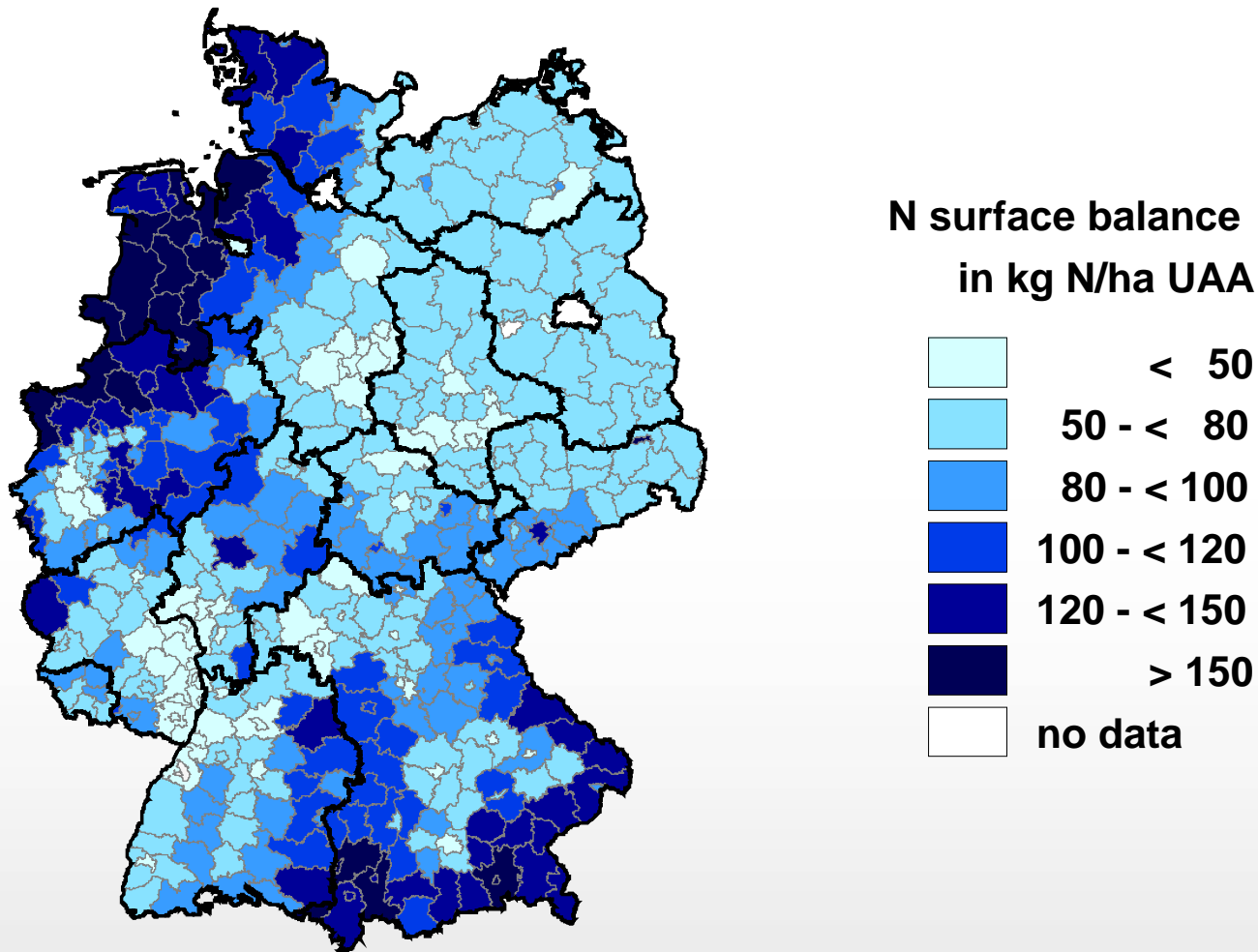
Example 2: Analysis of national time series

Germany - national N farm gate balance 1990 - 2010

in kg N/ha UAA	Diff. 2010-1990
Fertilizer	-26,34
N deposition	-1,4
N fixation	-1,33
Seeds	-0,31
Feed (inland)	6,06
Feed (import)	3,66
Sum of inputs	-26,98
plant products	17,47
livestock products	7,04
Sum of outputs	24,51
Reduction of N balance	-51,49

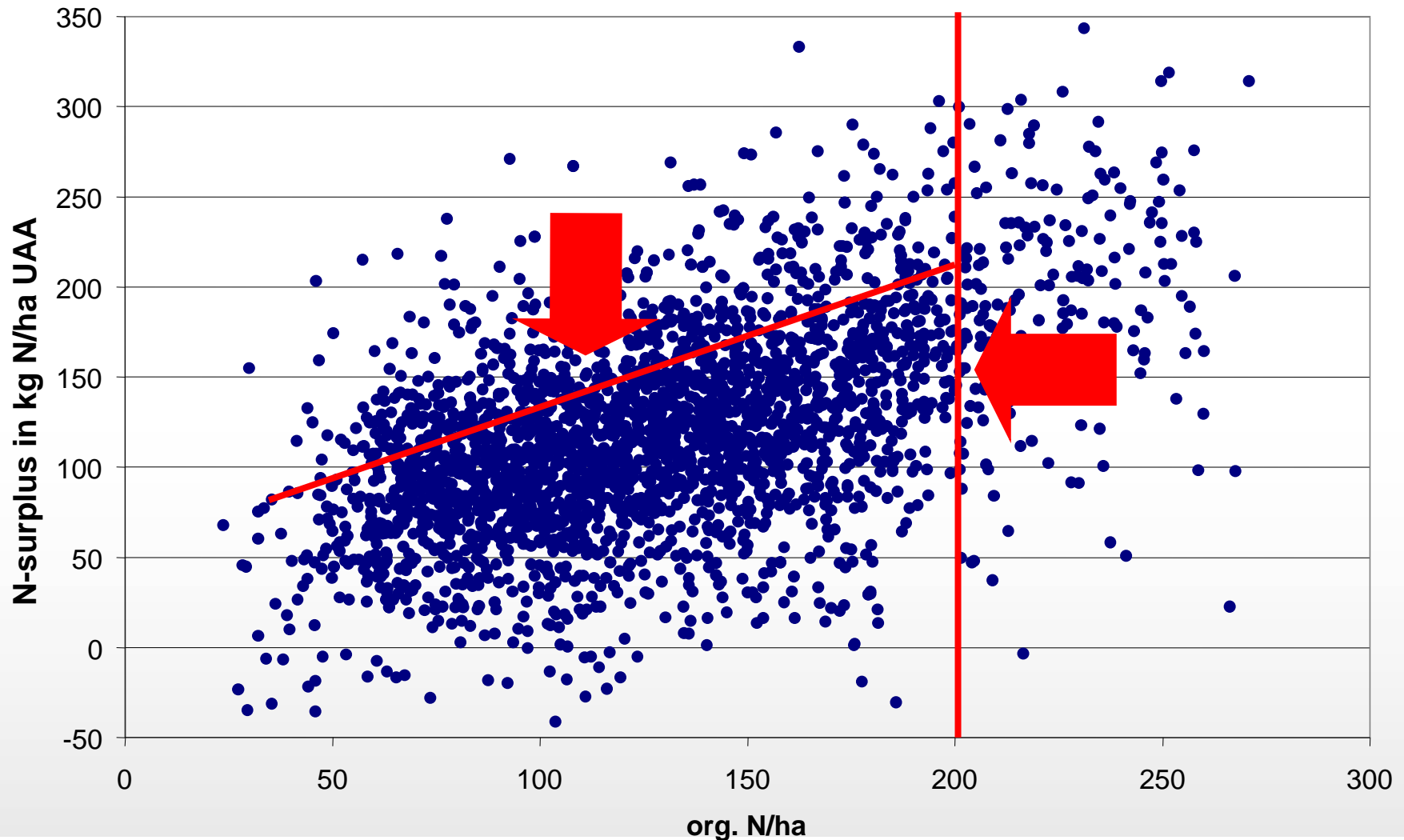
Example 3: Regional balances

Germany, gross N surface balance (2003)



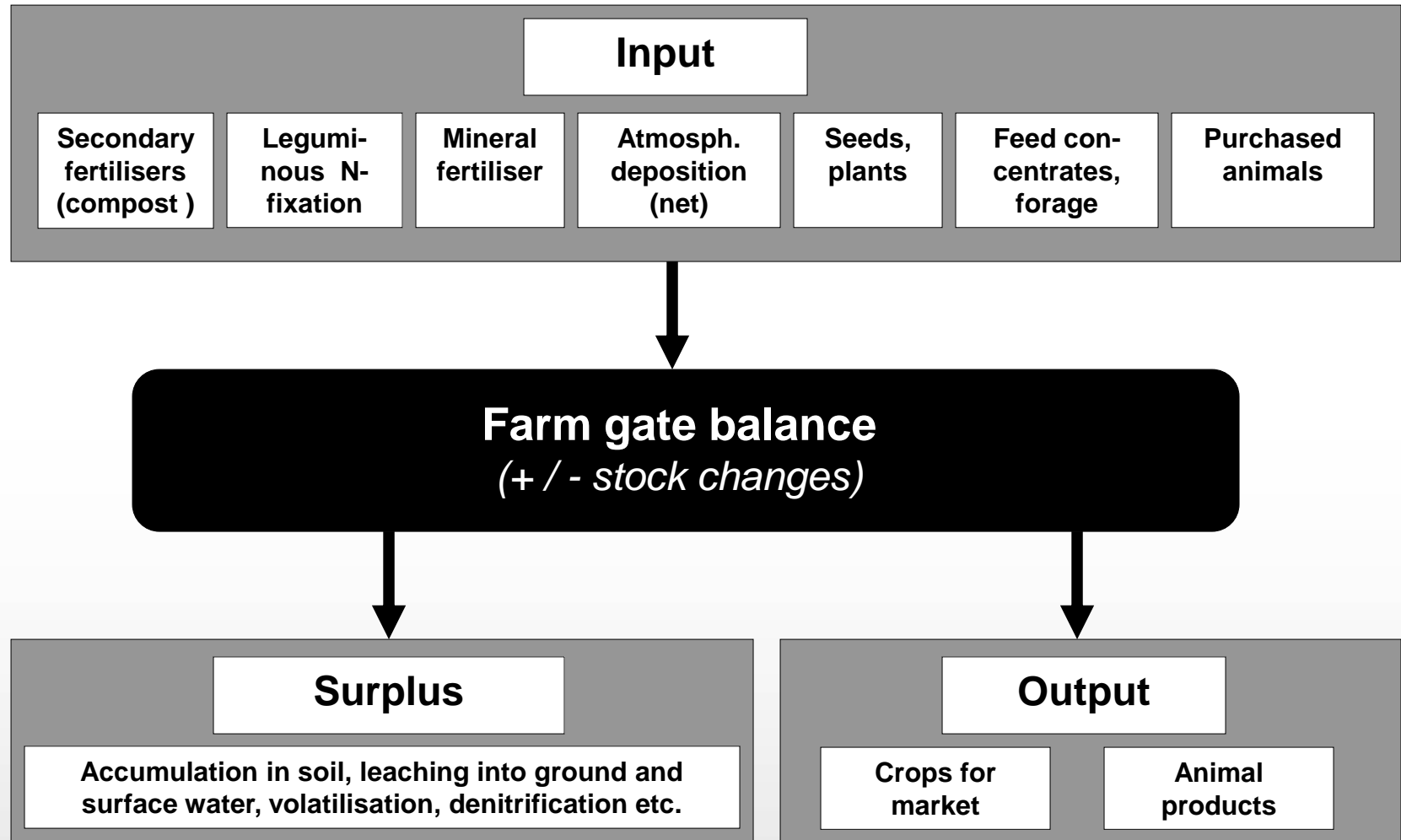
Example 4: Farm balances

Germany, gross N surface balance (1999/00-2000/01)

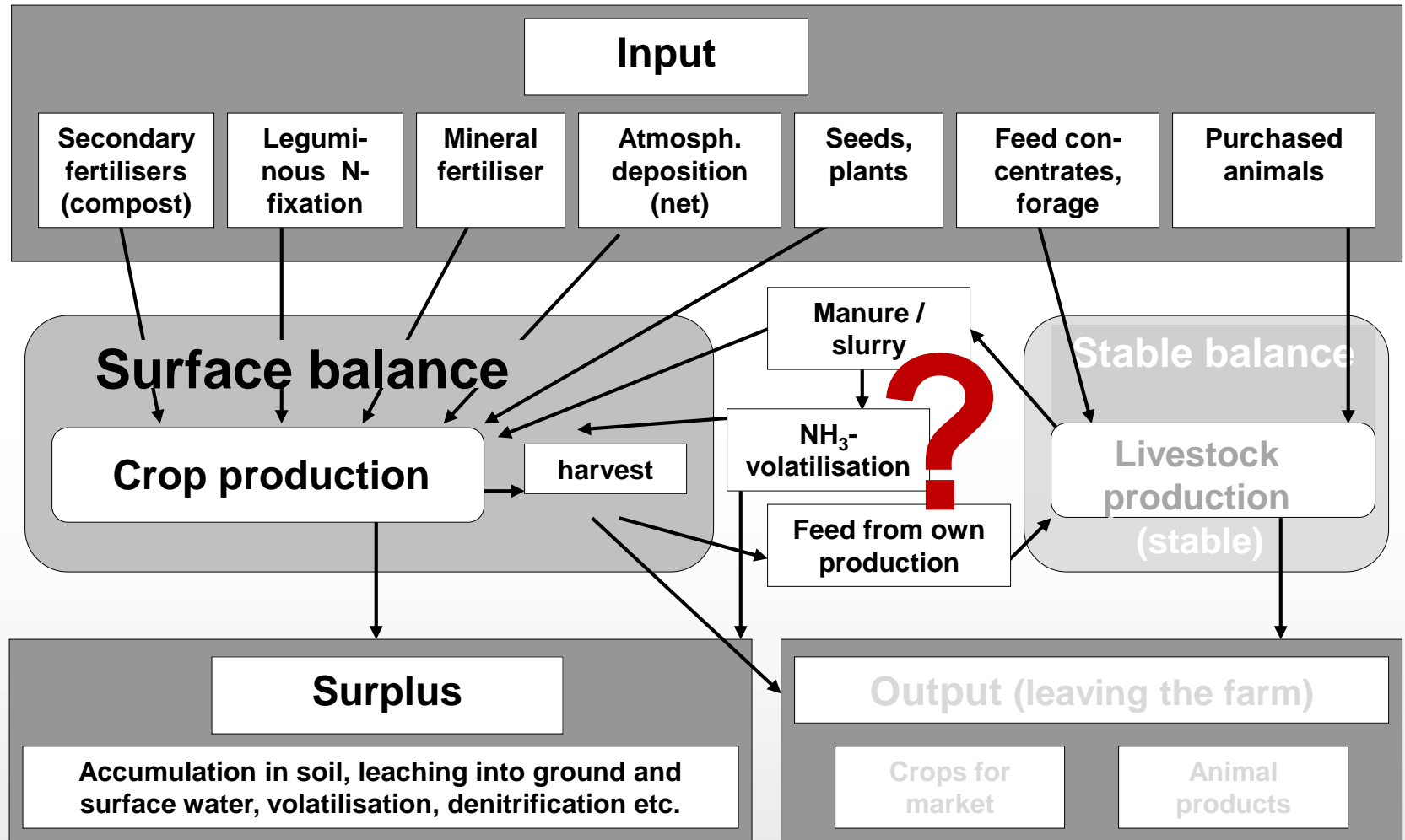


Concepts 1:

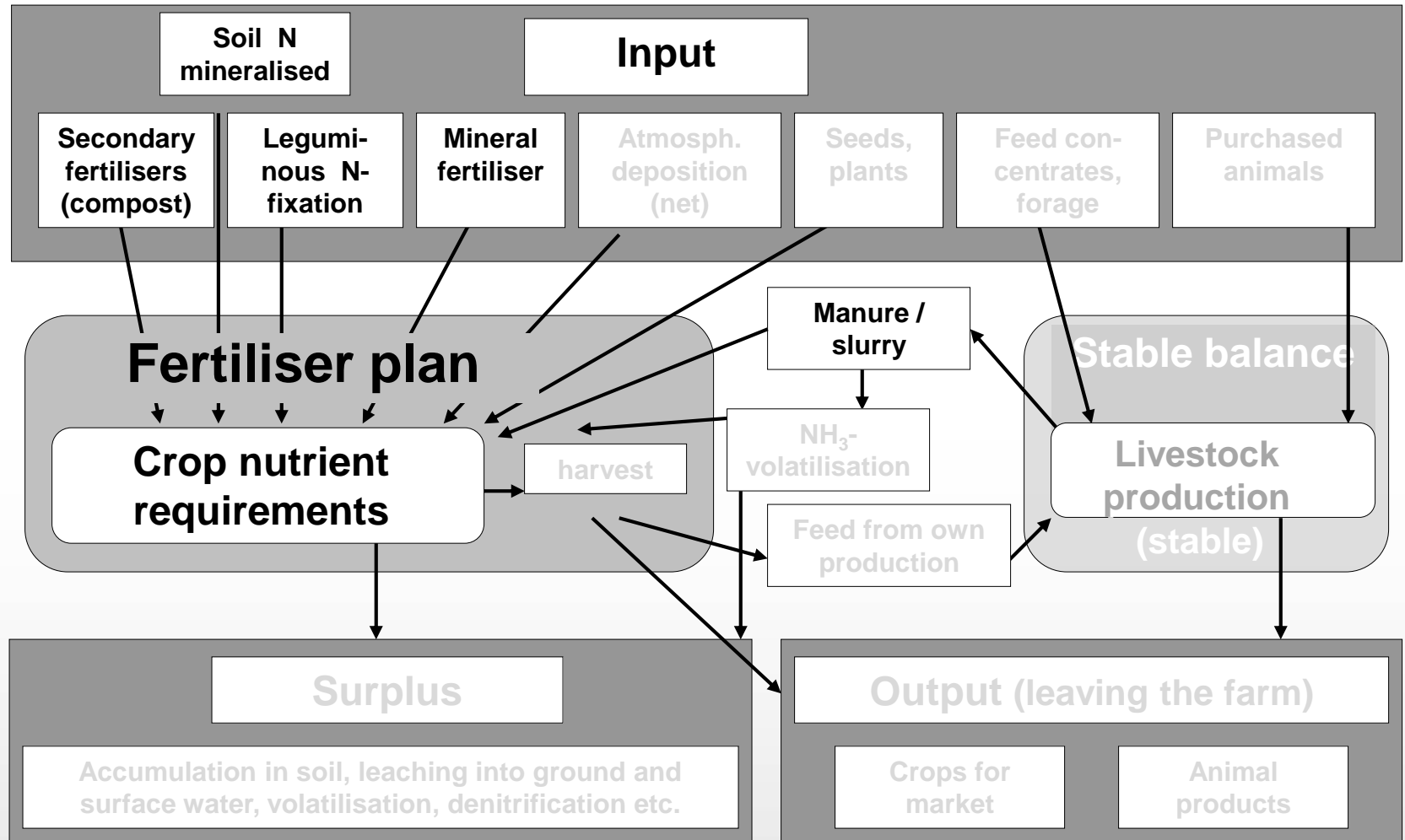
Farm Gate Balance



Concepts 2: Surface (Field) *and* Stable (Livestock) Balance



Concepts 3: Fertilisation planning



Uncertainties and methodological variations

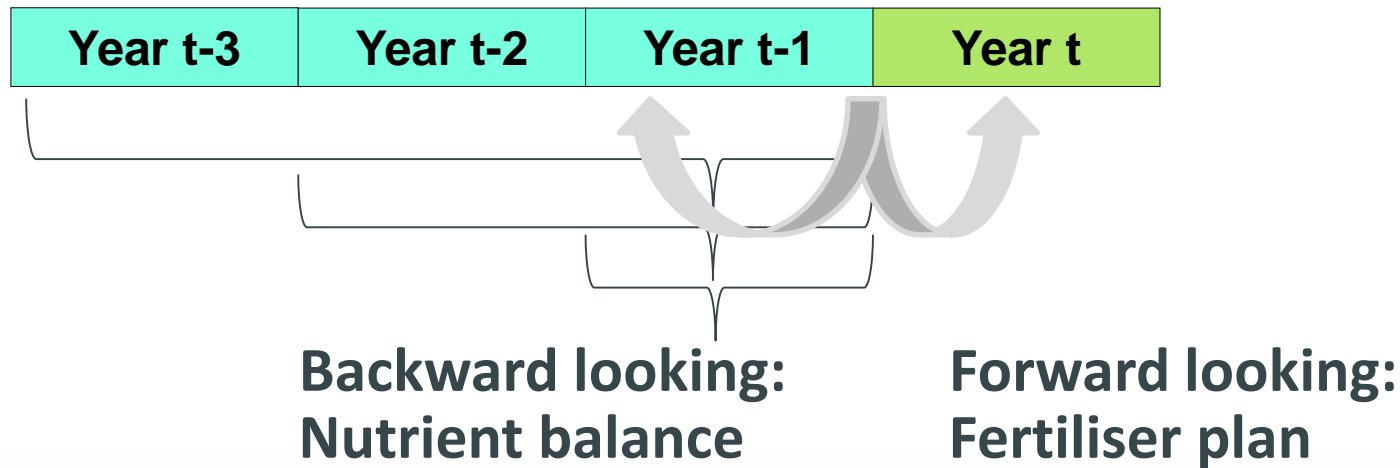
General uncertainties:

- Data on amounts of fertiliser and harvested products
- Coefficients for nutrient content (default values)
- Yearly variations

Methodological variations:

- Which nutrient flows are considered?
- Gross versus net nutrient accounting (nitrogen):
Deductions from total nutrient flow in order to account for gaseous nutrient losses or low nutrient availability
- Gross (farm gate) balances: appropriate AE indicator
- Net (surface) balances: appropriate for farm benchmarking
- Fertiliser plans: appropriate for farm management

Nutrient balances versus fertiliser plans



In both concepts:

- Inputs of fertilisers, accounting for losses etc. is similar
- Fixing the yield levels, realised or expected, is crucial

Fertiliser plans: fixing crop nutrient requirements is crucial

P: balances useful only for several years avg., observation of soil P

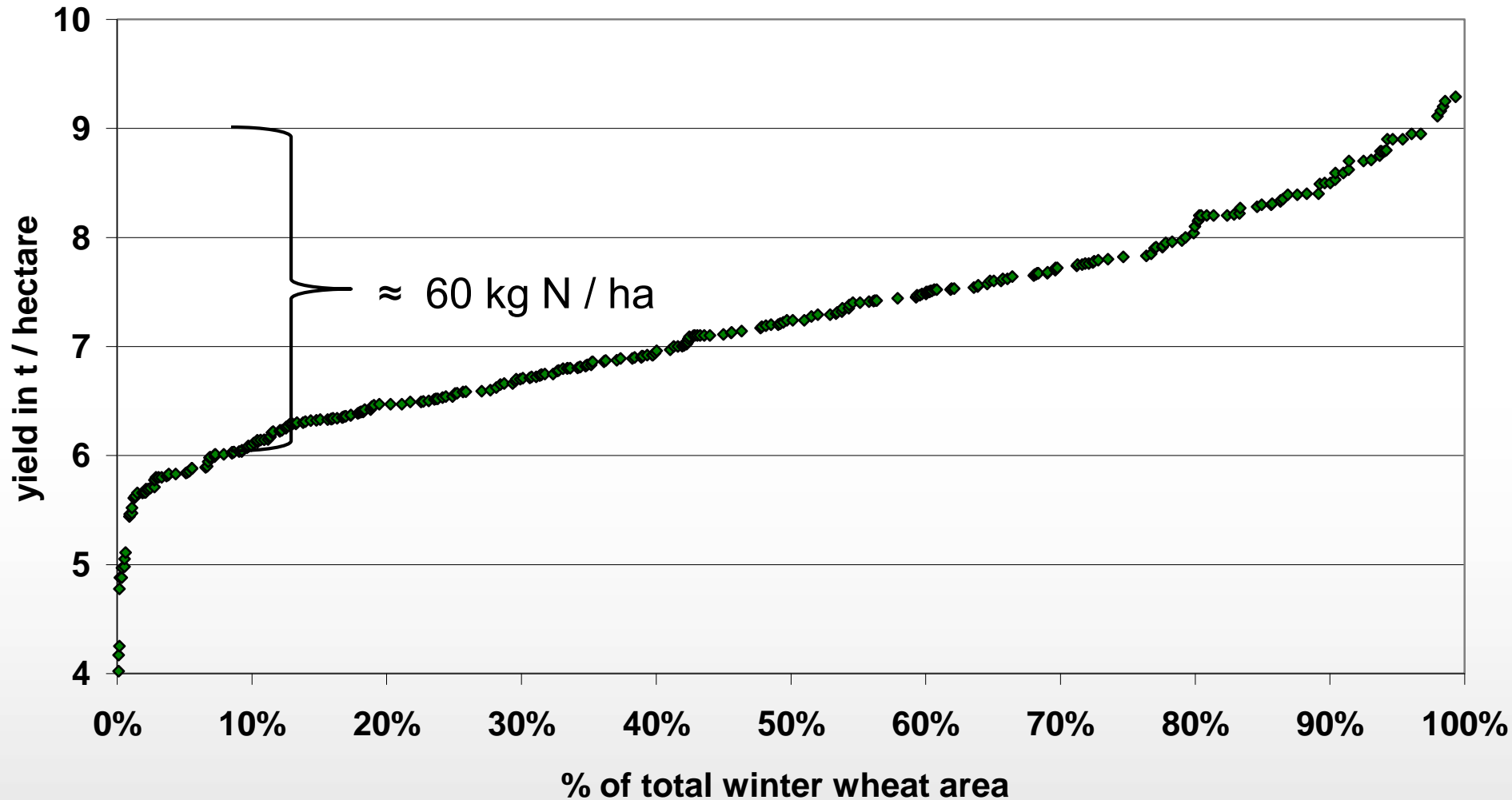
Data for calculation and verification of nutrient balances and fertiliser plans

	nutrient balance	fertiliser plan
Mineral N input	real input	≈ planned + real input
Manure N input	heads x excretion – loss	=
livestock numbers	livestock register	=
excretion rates, losses	standard rates	=
legume N fixation	area x standard rate	=
other N input	receipts/accounts	=
Cultivated area	area register / IACS	=
N removal with harvest	real yields	≠ standard yields
Marketed crops	receipts/accounts	≠ standard yields
Cereals etc. for feeding	plausibility checks	≠ standard yields
Higher N content (wheat)	receipts/accounts	=
Forage crops	consistent with excretion	≠ standard yields (?)

- Main difference is the calculation of yields
- Verification of real yields versus usefulness of standard yields

Is assumption of standards yields useful?

Yields of winter wheat throughout Germany (2010)



Discussion

- Integrated abatement strategy needed, curbing N surplus while increasing N use efficiency and avoiding negative impacts on productivity
- Using the N balance or fertiliser plans as indicator for good practice? Policies addressing P surplus and pollution?
- Maximum N balance surplus versus maximum nutrient inputs
- Mandatory versus voluntary, advice-oriented approaches
- Crucial points: verification of yield levels, control of mineral fertilisers purchase, manure im- /exports
- Impacts: N – concentration versus total loads
P – control of runoff

Thank you for your attention

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Livestock
production
(stable)