EU wide overview of phosphorus flows & data quality

Kimo van Dijk

Wageningen University

kimo.vandijk@wur.nl

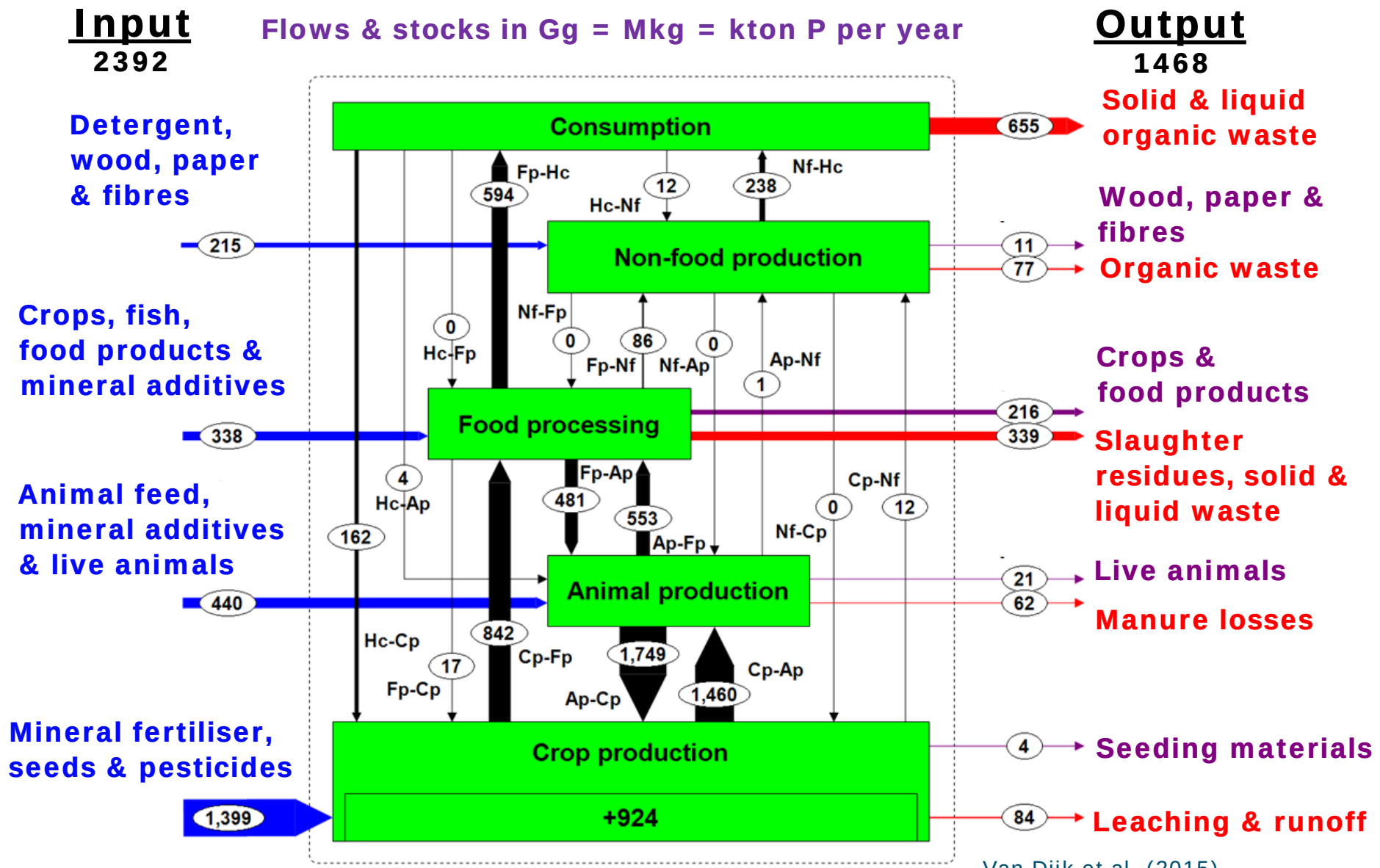
WAGENINGEN UR
For quality of life

DONUTSS workshop, Ghent, Belgium
3 September 2015

Overview

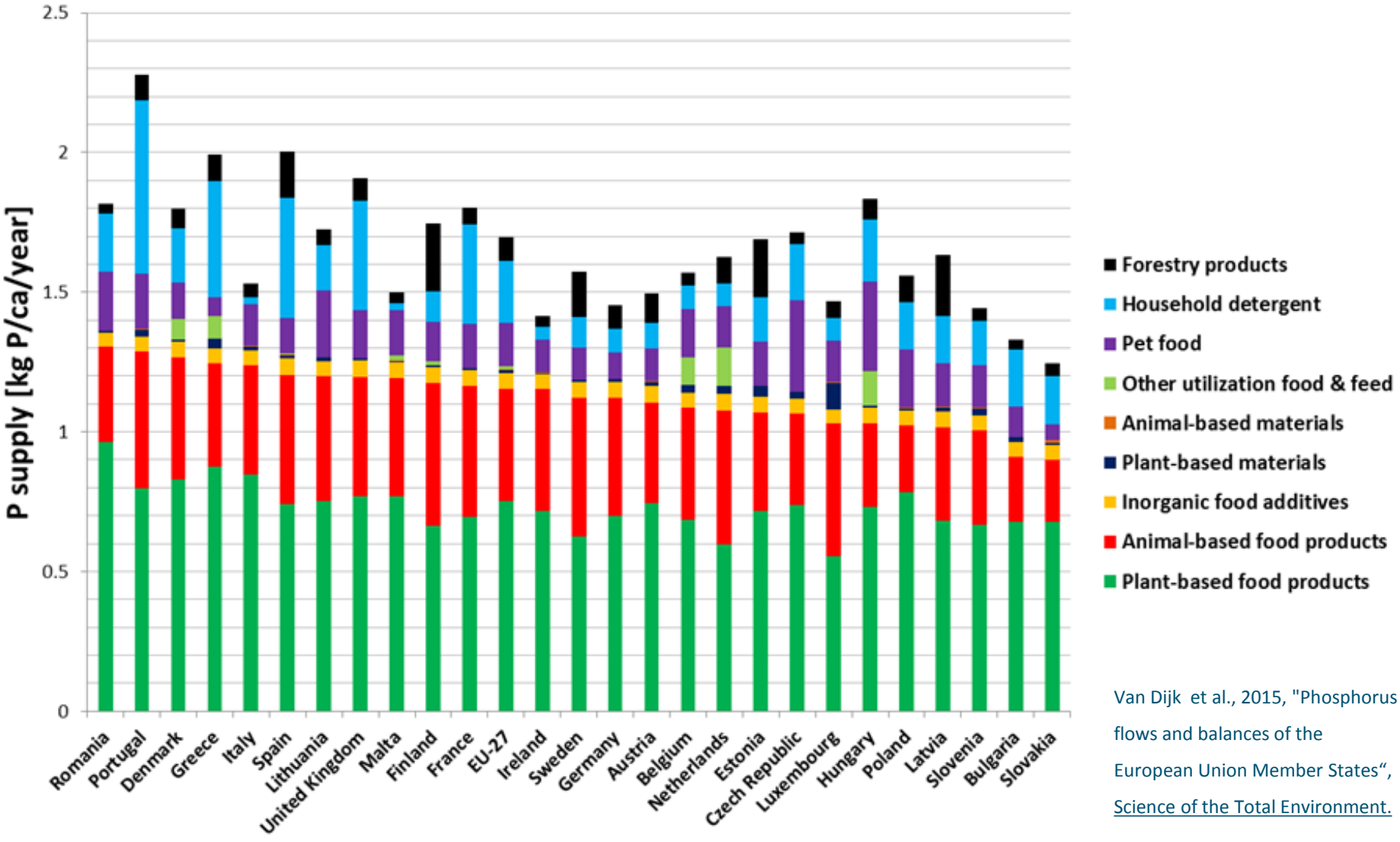
- Phosphorus (P) flows and balances in the EU-27 Member States
- Data & methods used
- Data quality & monitoring challenges

Phosphorus use in the EU-27 in 2005



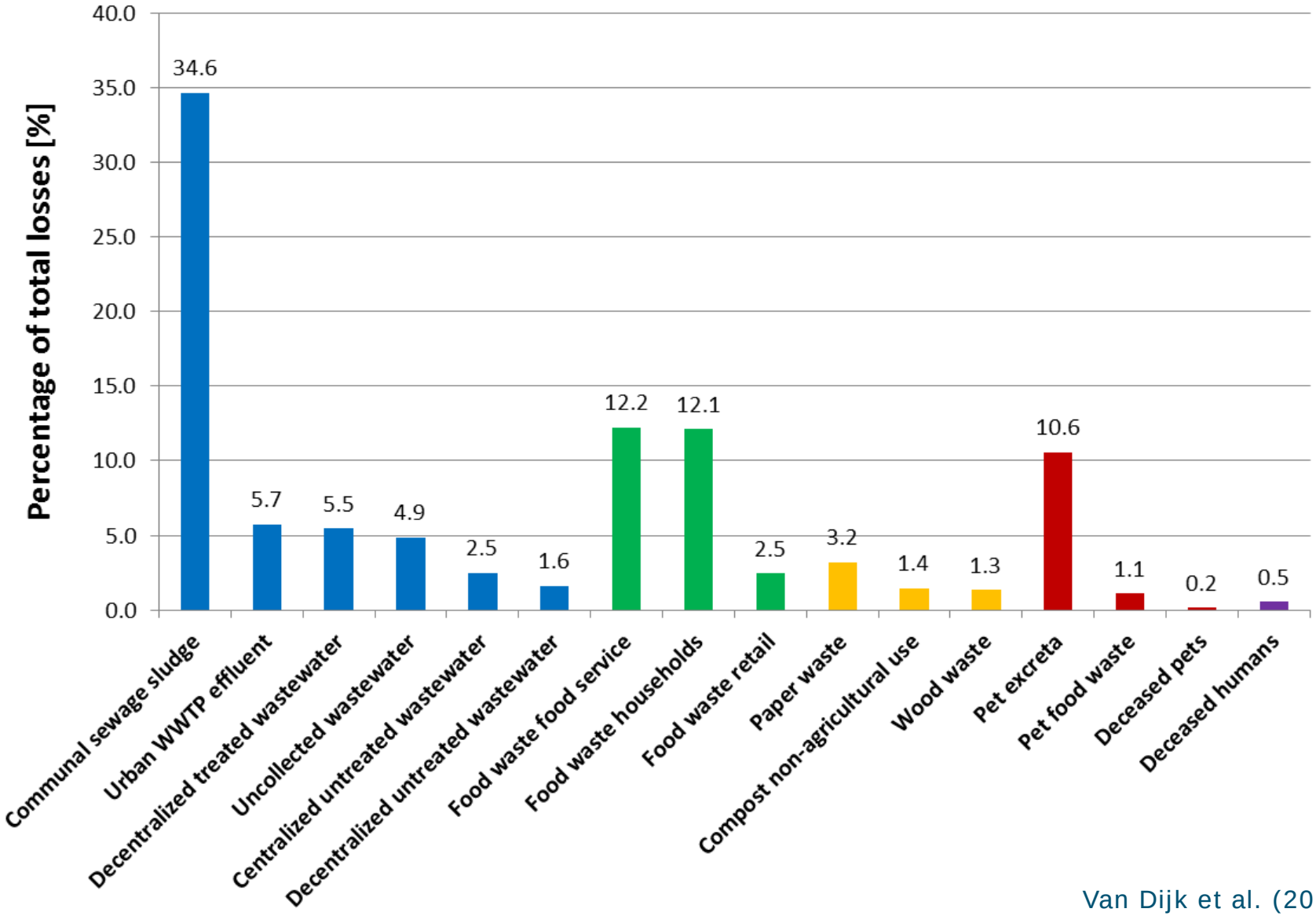
Van Dijk et al. (2015)

Per capita P supply per country in 2005



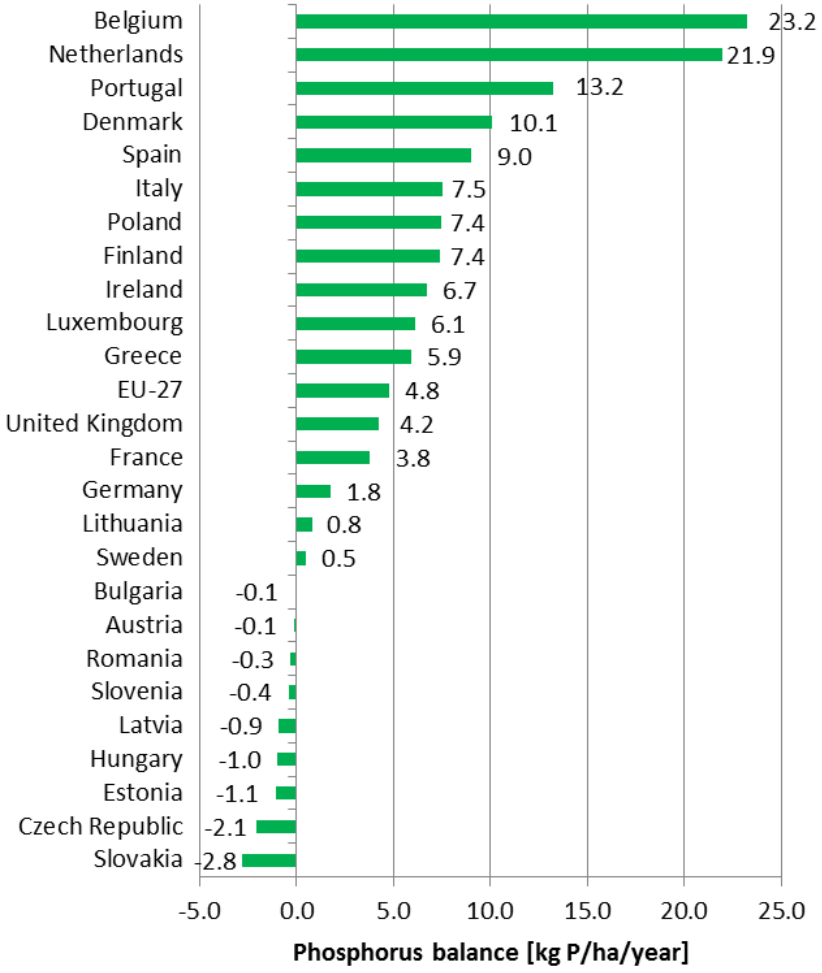
Van Dijk et al., 2015, "Phosphorus flows and balances of the European Union Member States", Science of the Total Environment.

EU-27 consumption sector P losses in 2005

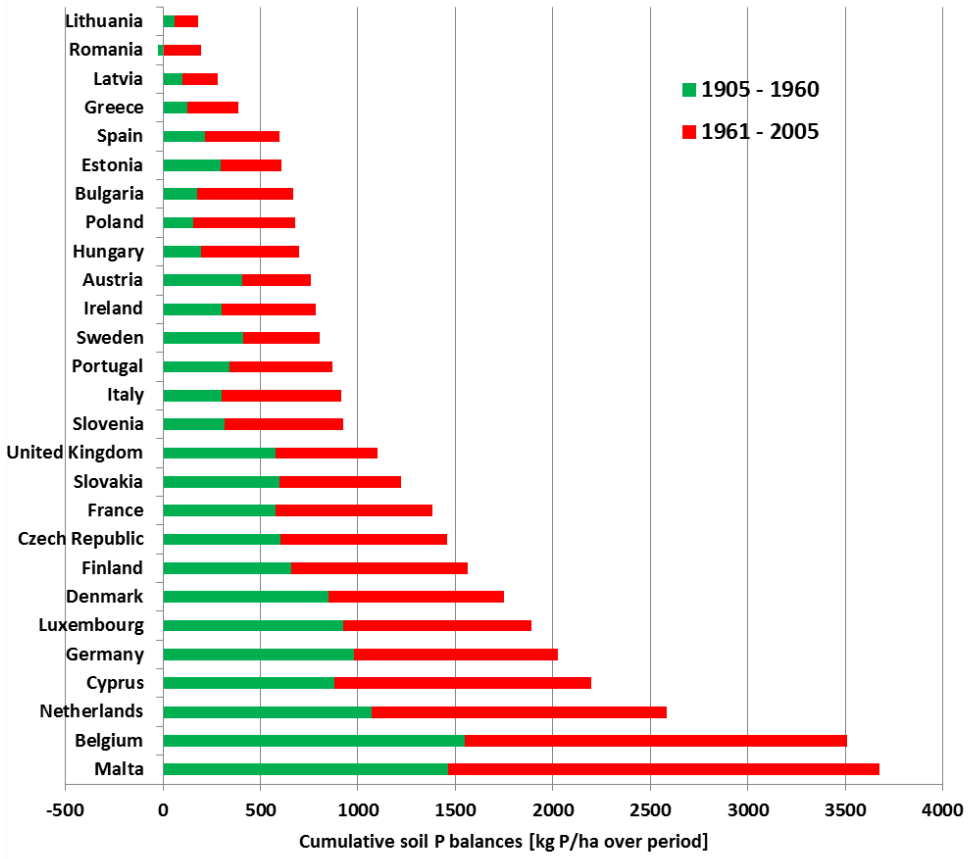


Van Dijk et al. (2015)

Agricultural P balances per country for 2005 & period 1905 - 2005



128 Mtons P accumulated
in agricultural soils between 1905 -2005



Van Dijk et al. (2015)

Van Dijk et al. (submitted)

Data & methods used

- For EU-27 and individual Member States
- As detailed as data allows: 93 sub flows
- Imports, exports, losses and internal flows
- Entire food system + non-food
  (e.g. forestry, detergents, pet food, etc.)
- Main data sources: Miterra-Europe, CAPRI, FAOSTAT, Eurostat, reports, articles and experts
- Time series if present in data (e.g. FAOSTAT, Eurostat)
- Data for 2005 complete and checked, other base years possible with additional data input
- Raw data is balanced based on mass balance principle
- EU-27 corrections for intra/extra trade

Data quality & monitoring challenges

- Data quality: trade > production > consumption > recycling
- Unclear definitions & not enough detail in data
- Eurostat data is incomplete and inconsistent
- Data gaps for waste flows & (new) recycling flows
- Literature data mostly not recent and only specific base years
- Trade databases not available for all products/materials
- Data gaps requires data filling procedures & flow balancing
- Industry data not publically available, sometimes commercially, but no peer reviewed
- Uncertainties for most data unknown
- Nutrient concentrations not monitored
- From quantity to quality, from theory to practise

Thank you for your attention

Questions? Comments? Suggestions?

kimo.vandijk@wur.nl / kimovandijk@xs4all.nl

Twitter: @kimovandijk

Website: kimovandijk.weebly.com

WAGENINGEN UR
For quality of life

Extra additional slides as background

EU-27 system & primairy P flows in 2005

	Absolute quantity [Gg P/year]			Relative fraction of total system import, export & losses [%]			Primary P import		
	Import	Export	Losses	Import	Export	Losses	Gg P/year	% of total system primary import	% of total sector import
CP	1399	4	84	58	1	7	1391	78	99
AP	440	21	62	18	9	5	250	14	57
FP	338	216	339	14	86	28	27	2	8
NF	215	11	77	9	4	6	110	6	51
HC	-	-	655	-	-	54	-	-	-
Total	2392	251	1217	100	100	100	1777	100	

Van Dijk et al. (2015)

EU-27 lost P destination per sector in 2005

	Ashes	Landfills	MSW	Hydrosphere	Lithosphere	Undefined	Total losses
CP	0	0	0	84	0	0	84
AP	0	0	0	62	0	0	62
FP	294	0	0	2	1	41	339
NF	10	0	0	1	0	66	77
HC	104	59	221	54	74	143	655
Total	408	59	221	204	76	250	1217
Relative share [%]	34	5	18	17	6	21	

Van Dijk et al. (2015)

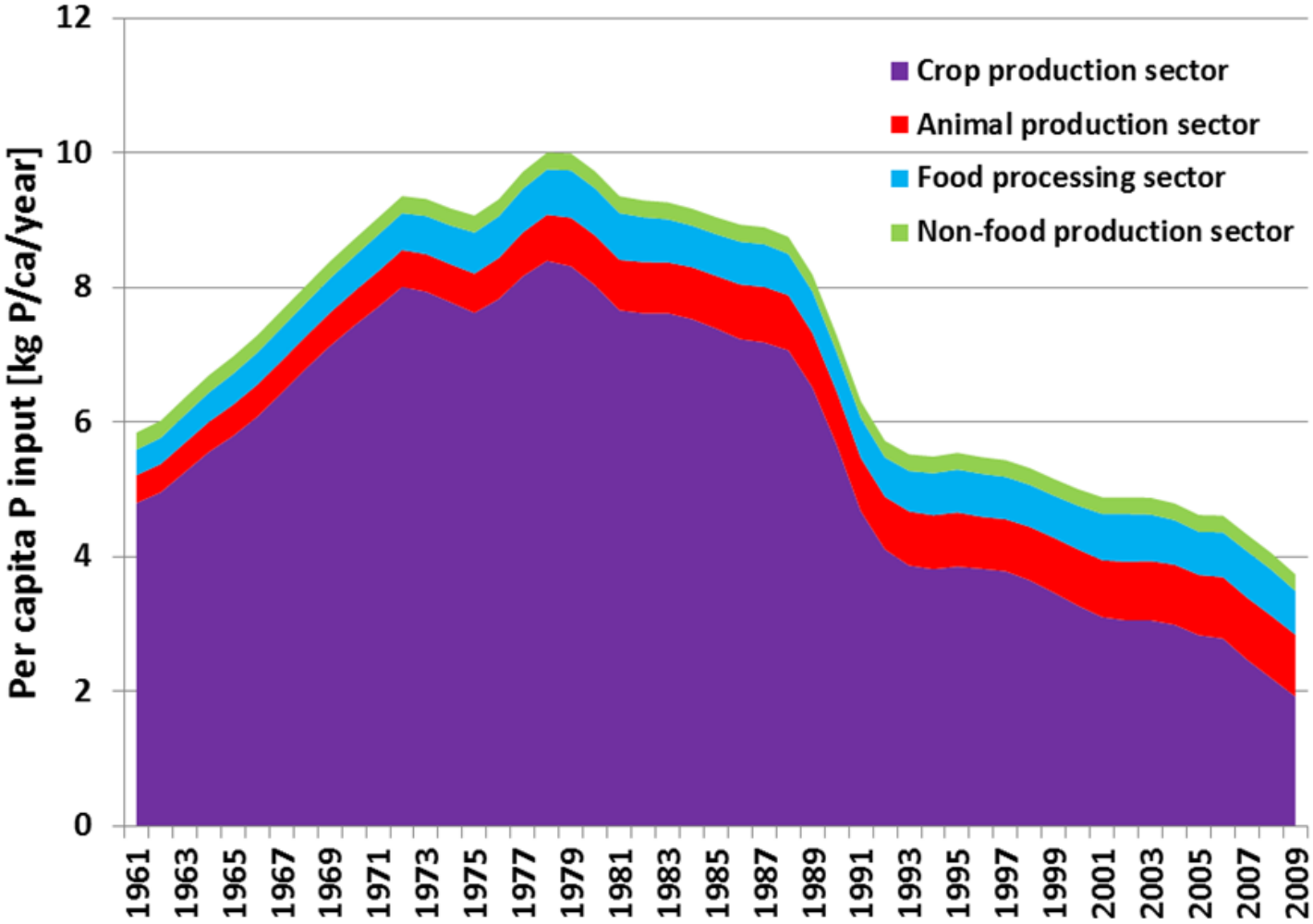
EU-27 P use efficiency per sector in 2005

	CP	AP	FP	NF	HC
PUE-1 Output flows minus losses	70	97	80	76	21
PUE-2 Upward output flows plus export	70	24	52	76	-

$$PUE_{sector} = \frac{Output_{effective}}{Input_{total}} * 100$$

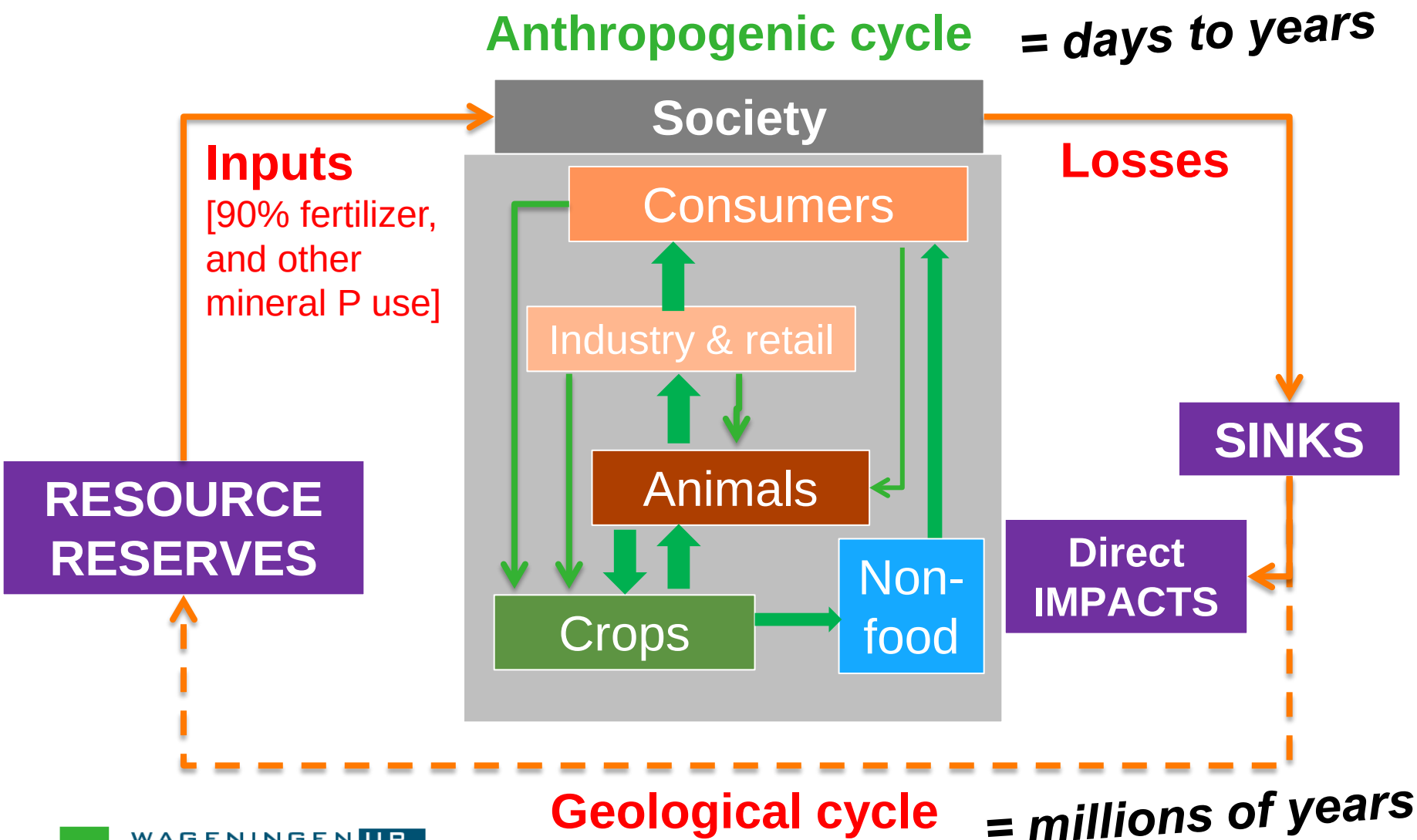
Van Dijk et al. (2015)

Changes in EU-27 P inputs 1961-2009



Van Dijk et al. (2015)

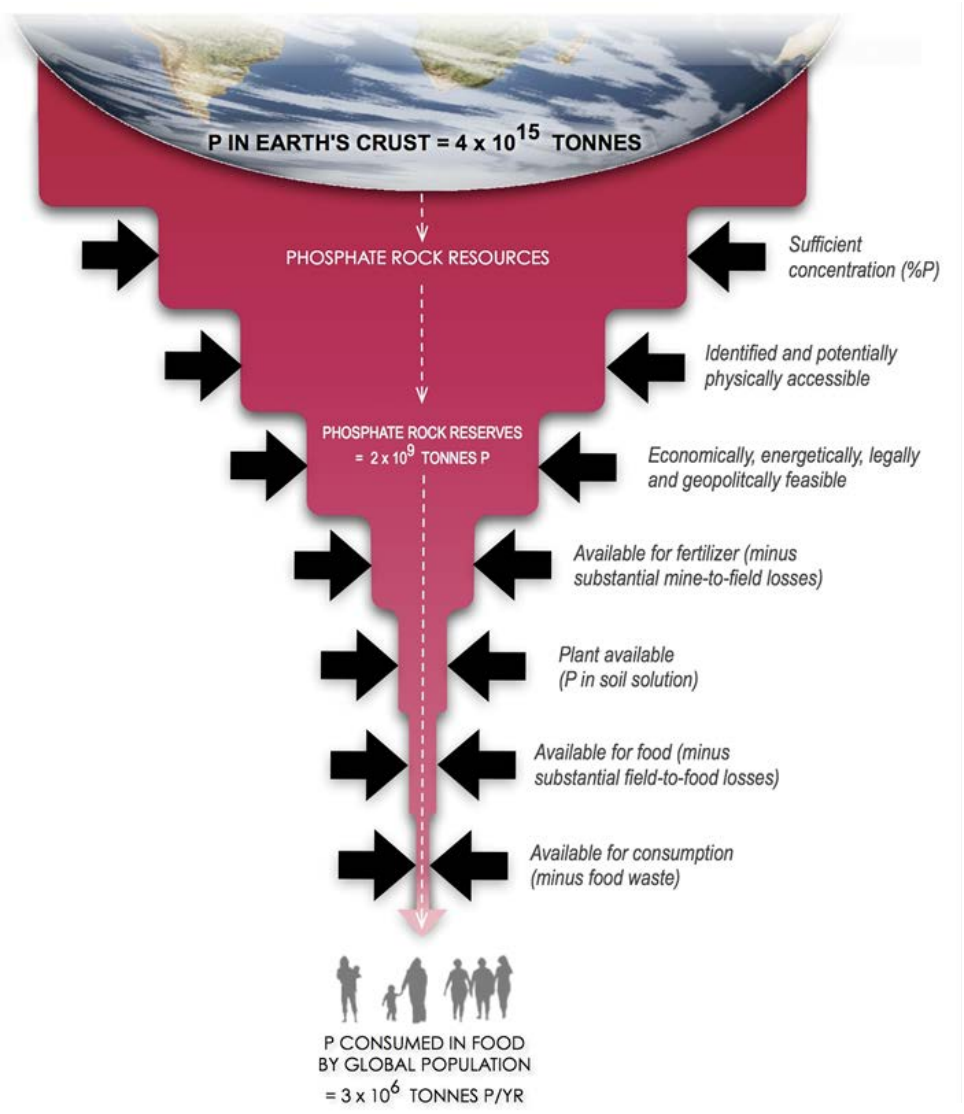
Geological versus anthropogenic cycles



WAGENINGEN UR
For quality of life

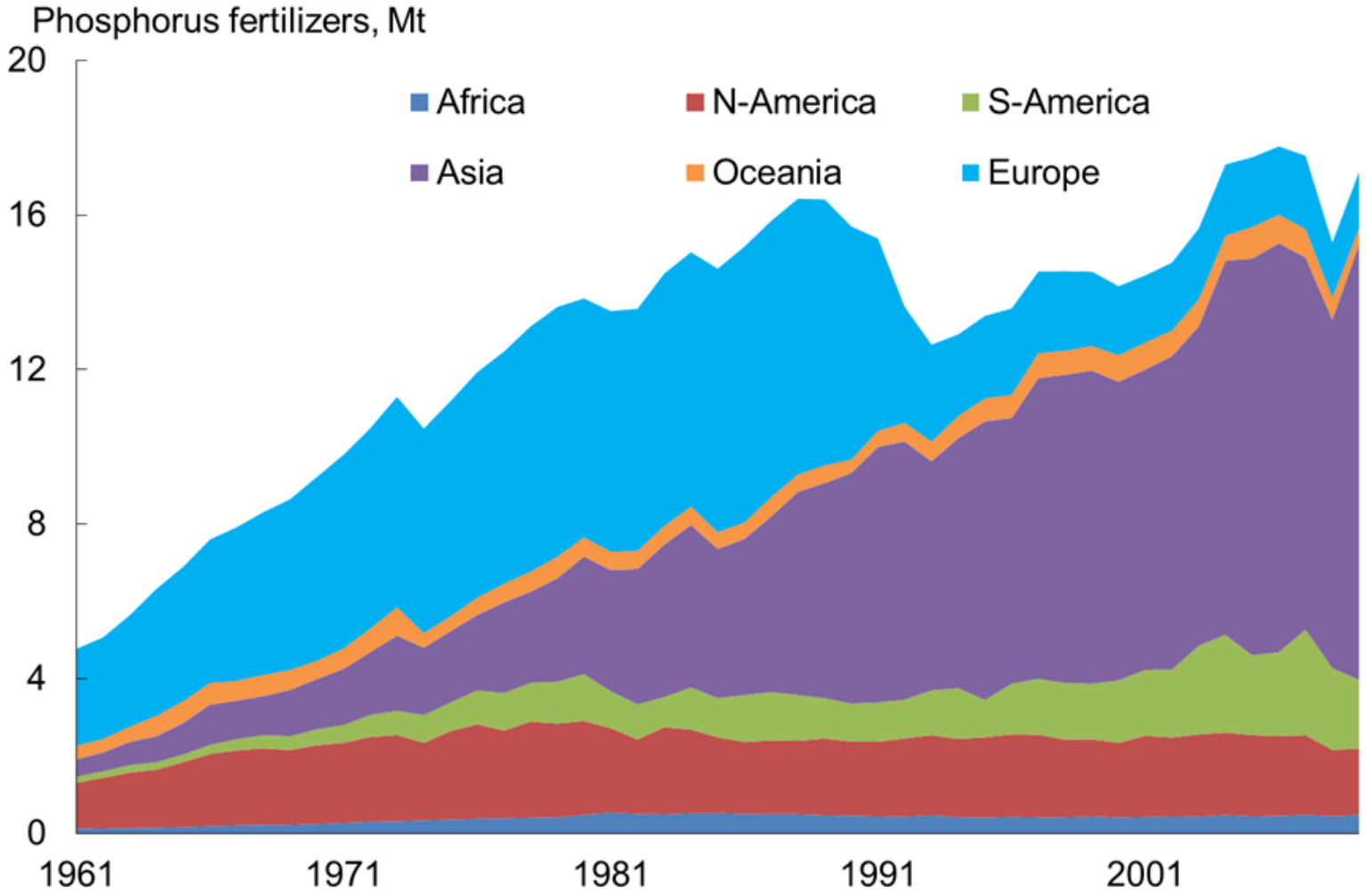
Phoshorus challenge

- Non-renewable at human time scale
- Spatially concentrated: geopolitical dependency and tension
- Relatively low price, but price volatility (2008 case)
- Lower P-rock quality:
  - decreasing P content
  - impurities (e.g. cadmium, uranium)
- Pollution and eutrophication



Cordell et al. 2009

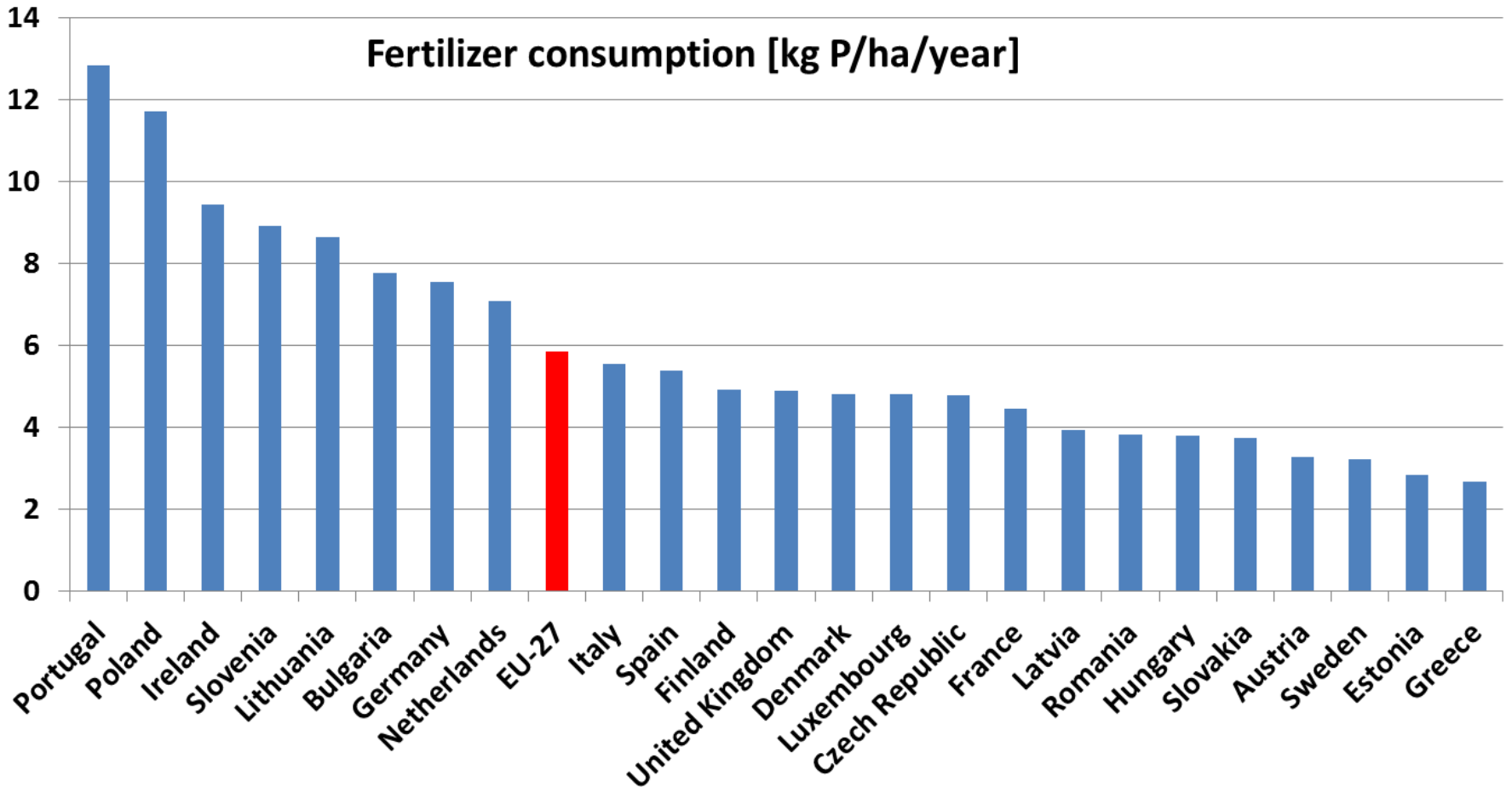
Global fertilizer P consumption 1961-2010



WAGENINGEN UR
For quality of life

FAOSTAT data 2010

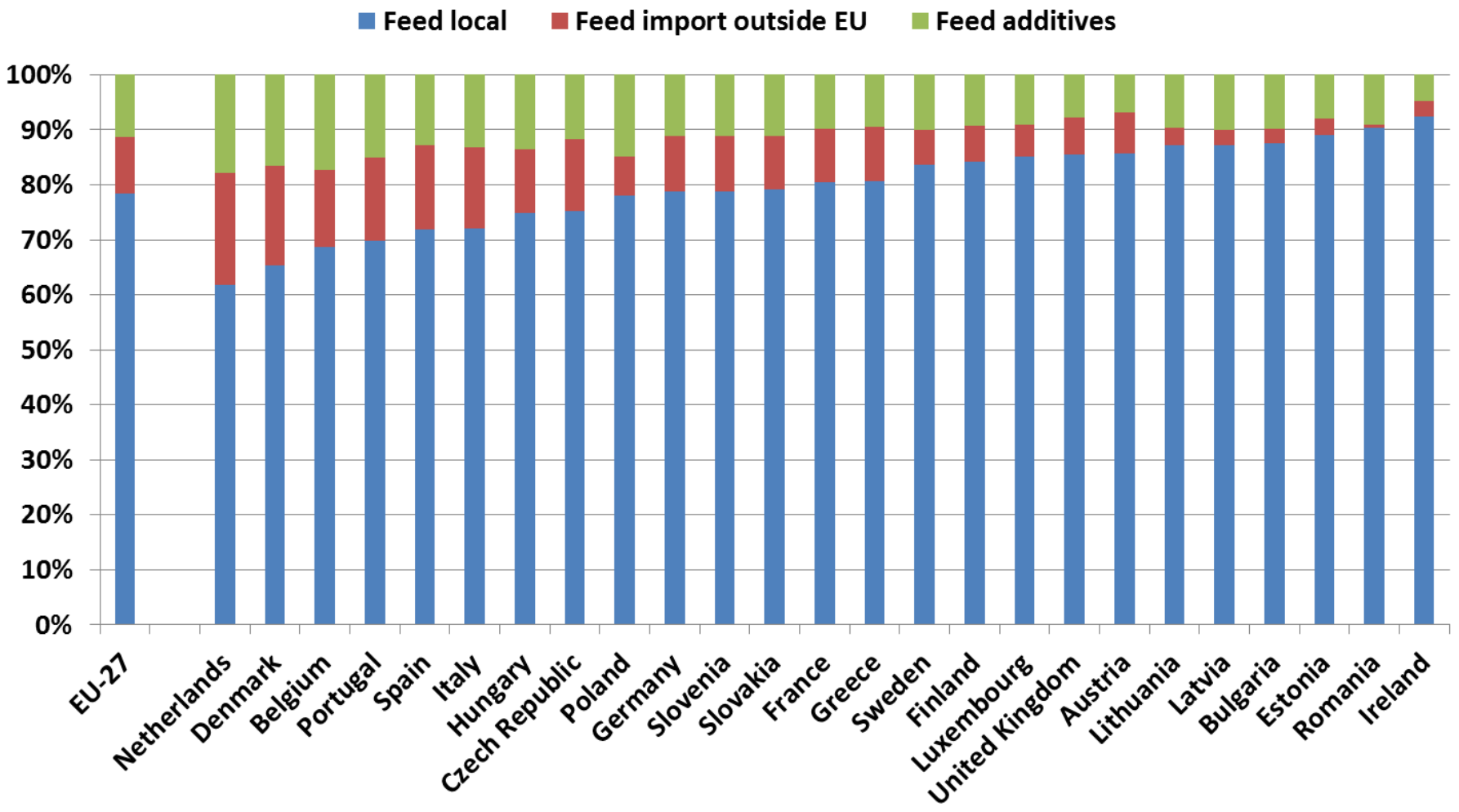
Fertilizer P consumption in EU-27 in 2010



WAGENINGEN UR
For quality of life

FAOSTAT data 2010

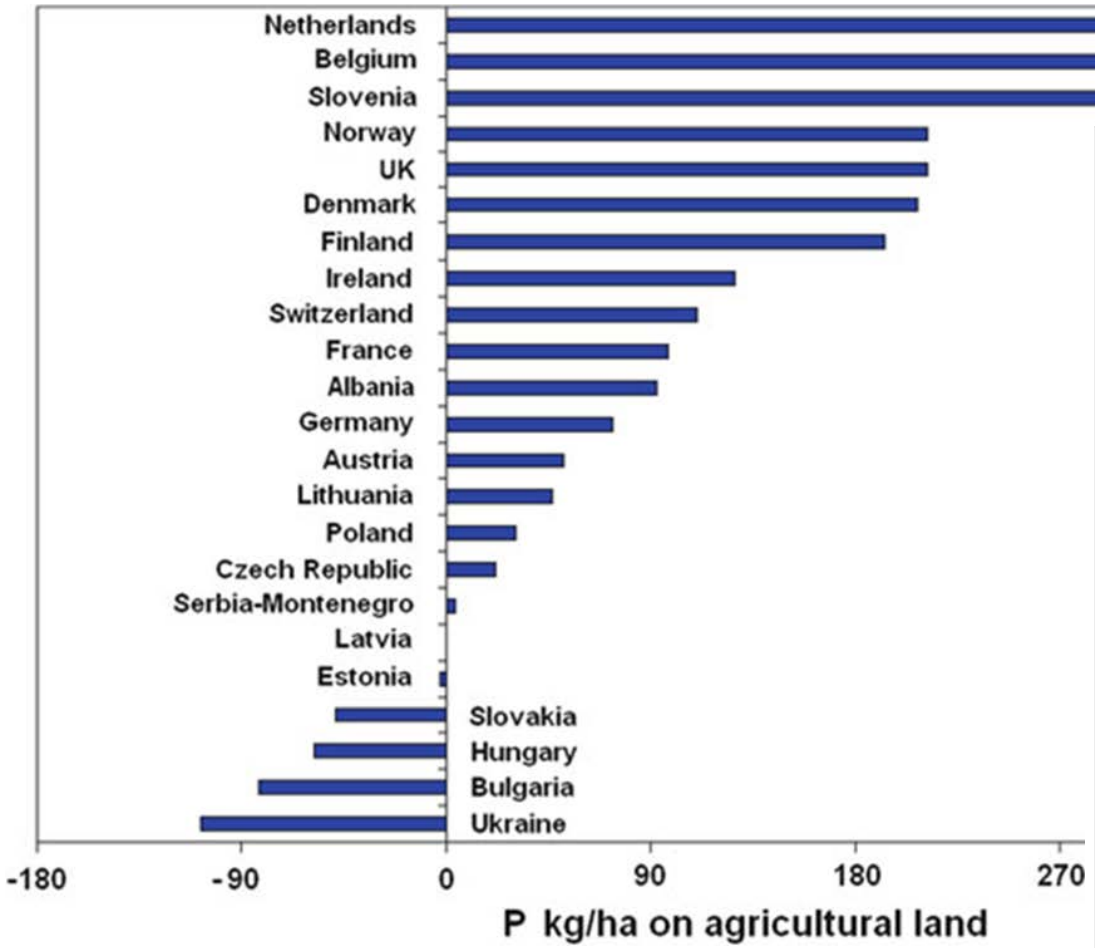
Animal feed P origin in EU-27 in 2005



WAGENINGEN UR
For quality of life

Source: Miterra-Europe model, CAPRI & FAOSTAT data 2003-2005

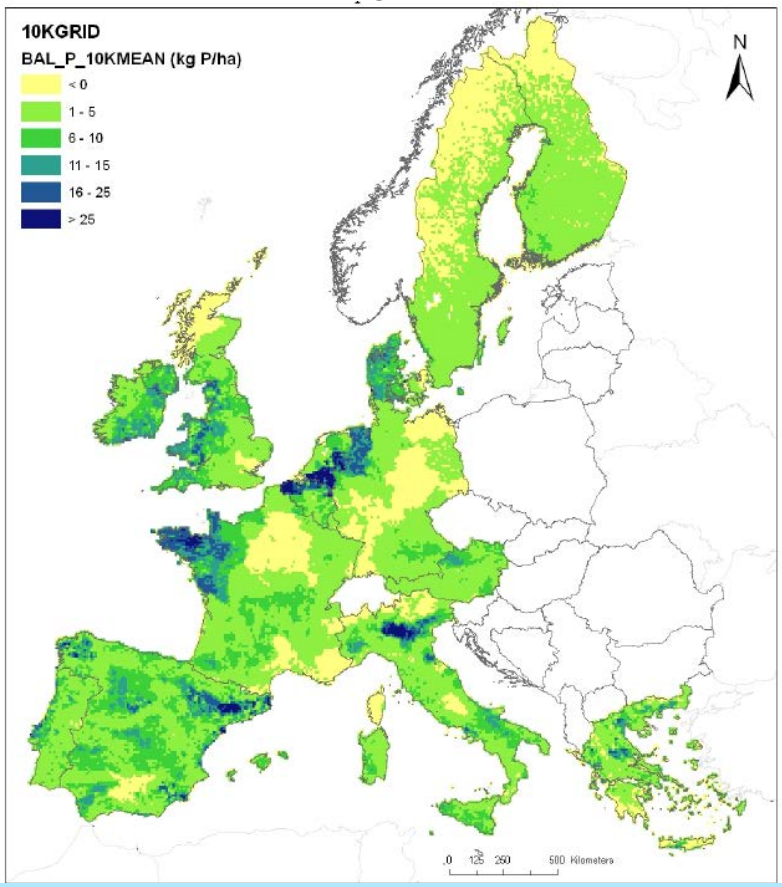
Agronomic P balances in the EU



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

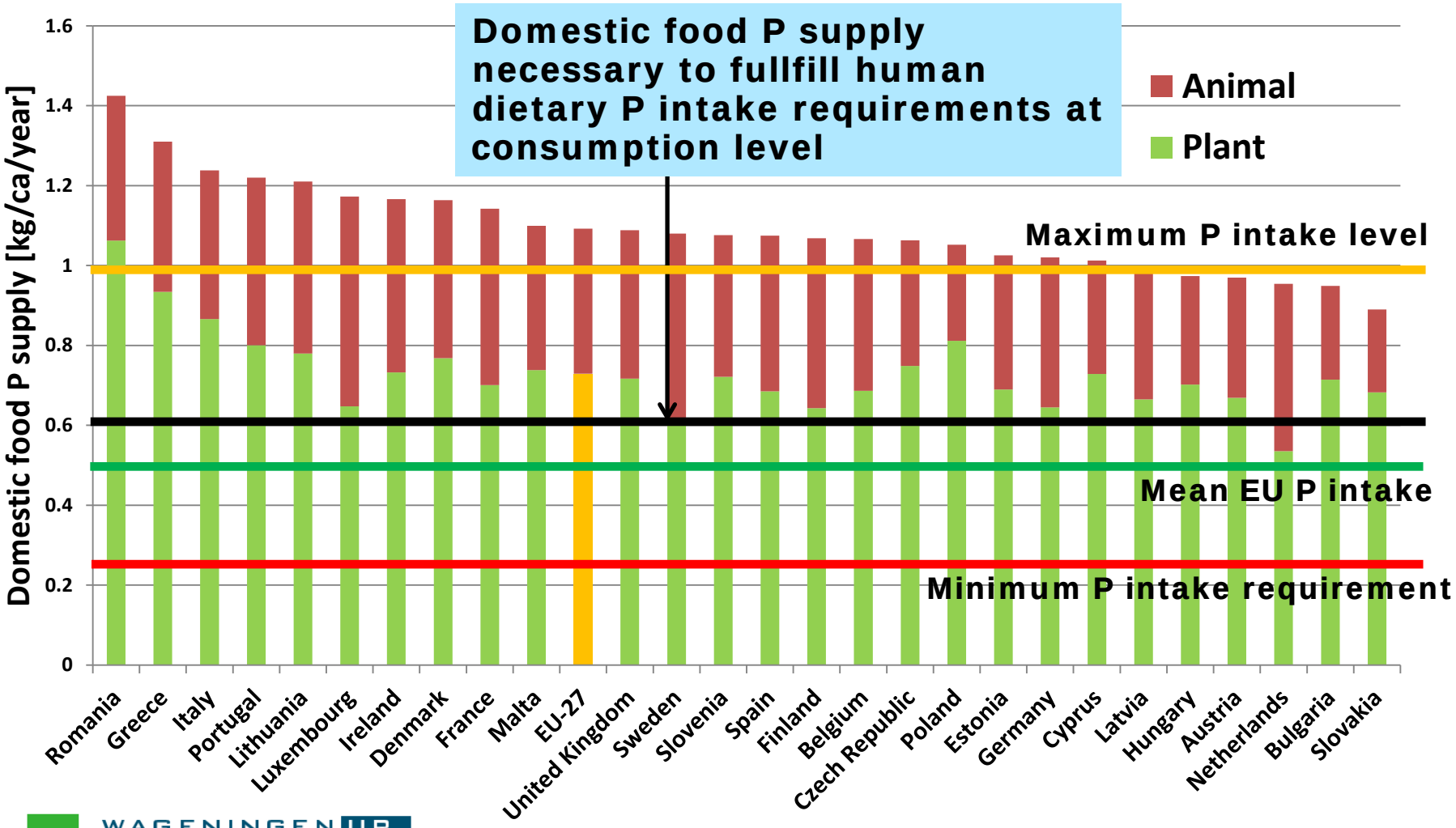
Source: Csathó & Radimszky 2012

Source: Csathó & Radimszky 2012



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

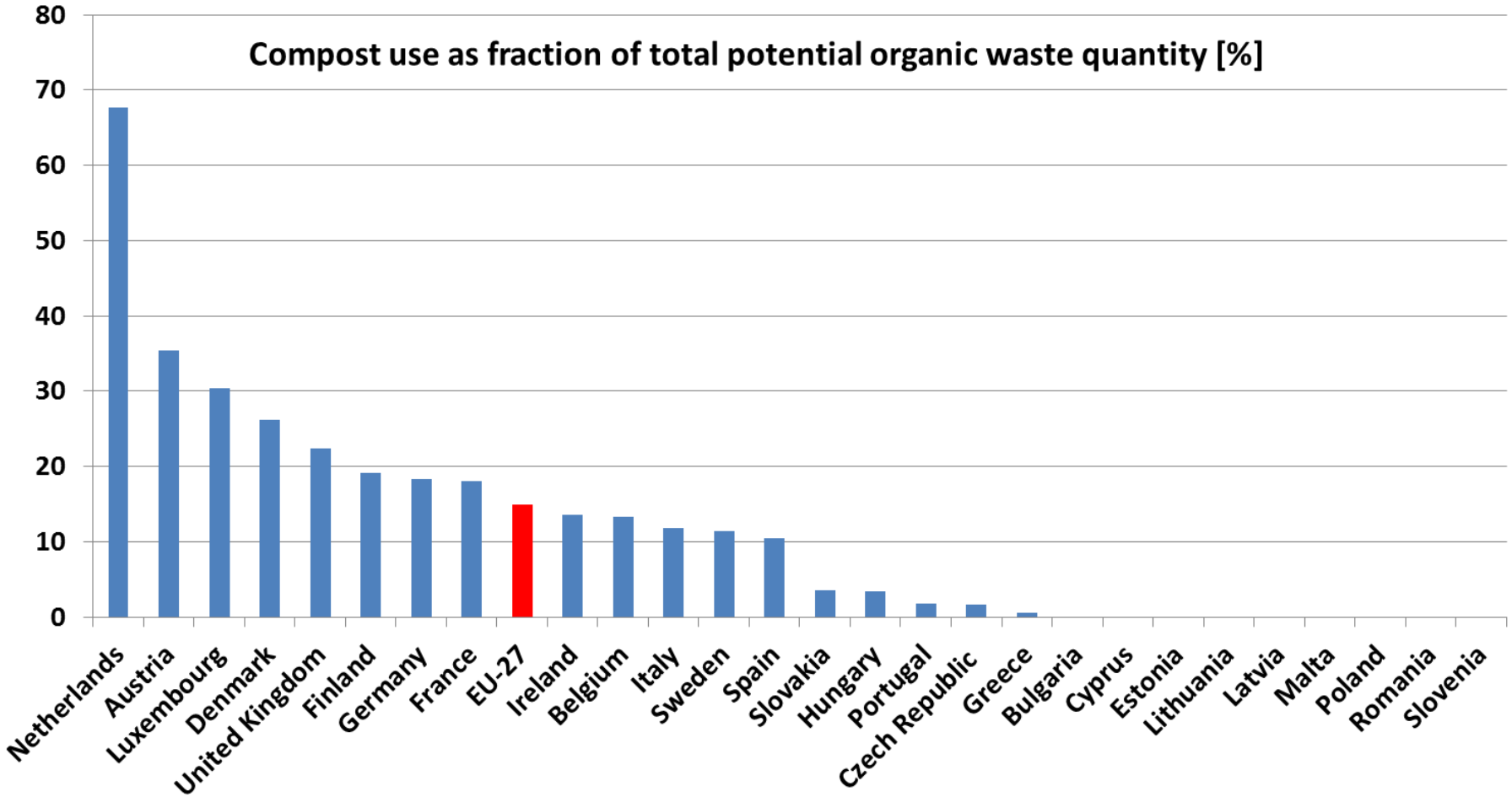
Domestic food P supply in EU-27 in 2005



WAGENINGEN UR
For quality of life

Van Dijk et al. (in preparation)

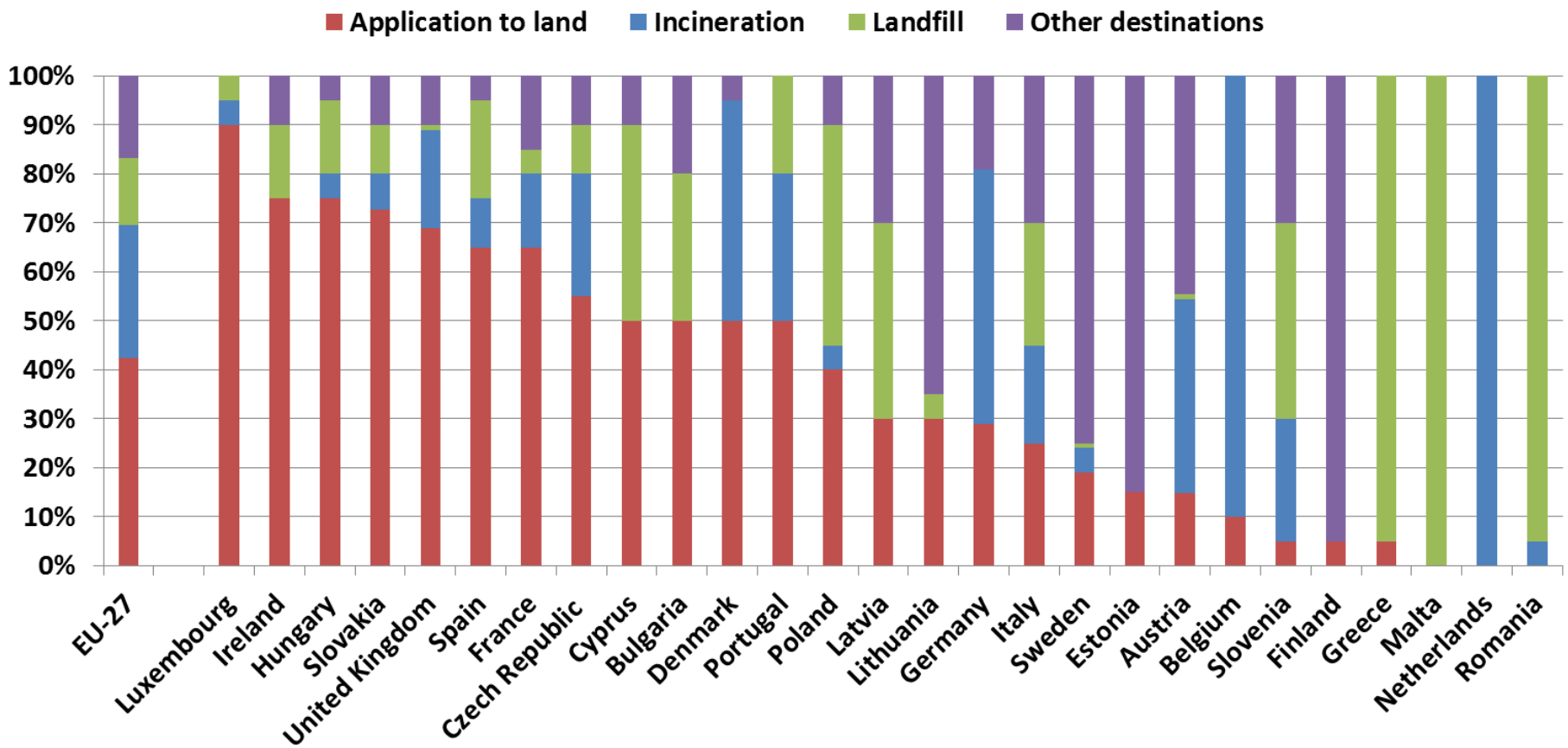
Reuse of organic waste in EU-27 in 2005



WAGENINGEN UR
For quality of life

Based on Barth et al. 2008

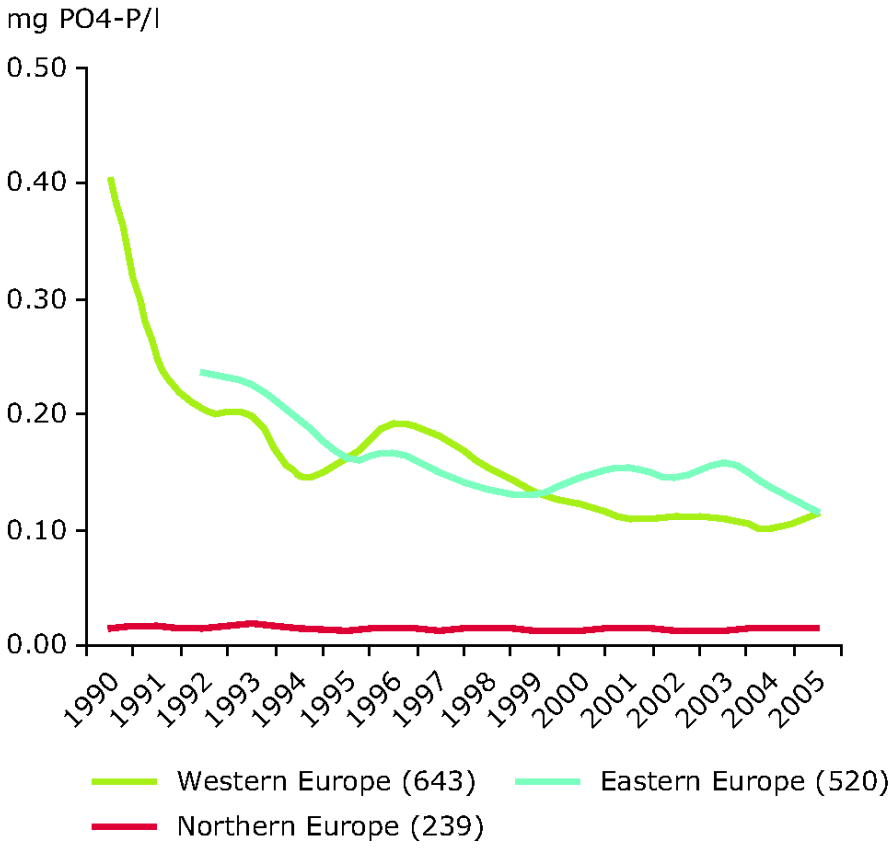
Sludge destinations in EU-27 in 2010

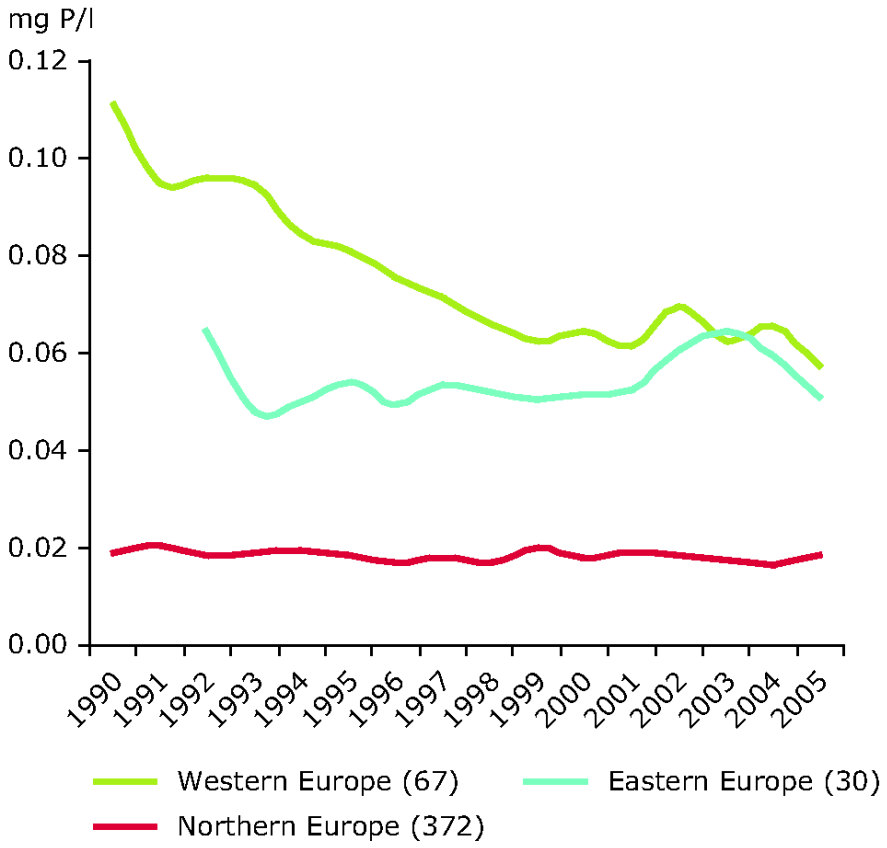


WAGENINGEN UR
For quality of life

Source: P-Rex, FP7 project, www.p-rex.eu; based on Eurostat 2010, Milieu Ltd 2010 & Destatis 2011

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





WAGENINGEN UR
For quality of life

Source: European Environment Agency, 2007