



Critical evaluation of the first 15 years of the Nitrate Directive: results, failures and urgent tasks, in respect of climate change

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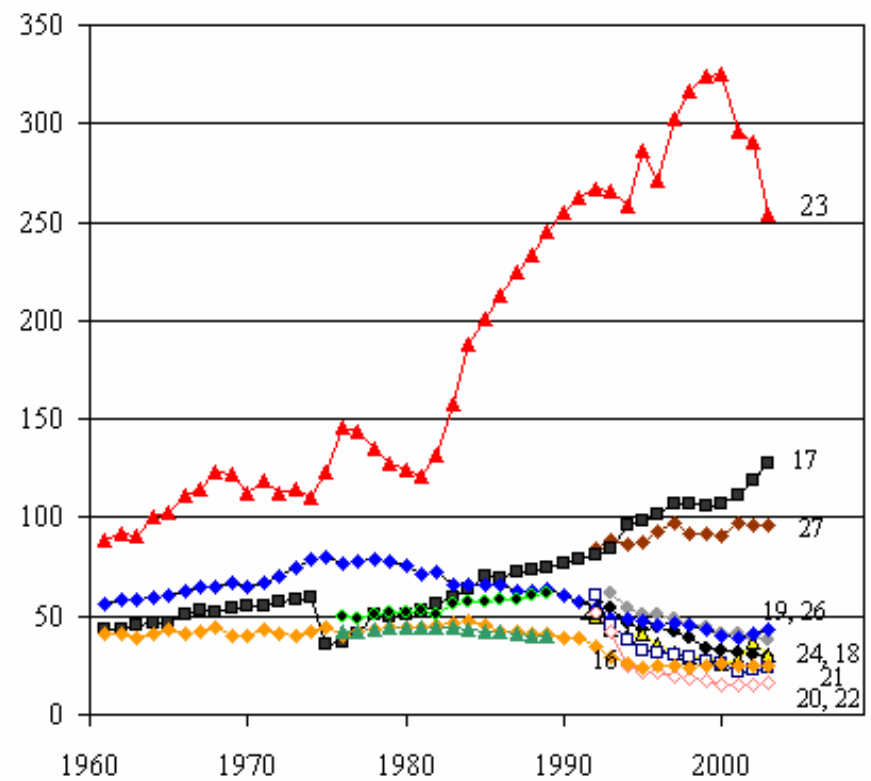
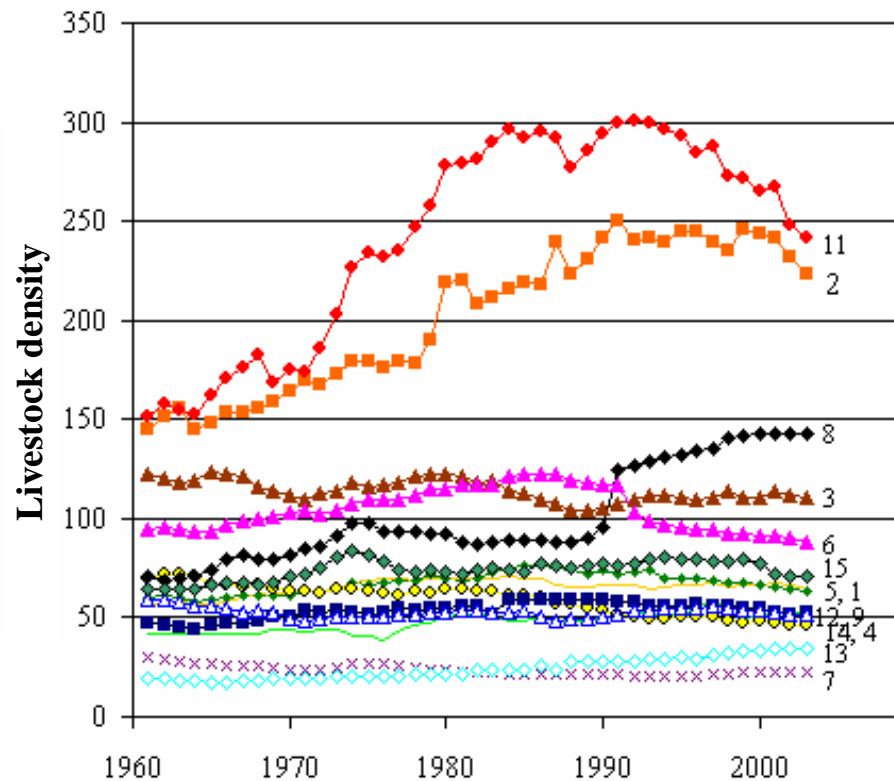
‘Union: a uniting into a coherent and harmonious whole’

Webster’s Dictionary

Livestock density (heads/100 ha) in...

Western Europe

Central and Eastern Europe



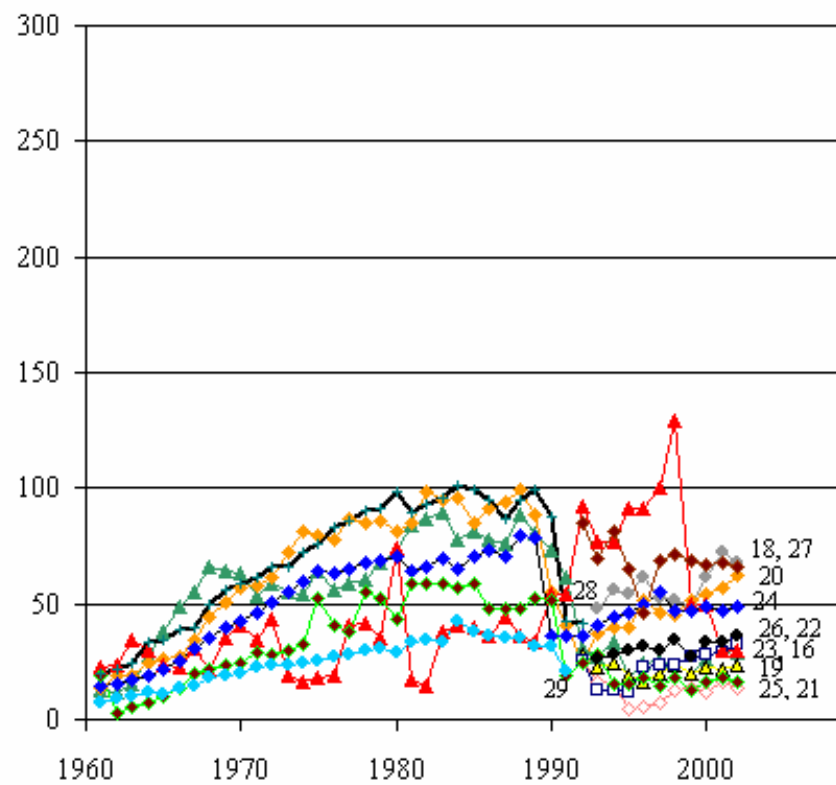
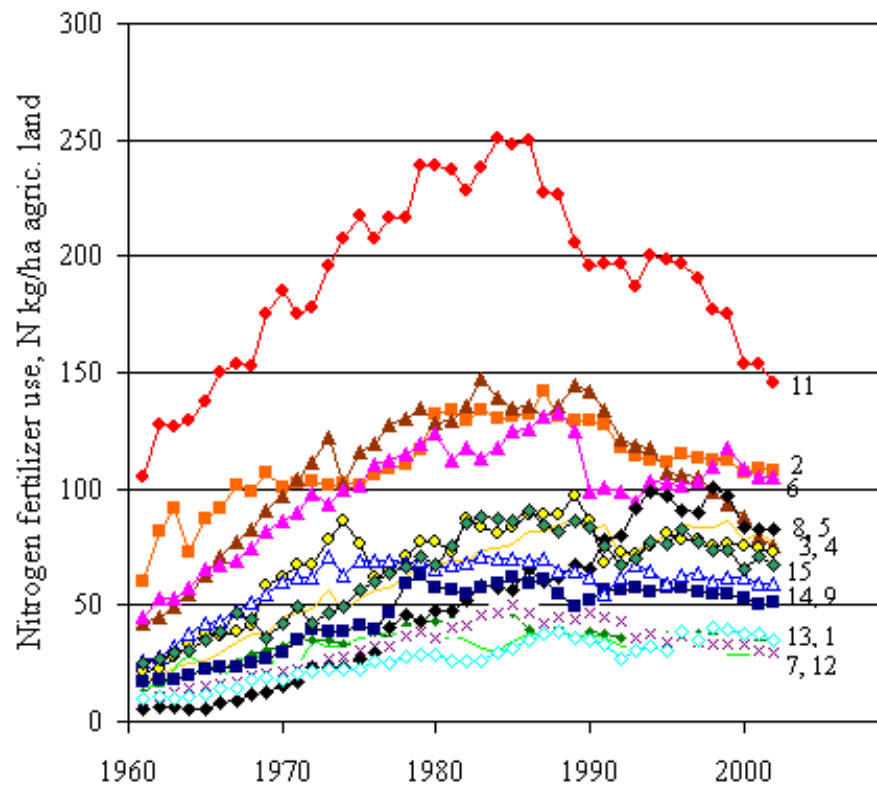
- | | | |
|------------------|---------------------|-------------|
| ◆ 1 Austria | ■ 2 Belgium-Lux. | ▲ 3 Denmark |
| ◇ 4 Finland | ■ 5 France | ▲ 6 Germany |
| × 7 Greece | ◆ 8 Ireland | ■ 9 Italy |
| ◆ 11 Netherlands | ■ 12 Portugal | ◇ 13 Spain |
| ▲ 14 Sweden | ◆ 15 United Kingdom | |

- | | | |
|---------------------|---------------------|---------------------|
| ▲ 16 Bulgaria | ■ 17 Cyprus | ◆ 18 Czech Republic |
| ▲ 19 Estonia | ■ 20 Hungary | ◆ 21 Latvia |
| ■ 22 Lithuania | ▲ 23 Malta | ◆ 24 Poland |
| ◆ 25 Romania | ◆ 26 Slovakia | ◆ 27 Slovenia |
| ◆ 28 Czechoslovakia | ◆ 29 Yugoslavia SFR | |

N-fertilizer use (N kg/ha) in...

Western Europe

Central and Eastern Europe



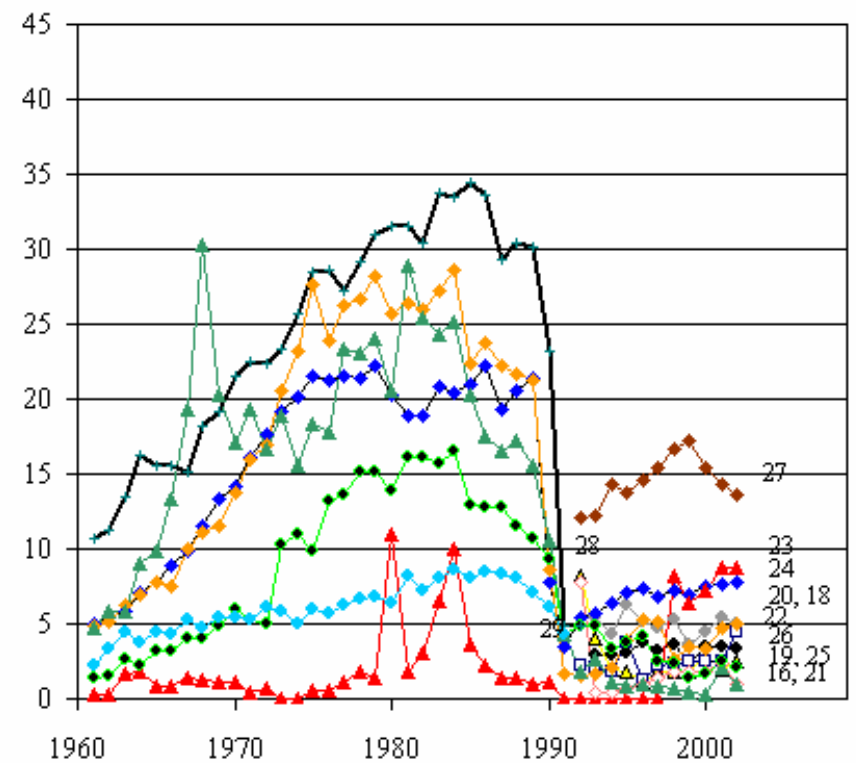
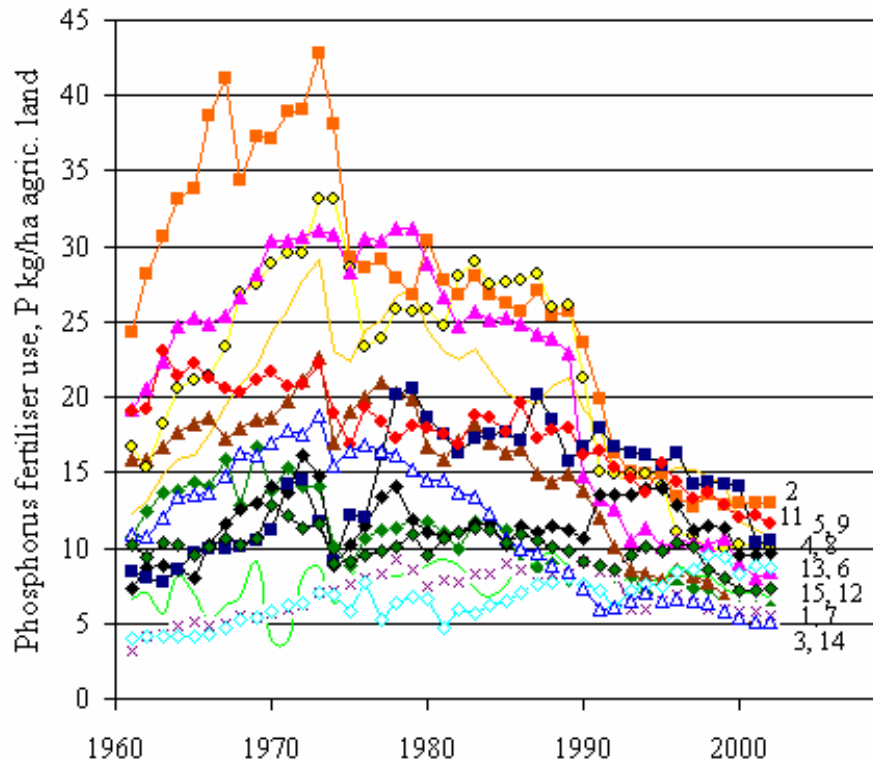
- ◆ 1 Austria
- ◆ 2 Belgium-Lux.
- ◆ 3 Denmark
- ◆ 4 Finland
- ◆ 5 France
- ◆ 6 Germany
- ◆ 7 Greece
- ◆ 8 Ireland
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- ◆ 12 Portugal
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- ◆ 16 Bulgaria
- ◆ 17 Cyprus
- ◆ 18 Czech Republic
- ◆ 19 Estonia
- ◆ 20 Hungary
- ◆ 21 Latvia
- ◆ 22 Lithuania
- ◆ 23 Malta
- ◆ 24 Poland
- ◆ 25 Romania
- ◆ 26 Slovakia
- ◆ 27 Slovenia
- ◆ 28 Czechoslovakia
- ◆ 29 Yugoslavia SFR

P-fertilizer use (P kg/ha) in...

Western Europe

Central and Eastern Europe

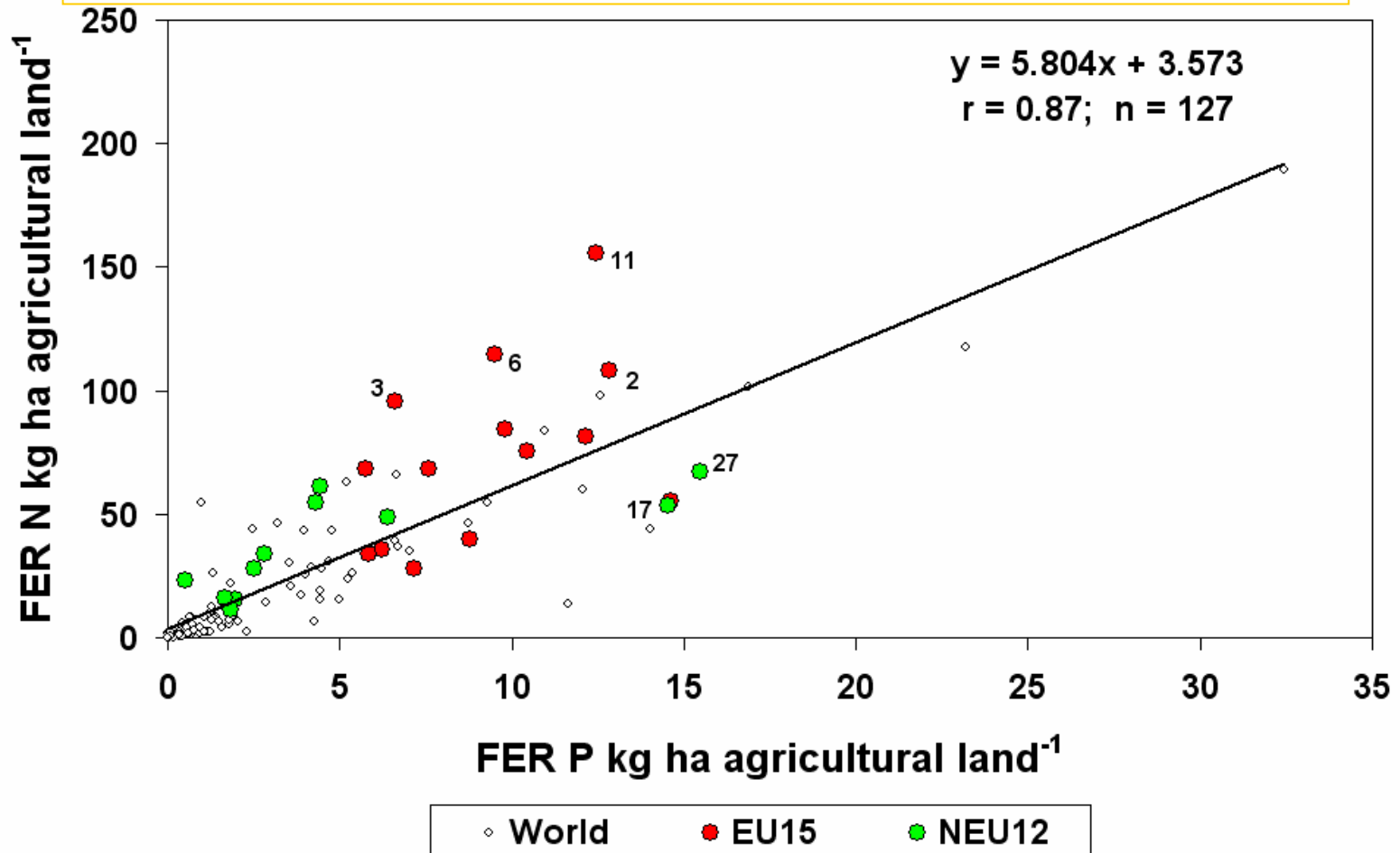


- 1 Austria
- 2 Belgium-Lux.
- 3 Denmark
- 4 Finland
- 5 France
- 6 Germany
- 7 Greece
- 8 Ireland
- 9 Italy
- 11 Netherlands
- 12 Portugal
- 13 Spain
- 14 Sweden
- 15 United Kingdom

- 16 Bulgaria
- 17 Cyprus
- 18 Czech Republic
- 19 Estonia
- 20 Hungary
- 21 Latvia
- 22 Lithuania
- 23 Malta
- 24 Poland
- 25 Romania
- 26 Slovakia
- 27 Slovenia
- 28 Czechoslovakia
- 29 Yugoslavia SFR

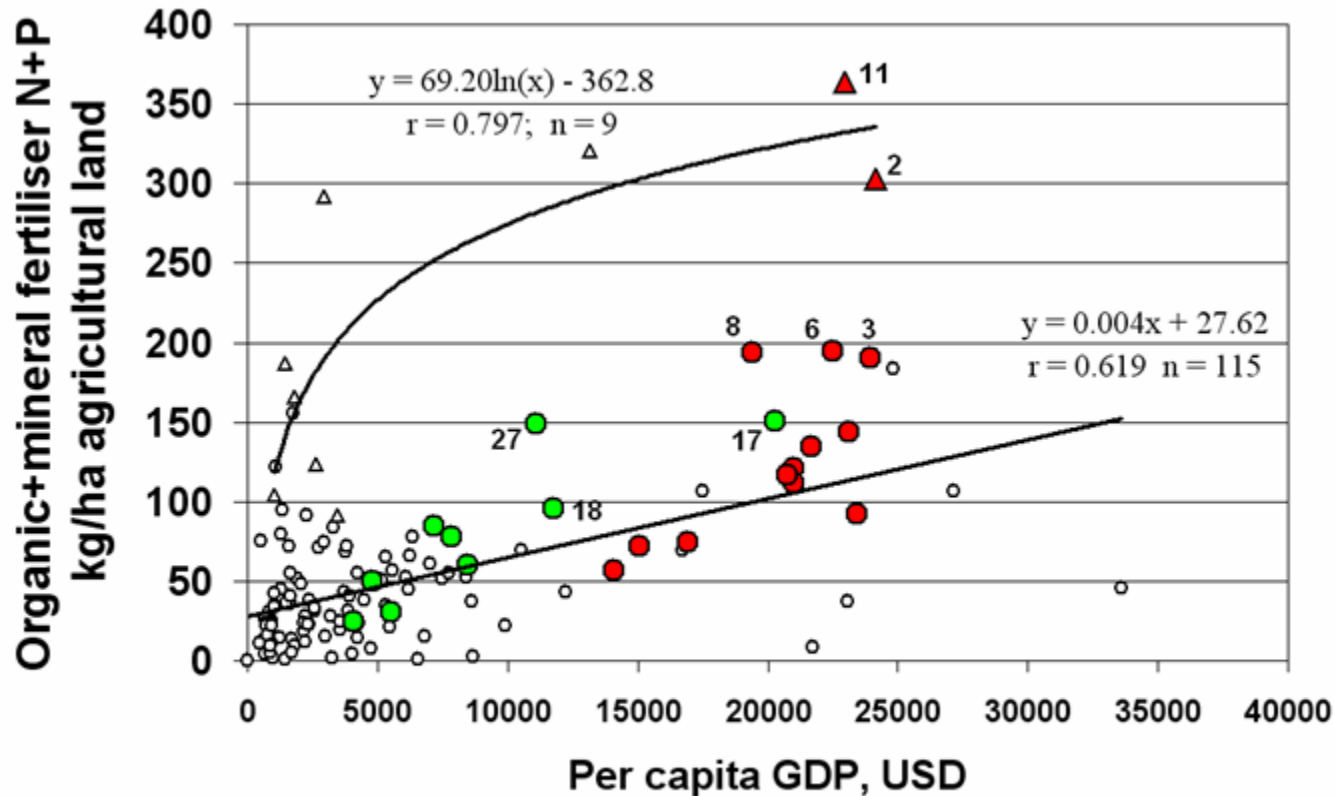
Correlation between the amount of applied fertiliser-N and fertiliser-P in the countries of the world in 2000

- | | | | | |
|----------------------|------------------|---------------|-----------------|----------------|
| 1 – Austria | 6 – Germany | 12 – Portugal | 17 – Cyprus | 22 – Lithuania |
| 2 – Belgium and Lux. | 7 – Greece | 13 – Spain | 18 – Czech Rep. | 23 – Malta |
| 3 – Denmark | 8 – Ireland | 14 – Sweden | 19 – Estonia | 24 – Poland |
| 4 – Finland | 9 – Italy | 15 – UK | 20 – Hungary | 25 – Romania |
| 5 – France | 11 – Netherlands | 16 – Bulgaria | 21 – Latvia | 26 – Slovakia |
| | | | | 27 – Slovenia |



Correlation between per capita income and total NP application as a function of population density in 2000

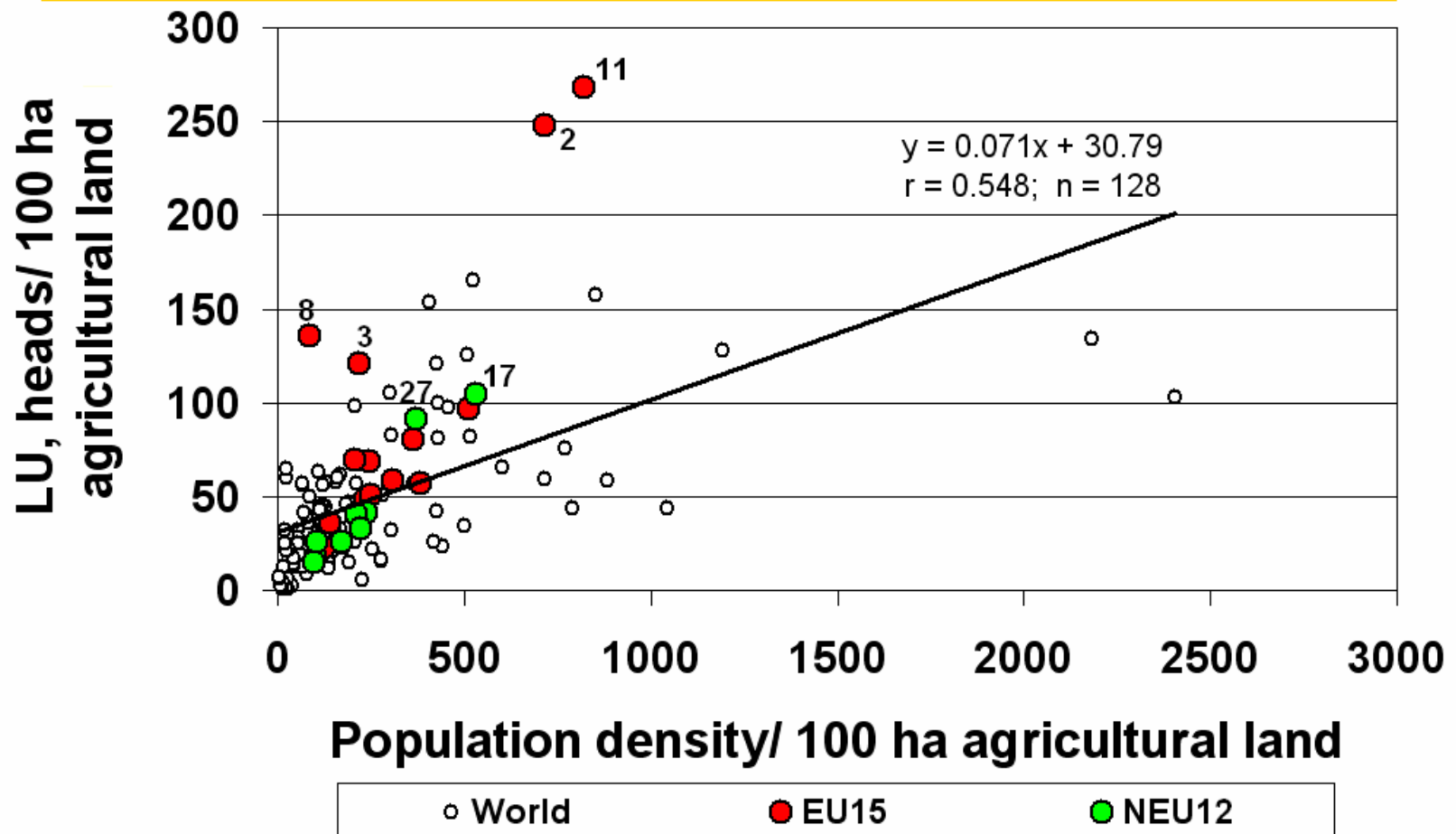
1 – Austria	6 – Germany	12 – Portugal	17 – Cyprus	22 – Lithuania
2 – Belgium and Lux.	7 – Greece	13 – Spain	18 – Czech Rep.	23 – Malta
3 – Denmark	8 – Ireland	14 – Sweden	19 – Estonia	24 – Poland
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5 – France	11 – Netherlands	16 – Bulgaria	21 – Latvia	26 – Slovakia
				27 – Slovenia



- | | |
|---|--|
| △ >600 persons/ 100 ha agricultural land | ○ <600 persons/ 100 ha agricultural land |
| ● EU15 <600 persons/ 100 ha agricultural land | ● NEU12 <600 persons/ 100 ha agricultural land |
| ▲ EU15 >600 persons/ 100 ha agricultural land | |

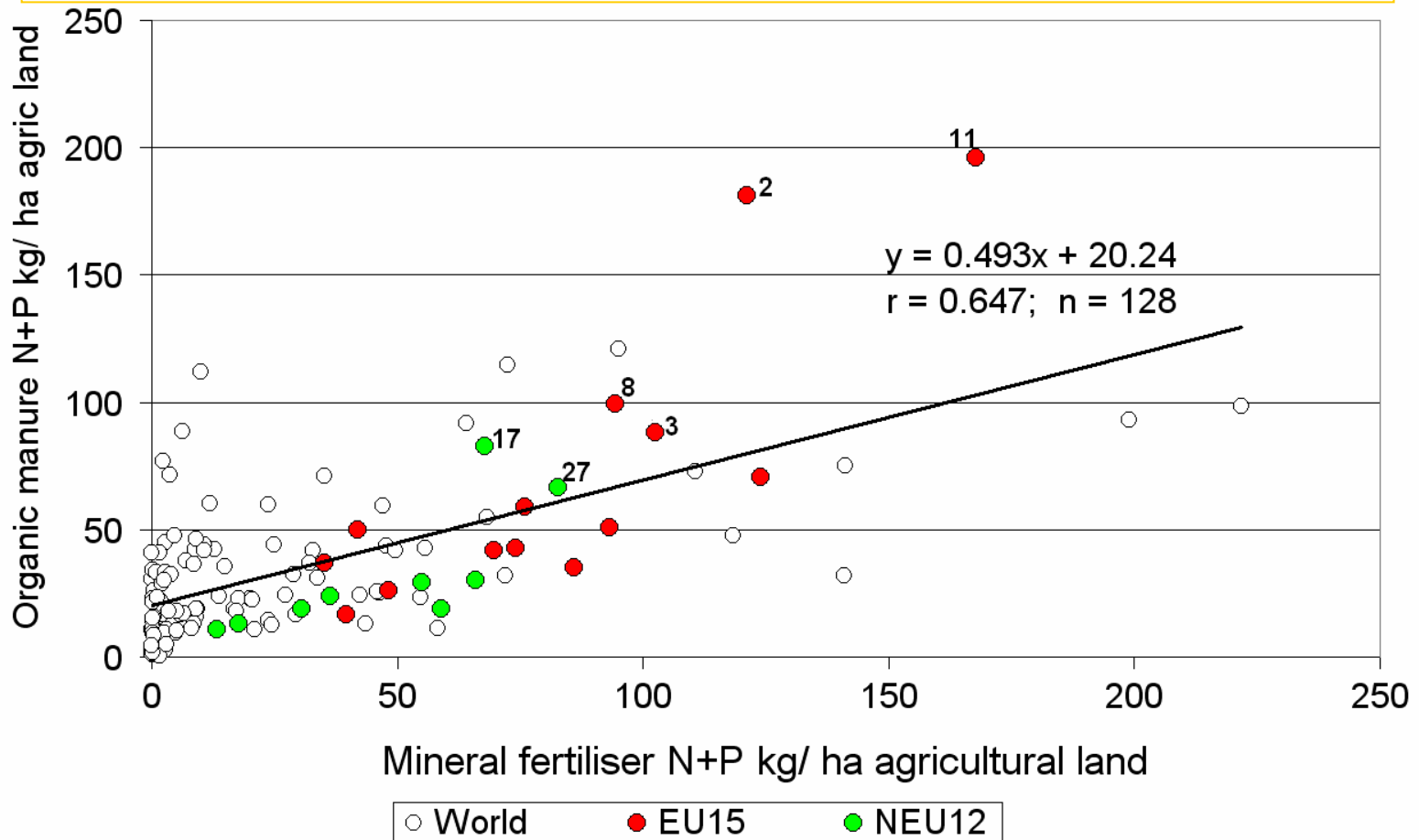
Correlation between population density and livestock density in 2000

1 – Austria	6 – Germany	12 – Portugal	17 – Cyprus	22 – Lithuania
2 – Belgium and Lux.	7 – Greece	13 – Spain	18 – Czech Rep.	23 – Malta
3 – Denmark	8 – Ireland	14 – Sweden	19 – Estonia	24 – Poland
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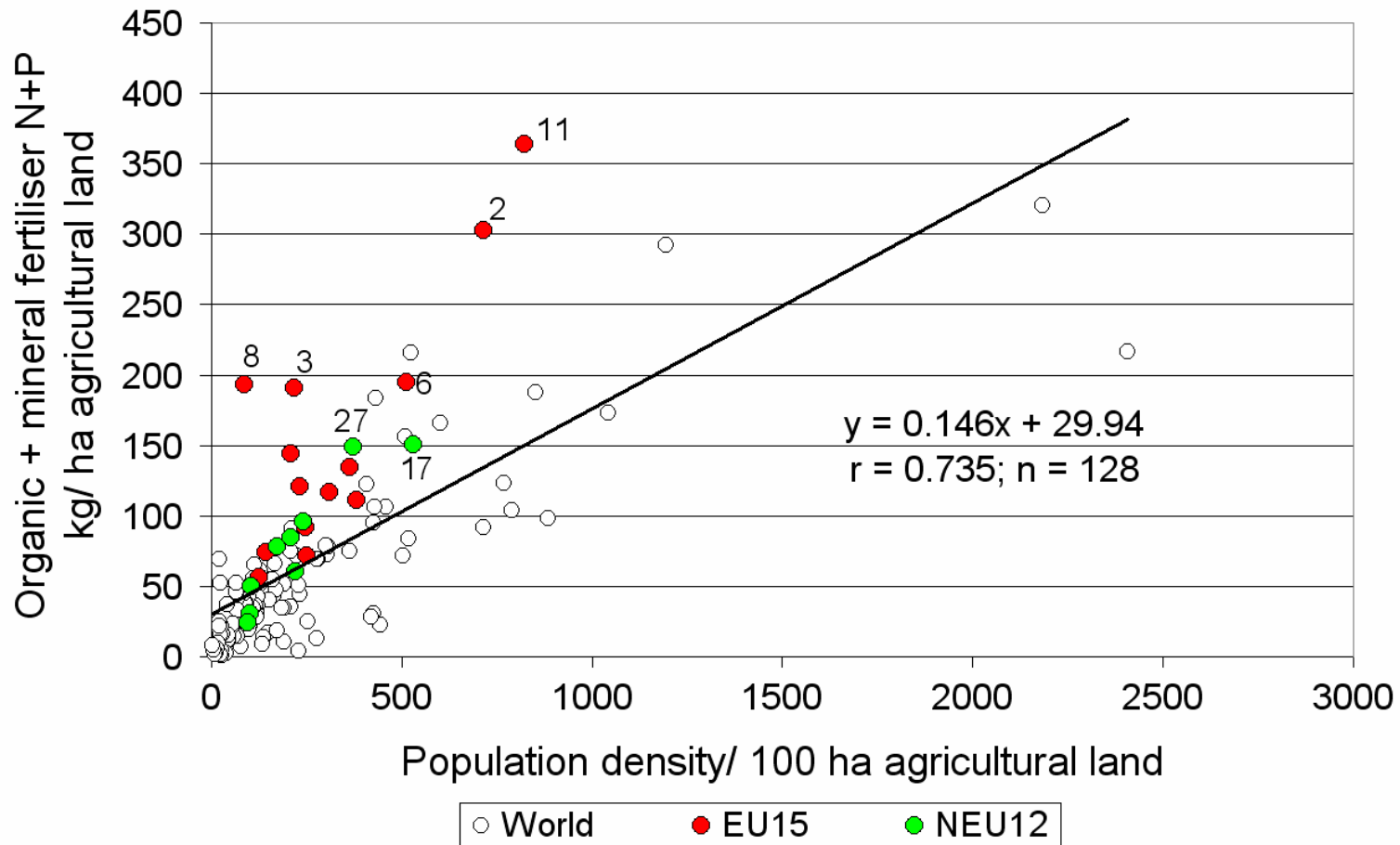
Correlation between organic and mineral NP use in 2000

1 – Austria	6 – Germany	12 – Portugal	17 – Cyprus	22 – Lithuania
2 – Belgium and Lux.	7 – Greece	13 – Spain	18 – Czech Rep.	23 – Malta
3 – Denmark	8 – Ireland	14 – Sweden	19 – Estonia	24 – Poland
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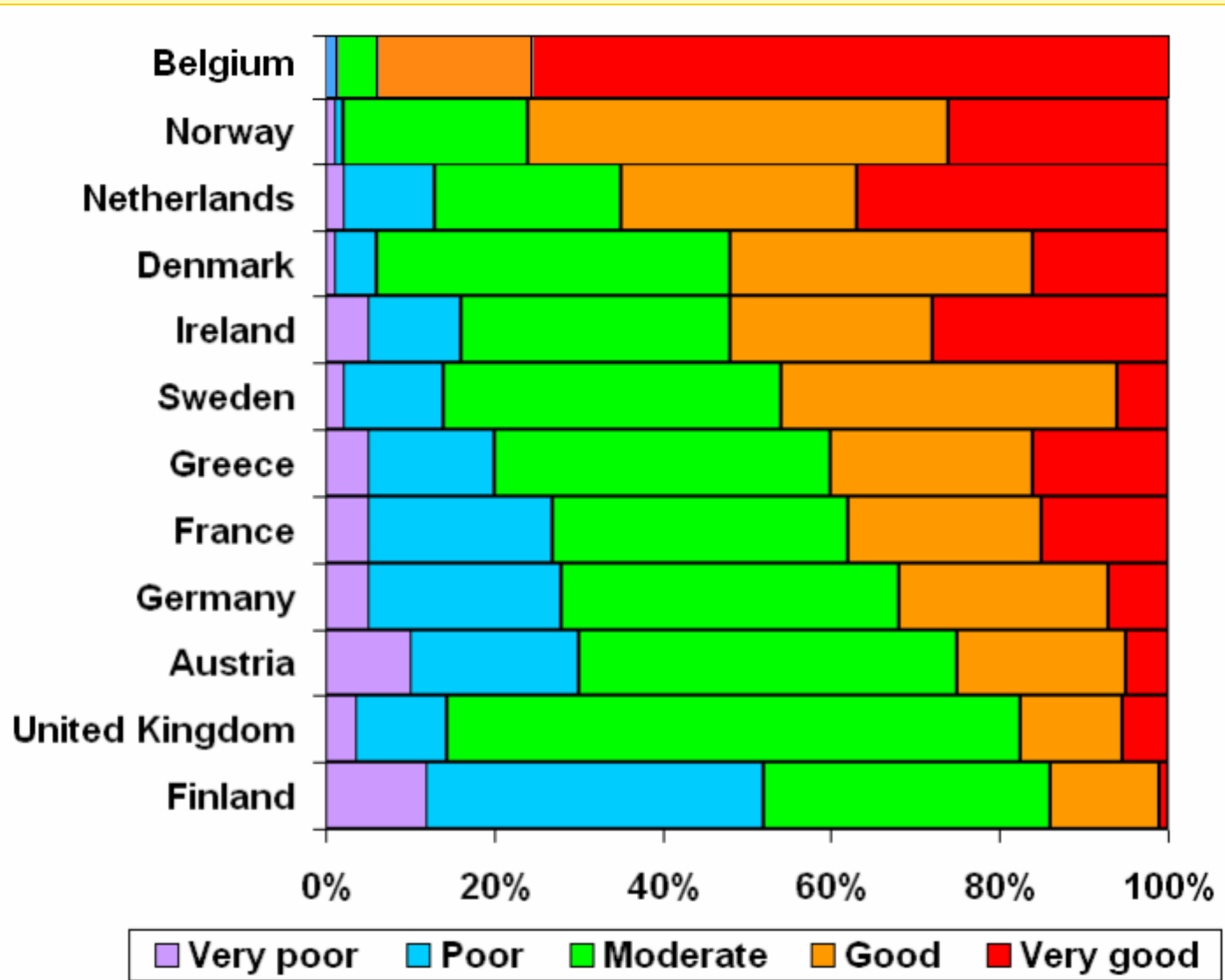
Correlation between the population density and NP use in 2000

1 – Austria	6 – Germany	12 – Portugal	17 – Cyprus	22 – Lithuania
2 – Belgium and Lux.	7 – Greece	13 – Spain	18 – Czech Rep.	23 – Malta
3 – Denmark	8 – Ireland	14 – Sweden	19 – Estonia	24 – Poland
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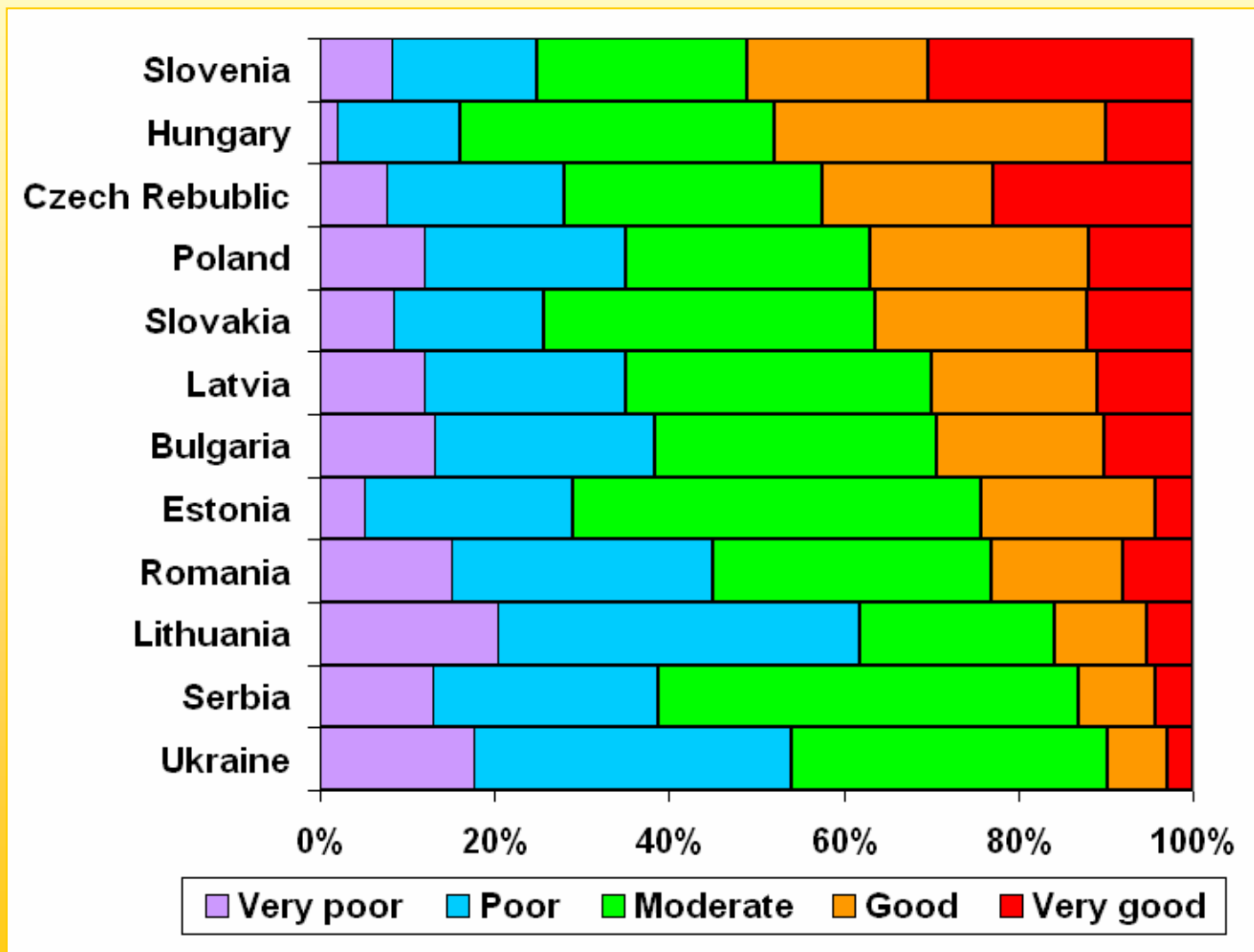
Phosphorus status in the soils of Western European countries in 1991

(Steén, 1997; Hofman, 2007)

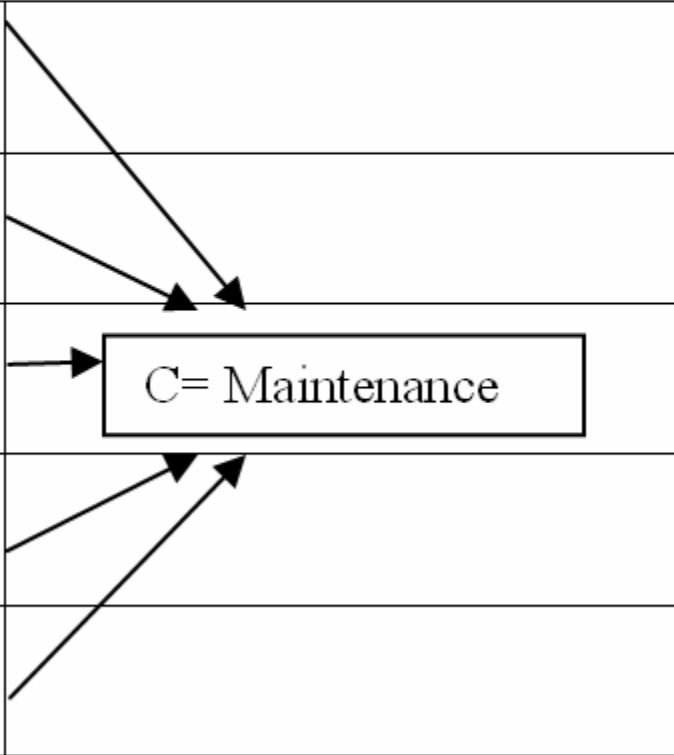


Phosphorus supplies of soils in Central and Eastern European countries in the early 1990s

(Csathó et al., 2006)

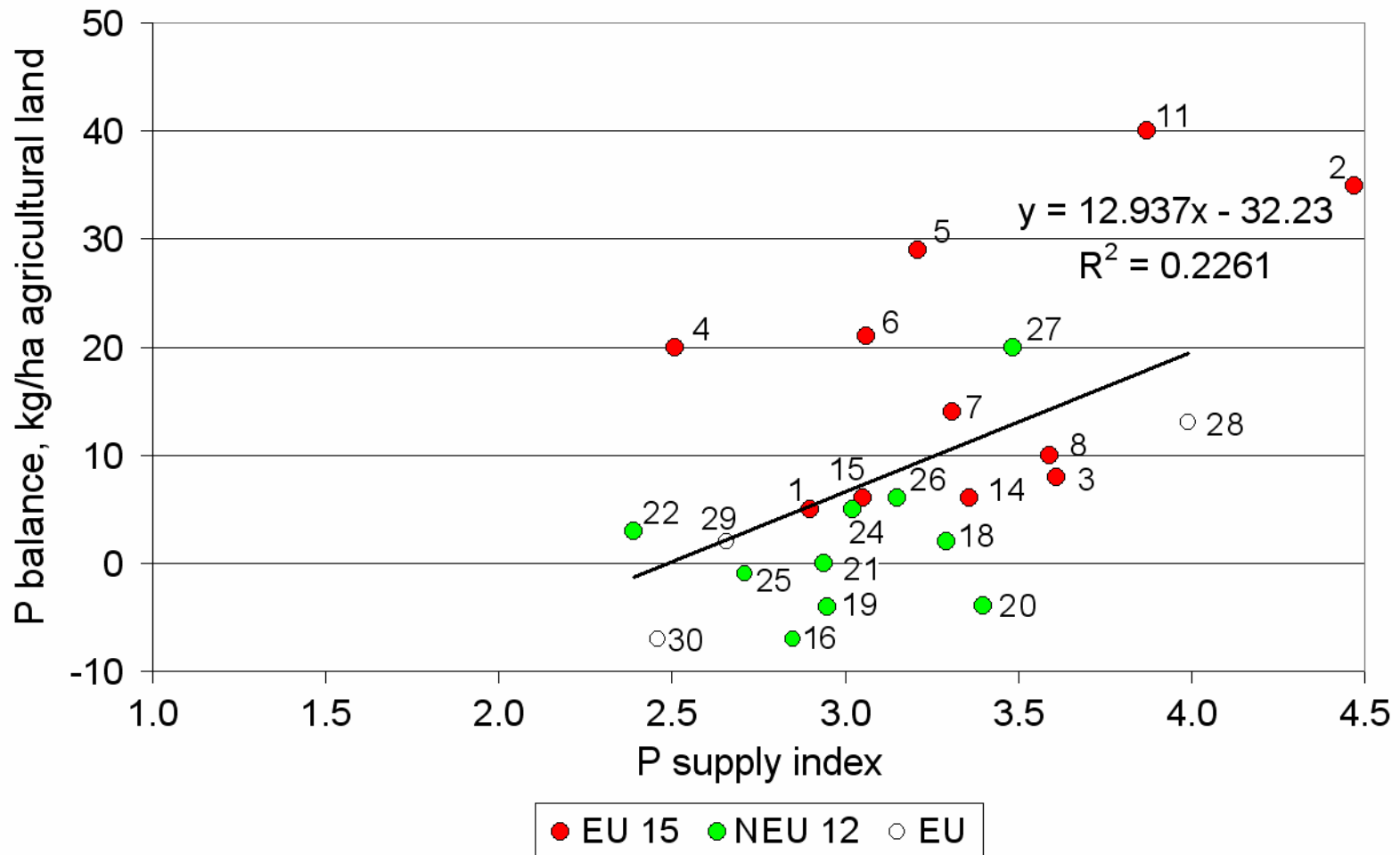


Phosphorus fertiliser recommendation for fields in Germany based on soil fertility class (STP) (Vetter and Fruchtenicht (1974),)

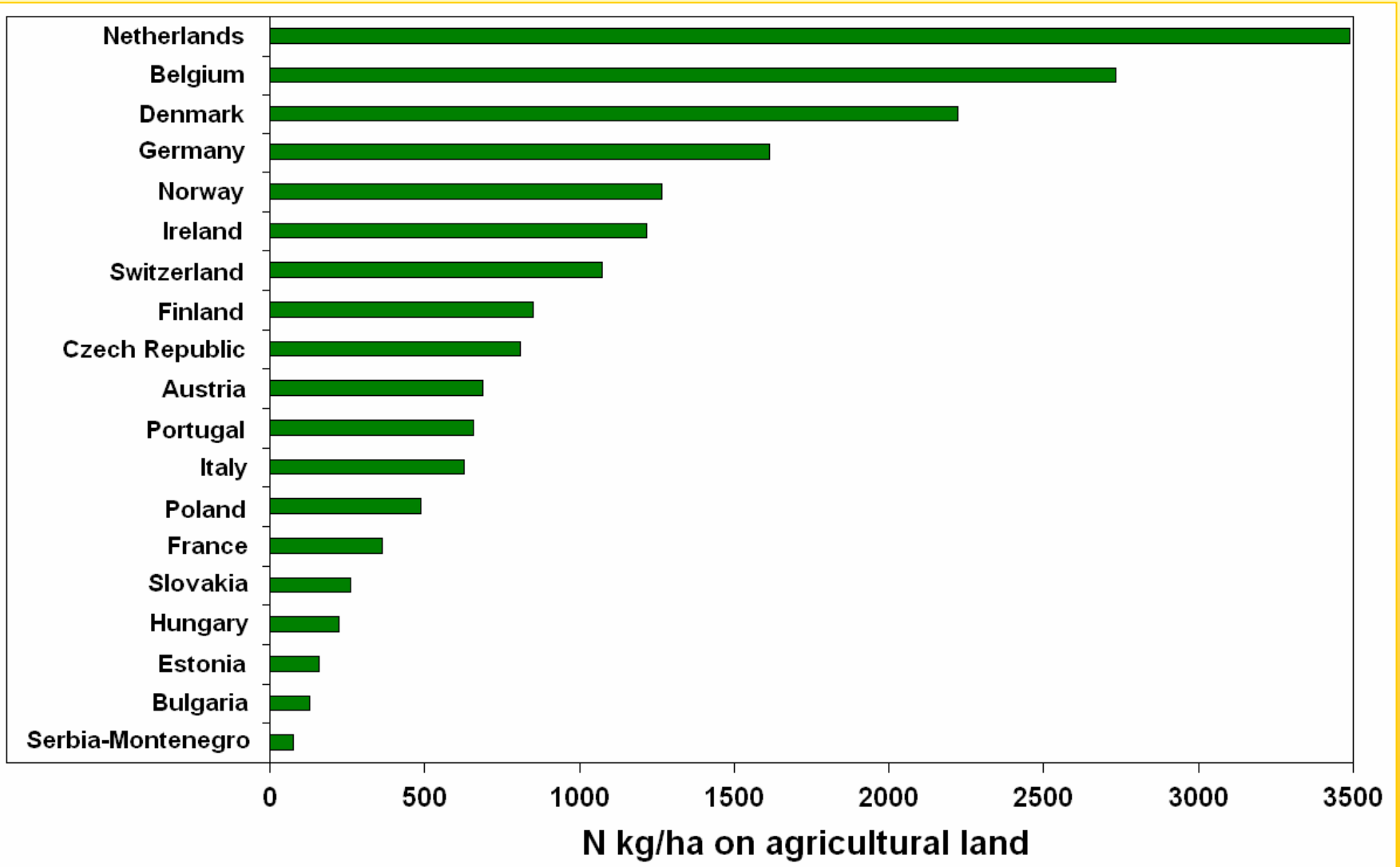
Fertility Class	Fertiliser Ratio	
E: Very high	0	 <p>C= Maintenance</p>
D: High	0.5	
C: Moderate	1.0	
B: Low	1.5	
A: Very low	2.0	

Correlation between P supply and P balances of the EU countries in 1991

1 – Austria	6 – Germany	12 – Portugal	17 – Cyprus	22 – Lithuania	27 – Slovenia
2 – Belgium and Lux.	7 – Greece	13 – Spain	18 – Czech Rep.	23 – Malta	28 – Norway
3 – Denmark	8 – Ireland	14 – Sweden	19 – Estonia	24 – Poland	29 – Serbia and Montenegro
4 – Finland	9 – Italy	15 – UK	20 – Hungary	25 – Romania	30 – Ukraine
5 – France	11 – Netherlands	16 – Bulgaria	21 – Latvia	26 – Slovakia	

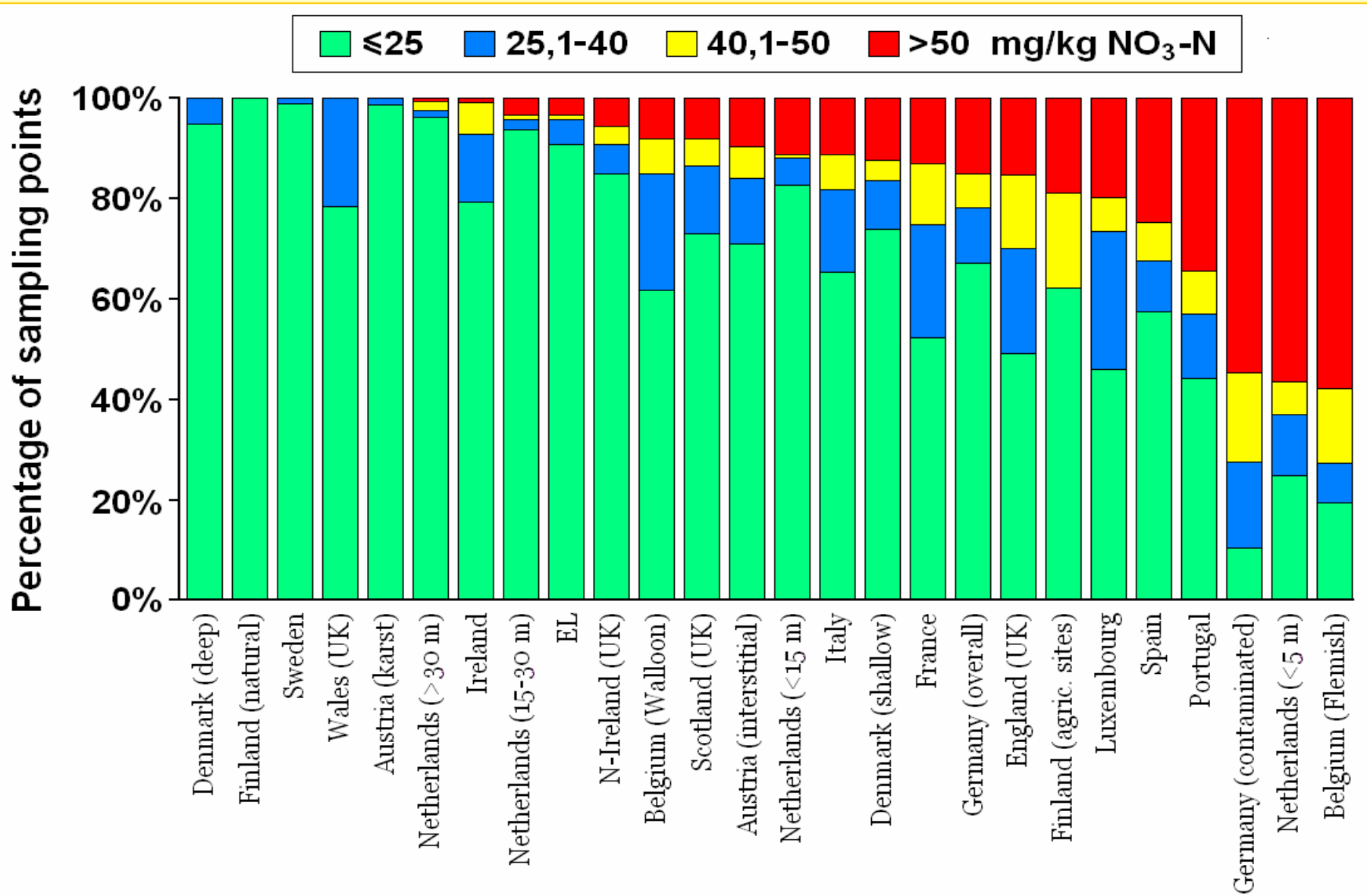


Estimated cumulative N balance of European countries, 1991–2005 (N kg/ha agricultural land)

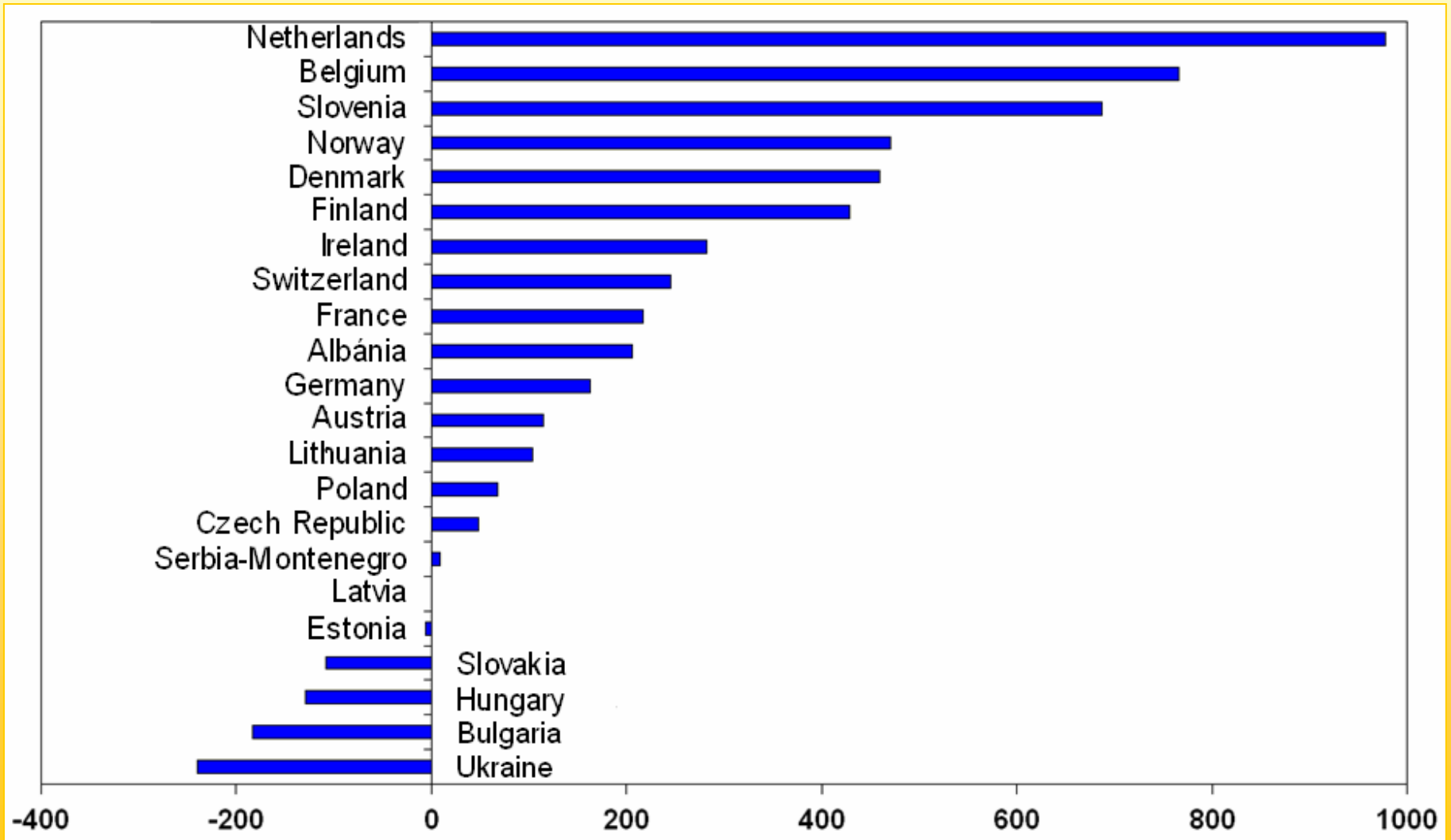


Nitrate pollution of ground water in the EU

(Hamell, 2007)



Estimated cumulative P balance of European countries, 1991–2005 (P₂O₅ kg/ha agricultural land)



Phosphorus surplus by administrative region early 1990s (EEA, 1999)

0 1000 km

P_2O_5 balance, kg/ha



Source: Eurostat



Pig density in the EU 15 countries



Comparison of the philosophies of intensive (MÉM NAK) and sustainable, environmentally friendly (RISSAC-RIA) fertiliser recommendation systems

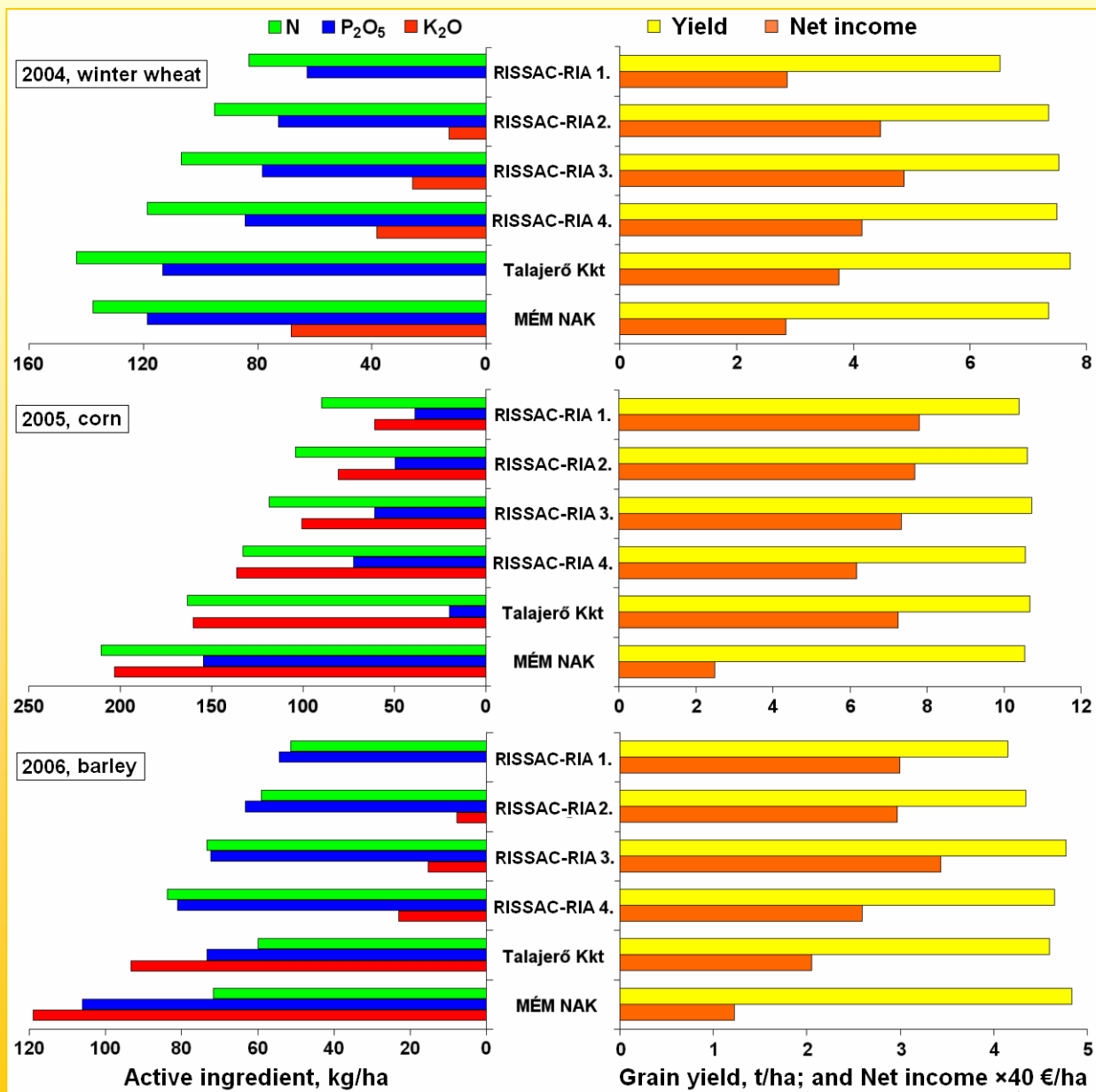
Principles for intensive plant nutrition (MÉM NAK 1979)

- Efforts for **maximum** yield levels
- Aim is: "**soil** nutrition"
- Aim is: to achieve and sustain **good** to **very good** soil PK supply
- **Quick** soil PK build-up
- PK fertilisation **each** year
- PK fertilisation on **any** soil PK supply level
- **Higher** limit values for soil nutrient supply categories
- **Unified** soil nutrient supply categories
- Highest soil PK supply category: **very good**
- **Higher** specific crop nutrient contents
- Specific crop nutrient contents **independent** of the planned yield level

Principles for sustainable fertilisation (RISSAC-RIA, 1998)

- Efforts for **economic** yield levels
- Aim is: "**plant** nutrition"
- Aim is: to achieve and sustain **moderate** to **good** soil PK supply
- **Slow** soil PK build-up
- PK fertilisation of the **rotation**
- **PK fertilisation only on moderate** or **poor** soil PK supply levels
- **Lower** limit values for soil nutrient supply categories
- Soil nutrient supply categories depending on the two main **crop groups**
- **Introducing excessive soil PK supply category**
- **Lower** specific crop nutrient contents
- Specific crop nutrient contents **dependent** of the planned yield level

Recommended NPK doses, yields and net incomes, obtained in the different recommendation systems. IMPHOS trials.



Climate change issues:

- **Extreme weather events**
- **P removal via run-off**
- **N leaching**

Thank you for your attention!