



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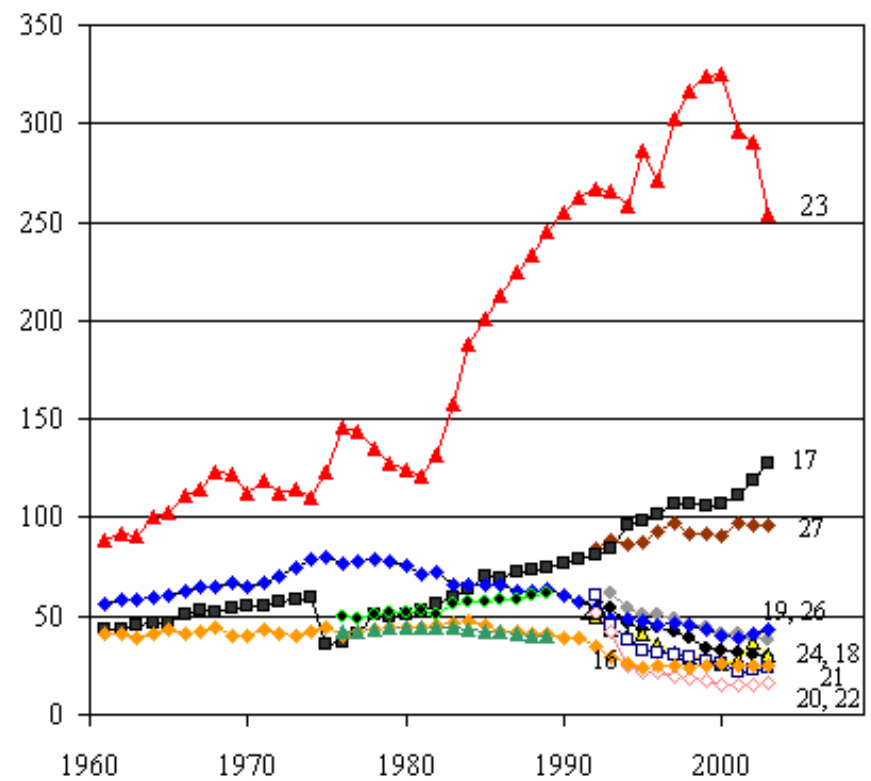
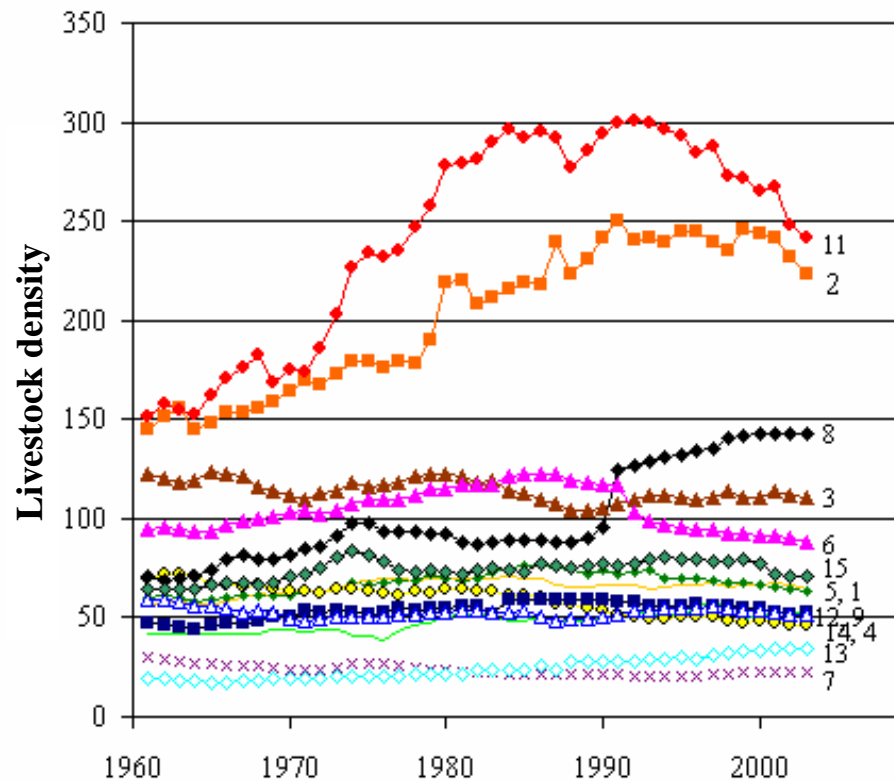
**‘Union: a uniting into a coherent and harmonious whole’**

**Webster’s Dictionary**

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

## Western Europe

## Central and Eastern Europe



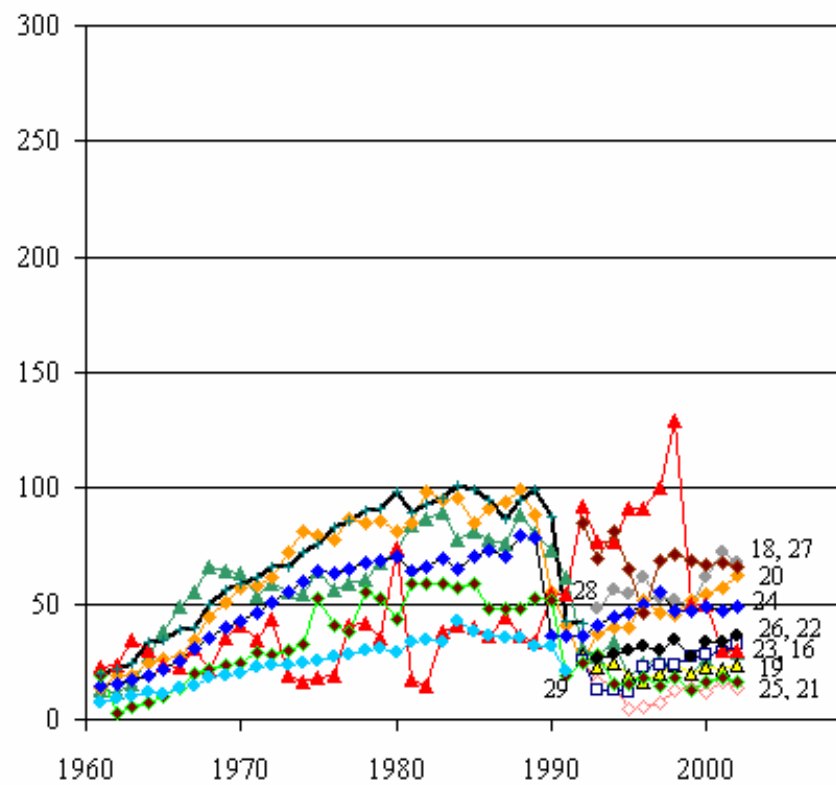
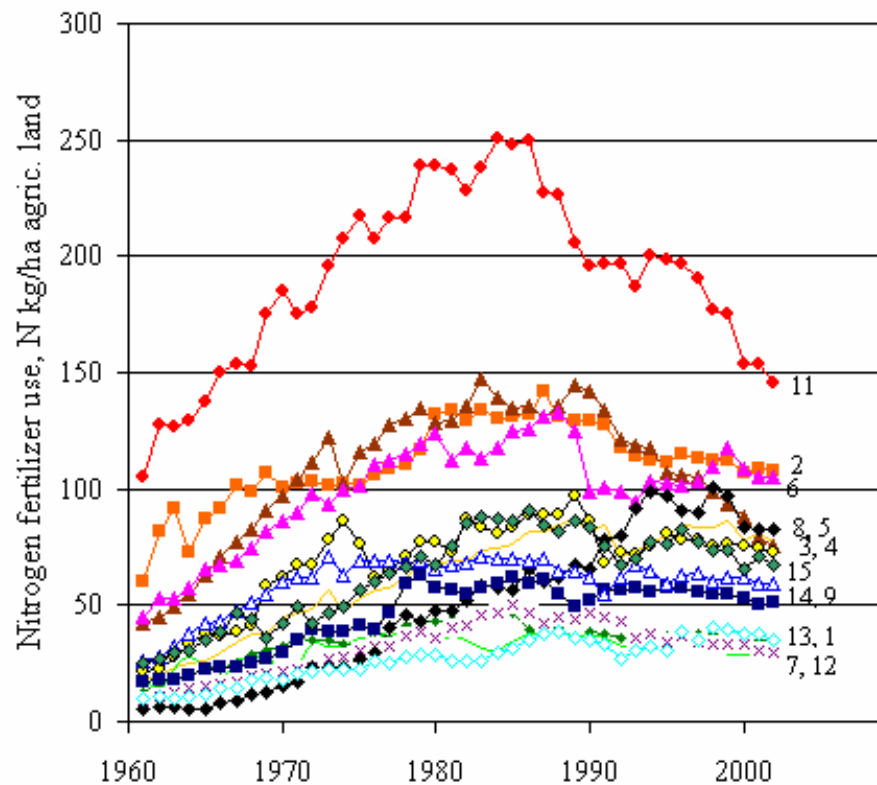
- ◆ 1 Austria
- ◆ 2 Belgium-Lux.
- ◆ 3 Denmark
- ◆ 4 Finland
- ◆ 5 France
- ◆ 6 Germany
- ◆ 7 Greece
- ◆ 8 Ireland
- ◆ 9 Italy
- ◆ 11 Netherlands
- ◆ 12 Portugal
- ◆ 13 Spain
- ◆ 14 Sweden
- ◆ 15 United Kingdom

- ◆ 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



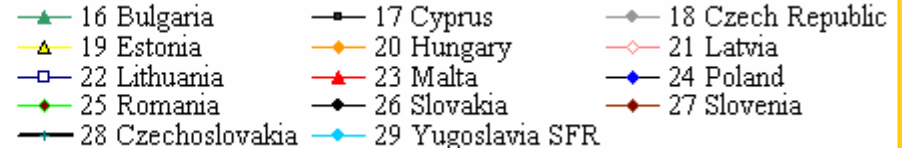
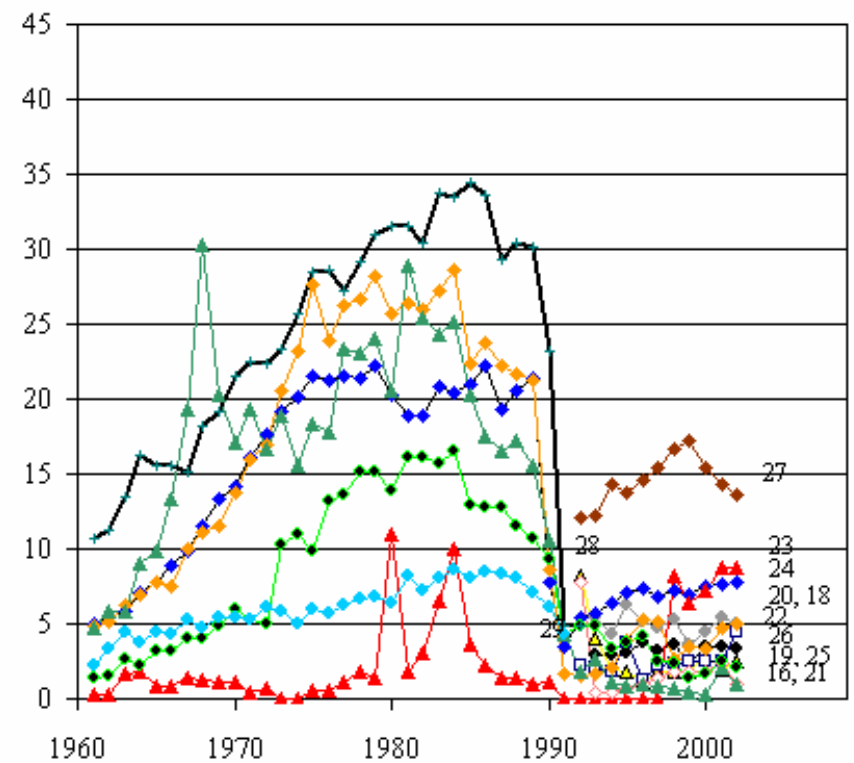
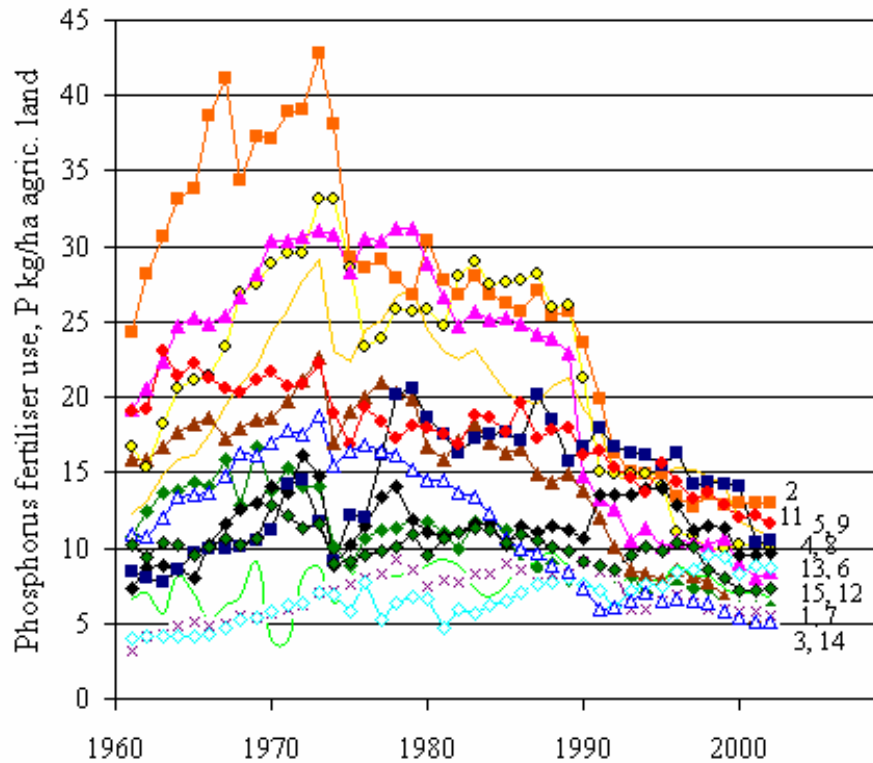
- 1 Austria
- 2 Belgium-Lux.
- 3 Denmark
- 4 Finland
- 5 France
- 6 Germany
- 7 Greece
- 8 Ireland
- 9 Italy
- 11 Netherlands
- 12 Portugal
- 13 Spain
- 14 Sweden
- 15 United Kingdom

- 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

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

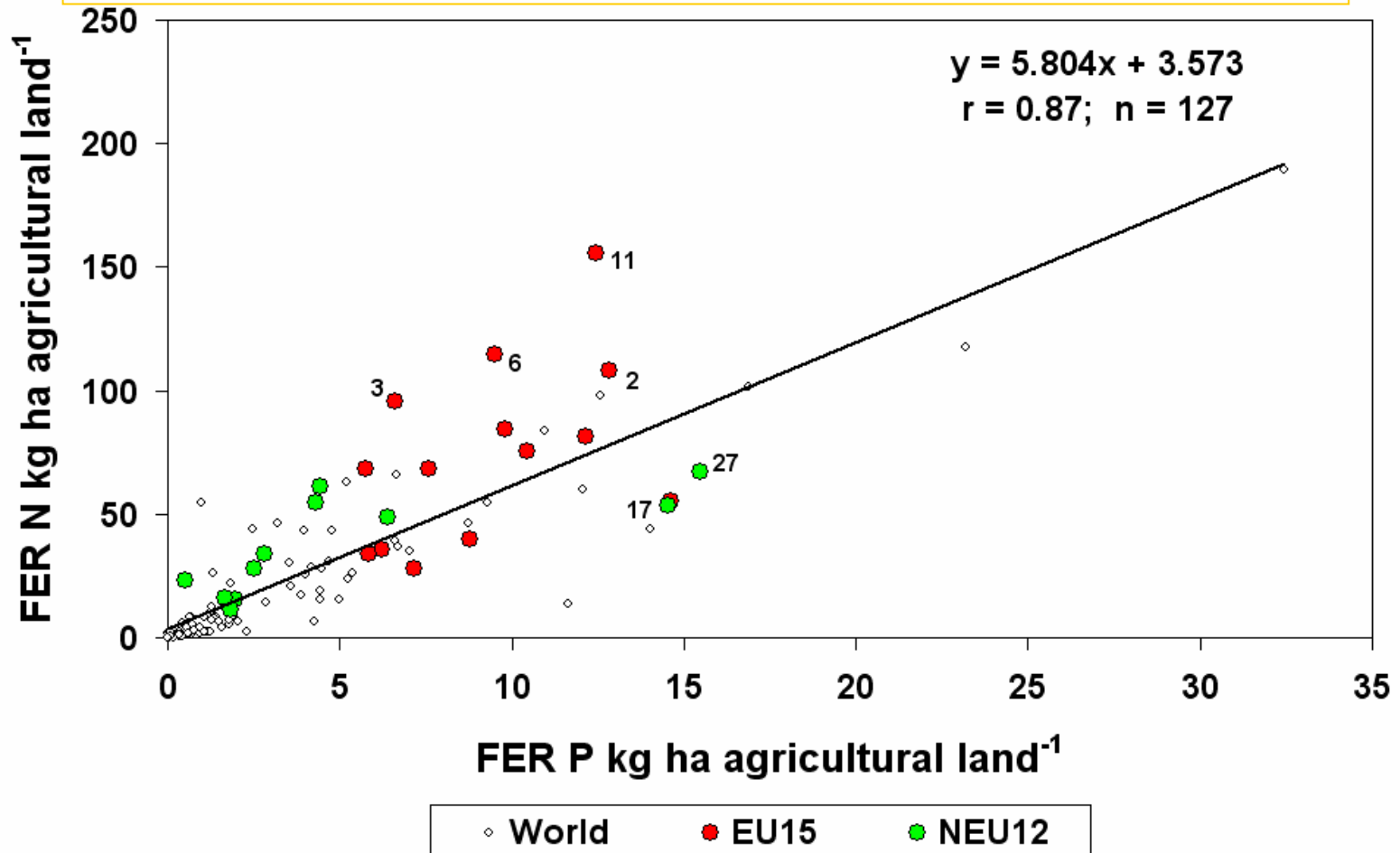
## Western Europe

## Central and Eastern Europe



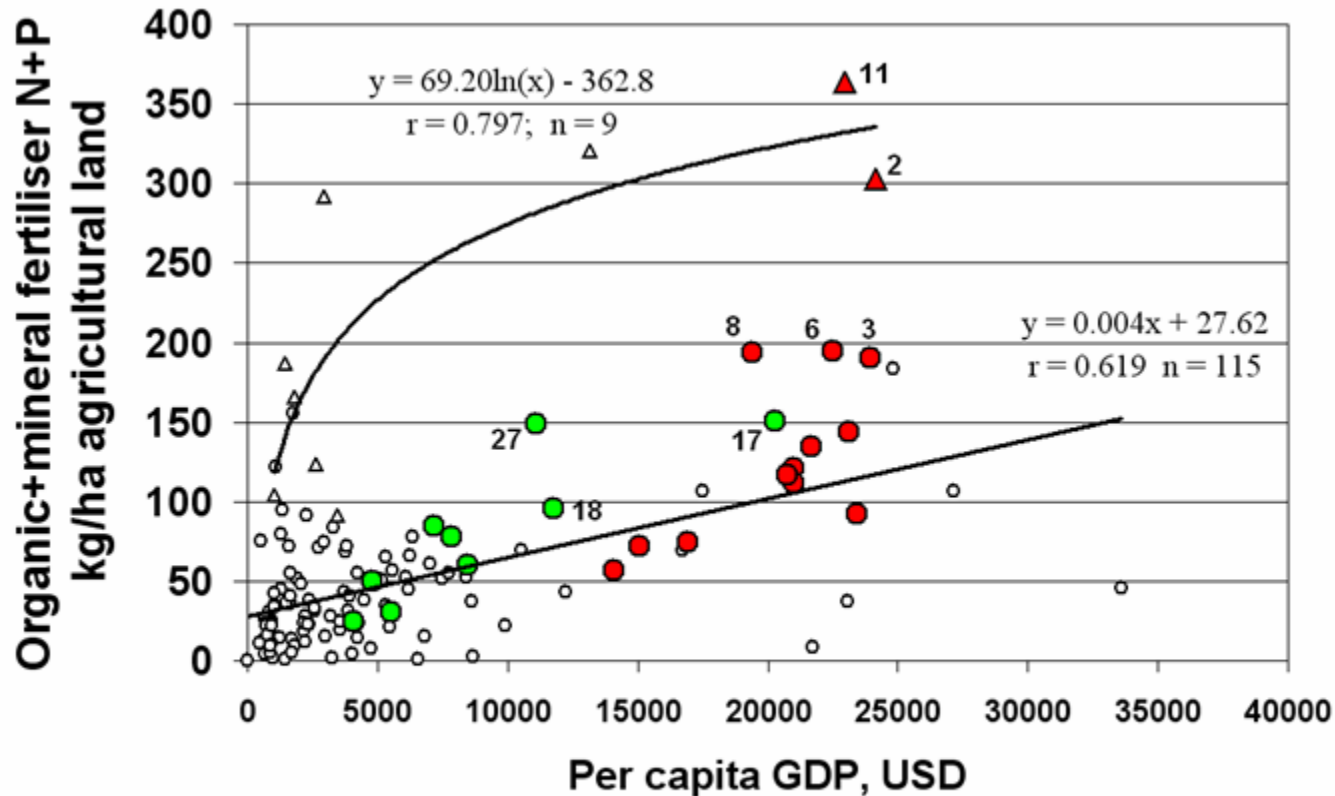
# Correlation between the amount of applied fertiliser-N and fertiliser-P in the countries of the world in 2000

- |                      |                  |               |                 |                |
|----------------------|------------------|---------------|-----------------|----------------|
| 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

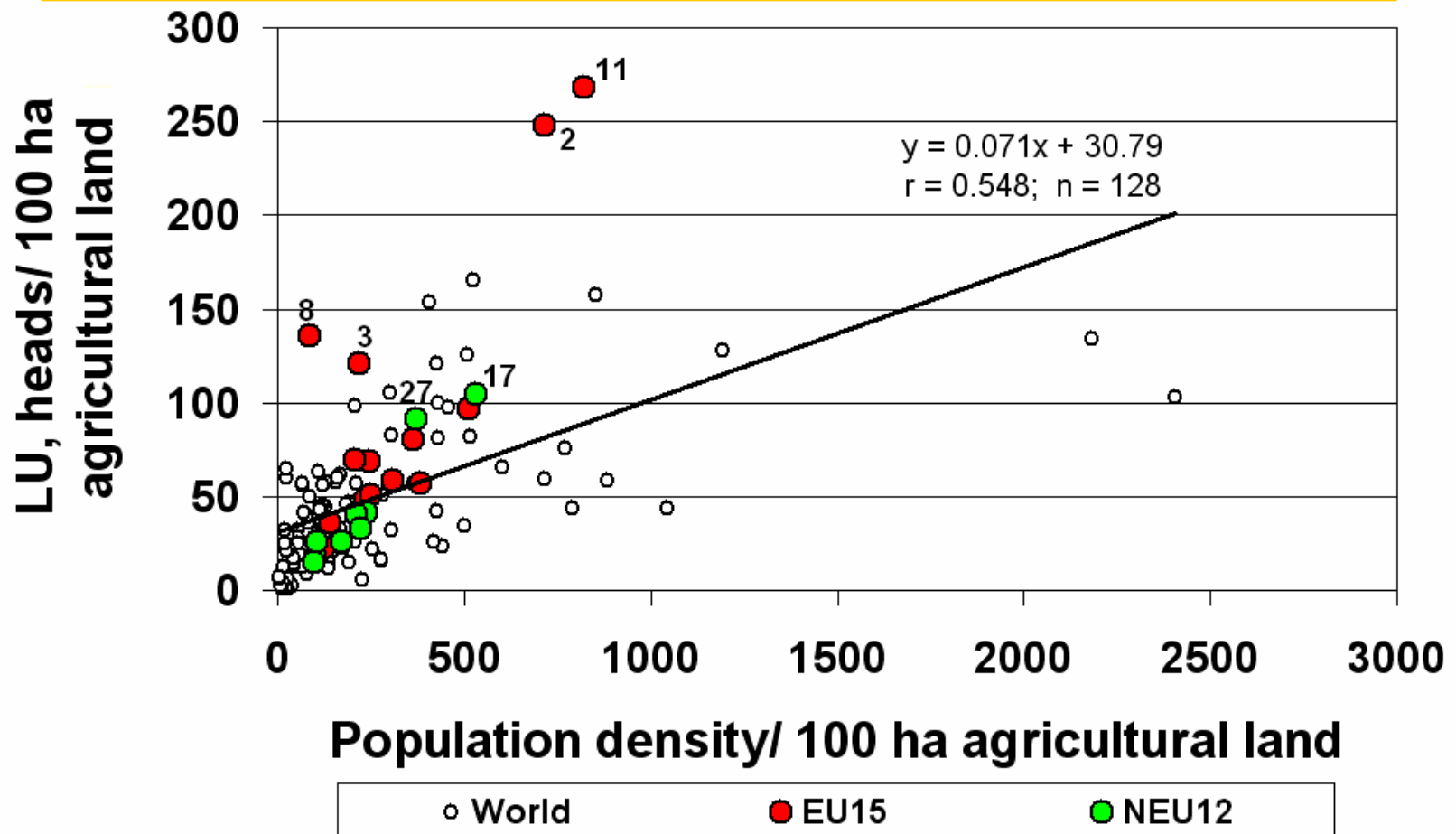
1 – Austria	6 – Germany	12 – Portugal	17 – Cyprus	22 – Lithuania
2 – Belgium and Lux.	7 – Greece	13 – Spain	18 – Czech Rep.	23 – Malta
3 – Denmark	8 – Ireland	14 – Sweden	19 – Estonia	24 – Poland
4 – Finland	9 – Italy	15 – UK	20 – Hungary	25 – Romania
5 – France	11 – Netherlands	16 – Bulgaria	21 – Latvia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

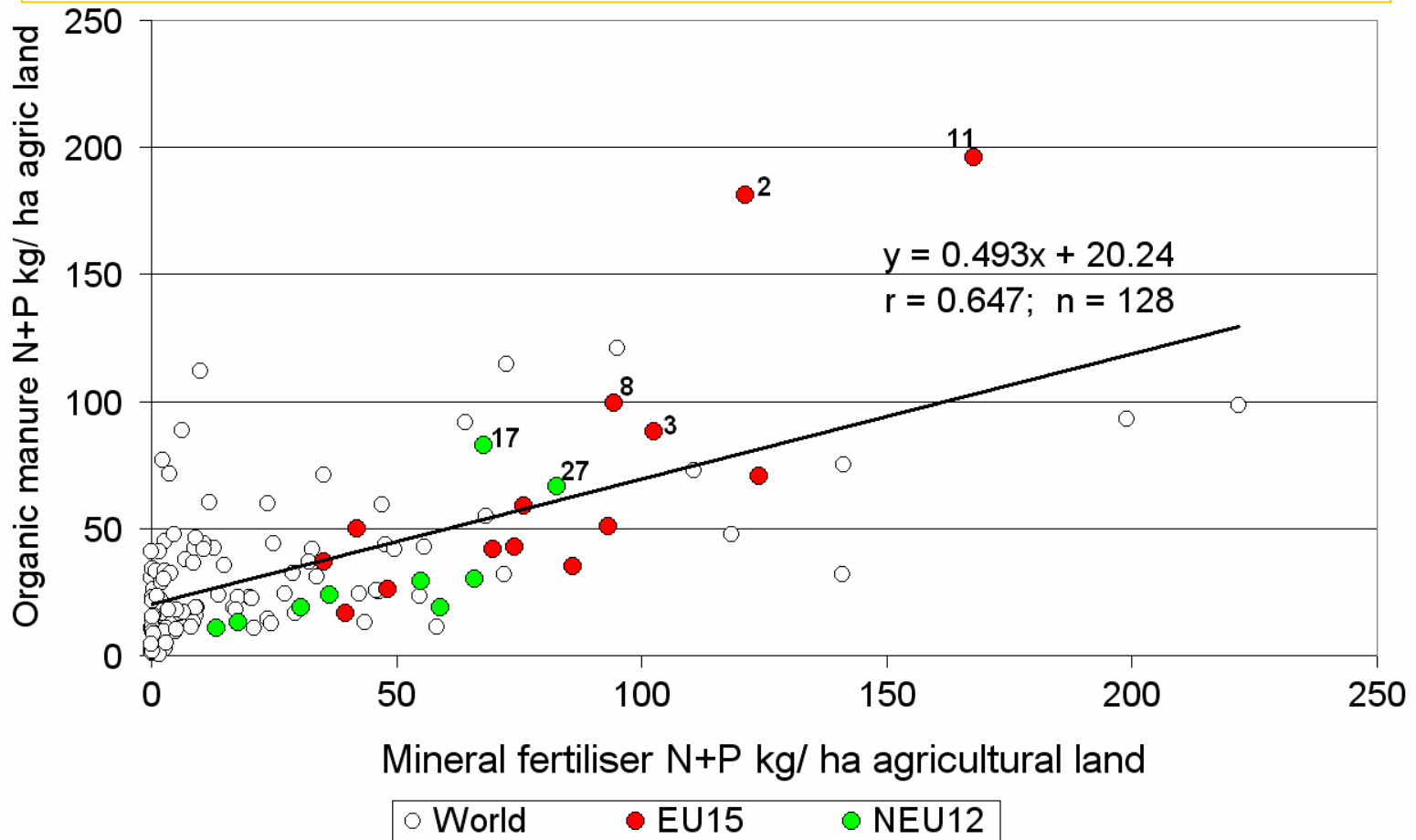
1 – Austria	6 – Germany	12 – Portugal	17 – Cyprus	22 – Lithuania
2 – Belgium and Lux.	7 – Greece	13 – Spain	18 – Czech Rep.	23 – Malta
3 – Denmark	8 – Ireland	14 – Sweden	19 – Estonia	24 – Poland
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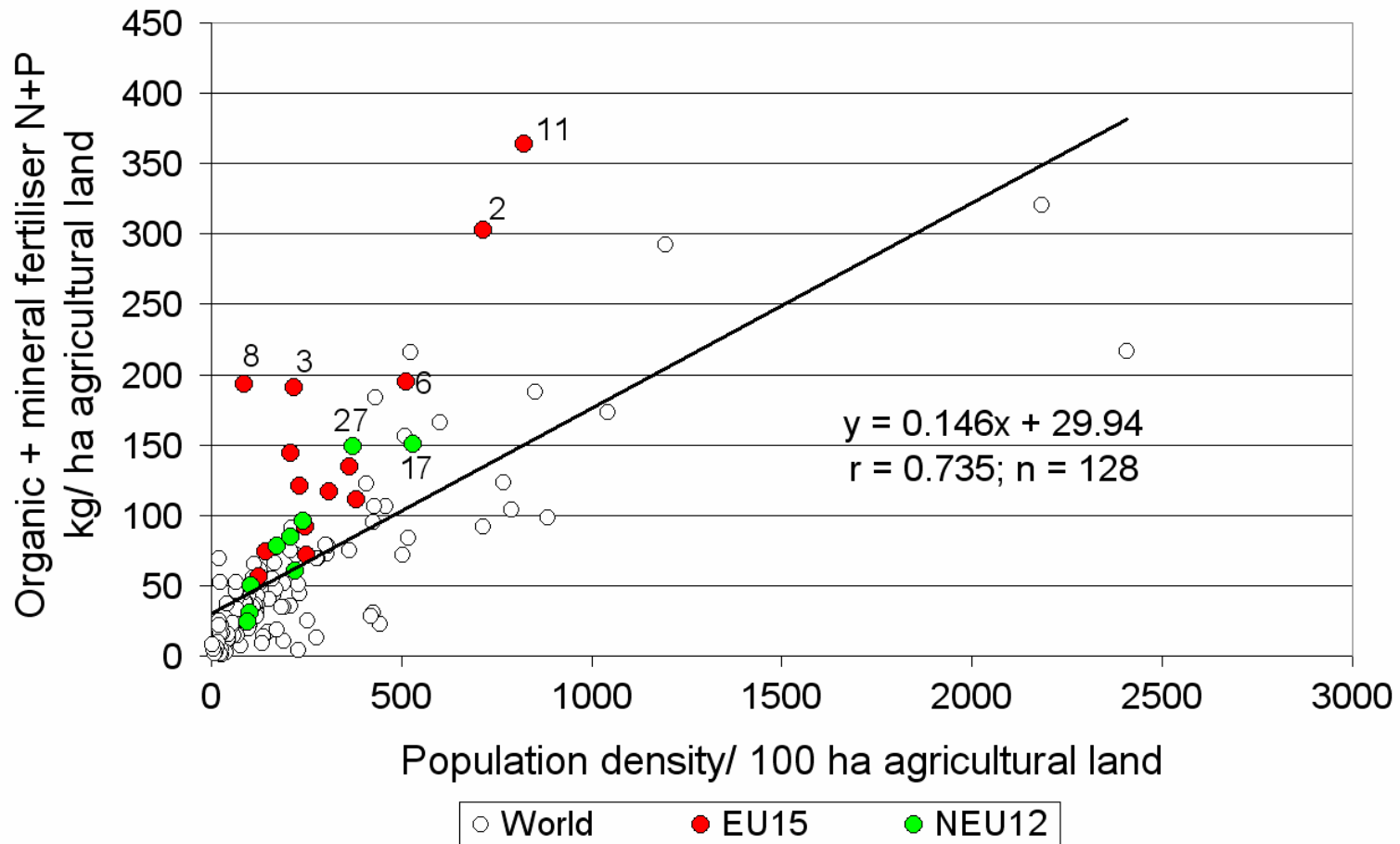
# Correlation between organic and mineral NP use in 2000

- |                      |                  |               |                 |                |
|----------------------|------------------|---------------|-----------------|----------------|
| 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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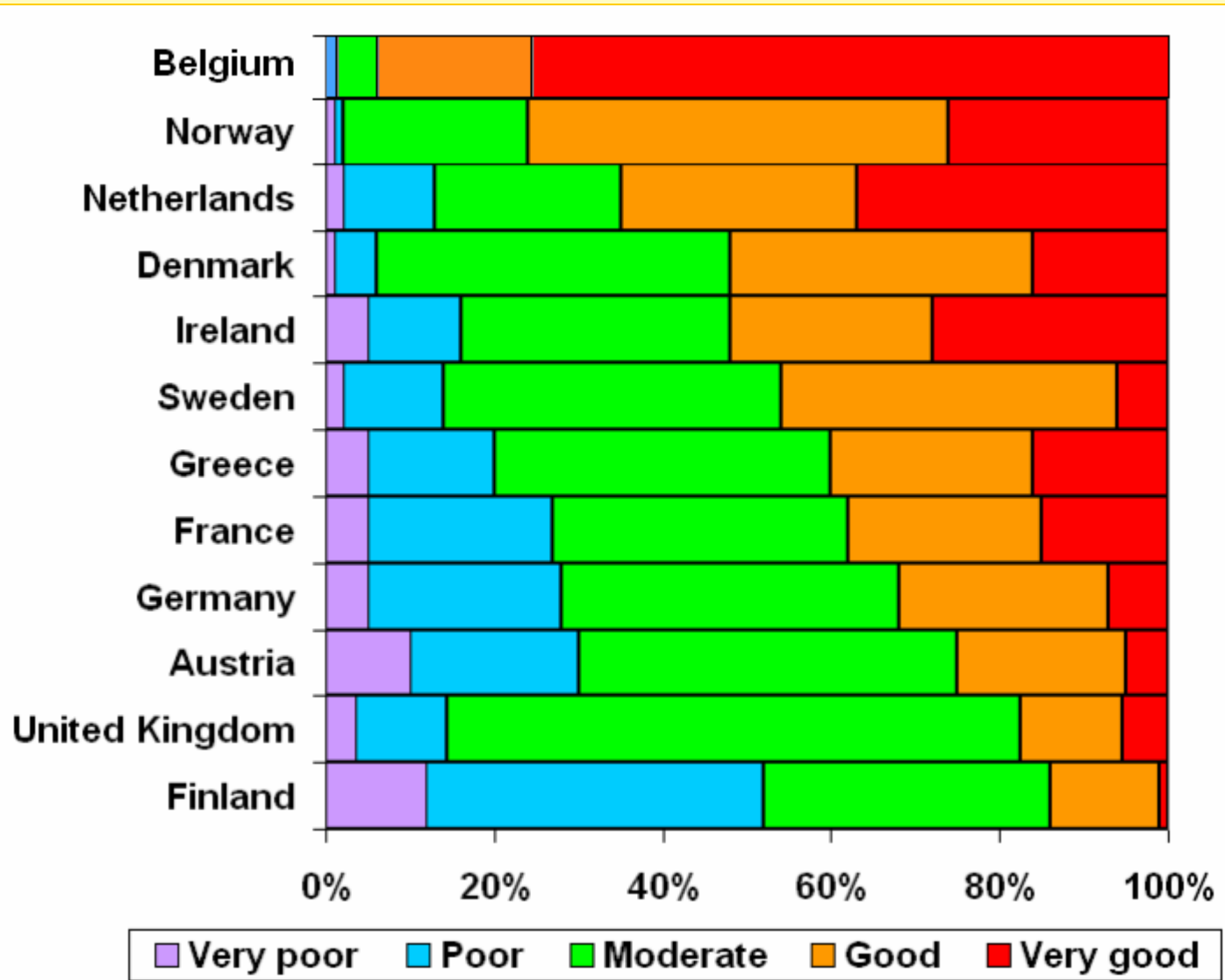
# Correlation between the population density and NP use in 2000

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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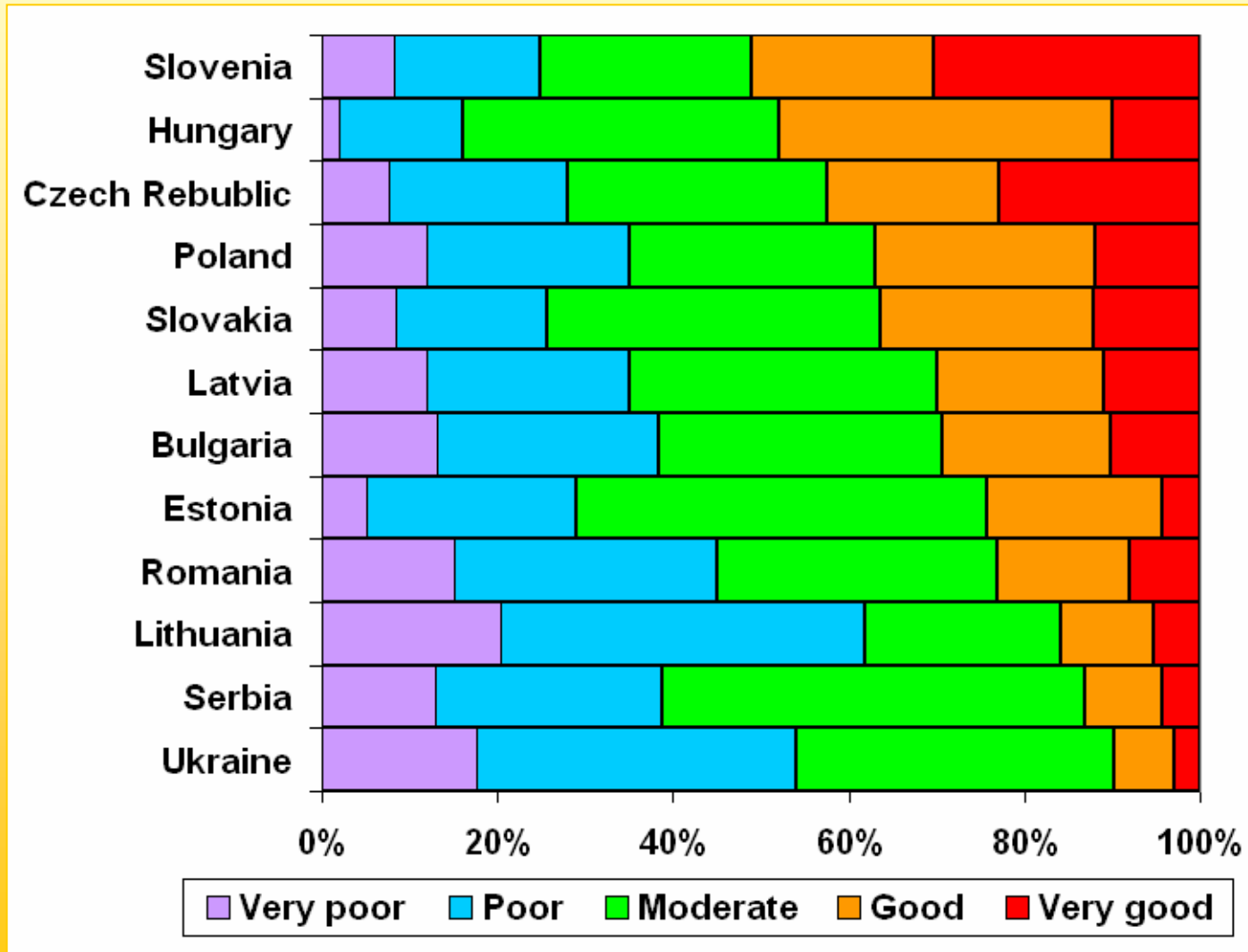
# Phosphorus status in the soils of Western European countries in 1991

(Steén, 1997; Hofman, 2007)

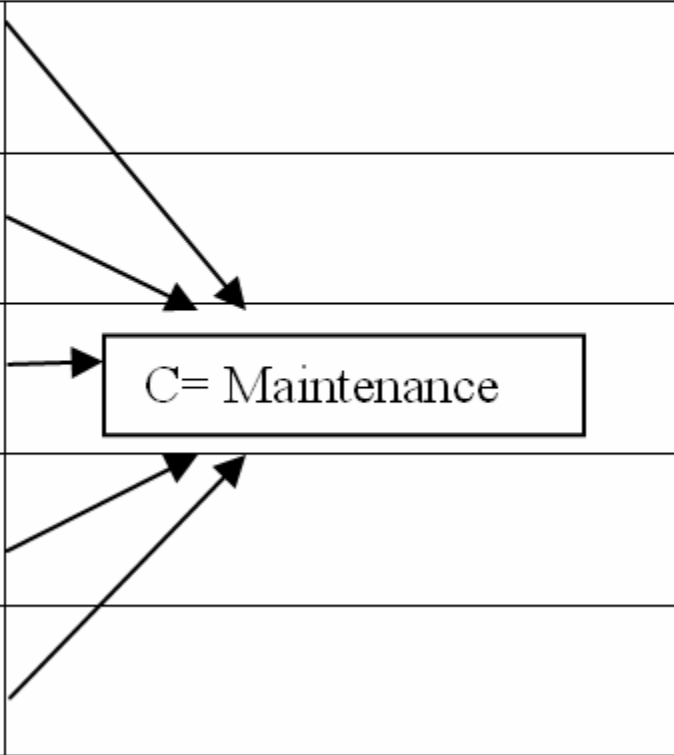


# Phosphorus supplies of soils in Central and Eastern European countries in the early 1990s

(Csathó et al., 2006)

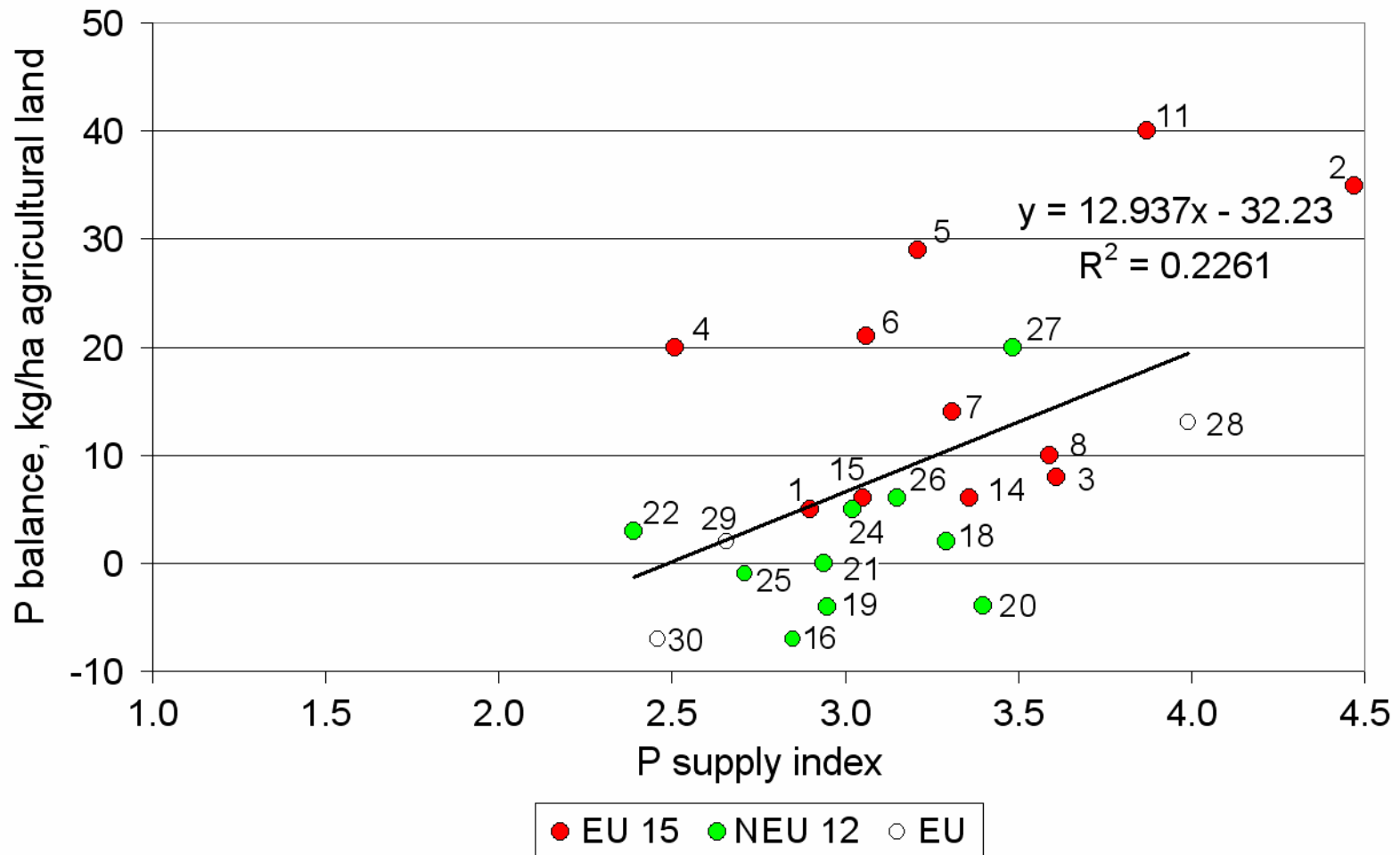


# Phosphorus fertiliser recommendation for fields in Germany based on soil fertility class (STP) (Vetter and Fruchtenicht (1974), )

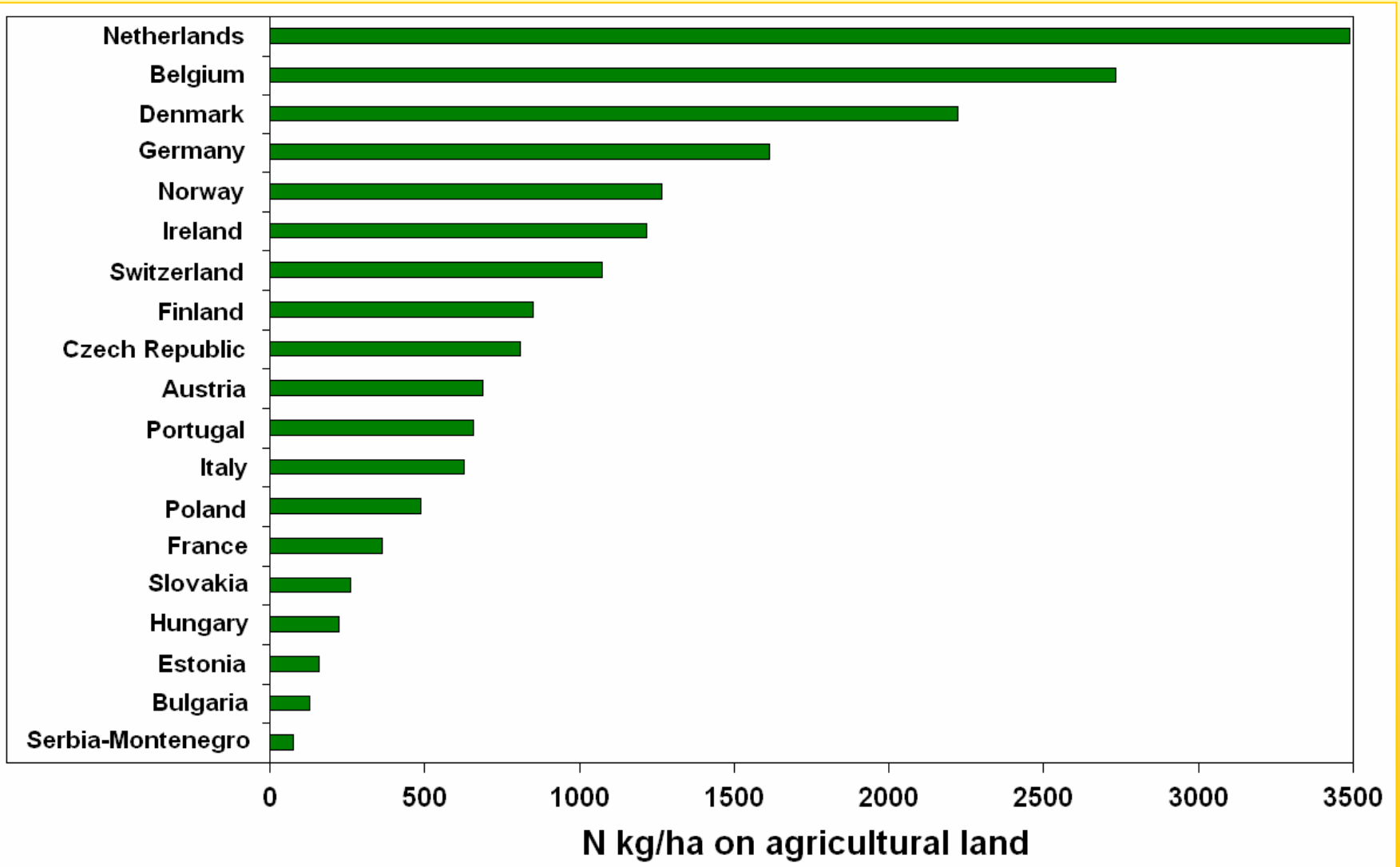
Fertility Class	Fertiliser Ratio	
E: Very high	0	
D: High	0.5	
C: Moderate	1.0	
B: Low	1.5	
A: Very low	2.0	

# 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	

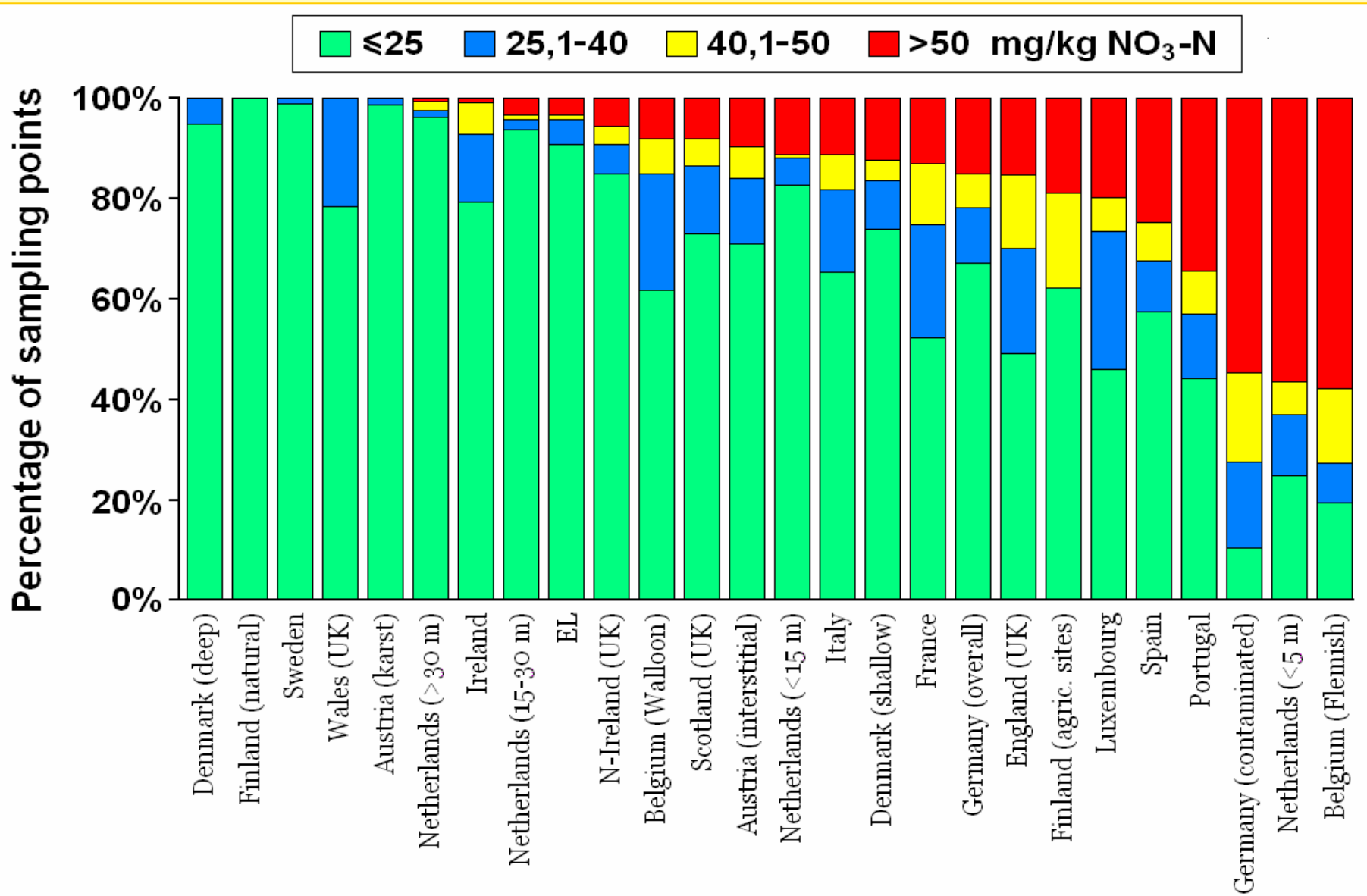


# Estimated cumulative N balance of European countries, 1991–2005 (N kg/ha agricultural land)



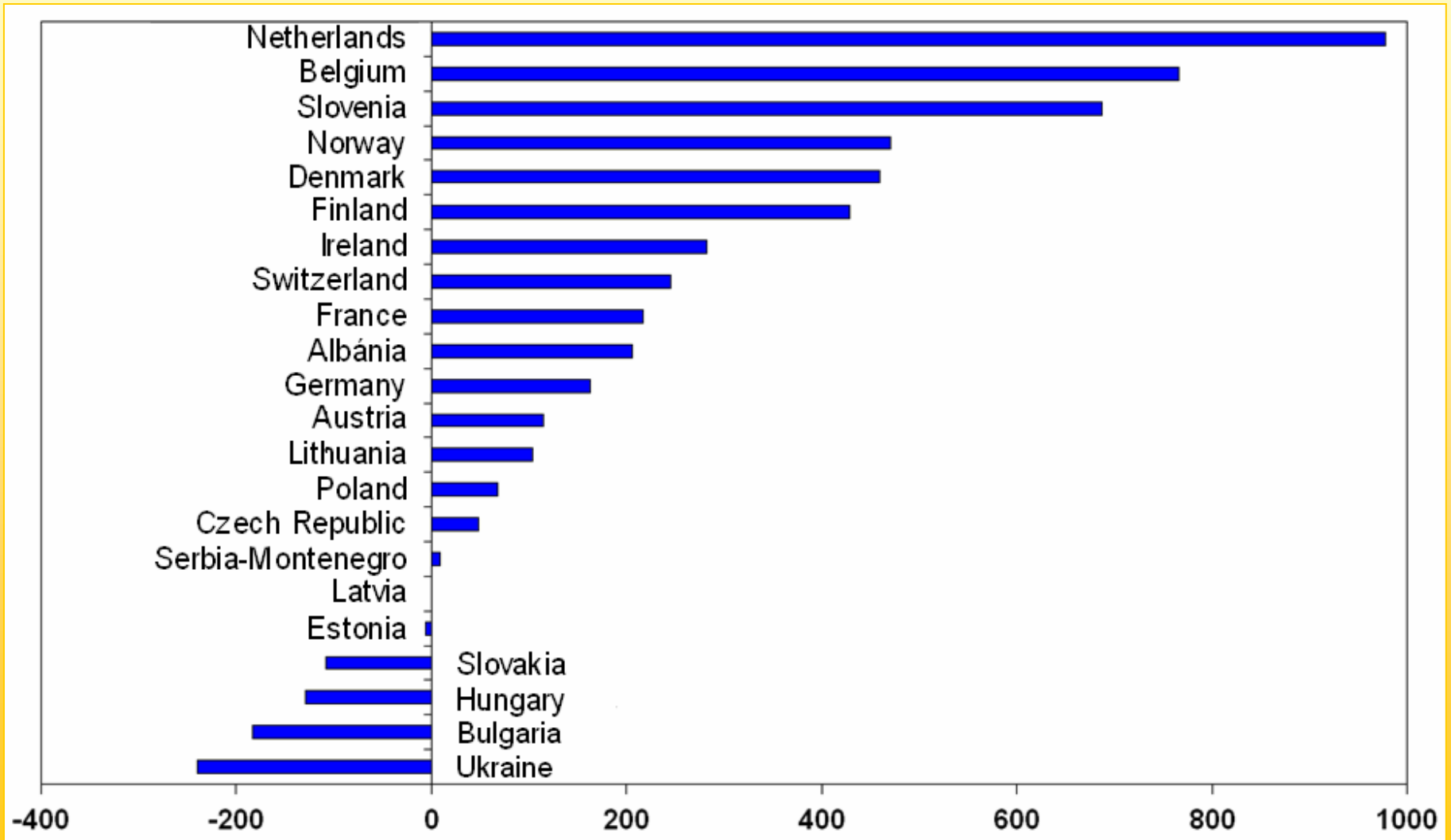
# Nitrate pollution of ground water in the EU

(Hamell, 2007)





# Estimated cumulative P balance of European countries, 1991–2005 (P<sub>2</sub>O<sub>5</sub> 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

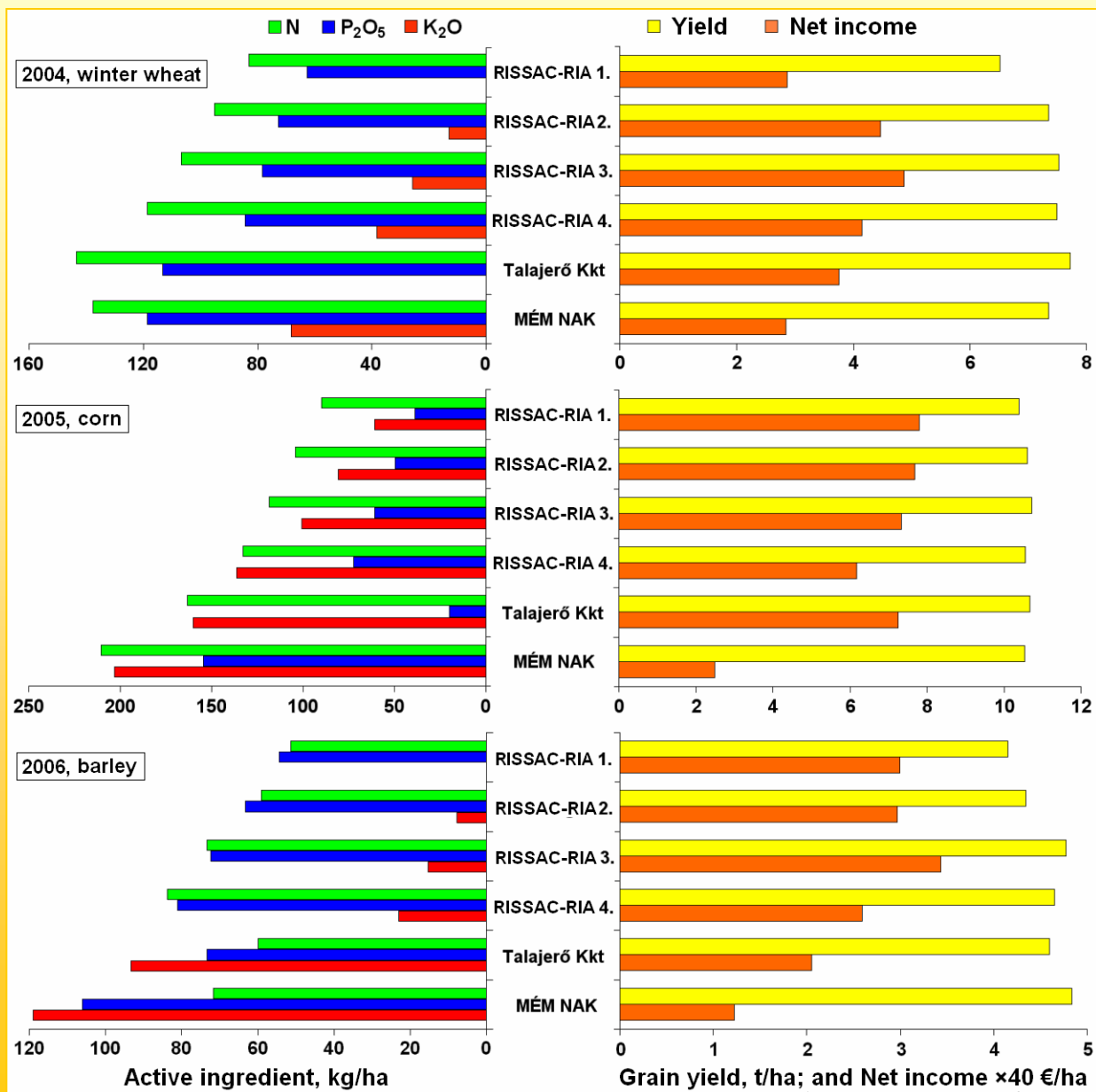
## Principles for intensive plant nutrition (MÉM NAK 1979)

- 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:**

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

**Thank you for your attention!**