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Challenges in P-recycling to control P- loads in waters

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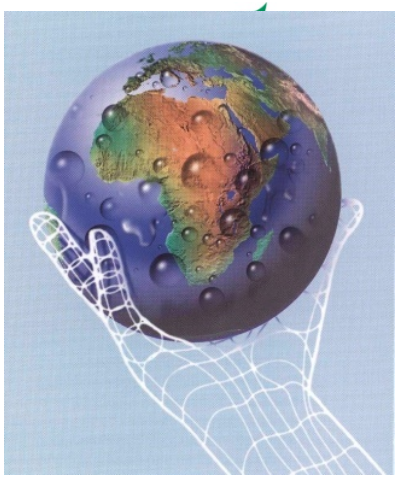
Phosphorus and sustainability
Two birds with one stone



- Key element in sustaining food production
- Critical element in regard to water quality
- Critical in terms of resource availability

Recycling of P in order to:

- ***Reduce the pressure on the earth´s P resources***
- ***Reduce P loads into surface waters***

Phosphorus loads to (surface) waters

- Point sources
  - Agriculture
  - Waste-water
- Diffuse sources

- Substantial improvements in reducing discharges from point sources
- The relative importance of diffuse sources has increased

Managing diffuse agricultural P losses;
Key challenge to control P loads to waters

- Difficult to measure
- Difficult to quantify processes
- Difficult to control in terms of cost-efficient measures

Extremely variable

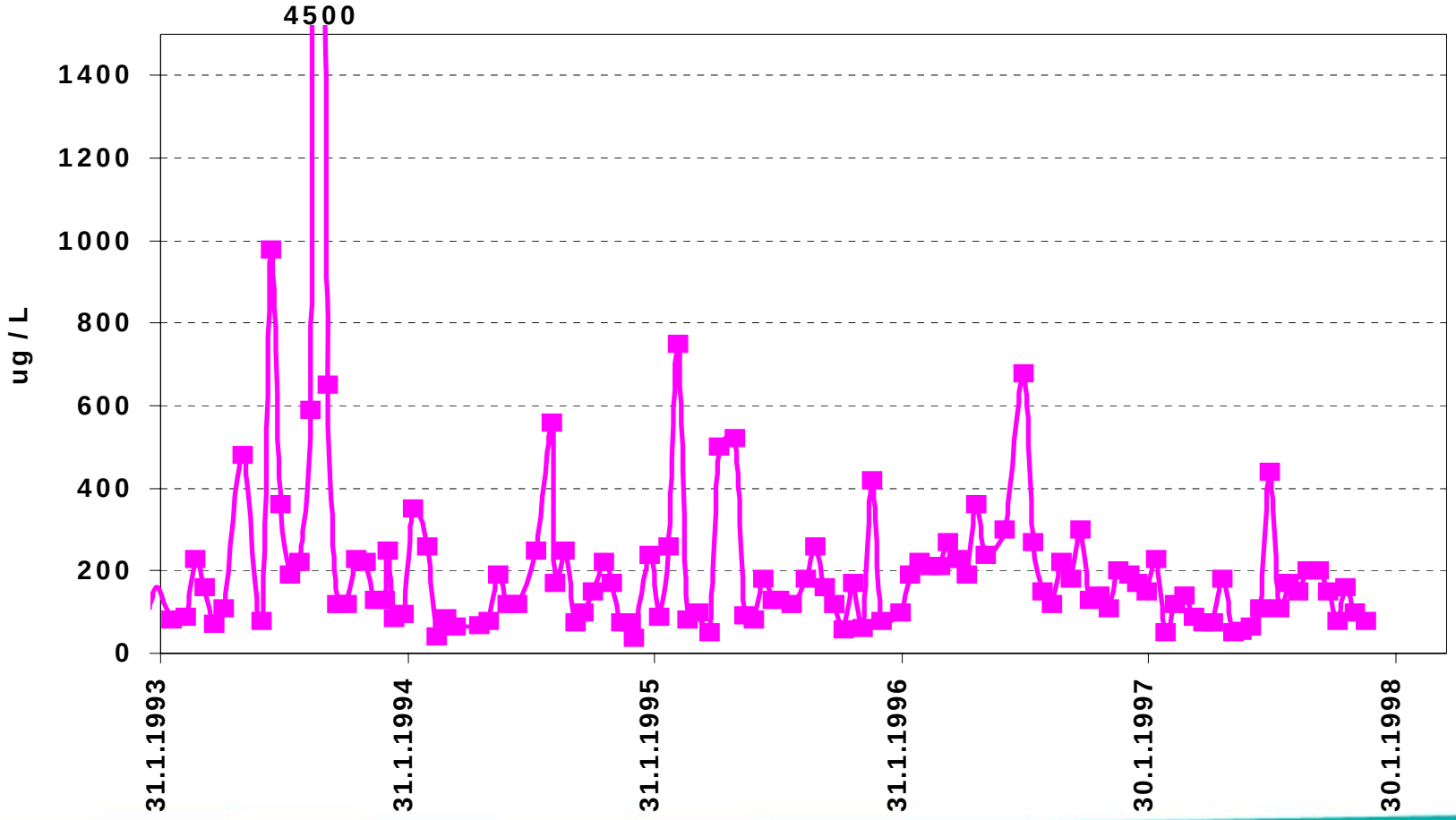
- Spatially
- Temporarely

P loss processes – and transfer from land to waters

- Soil erosion
  - Different processes on soil surface
  - Preferential flow
- Leaching (freezing, etc) from plants and plant residues at soil surface
- Leaching and runoff from animal manure
- Leaching from soil matrix

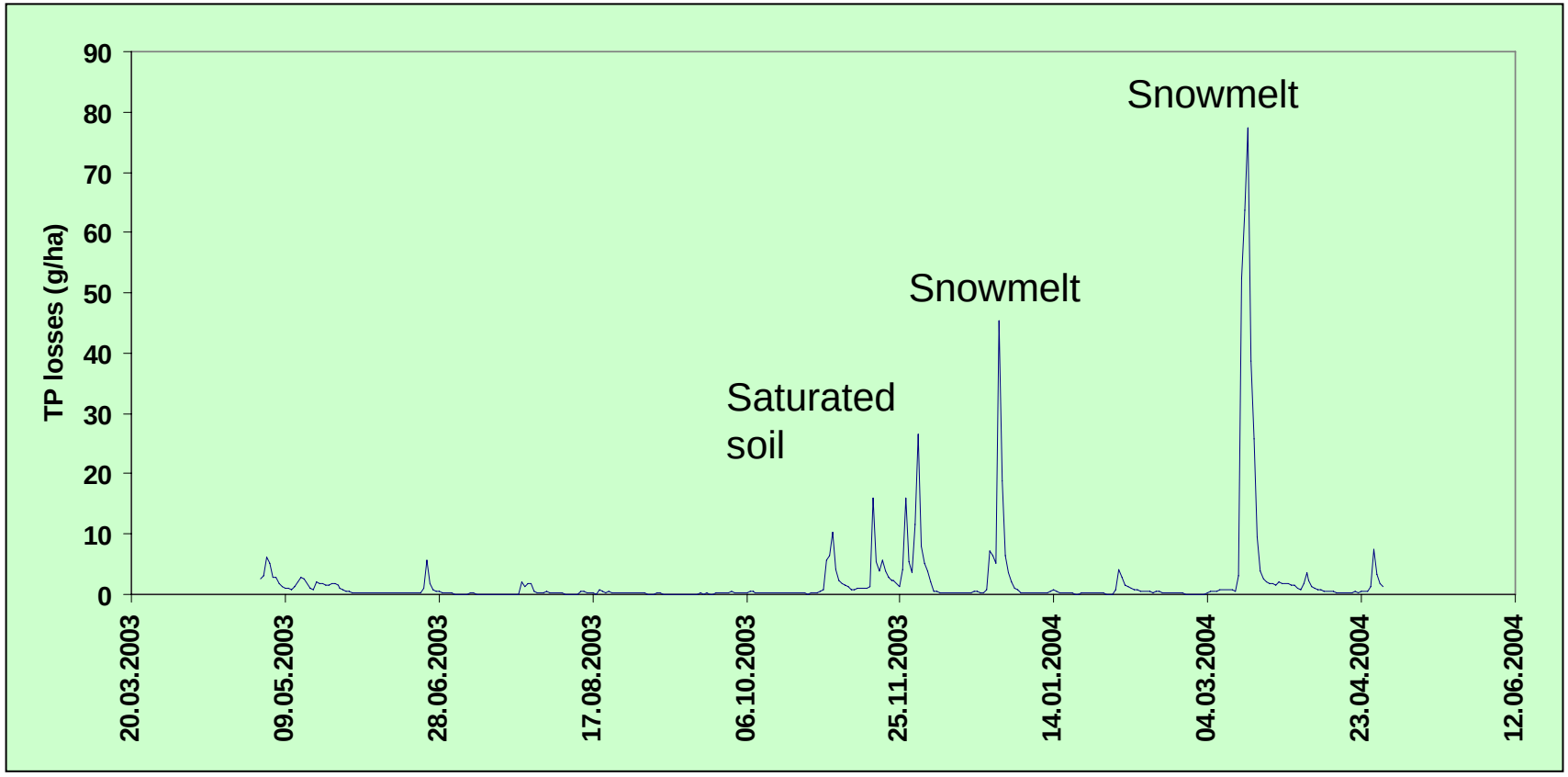
P transfer dependent on: Catchment & Landscape Characteristics and Hydrological Pathways

Phosphorus dynamics in a typical small agricultural stream during a periode of 5 years



P losses dominated by single events

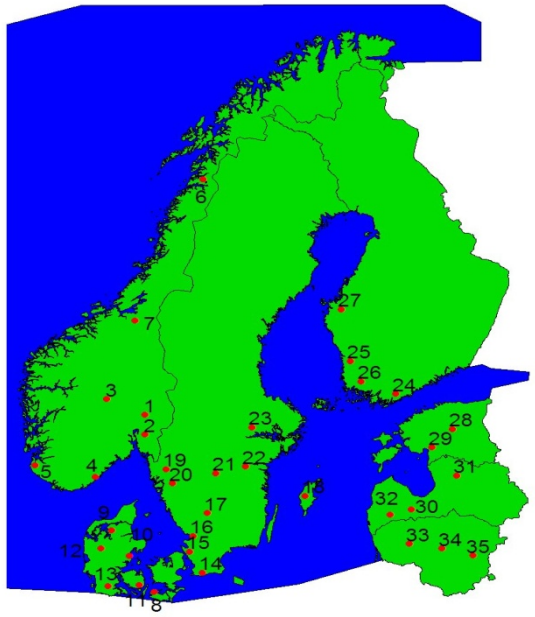
Example from an agricultural catchment May 03-May 04

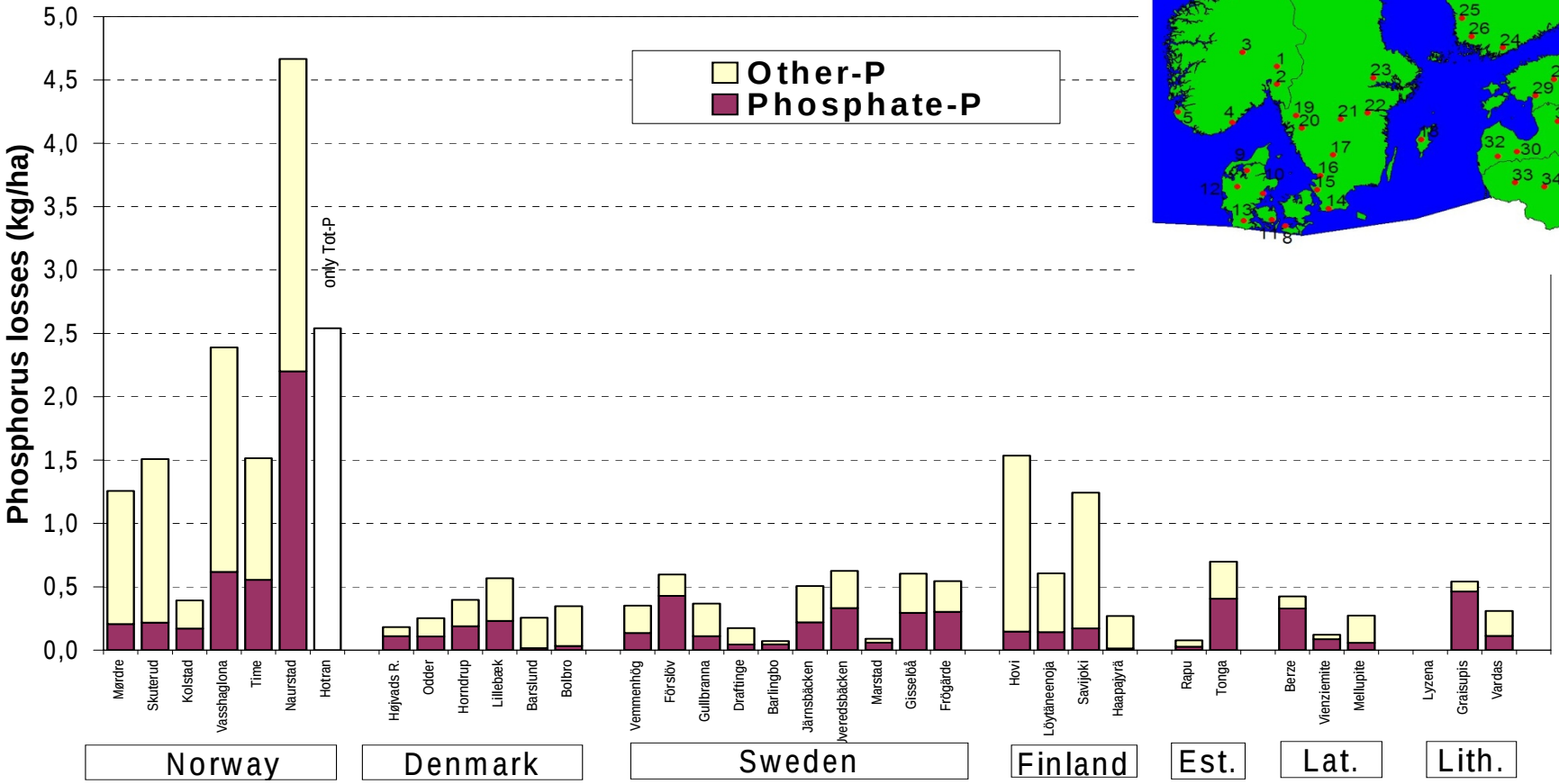


P losses in kg/ha agricultural land

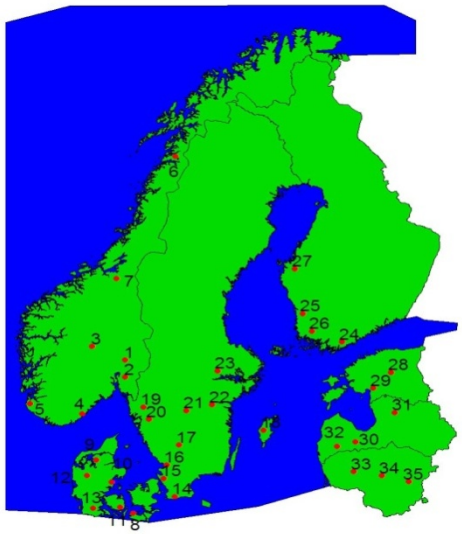
35 Nordic-Baltic catchments

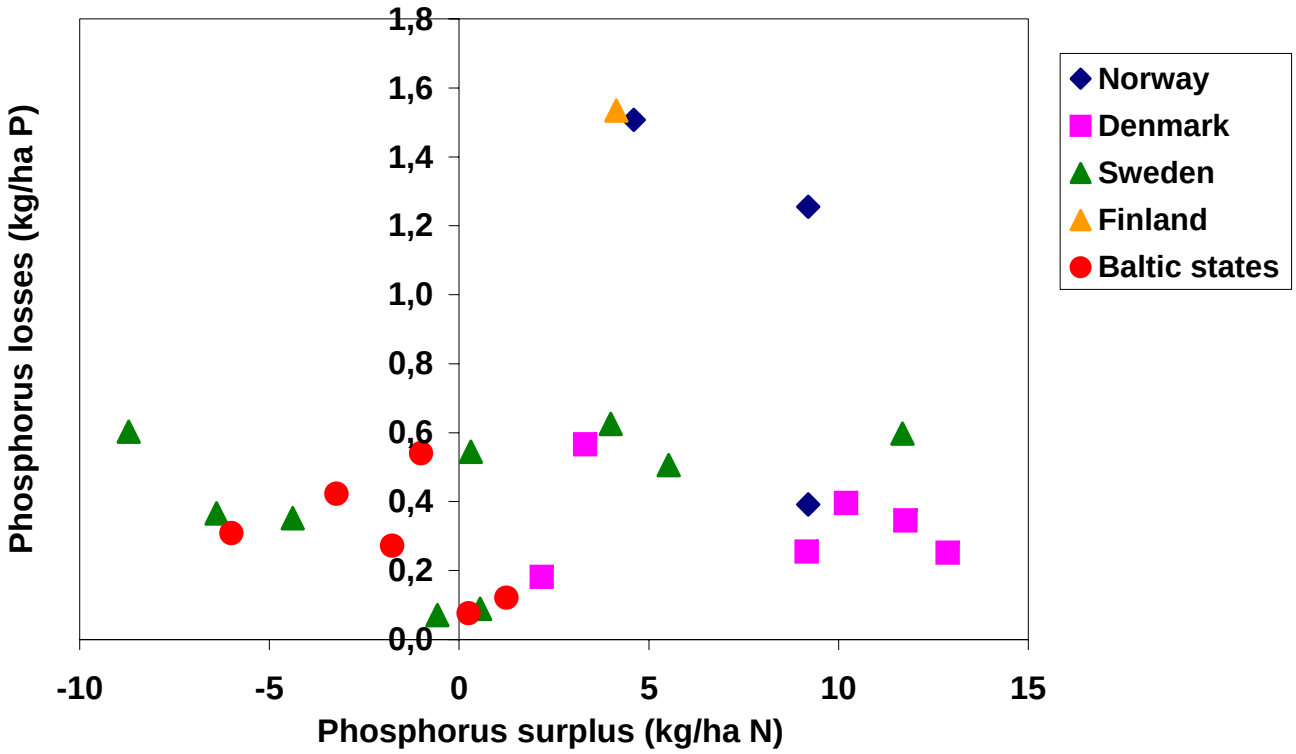
Five-year average





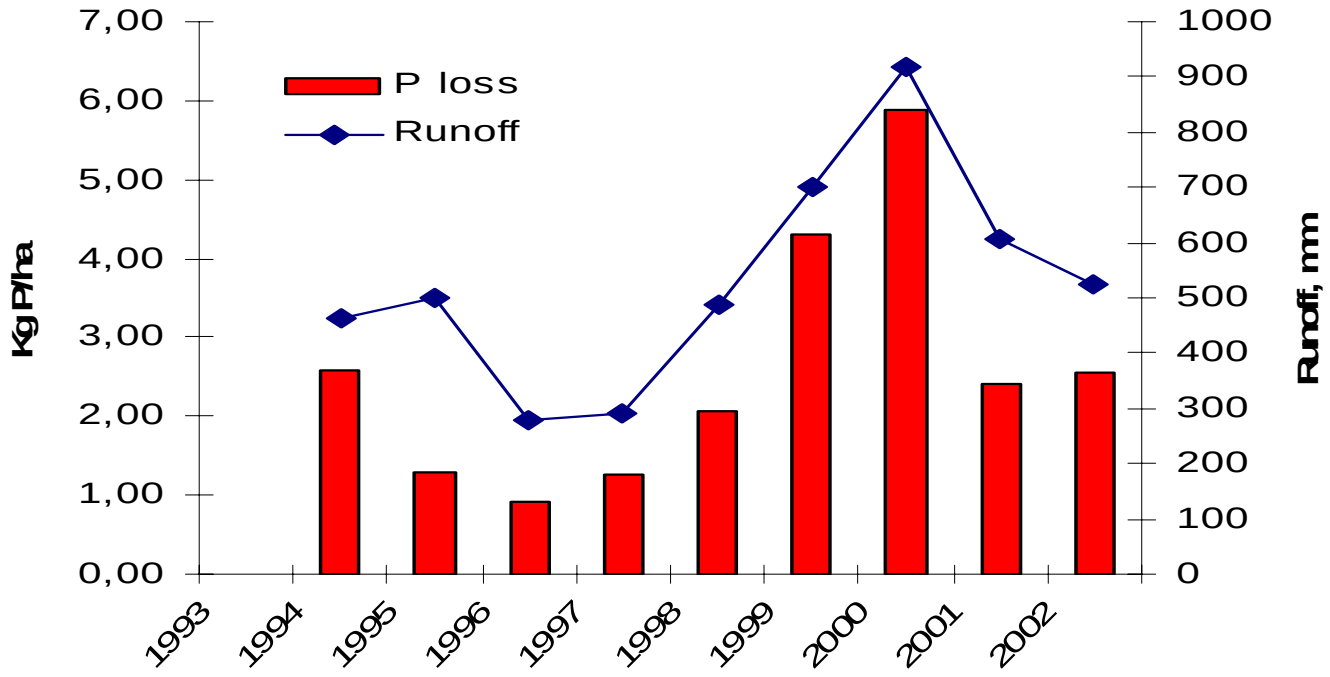
Weak correlations between P surplus and P losses at catchment scale





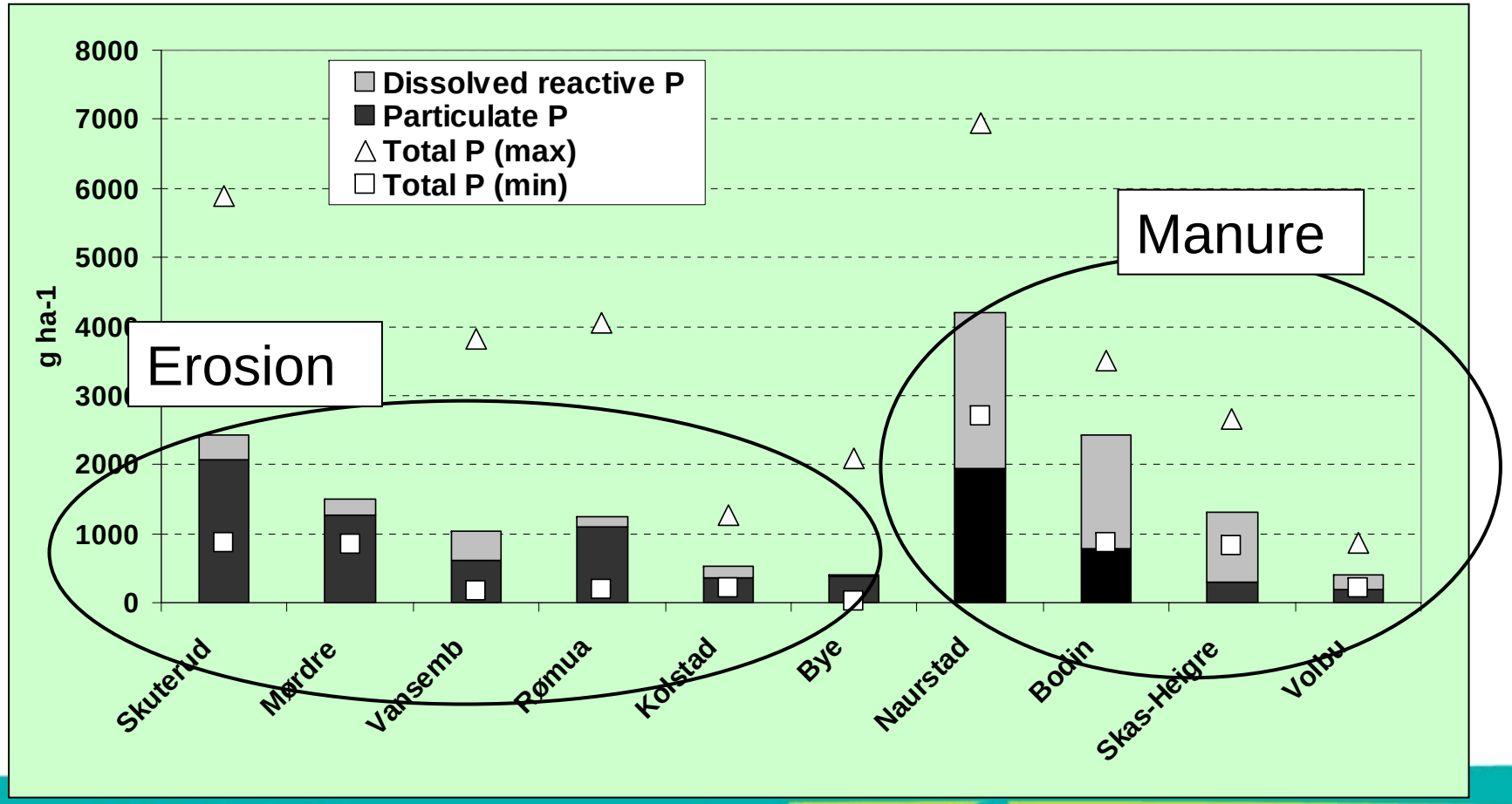
Runoff and P losses – individual years

Exemplified by data from the Skuterud catchment in Norway, 1994-2002



Impacts depending on bio-availability – which depends on processes and sources of losses.

Example of variations in P fractions – catchments with different productions and loss processes



Intensive Livestock farming – potential hot spots

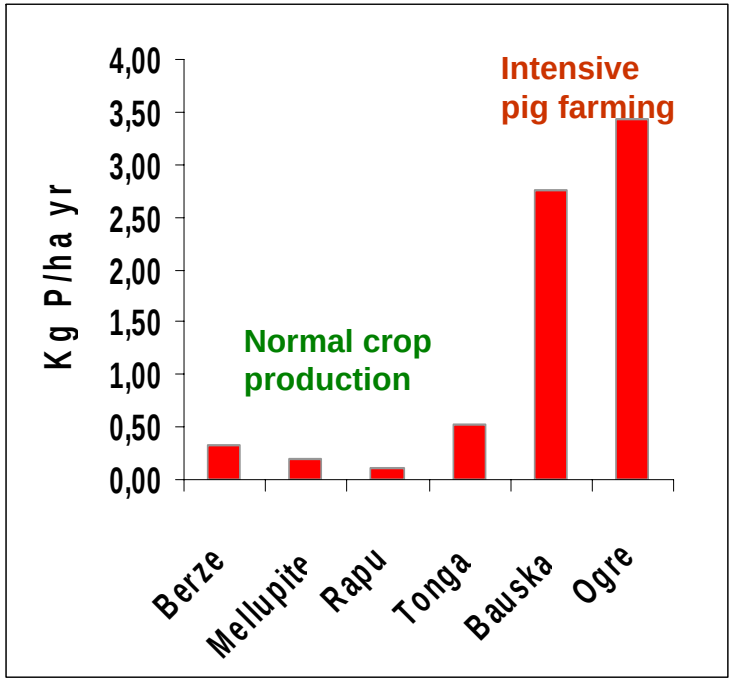
Examples;

Measured P losses from different type of farming in Latvia and Estonia

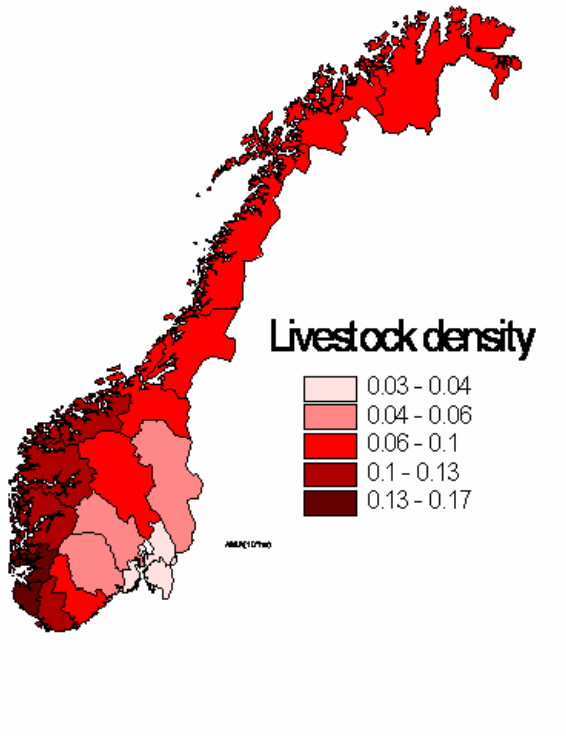
Area with <u>intensive pig production;</u>

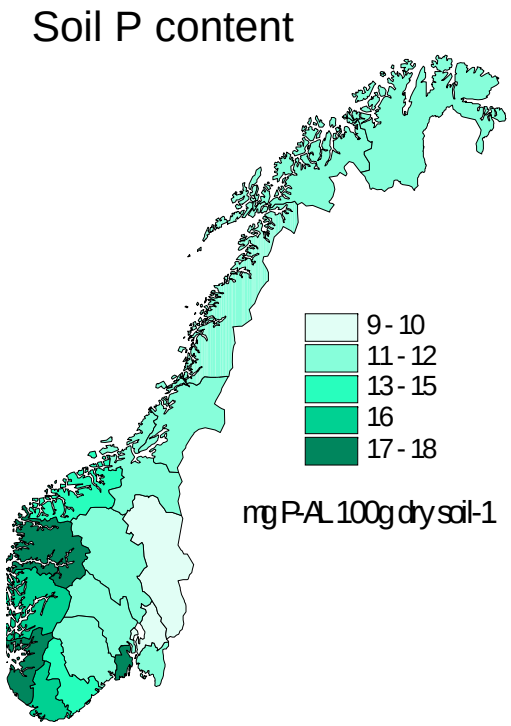
5-20 times higher P loss

than from areas with only <u>arable farming</u>



P accumulation in soils – closely related to livestock production

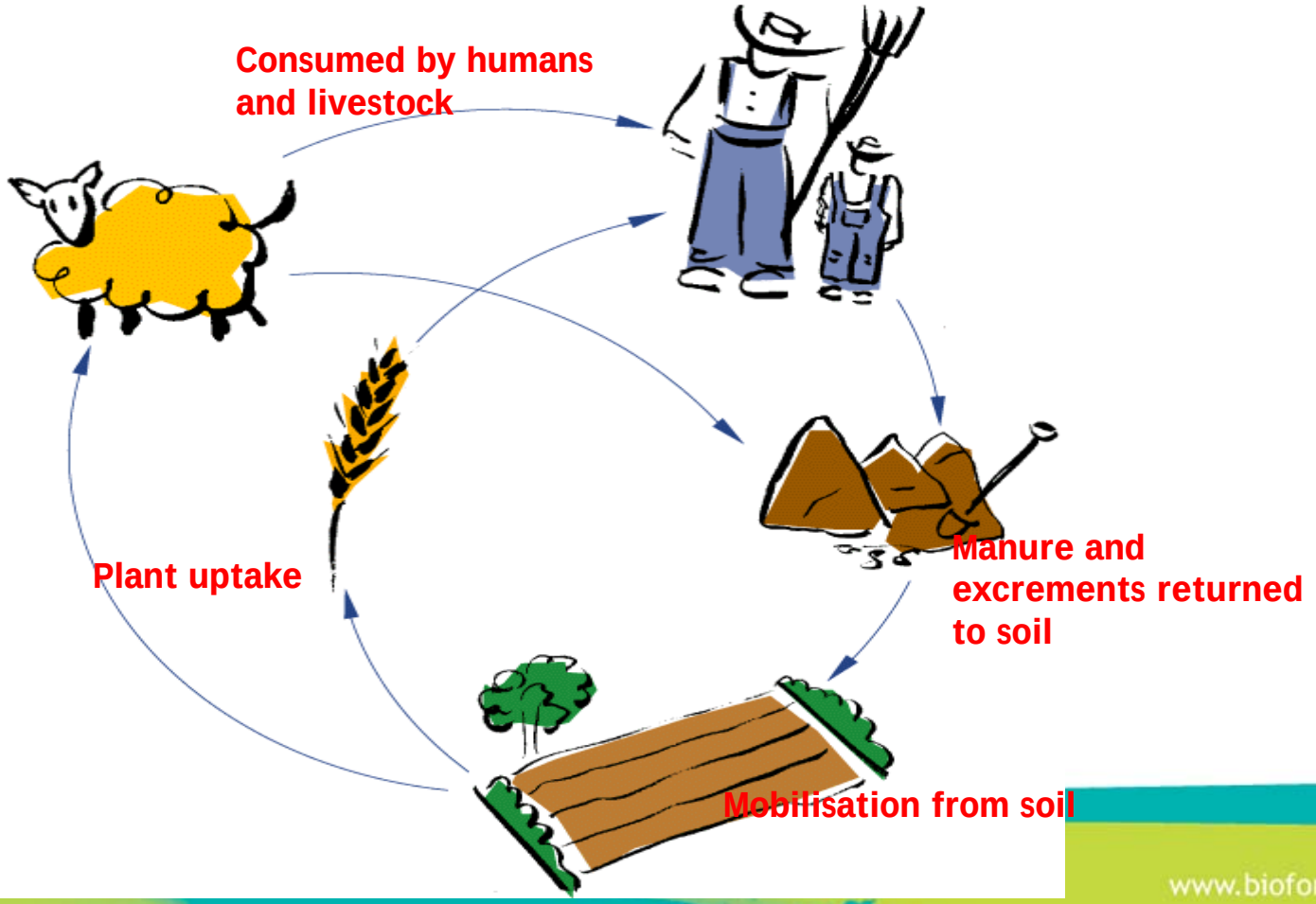




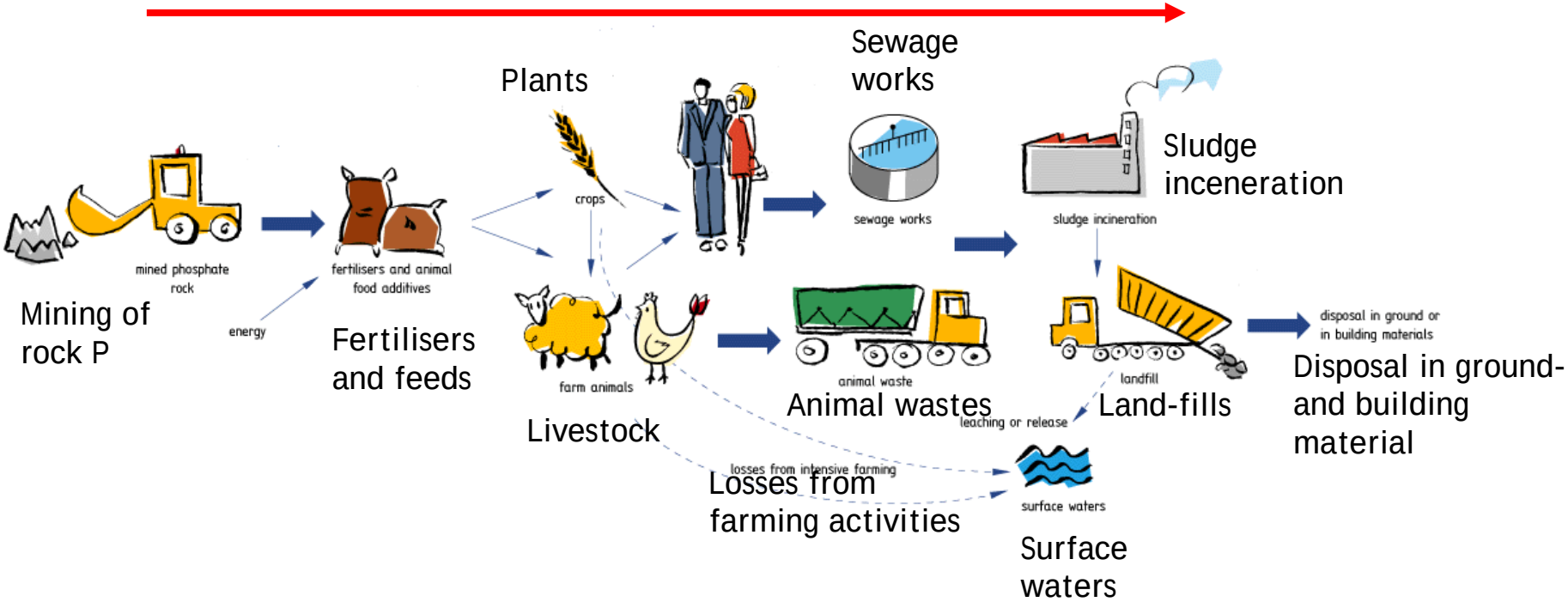
We have left the old, closed P cycle

Derived from soil

Returned to soil



And moved to a more one-way direction flow of P



Intensification of Livestock Productions

Relative to population increases;

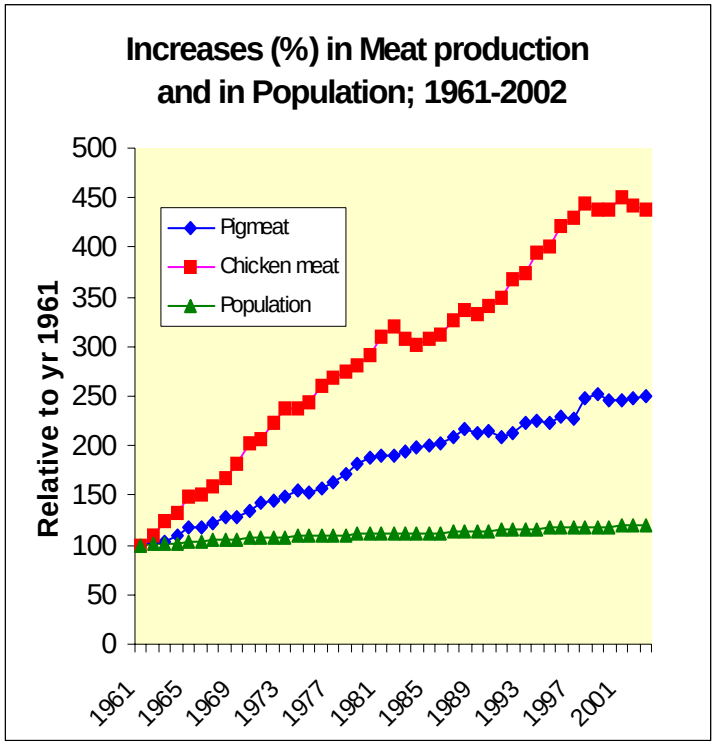
- Poultry: 4.5 times
- Pigs: 2.5 times

Pre-conditions

- Intensified crop production
- Import of feed concentrates

Concequences;

- High nutrient supluses with serious impacts on the environment *(domestic - on-site)*
- Additional *"external and off-site"* impacts linked to the "external" feed production



Structural changes with great impacts on P recycling

Specialised agricultural production systems

- De-coupling of plant production and livestock & animal production
- Impliactions for the efficient recycling of manure P

Demographic structure and diets

- Population increases
- Urbanisation
- Diets increasingly based on
  - Processed products
  - Animal products

The issue of **”Land Grabbing”** and ”**neo-colonialism”**

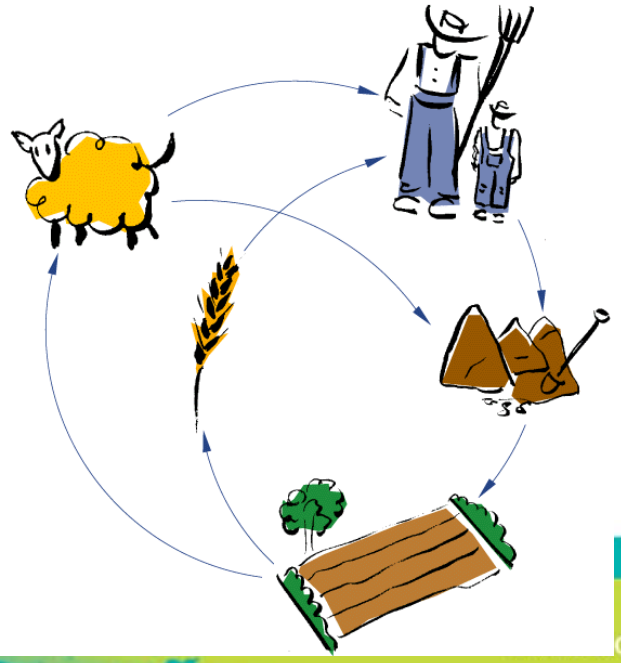
Increased efficiency of P recycling - Two major options:

- Increased utilisation of soil P – increased plant uptake if applied P

- Increased recycling of P in organic and inorganic wastes

Approaching a closing of the P cycle

Economic incentives to enhance recycling



Sources of P recycling - and challenges

- **Efficiency in the utilisation of animal manure**
  - Optimising P contents in feed concentrates
  - Distribution and availability (geographically)
  - Technology – storage and spreading/application
- **Recycling of P in different waste products from food production**
  - Meat and bone meal from slaughtering
  - Sludge/sewage from waste water treatment
  - Composts from different organic wastes
- **Ashes from bio-energy production and incinerations processes**

Managing P losses to reduce water pollution – not just about recycling

- Managing the land
- Managing the landscape
- Managing the water and the hydrology
- Managing the crops
- Managing the nutrients

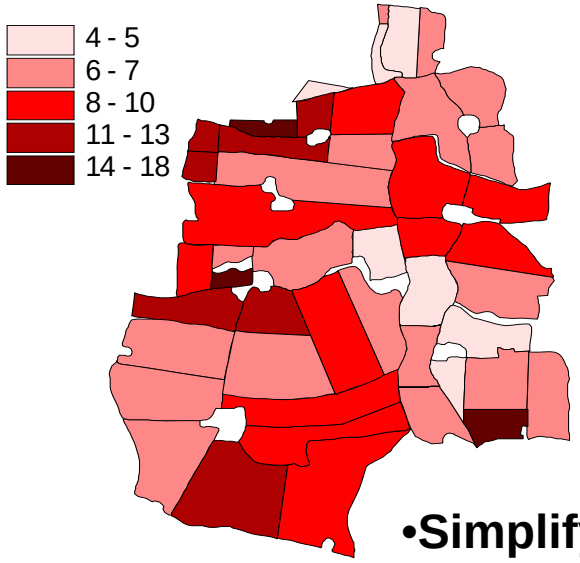
But sometimes you

Solve one problem, and
Create several new problems !

Managing P and P Losses:

⇨ *Variability Management*

⇨ *Risk Management*



- **Simplify Spatial Information**
- **Identify risk factors and critical source areas**
- **Quantify risks into a managable tool: P-Index**

Thank you for your attention

How much is it ?

Figures in kg P/ha agr land - Norwegian conditions

Farm gate balance approach:

Inputs

• Fertilisers	12,5
• Imported feed	1,5
• Others	1,0
	15,0

Outputs

• Consumed food	3,5
• Processing residues	2,0
• Losses	1,0
	6.5

Accumulation: 8,5

Soil surface balance approach:

Inputs through

• Fertilisers	12,5
• Manure	13

External sources

• Municipal wastes	3
• Meat/bone meal	2
• Other org wastes	0,5