# Diffuse loss of dissolved inorganic phosphorus – factors of influence

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## Introduction

The diffuse P load to streams partly comes from dissolved inorganic P (DIP). In sandy Danish stream catchments DIP is the dominant form.

Sandy catchments:
typically 50 % - 75 % of the total diffuse P load, 40 - 80 µg DIP/l.

Clayey catchment:
typically 30 % - 50 % of the total diffuse P load, 20 - 60 µg DIP/l.

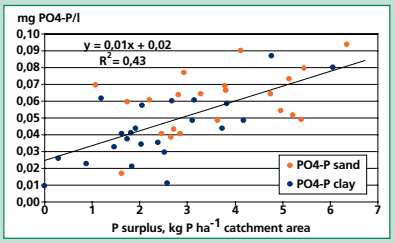
In P risk assessment it is therefore essential also to look at the factors influencing the loss of DIP. Different catchment characteristics have been estimated and related to the DIP concentration in streams. Correlations can both be used in estimating DIP loss from unmeasured catchments and they too can indicate casual relations.

## Experimental design

The measured DIP concentration (discharge weighted average concentration) in 45 Danish streams without pollution from sewage or industry is used in correlation analysis together with different catchment characteristics. The following catchment characteristics have been estimated:

- degree of agricultural landuse
- livestock density
- phosphorus surplus at field level
- soil texture in the root zone
- potential degree of tile drainage
- P adsorption capacity
- degree of peat soil
- distance between fields and streams.

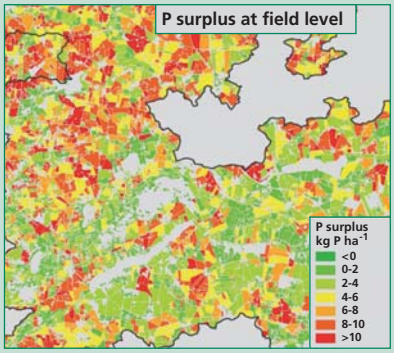
The correlations between DIP and the different catchment characteristics have been analysed in simple and multiple regression analysis.

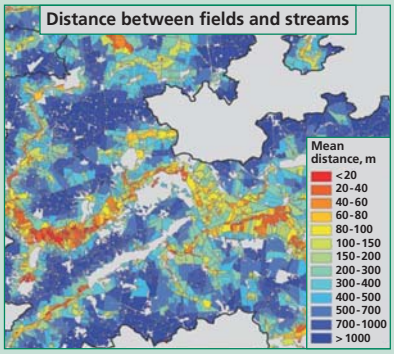


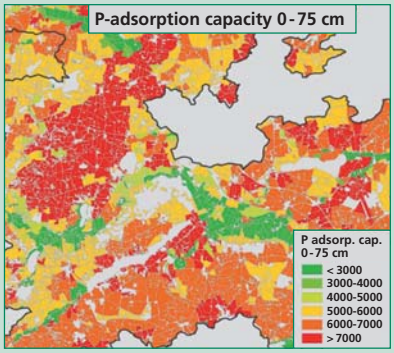

*Measured DIP concentrations in streams in relation to P surplus at catchment level.*

The correlation between DIP and the agricultural surplus could be partly indirect reflecting that catchments with a high P surplus probably also have a high P status in the soil.

However especially in clayey catchments with macropores and good hydraulic contact between the field and the stream, the stream concentration could also be more directly related to P surplus.




## Results

The concentration of DIP is most strongly correlated to the agricultural surplus of phosphorus ($r^2 = 0.43$, $p = 0.05$). Including distance between the fields and the streams in the multiple regression analysis increase the correlation coefficient to $r^2 = 0.50$ (Tabel 1).

In clayey catchments the transport pathway between field and stream is expected to be more direct due to macropores and drainage. When data from the 28 clayey catchments are analysed, P surplus is still the most important factor followed by distance between fields and streams and P adsorption capacity.

The correlation coefficient including all threse factors is $r^2 = 0.65$ (Tabel 2).

All catchments — Tabel 1

n = 45

Multiple stepwise regressions
accumulated r-values for significant parameters

Cut off value: 0.017

| | r | r² | beta | signif. beta |
|---|---|---|---|---|
| P surplus, kg P ha⁻¹ catchment area | 0.656 | 0.43 | 0.62 | 0.000001 |
| Distance between fields and stream | 0.70 | 0.50 | 0.29 | 0.024 |

Clayey catchments — Tabel 2

n = 28

Multiple stepwise regressions
accumulated r-values for significant parameters

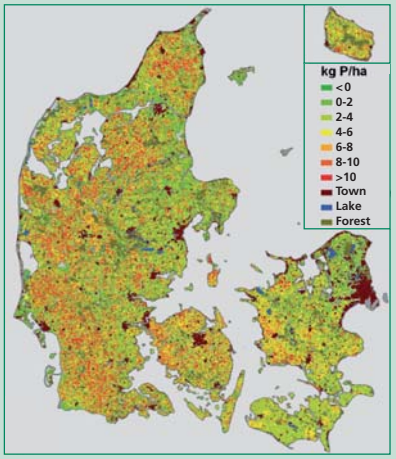
Cut off value: 0.042

| | r | r² | beta | signif. beta |
|---|---|---|---|---|
| P surplus, kg P ha⁻¹ catchment area | 0.75 | 0.57 | 0.88 | 0.000004 |
| Distance between fields and stream | 0.80 | 0.63 | 0.27 | 0.034 |
| P adsorption capacity | 0.81 | 0.65 | -0.67 | 0.047 |

## Conclusion

Concentration of DIP is strongest correlated to the P surplus in the catchments, distance between the fields and the streams also appears to be a significant but less important factor.

The results emphasize the importance of including P surplus as a factor in coming action plans to reduce the diffuse P load.




*P surplus at field level calculated from register data (50.000 farms and 800.000 fields). The highest surplus in the western part of the country reflects a higher livestock density and a more sandy soil.*

## References:

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