Spatial and temporal patterns of pesticide concentrations in streamflow, drainage and runoff in a small Swedish agricultural catchment

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Background

Diffuse losses of pesticides to surface waters often originate from small fractions of the agricultural landscape susceptible to fast flow processes, i.e. surface runoff and/or macropore flow to drains

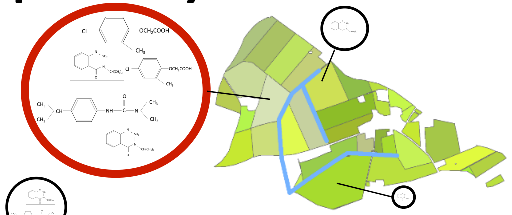
Cost-effective mitigation requires identification of the main contributing areas and understanding of the relative importance of different transport pathways

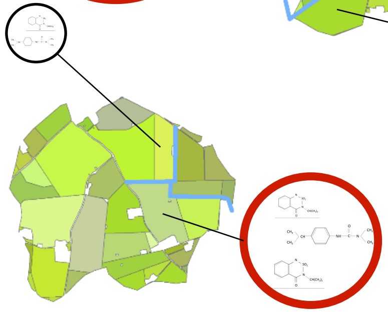
Very few studies carried out under Swedish agro-environmental conditions

Monitoring study in a small Swedish agricultural catchment:

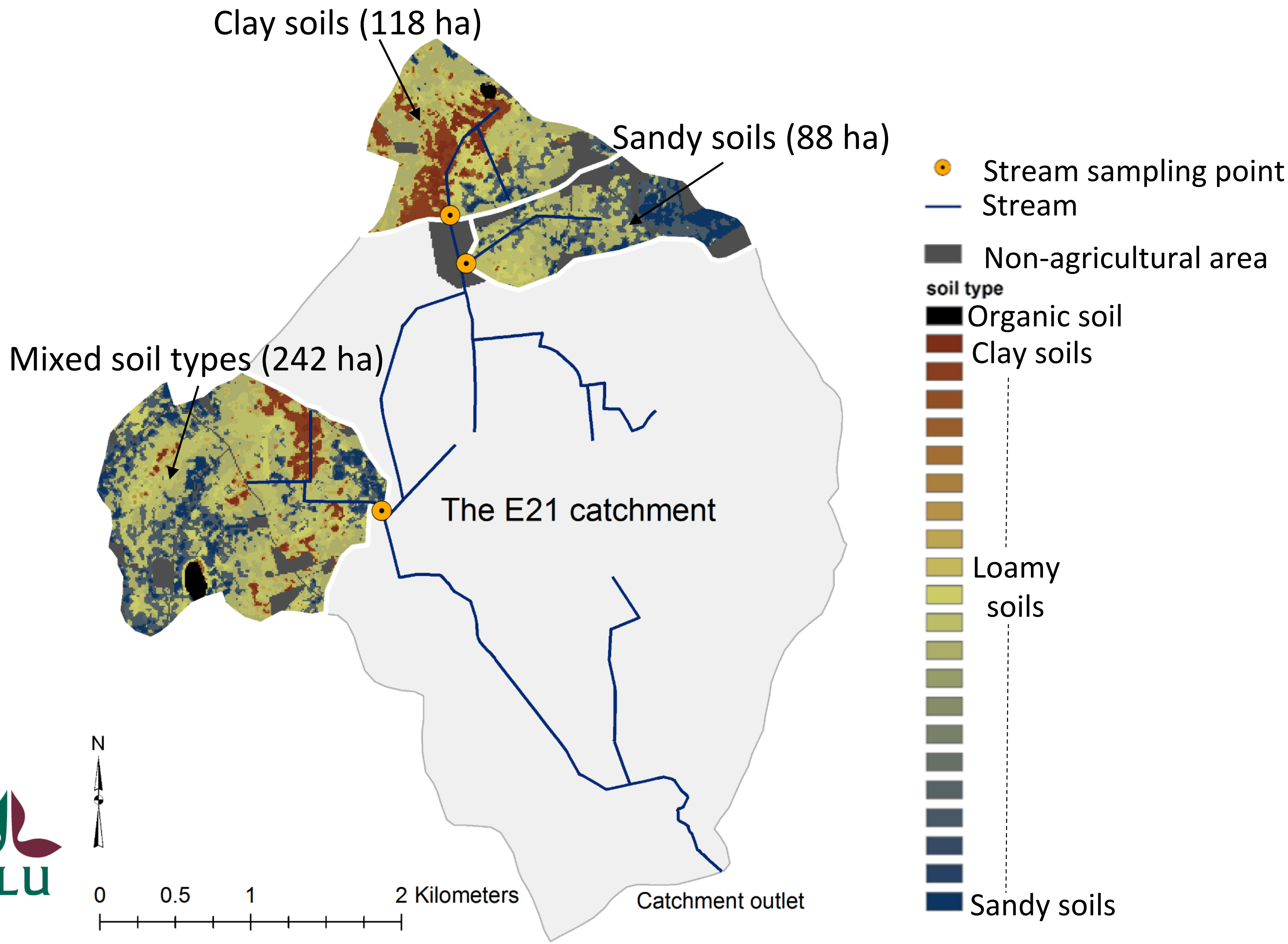
-> Can spatial variation in pesticide concentrations in streamflow be related to variations in soil texture?

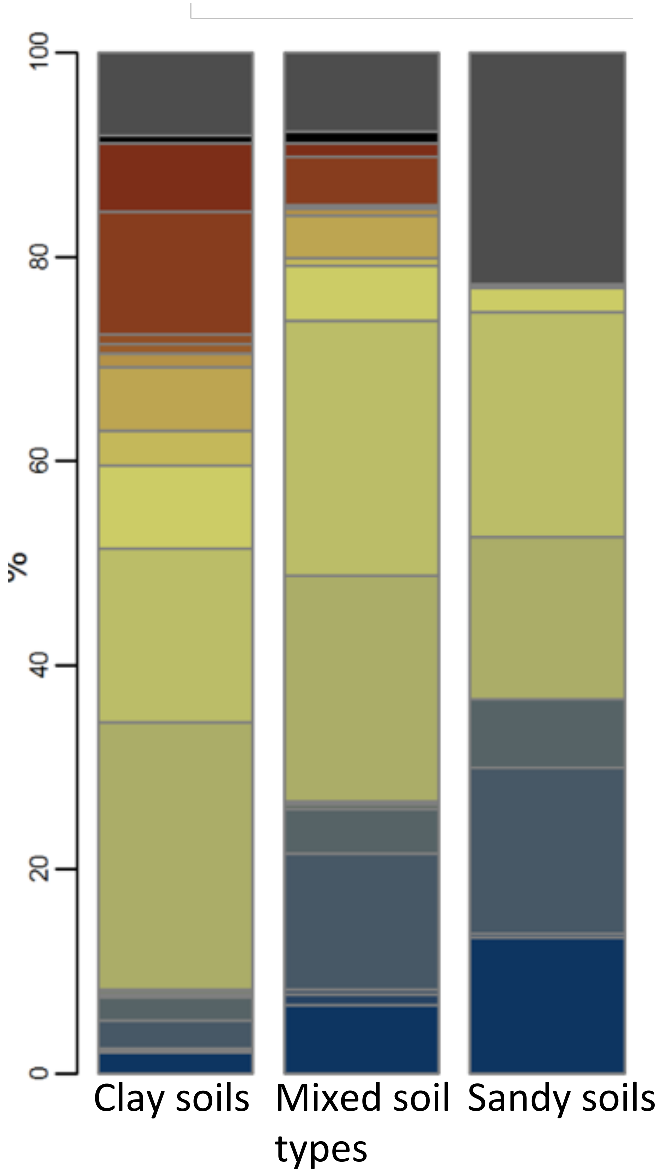
-> Relative importance of surface and subsurface transport pathways?





A small Swedish agricultural catchment with large variation in soil types





Sampling of streamflow, drainage and surface runoff

Stream

Drains

Surface runoff

- Sampling May and June 2013 – 2015
- LC-MS/MS analyses of 99 compounds
- Pesticide use data from annual farmer interviews

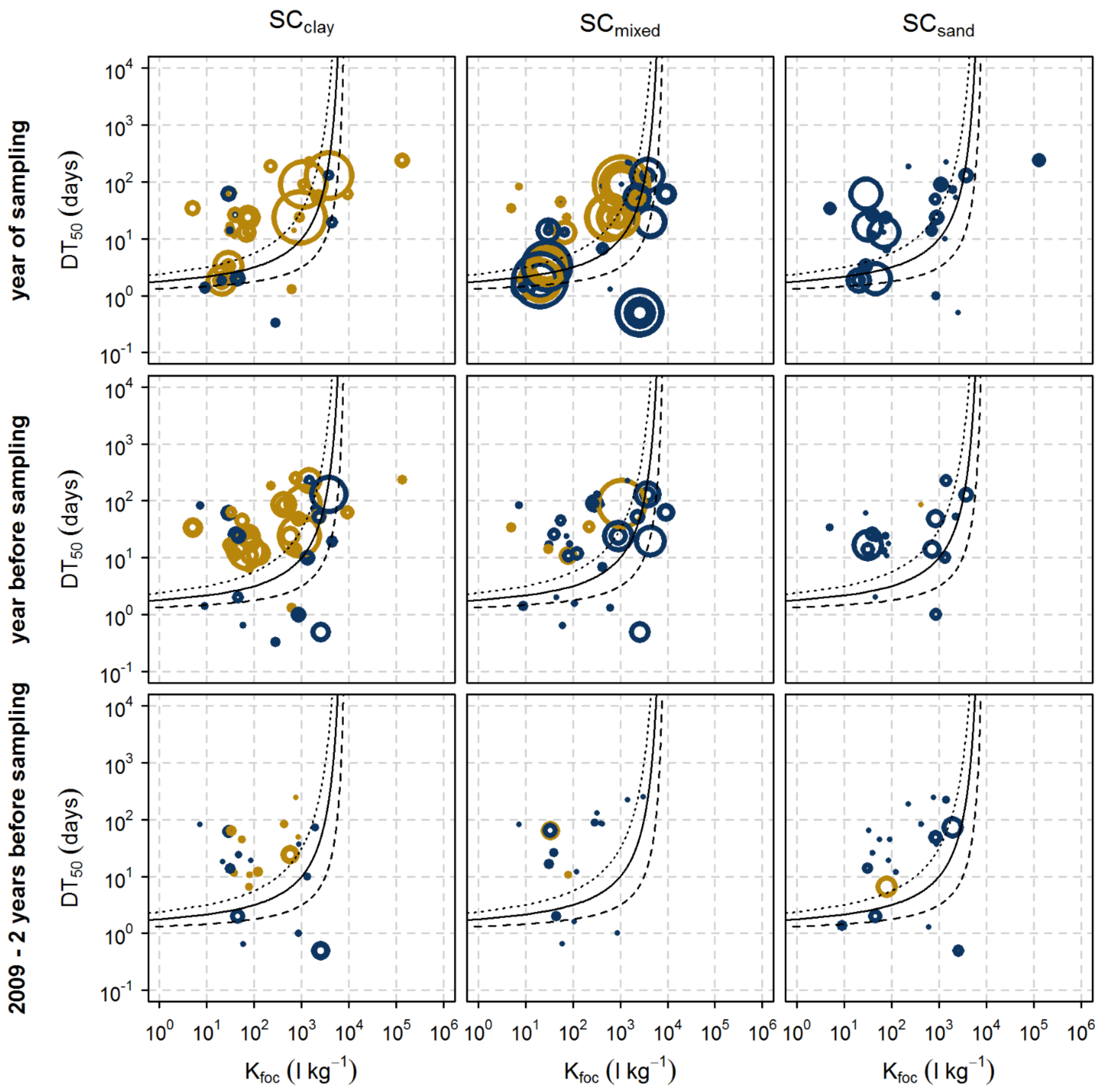
Main results: Pesticide occurrence in stream water
clay soils > mixed soil types >> sandy soils

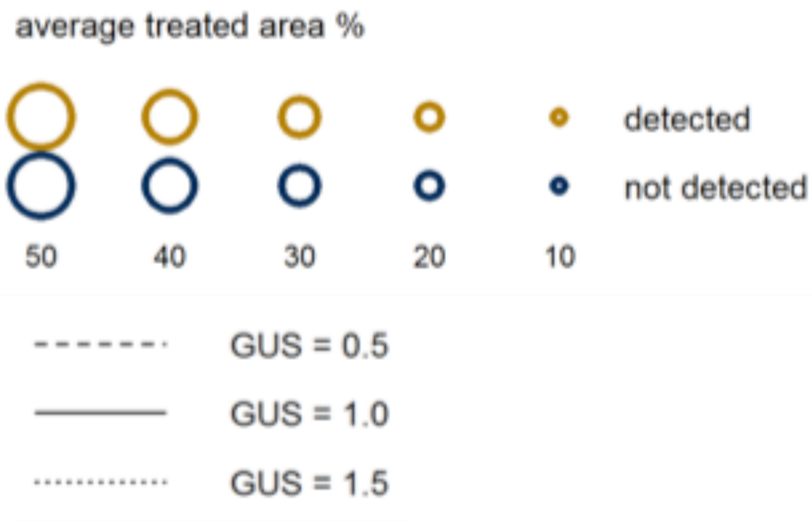
Pesticides detected in stream water

	Clay soils	Mixed soil types	Sandy soils
# compounds	30-35	9-24	1-2
Maximum concentration µg l^{-1}	0.57-55	0.10-0.88	0.002-0.003
Sum of concentrations	3.31-65.21	0.17-1.90	0.003-0.005
#compounds >WQO*	4-7	1-2	0

*Swedish national Water Quality Objectives are used to evaluate the environmental quality of surface waters

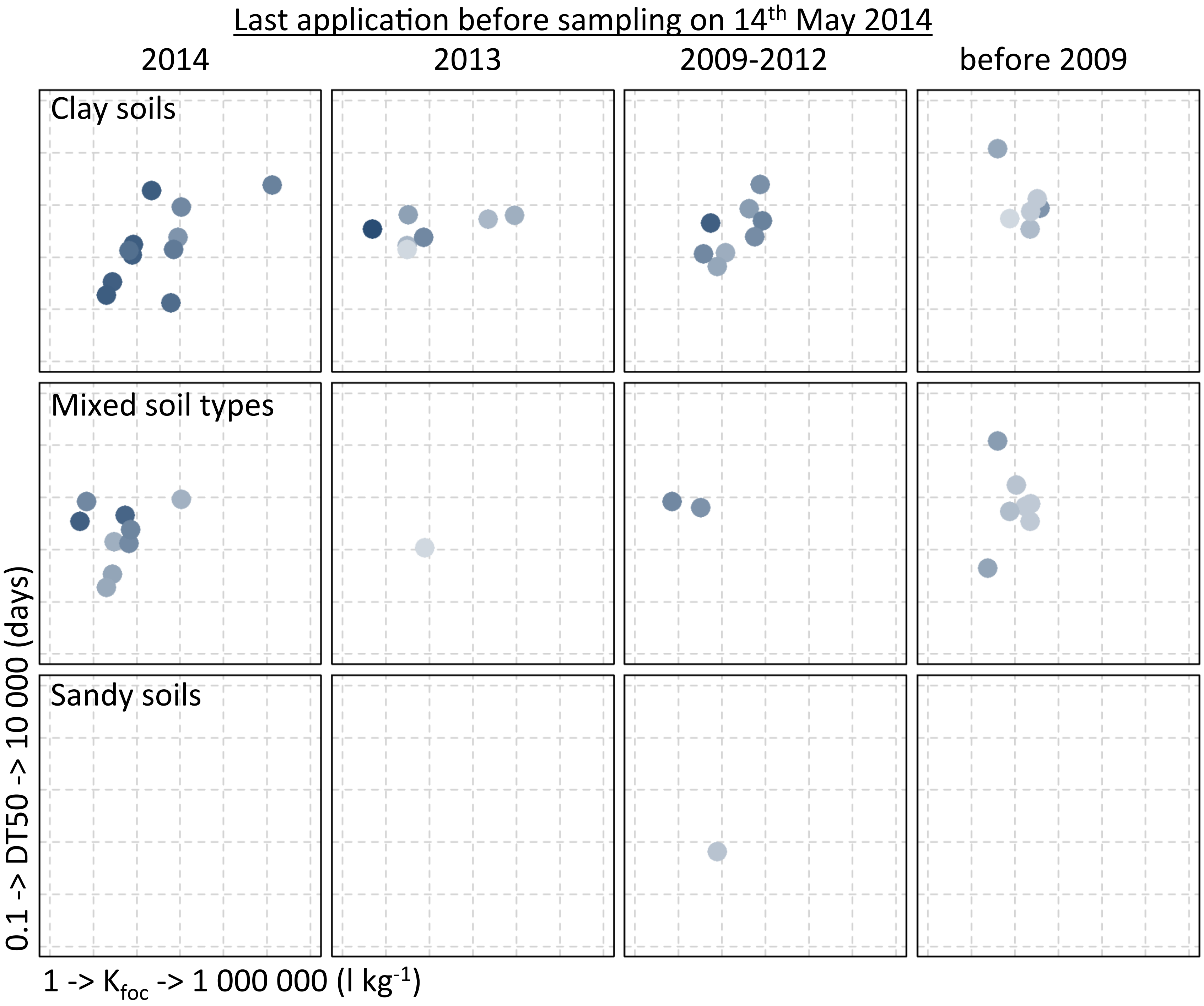
Last application:





Pesticides with GUS-index above 1.5 were more frequently detected in stream flow (i.e. pesticides in the upper left of each diagram)

Also, pesticides applied on larger areas were more frequently detected. However, especially in the clay soil area also pesticides with lower GUS-index were detected (applies also to previously applied pesticides).



Pesticide concentrations in stream flow

10 µg l^{-1} - - - - - - - - - - > 0.001 µg l^{-1}

Many detections in streamflow of compounds that had not been applied recently (44-88% and 50-100%, respectively, applied year before sampling or earlier).

The same pattern was also observed in water collected from tile drains

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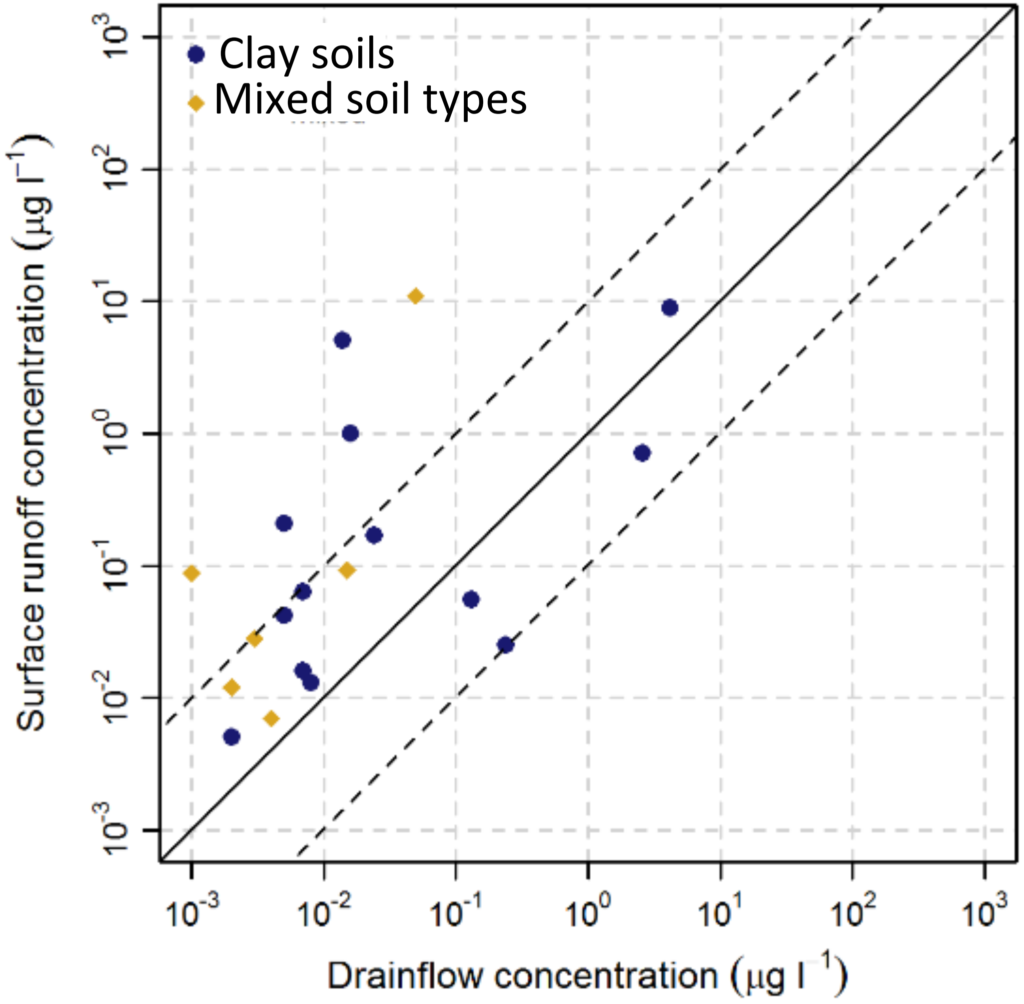

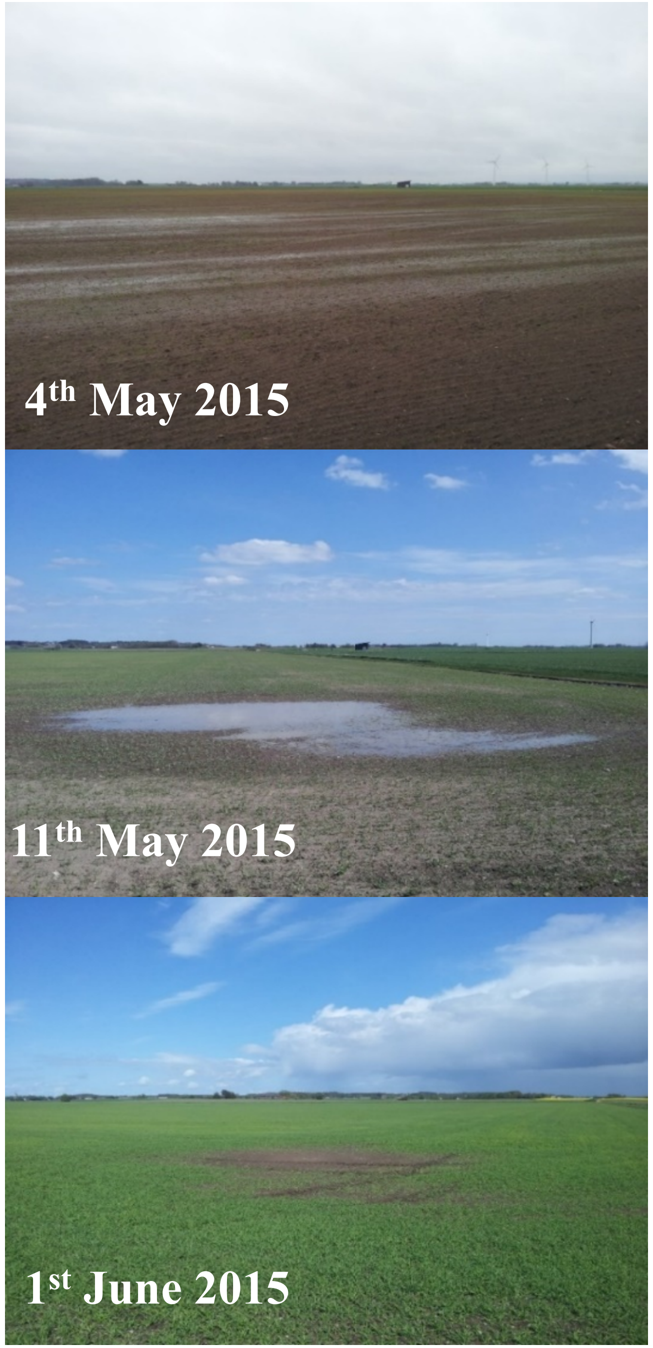

Pesticide concentrations larger in surface runoff than in drainage

Topography implies that surface runoff water did not reach the stream, but infiltrated locally (i.e. lack of surface connectivity)

Macropore flow to drains likely dominant transport pathway

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Summary and conclusions

Clay soils>Mixed soil types>>Sandy soils

Soil texture maps potentially useful tool

Transport times often long – temporary storage along pathways

Macropore flow to drains likely dominant transport pathway

Thank you for listening!

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Read more in:
Sandin et al. (2018) Spatial and temporal patterns of pesticide concentrations in streamflow, drainage and runoff in a small Swedish agricultural catchment. *Science of the Total Environment* 610-611, 623-634

Maria's thesis: Surface and subsurface transport pathways of pesticides to surface waters
https://pub.epsilon.slu.se/14474/

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