Sveriges lantbruksuniversitet
Swedish University of Agricultural Sciences

KompetensCentrum för Kemiska Bekämpningsmedel
CKB

Pesticide transport – ongoing research in Sweden

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3-4 September 2014, Ås

Ongoing research in Sweden
- an incomplete list of projects

- Pesticide transport to shallow and deep groundwater, Maria Åkesson, Charlotte Sparrenbom (Lund University):
- Retention of pesticides in biochar amended soil, Harald Cederlund (SLU)
- Pesticide processes in railway embankments, Harald Cederlund (SLU)
- Reducing pesticide leaching from arable land using biochar traps, John Stenström, Lars Bergström (SLU)
- Methods to limit pesticide leaching from green houses, Klara Löfkvist (JTI), Lars Bergström, John Stenström (SLU)

- **Centre for chemical pesticides (CKB)/SLU**
  - Surface runoff field experiments
  - Identifying and quantifying loss pathways of pesticides to surface water
  - Controls of macropore network characteristics on preferential solute transport

1. Surface runoff field experiments

Background

- FOCUS scenario R1 likely overestimates the risk for pesticide runoff and erosion losses for Sweden
- Data on runoff and erosion in Sweden are very limited

Objectives

- Determine conditions that lead to pesticide losses in surface runoff
- Collect data for model evaluation

1. Surface runoff field experiments

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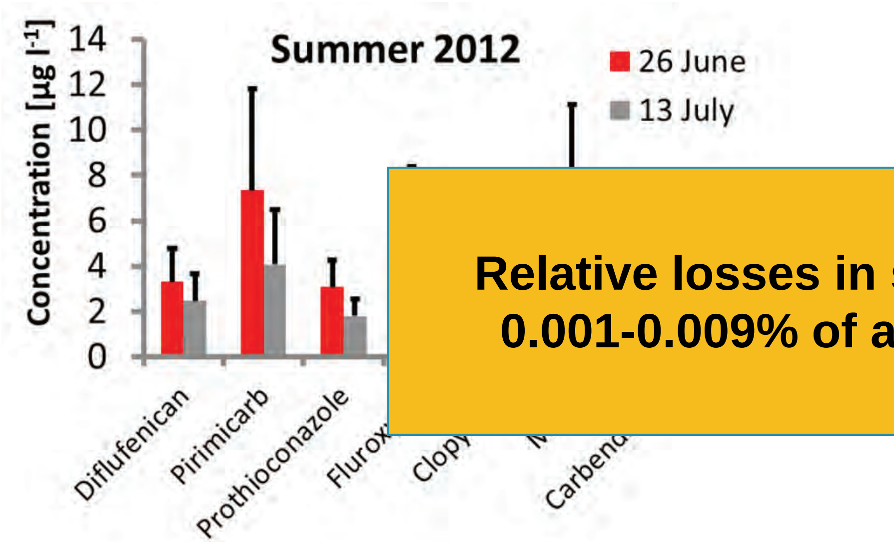
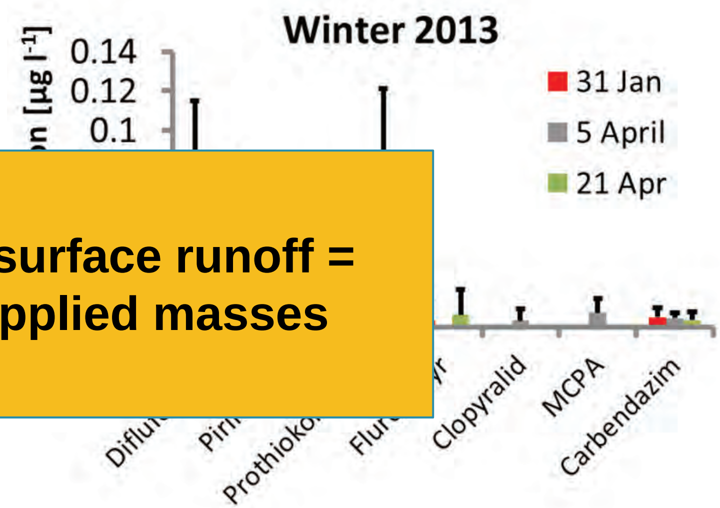
<u>Experimental field site established in 2011 outside Uppsala</u>

- 1% slope
- 32% clay, 33% silt, 35% sand
- 12 drained plots with collection gutters
- Automatic flow proportional sampling
- 2012: Spring pesticide application
- 2013: Spring pesticide application, autumn glyphosate application
- 2014: Spring pesticide application, autumn glyphosate application

1. Surface runoff field experiments

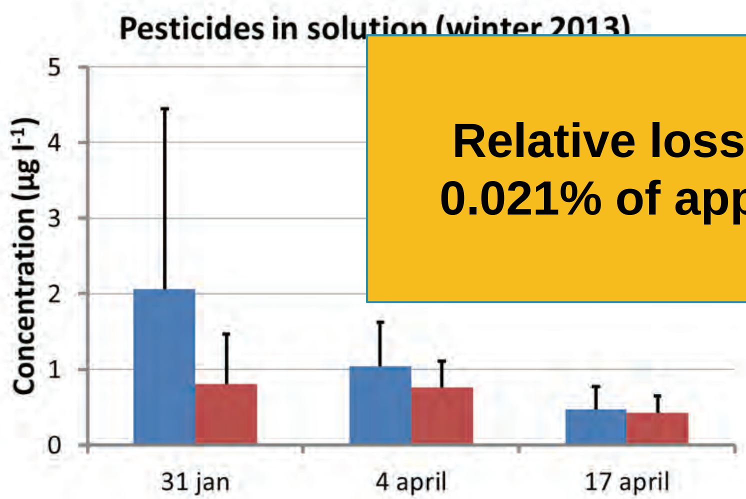
Spring applied pesticides

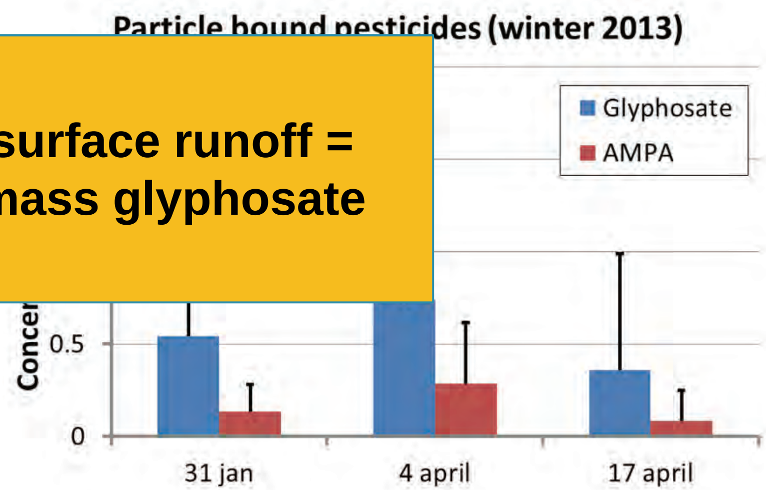




Relative losses in surface runoff = 0.001-0.009% of applied masses

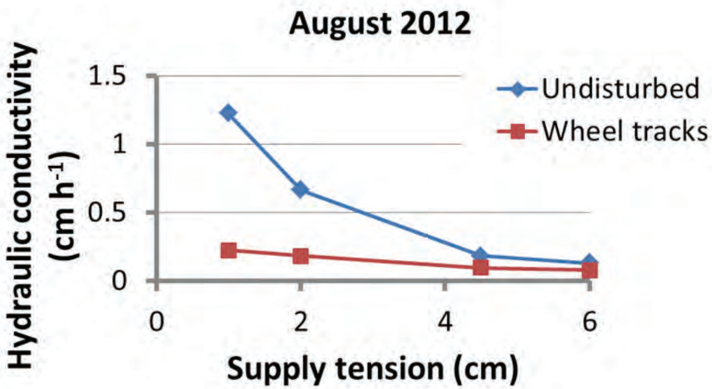
Autumn applied glyphosate

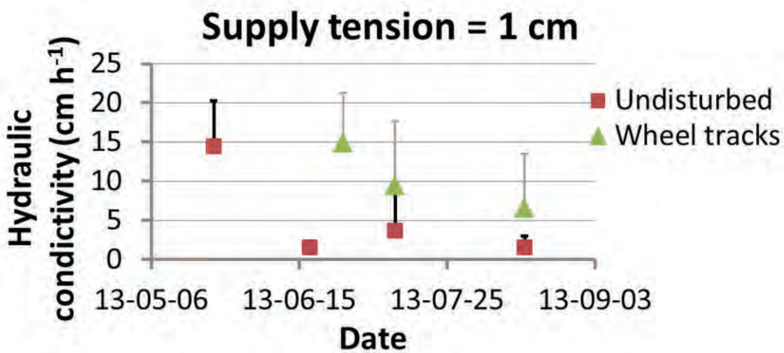


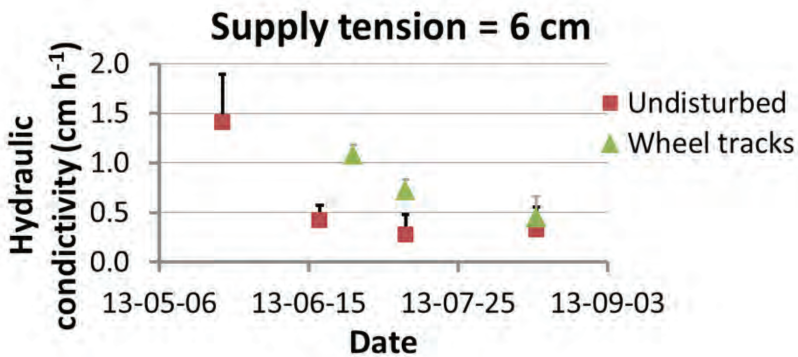


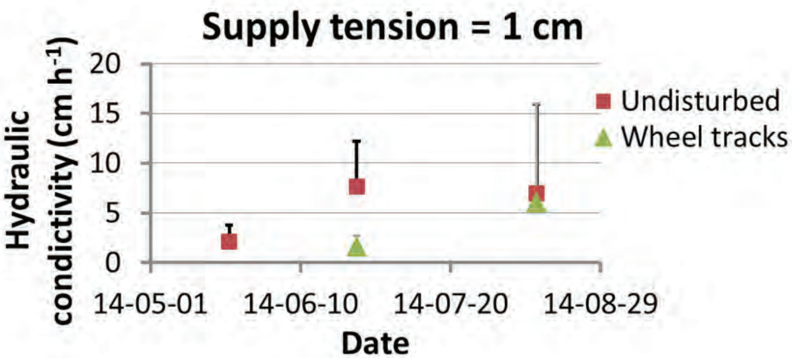
Relative losses in surface runoff = 0.021% of applied mass glyphosate

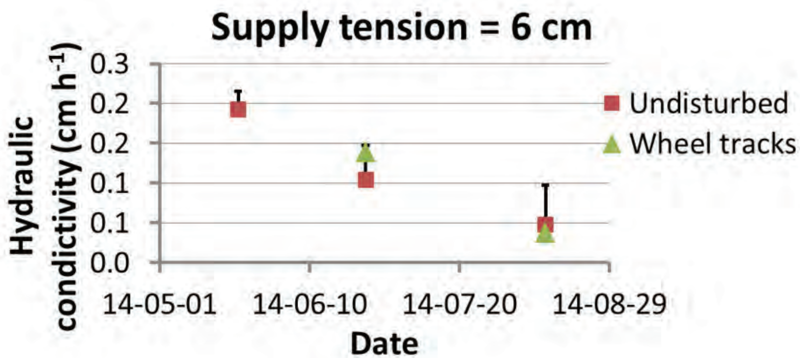
1. Surface runoff field experiments











2. Identifying and quantifying loss pathways of pesticides to surface water

Objectives

- Identify and quantify the contribution of different pesticide loss pathways in a small agricultural catchment
- Collect data for model validation

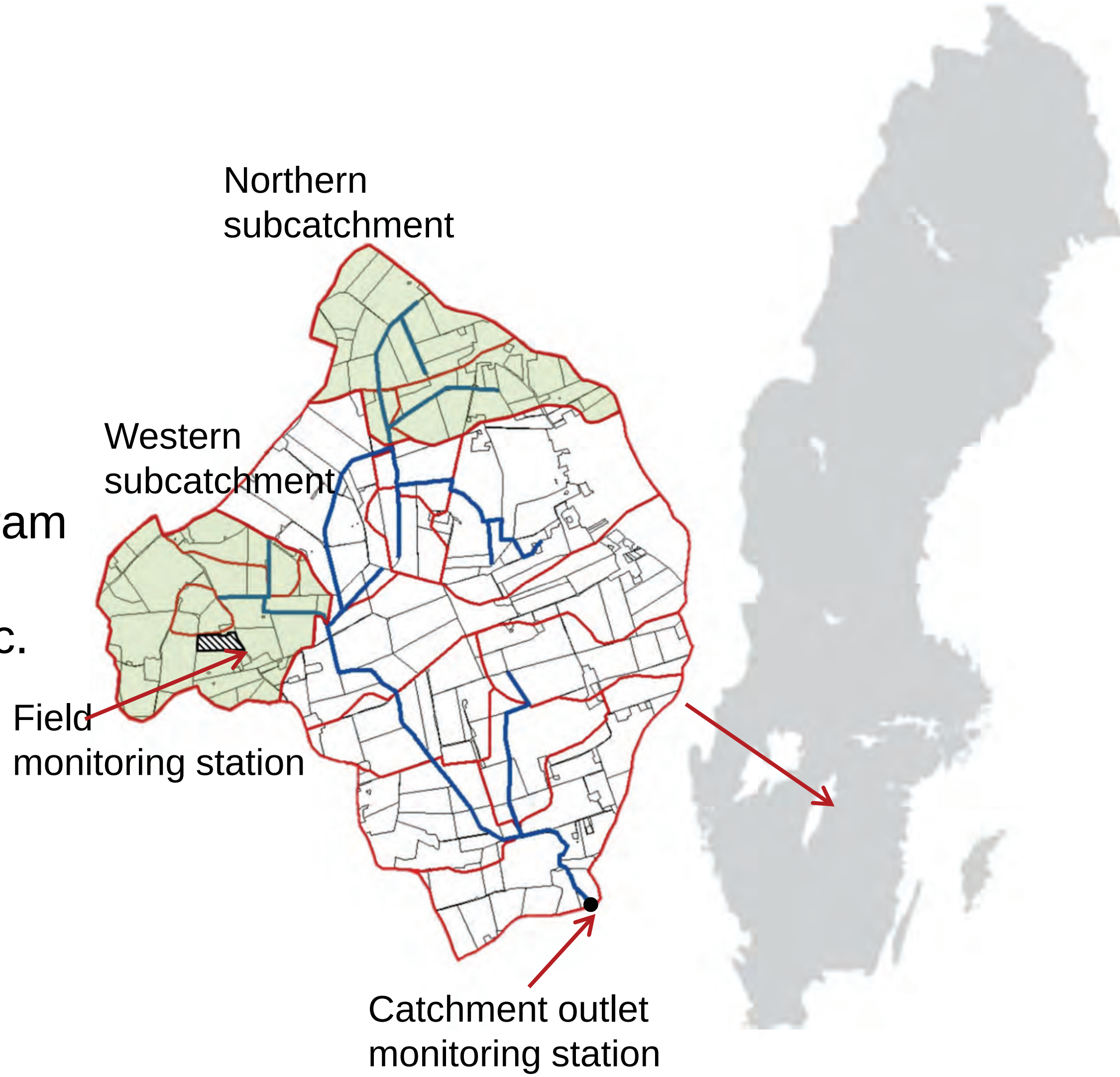
2. Identifying and quantifying loss pathways of pesticides to surface water

Catchment E21

- Large variation in soil types
- Large variation in crops grown
- Large variation in pesticide use

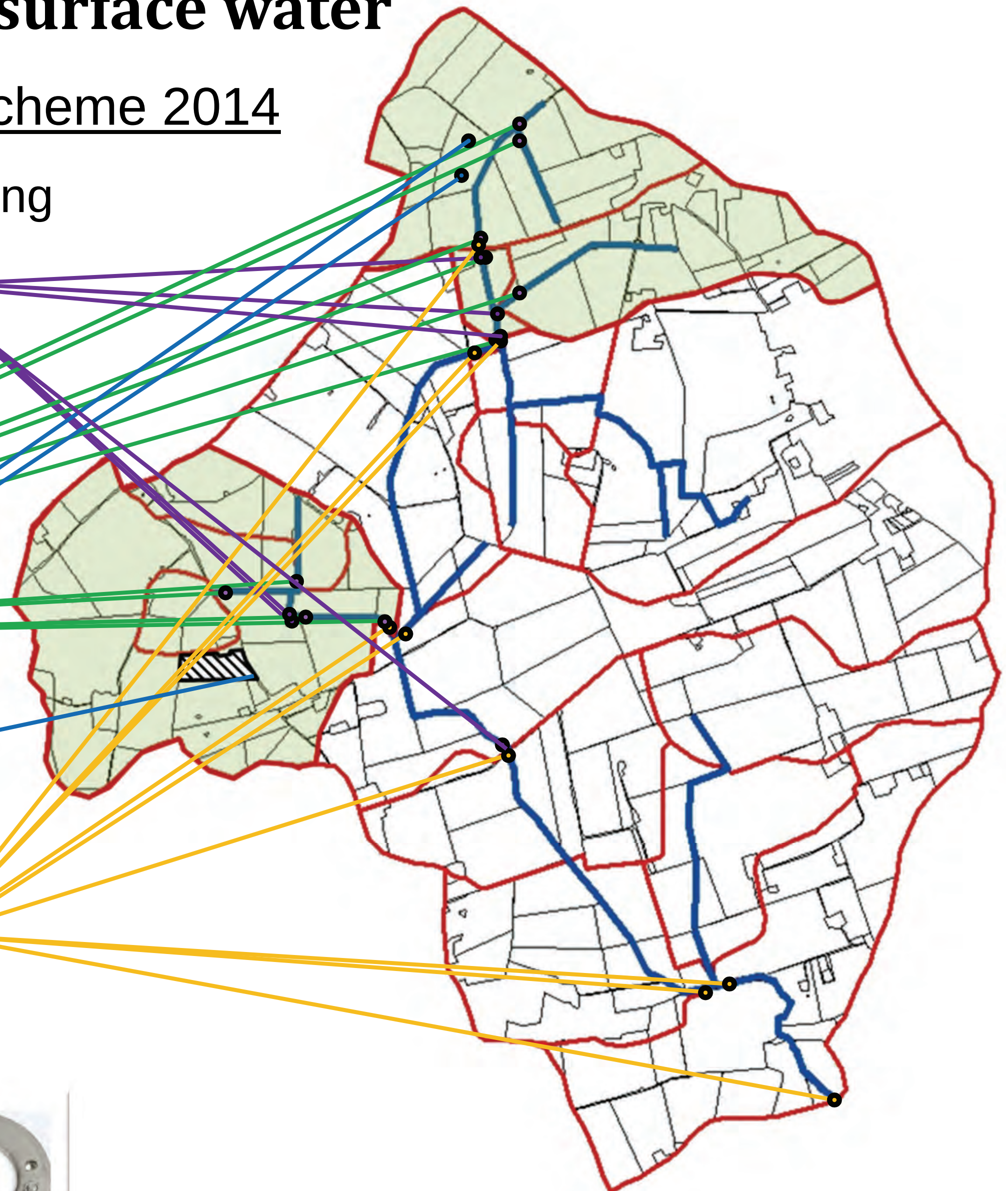
- Mainly open watercourses

- Part of national monitoring program
  - Available data on crops, management, pesticide use etc.
  - More than 10 years of measured pesticide concentrations from the catchment outlet



2. Identifying and quantifying loss pathways of pesticides to surface water

Sampling scheme 2014

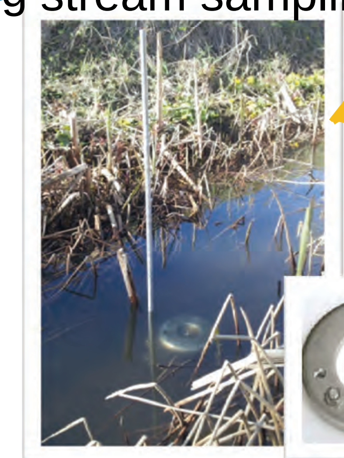


Drainflow sampling

Passive ”event-driven” stream sampling

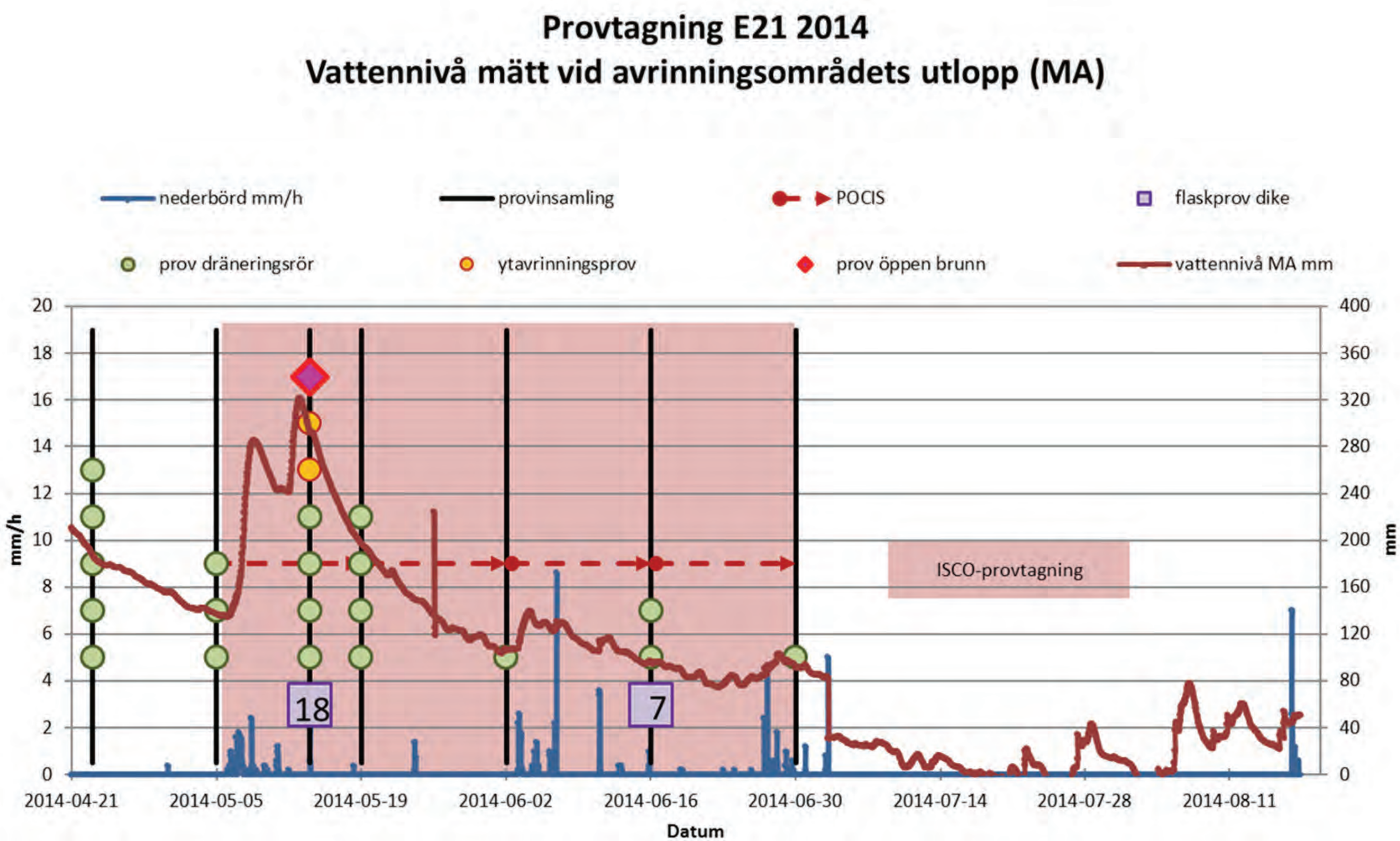
Surface runoff sampling

Passive (POCIS) stream sampling



2. Identifying and quantifying loss pathways of pesticides to surface water

2013: A few samples collected from a single precipitation event due to dry summer. Chemical analyses completed
2014: A large number of samples collected and awaiting chemical analyses
2015: Sampling campaign repeated



3. Controls of macropore network characteristics on preferential solute transport

Objective

- Determine which properties of the macropore system that control the degree of preferential transport in soil under near-saturated conditions

3. Controls of macropore network characteristics on preferential solute transport

Methods

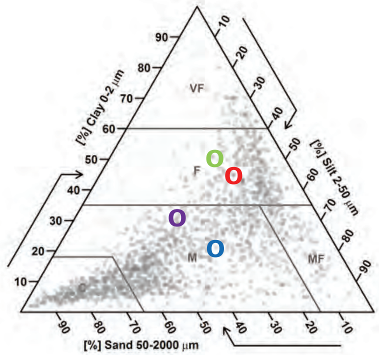
5 replicate undisturbed topsoil columns (≈18 cm high, 20 cm diameter) from 4 sites in the Uppsala region (Sweden)

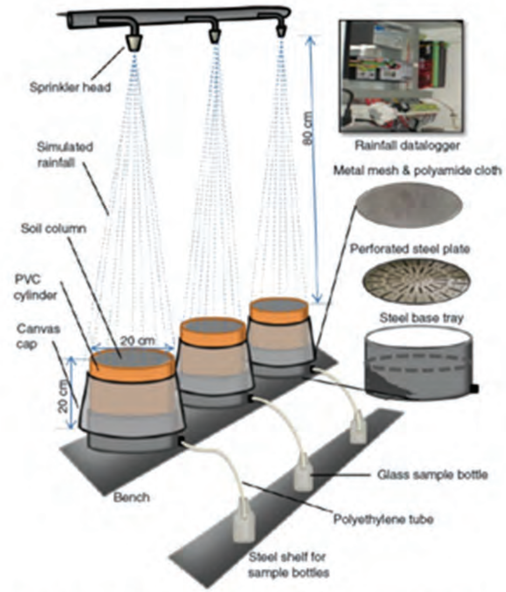
Säby 1 (loam) o

Säby 2 (clay) o

Ultuna (clay) o

Krusenberg (clay loam) o





From Liu et al. 2012. Soil Use & Management

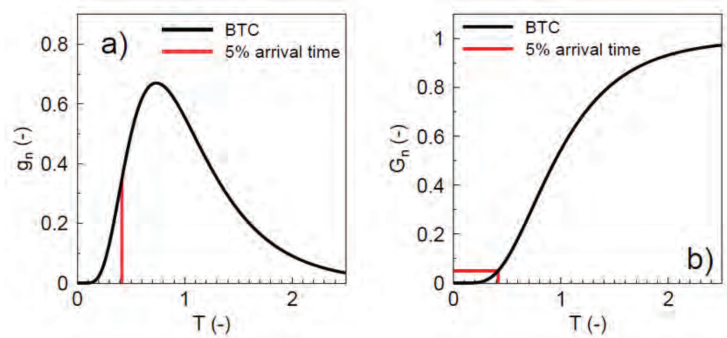
Constant irrigation non-reactive tracer experiments at 5 irrigation rates (2, 4, 6, 8 and 12 mm h^{-1})

The electrical conductivity was logged with 1-5 minute resolution

Measures of preferential transport

5% arrival time

Small arrival time → High degree of preferential transport



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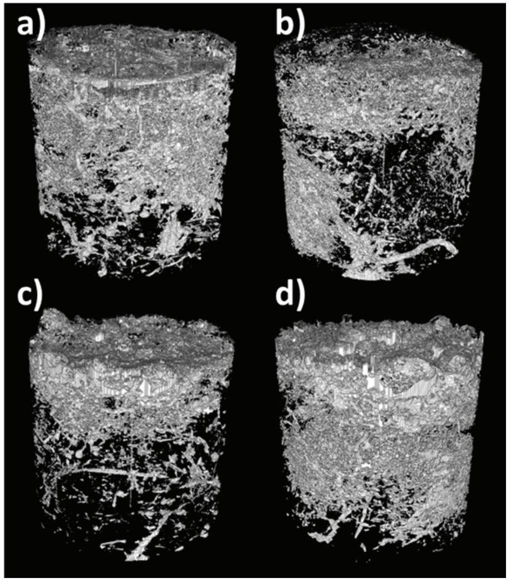
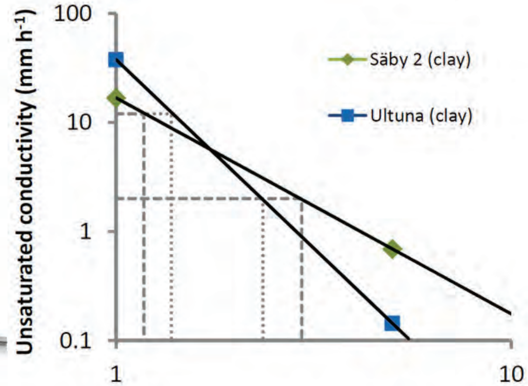
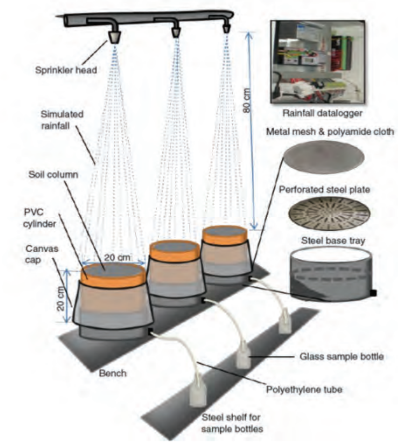


X-ray tomography

Measures of the macropore network



Largest water-filled pore during transport



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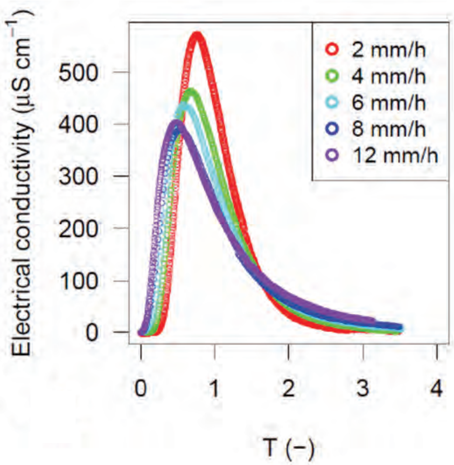
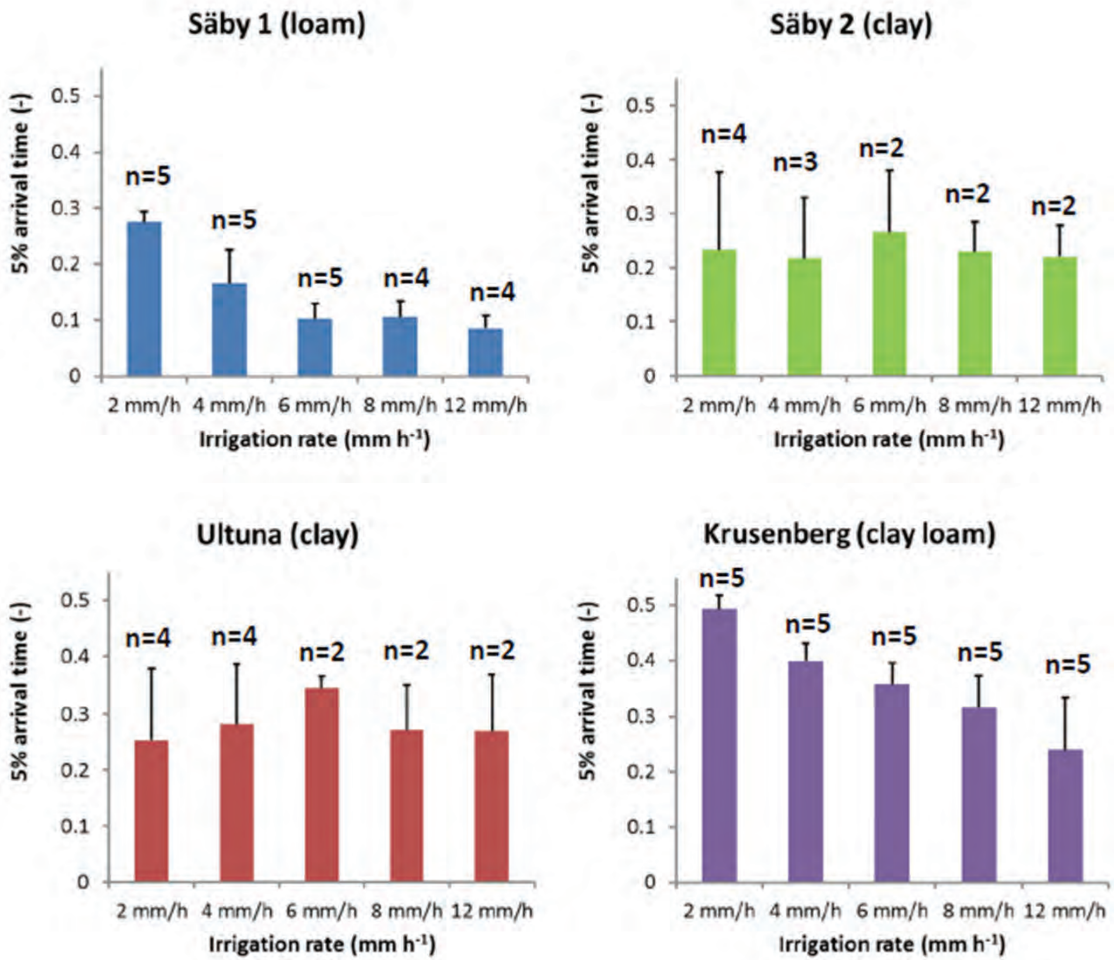


Measures of the degree of preferential transport

3. Controls of macropore network characteristics on preferential solute transport

Results

Transport behaviour of the soils



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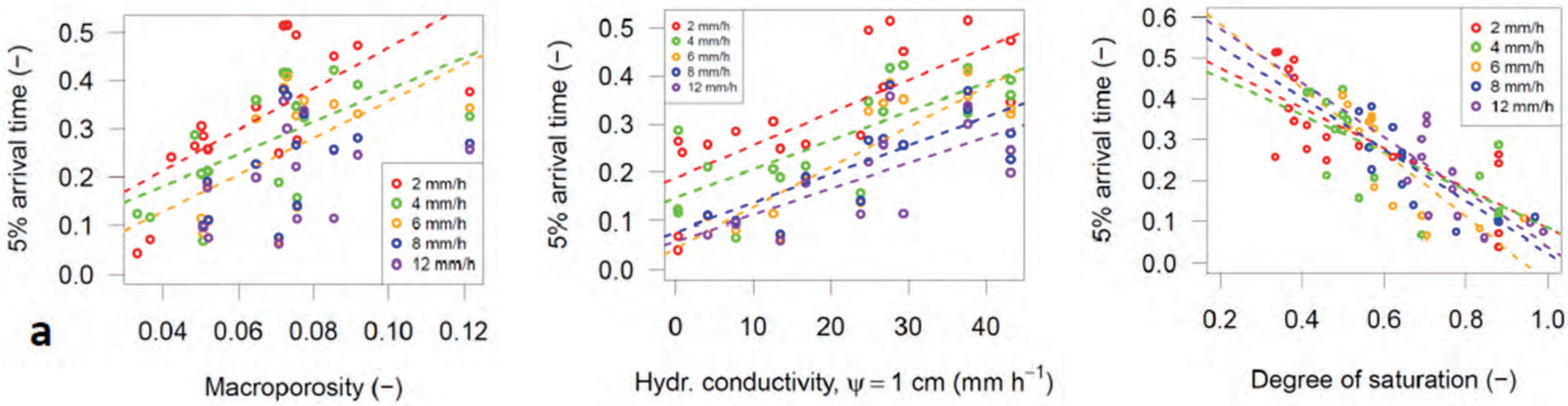

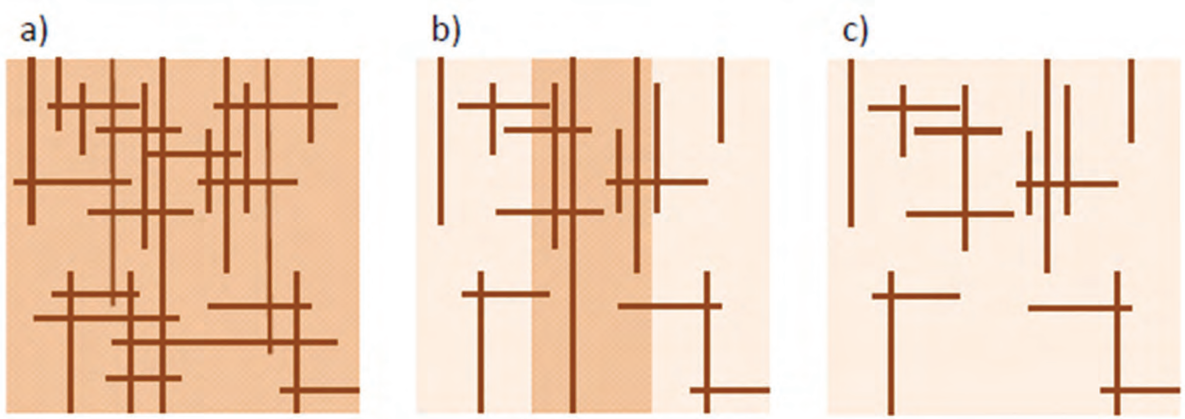

Larsbo et al., 2014, Controls of macropore network characteristics on preferential solute transport, HESSD, 11, 9551-9588

Thank you!

Financed by:

The Royal Swedish Academy of Agriculture and Forestry

Centre for Chemical Pesticides at SLU

Swedish Board of Agriculture

Swedish Farmers´Foundation for Agricultural Research