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Surface runoff of pesticides in Sweden

– risk assessment and mitigation

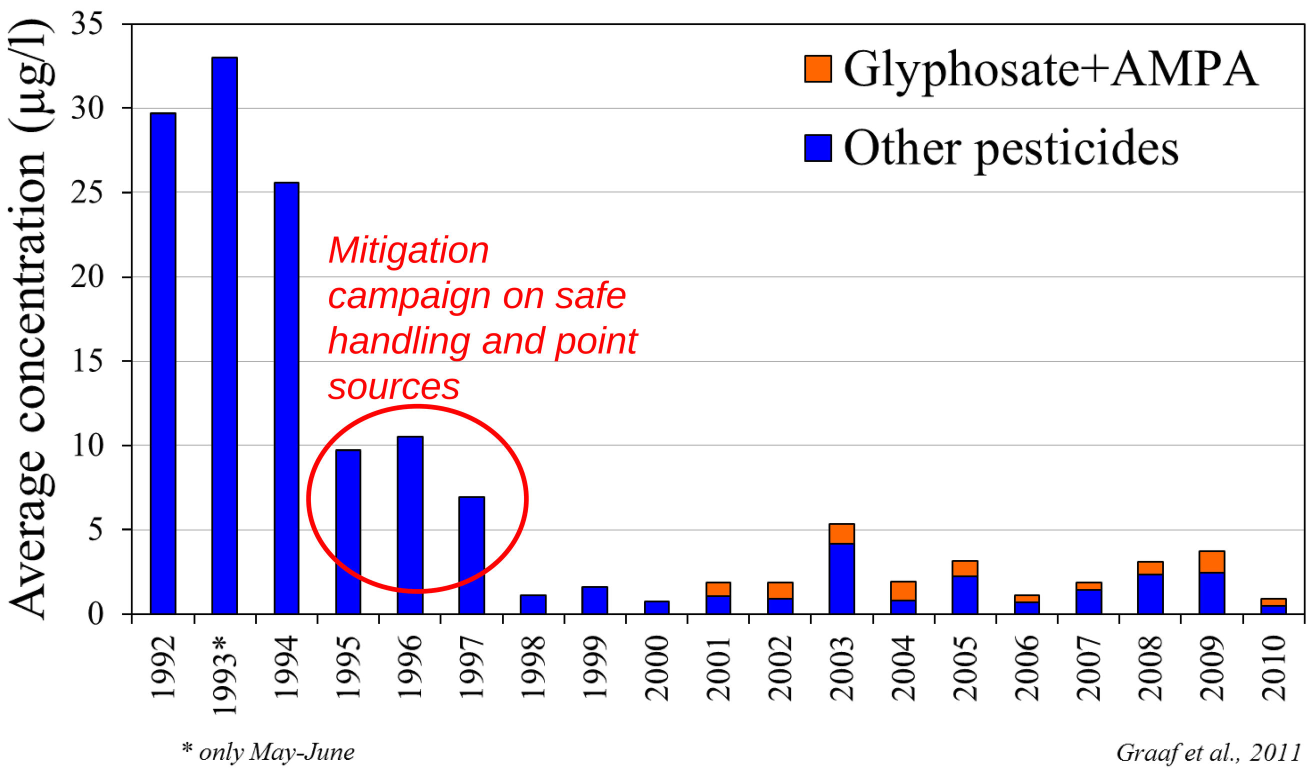

***Figure 1.** Changes in seasonal (May-September) average total pesticide concentration in a farm creek in Skåne (Southern Sweden) during 18 years of environmental monitoring.*

Aims

A knowledge compilation to determine:

- Importance of surface runoff of pesticides in Sweden
- Relevance of FOCUS R1 scenario for Sweden
- Possible mitigation strategies for Sweden

Photo: Nicholas Jarvis *Photo: Örjan Folkesson* *Photos: Kristin Boye*

*Observations of surface runoff in Sweden during the growing season are commonly associated with tramlines and soil compaction from machinery (**two upper left photos**). Most of the runoff occurs during the snowmelt, when buffer strips are ineffective (**lower left and middle**). The connectivity of water pathways in the landscape is important to consider. In Sweden large parts of the arable land is artificially drained and ditches and drainage wells are probably important pathways for pesticide transportation (**two upper right photos and lower right photo**).*

All lower photos: Örjan Folkesson

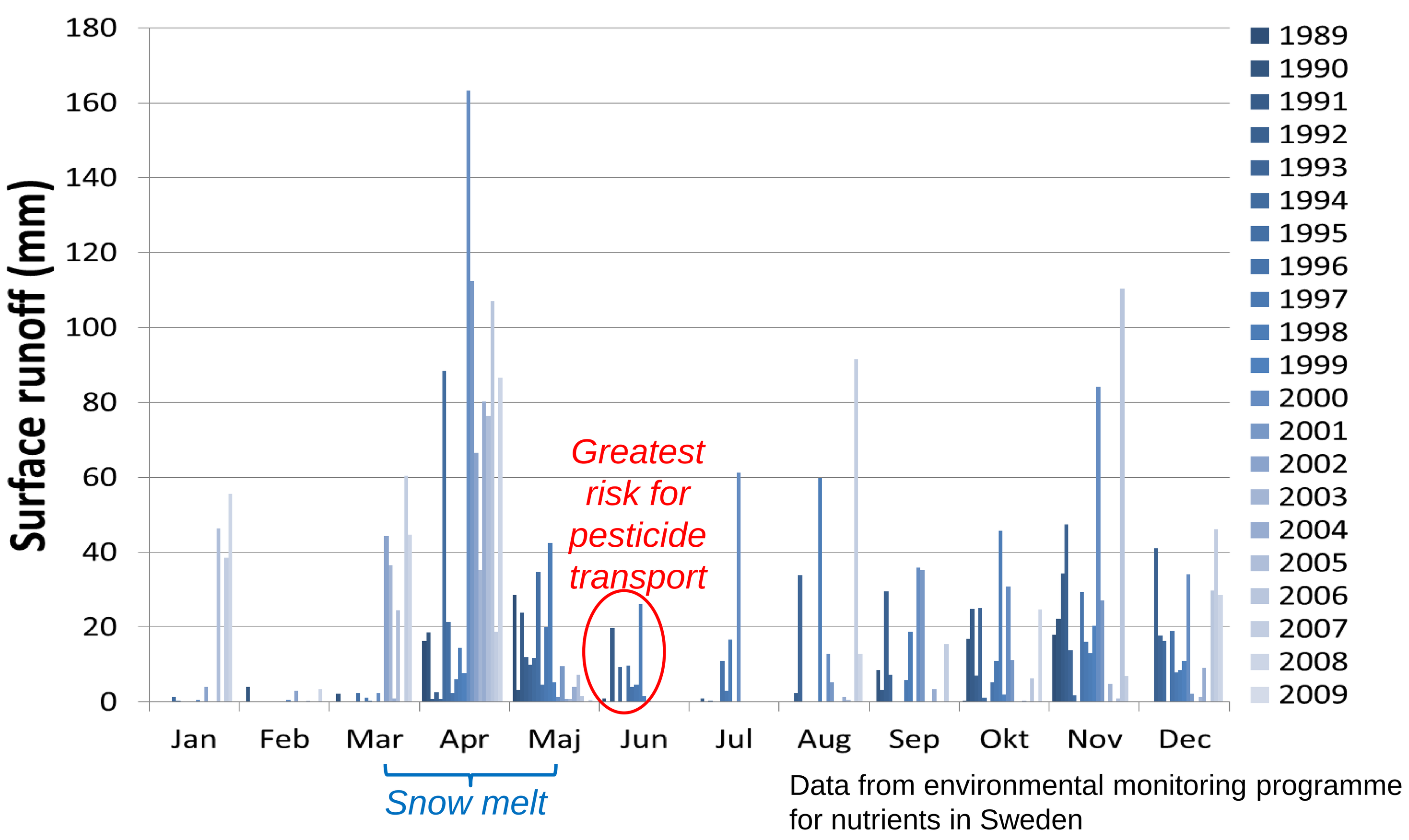

***Figure 3.** Surface runoff from an arable field in Västerbotten (northern Sweden) measured in a ditch (green cross in figure 2). Pesticide application is most intense in June, when runoff on average occurs every 3 years (7 of 21 years), although 78% of the total runoff in June occurred during two years (1991 and 1998).*

Background

- Pesticides are commonly found in Swedish surface waters (Figure 1)
- Mitigation aimed at safe handling of pesticides during the 1990s reduced concentrations (Figure 1)
- Diffuse sources are on the agenda for legislation, support systems and risk assessment for product registration
- Contribution from surface runoff and potential effect of mitigation measures is currently unknown

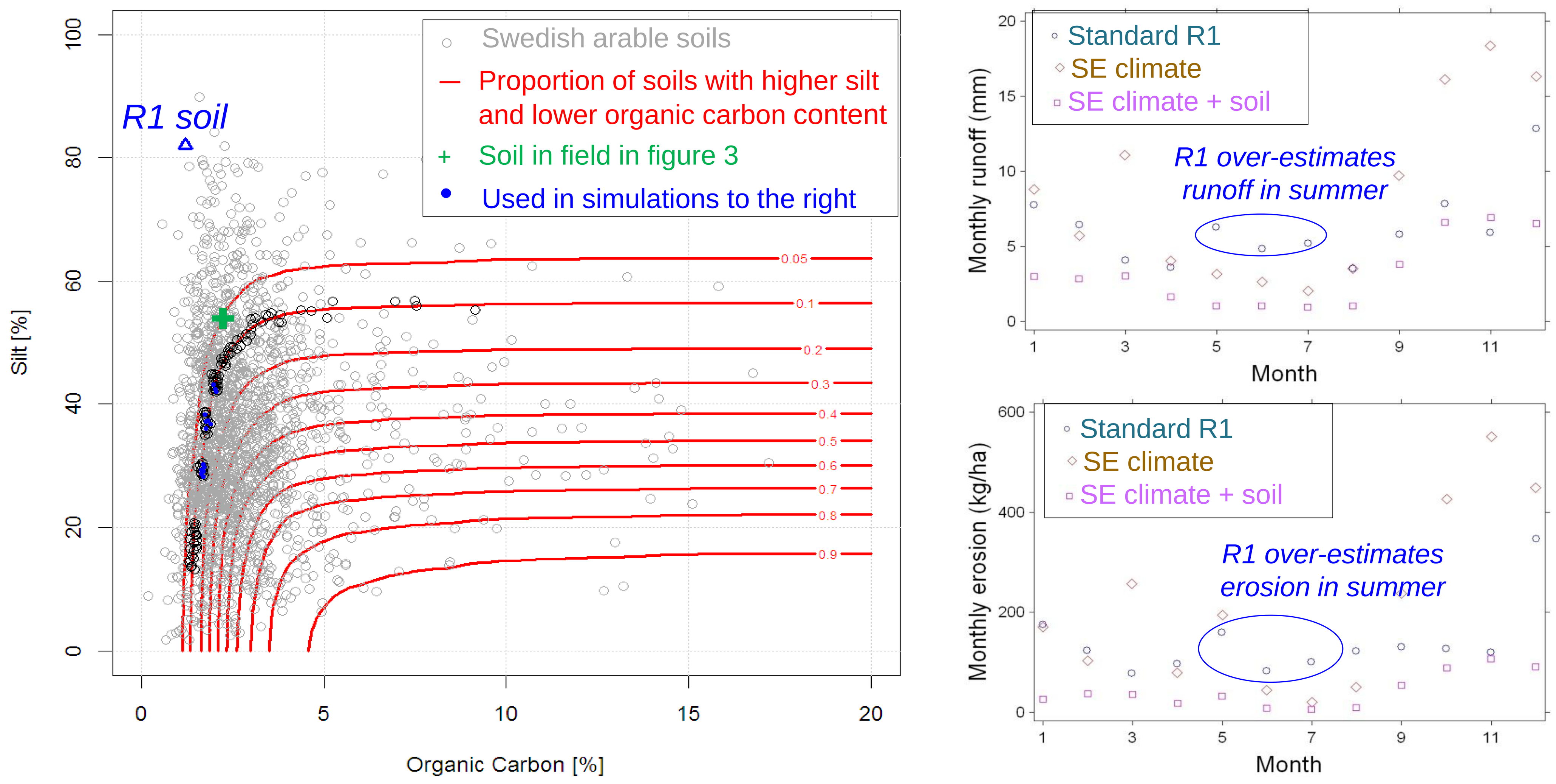

***Figure 2.** Relevance of FOCUS R1 scenario for Swedish conditions.*

***Left:** Silt (S) and organic carbon content (OC) in Swedish arable soils (grey circles) and the R1 soil (blue triangle) show that no soil sample in our database has both a higher S and a lower OC than the R1 soil (from SW Germany), two properties strongly influencing the risk of surface runoff. The red lines represent equal-probabilities, defined as the fraction of samples in our database that both exceed S and do not exceed OC, for each point on the lines. The green cross represents the soil in the field in figure 3. The soil used in the simulations shown to the right is one of the blue points on the 90th percentile.*
***Right:** PRZM-in-FOCUS simulations of runoff (top) and erosion (bottom) with original R1 data (circles), R1 with Swedish worst-case weather data (diamonds) and R1 with Swedish weather and soil data (the soil represented by the green cross in the figure on the left).*
Stefan Reichenberger (FOOTWAYS, Orléans, France) is gratefully acknowledged for performing these PRZM simulations.

Conclusions

- There is very limited data on surface runoff in Sweden (none on pesticides)
- FOCUS R1 scenario over-estimates risks for Sweden (Figure 2)
- Surface runoff is deemed a locally important transport route for pesticides (Figure 3)
- Suggested possible strategies:
  - Identification of risk areas through GIS-based modeling
  - Locally adapted mitigation measures
  - Developing a Swedish scenario for product risk assessment
- Research should focus on
  - Identifying main transport pathways for pesticides and the most important controlling factors
  - Monitoring effects of mitigation measures in real situations
  - Development of modeling tools for risk assessment and mitigation

References

- Graaf, S., Adielsson, S., Kreuger, J. (2011) *Ekohydrologi 128* (Annual report from environmental monitoring programme on pesticides in Sweden)
- http://jordbruksvatten.slu.se (data from environmental monitoring of nutrients and pesticides in surface waters in Sweden)
- http://www.slu.se/ckb (Centre for Chemical Pesticides, Sweden)