

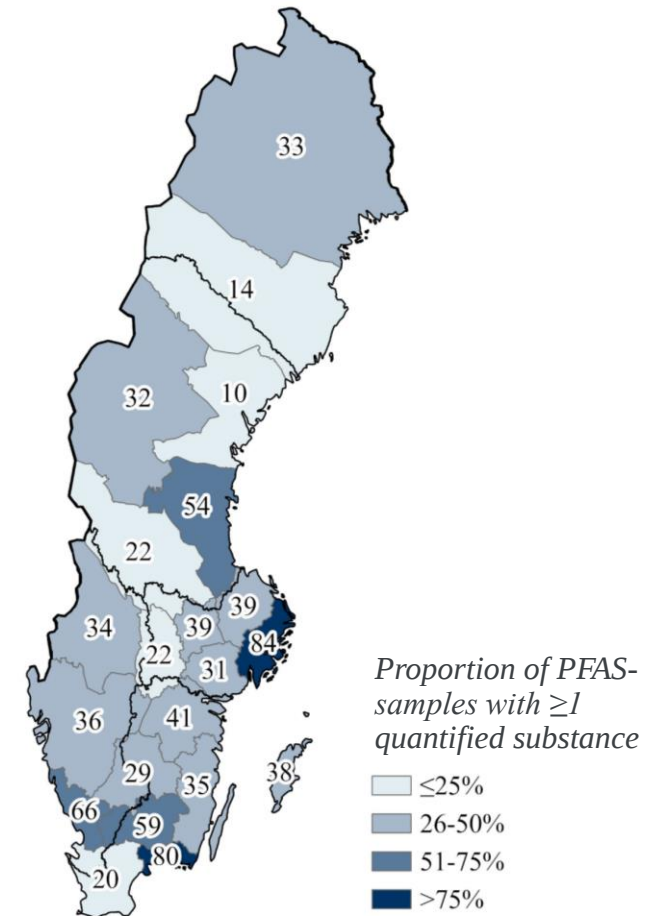
Diffuse PFAS-pollution of Swedish groundwater and the case of TFA

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Background

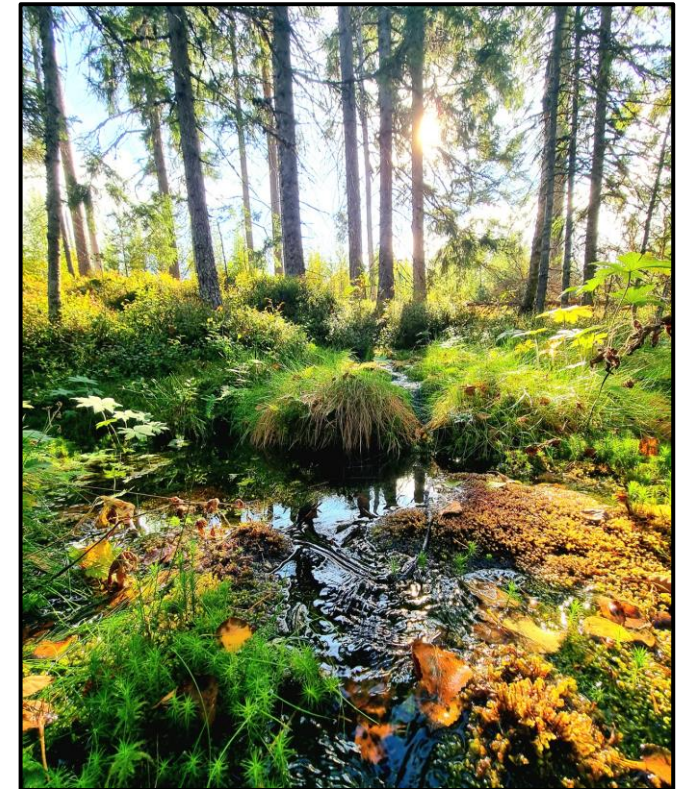
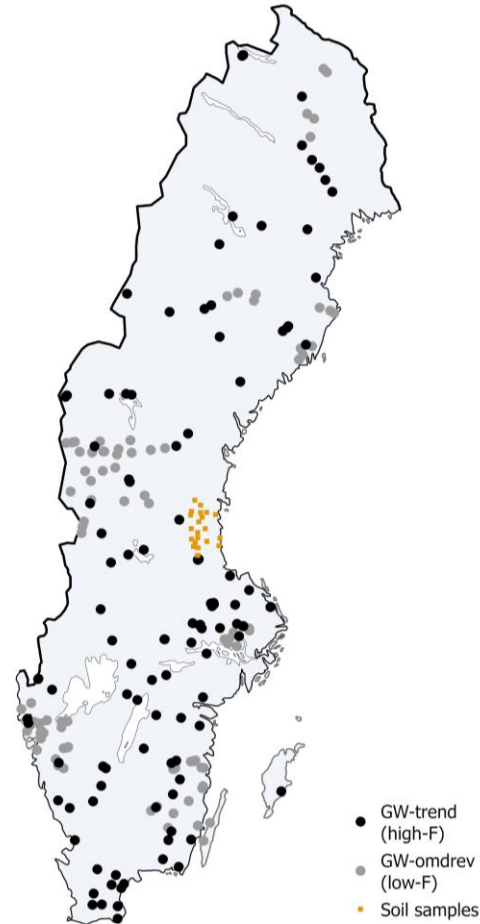
- PFAS primary concern with regards to chemical groundwater status and drinking water suitability in SE
- Signs of deficient agreement with WFD-risk assessment
- Scientific literature indicating potential for diffuse pollution
- National effort for *Strengthened coordination and guidance on PFAS-contaminated areas (SEPA//NV)*
- SGU allocated 8M SEK/yr 2023-202X to investigate ambient levels of PFAS in soil and groundwater



Ambient levels of PFAS in SE soil and groundwater

Scope 2023

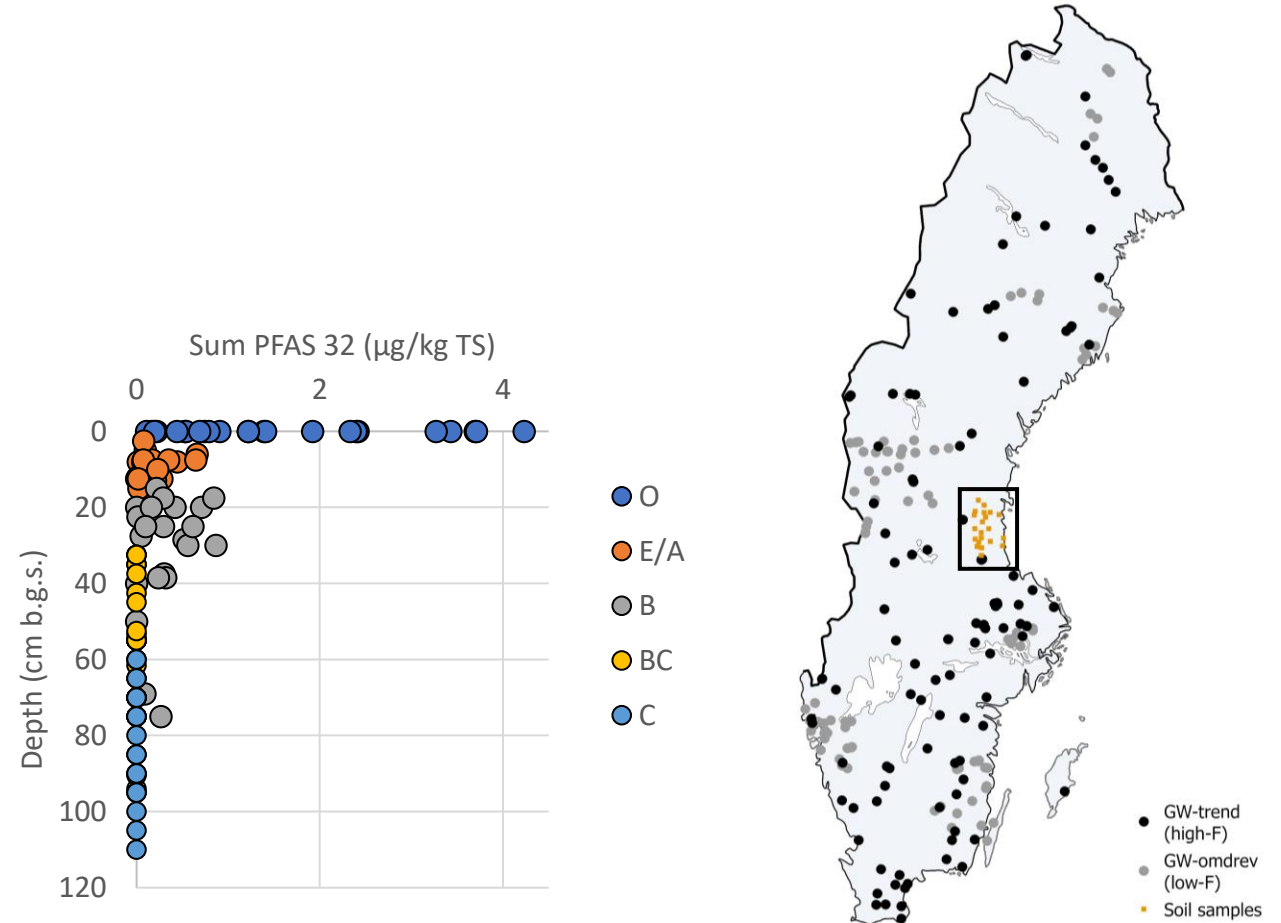
- 196 groundwater samples
 - surficial groundwater, national monitoring stations
 - 46 PFAS incl. PFAS24 and ultrashort PFAS
- 21 soil sample pits
 - 5 horizons
 - 32 PFAS



Ambient levels of PFAS in SE soil and groundwater

Results, soil

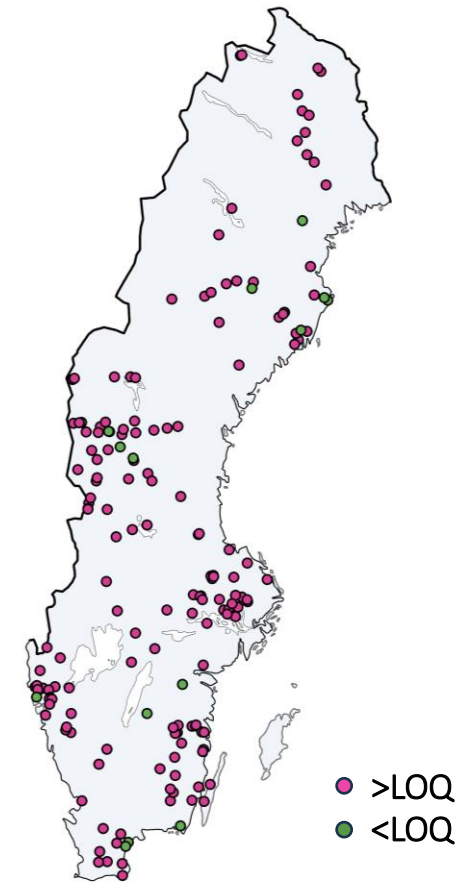
- PFAS present in all sample pits
- Distinct depth-dependence
 - nothing in B/C-horizons
 - TOC-analogue



Ambient levels of PFAS in SE soil and groundwater

Results, groundwater

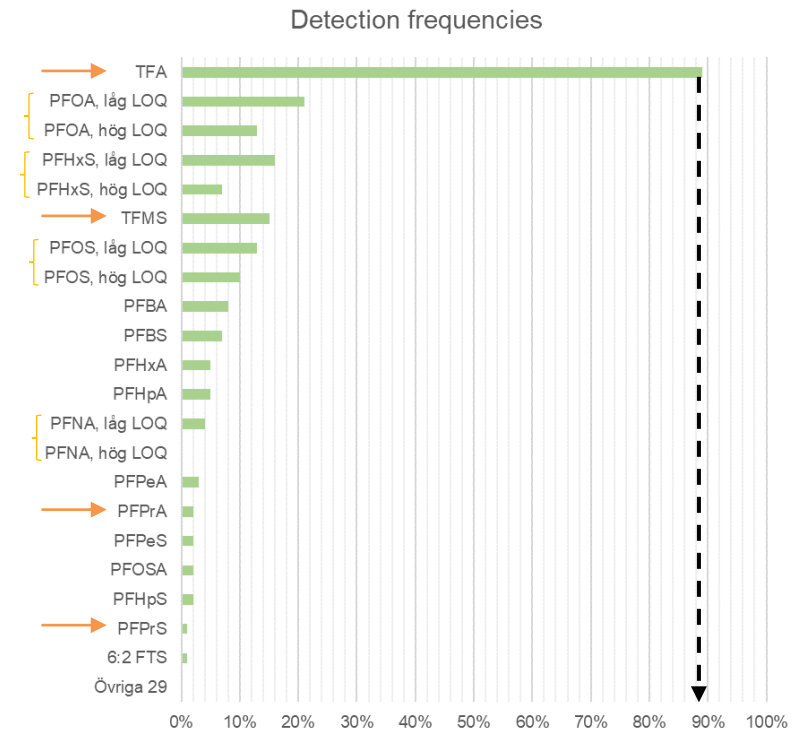
- **Excluding** ultrashort PFAS
 - Overall detection frequency = **30%**
 - 3 exceedances of PFAS24
 - $M < \text{LOQ}$, max = 30 ng/l
- **Including** ultrashort PFAS
 - Overall detection frequency = **90%**
 - $M = 190 \text{ ng/l}$, max = 2 700 ng/l



Ambient levels of PFAS in SE soil and groundwater

Results, groundwater

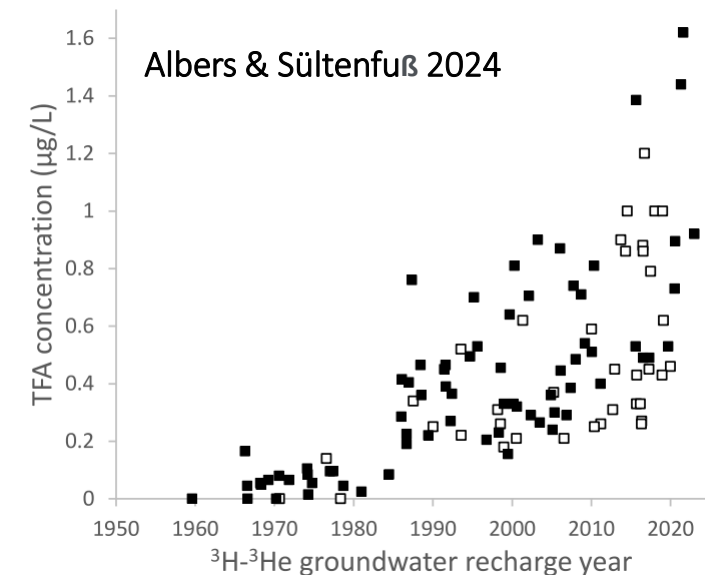
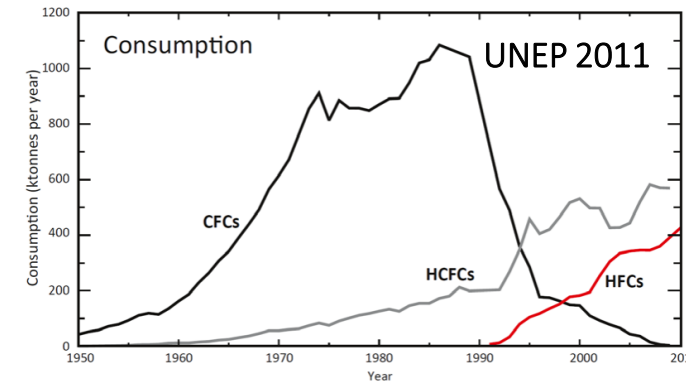
- Relatively mobile substances
- Importance of LOQ
- TFA just about everywhere



Ambient levels of PFAS in SE soil and groundwater

TFA

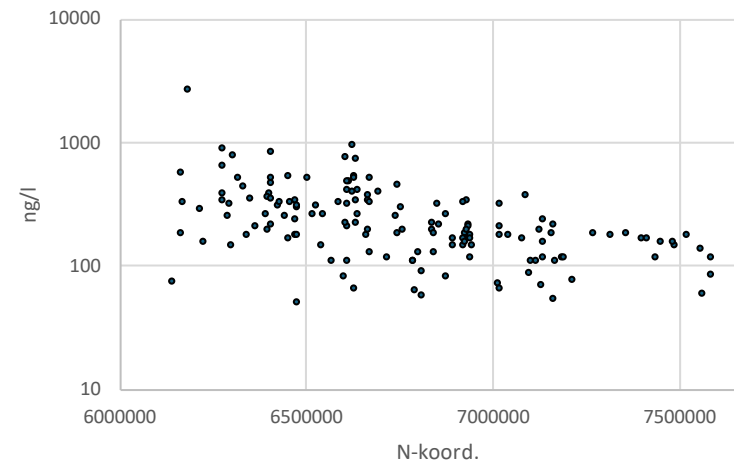
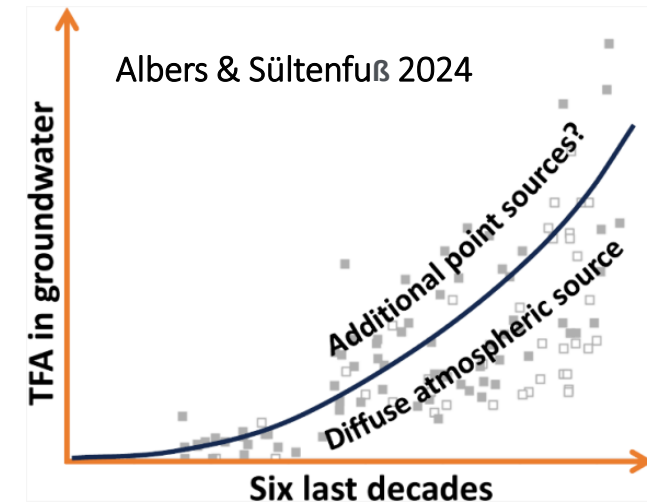
- Trifluoroacetic acid
- Multiple anthropogenic sources
- Chemically stable
- Drinking water limits
 - DK: 9 µg/l
 - DE: 60 µg/l ("10 or less")
 - DWD: PFAS-tot 0,5 µg/l
 - DWD: Pesticides 0,1 // 0,1 µg/l



Ambient levels of PFAS in SE soil and groundwater

TFA

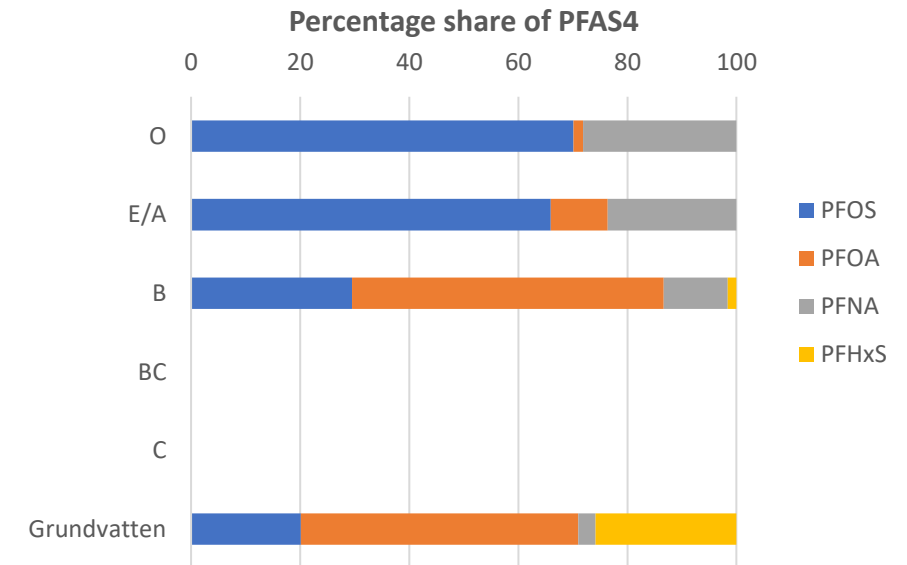
- Proposed, DK: diffuse regional background + local contributions (increasing with time)
- SE:
 - Regional differentiation (N-S)
 - Correlation with
 - Arable land (+)
 - pH, NH₄, wetlands (-)



Ambient levels of PFAS in SE soil and groundwater

Conclusions

- Diffuse PFAS-pollution – Yes
- Selective adsorption → different signals soil-gw
- Different sources and modes of transport → different signatures

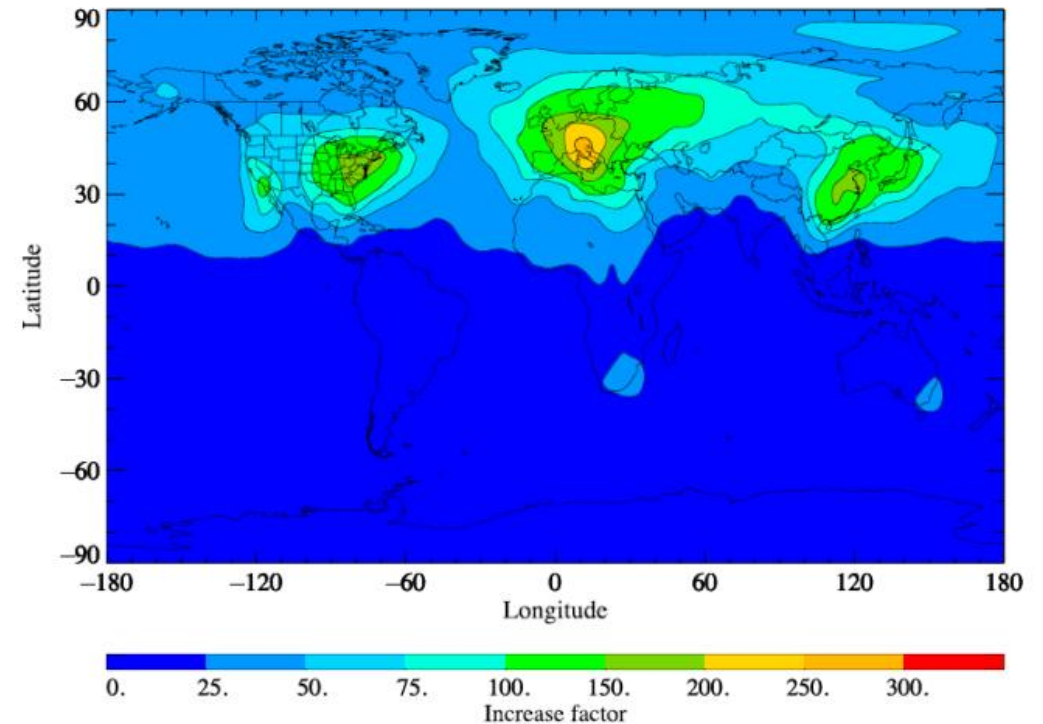


Continuation



Final reflections

- PFAS = joint concern
- Diffuse pollution often = joint concern
- TFA pot. increasing concern
- Opportunity for enhanced and more efficient assessments and measures through collaboration and data/information sharing



Modelled increase of TFA in troposphere for HFC-HFO-transition
Holland et al. 2021

Thank you!

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<https://www.sgu.se/grundvatten/pfas-i-grundvatten/>

References

- Albers, Christian & Sültenfuss, Jürgen. (2024). A 60-Year Increase in the Ultrashort-Chain PFAS Trifluoroacetate and Its Suitability as a Tracer for Groundwater Age. *Environmental Science & Technology Letters*. 10.1021/acs.estlett.4c00525.
- Albers, C. N. (2024). Diffus grundvandsforurening med trifluoreddikesyre (TFA). GEUS. Danmarks og Grønlands Geologiske Undersøgelse Rapport Bind 2024 Nr. 4 <https://doi.org/10.22008/gpub/34725>
- Holland, R., M.A.H. Khan, I. Driscoll, R. Chhantyal-Pun, R.G. Derwent, C.A. Taatjes, A.J. Orr-Ewing, C.J. Percival, and D.E. Shallcross. 2021. Investigation of the Production of Trifluoroacetic Acid from Two Halocarbons, HFC-134a and HFO-1234yf and Its Fates Using a Global Three-Dimensional Chemical Transport Model. *ACS Earth Sp. Chem.* 5(4): 849–857.
- UNEP. 2011. HFCs: A Critical Link in Protecting Climate and the Ozone Layer