

Technical University of Denmark



Novel insights linking ecological health to biogeochemical hotspots across the groundwater-surface water interface in mixed land use stream systems

McKnight, Ursula S.; Sonne, Anne Thobo; Rasmussen, Jes J.; Rønne, Vinni Kampman; Traunspurger, Walter; Höss, Sebastian; Bjerg, Poul Løgstrup

Publication date:
2017

Document Version
Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

Citation (APA):
McKnight, U. S., Sonne, A. T., Rasmussen, J. J., Rønne, V. K., Traunspurger, W., Höss, S., & Bjerg, P. L. (2017). Novel insights linking ecological health to biogeochemical hotspots across the groundwater-surface water interface in mixed land use stream systems. Abstract from 2017 AGU Fall Meeting, New Orleans, United States.

DTU Library
Technical Information Center of Denmark

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Novel insights linking ecological health to biogeochemical hotspots across the groundwater-surface water interface in mixed land use stream systems

Ursula S. McKnight¹, Anne Th. Sonne¹, Jes J. Rasmussen², Vinni Rønde¹, Walter Traunspurger³, Sebastian Höss^{3,4}, Poul L. Bjerg¹

¹ Department of Environmental Engineering, Technical University of Denmark, 2800 Kgs. Lyngby, Denmark

² Department of Bioscience, Aarhus University, Vejlsovej 25, 8600 Silkeborg, Denmark

³ University of Bielefeld, Department of Animal Ecology, Konsequenz 45, 33615 Bielefeld, Germany

⁴ Ecosa, Giselastr. 6, Starnberg, Germany

Increasing modifications in land use and water management have resulted in multiple stressors impacting freshwater ecosystems globally. Chemicals with the potential to impact aquatic habitats are still often evaluated individually for their adverse effects on ecosystem health. This may lead to critical underestimations of the combined impact caused by interactions occurring between stressors not typically evaluated together, e.g. xenobiotic groundwater pollutants and trace metals.

To address this issue, we identified sources and levels of chemical stressors along a 16-km groundwater-fed stream corridor (Grindsted, Denmark), representative for a mixed land use stream system. Potential pollution sources included two contaminated sites (factory, landfill), aquaculture, wastewater/industrial discharges, and diffuse sources from agriculture and urban areas. Ecological status was determined by monitoring meiobenthic and macrobenthic invertebrate communities.

The stream was substantially impaired by both geogenic and anthropogenic sources of metals throughout the investigated corridor, with concentrations close to or above threshold values for copper, nickel and zinc in the stream water, hyporheic zone and streambed sediment. The groundwater plume from the factory site caused elevated concentrations of chlorinated ethenes, benzene and pharmaceuticals in both the hyporheic zone and stream, persisting for several km downstream.

Impaired ecological conditions, represented by a lower abundance of meiobenthic individuals, were found in zones where the groundwater plume discharges to the stream. The effect was only pronounced in areas characterized by high xenobiotic organic concentrations and elevated dissolved iron and arsenic levels – linked to the dissolution of iron hydroxides caused by the degradation of xenobiotic compounds in the plume. The results thus provide ecological evidence for the interaction of organic and inorganic chemical stressors, which may provide a missing link enabling the reconnection of chemical and ecological findings. This study highlights the importance of stream-aquifer interfaces for ecosystem functioning in terms of biological habitat, and that multiple stressor systems need to be tackled from a holistic perspective.