



UMEÅ UNIVERSITET

# **The influence of riparian zone heterogeneity on land-water connections in boreal headwaters**

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**Abstract**

Riparian zones are hydrogeomorphically heterogeneous, which may influence how, when, and where groundwater forms lateral connections between riparian soils and streams. These lateral connections represent important linkages between organic riparian soils and the expansive network of smaller headwater streams that are ubiquitous features of northern boreal landscapes. By way of lateral connections, riparian zones function as a source of organic and inorganic solutes to aquatic ecosystems. Yet, heterogeneity within the riparian interface complicates how we can mechanistically explain the role of the riparian zone as a source.

Here, I explore the influence of hydrogeomorphic heterogeneity on the biogeochemical role of boreal riparian zones. By assessing soil properties, extracellular enzyme activity and microbial community composition I show that the capacity of a riparian site to do important biogeochemical work is directly influenced by the hydrogeomorphic setting. This creates substantial spatial and temporal complexity in the generation and transfer of degradable organic matter from riparian soils to inland water continua. Additionally, we experimentally test how drying and rewetting changes the mobilization of dissolved organic carbon in riparian soils, which may hint to how riparian zones will respond to drought as part of a changing climate. Further, I use relationships between solute concentration and groundwater discharge to show that a range of solute mobilization patterns from riparian sites are linked to the hydrogeomorphic heterogeneity of the riparian interface. Finally, I show that contrasting modes of lateral connectivity can simultaneously influence the stream, but do so via different mechanisms, across different response variables and at different spatial scales.

This thesis shows that hydrogeomorphic heterogeneity influences a boreal riparian zone by determining the capacity of riparian soils to do important biogeochemical work, and the level of hydrological opportunity that riparian zones have to influence the adjacent stream via lateral connectivity. Ultimately, the riparian zone offers us the chance to use interactions between capacity and opportunity to more effectively manage and protect streams and aquatic networks in headwater catchments.

**Keywords**

Riparian zone, boreal, headwaters, streams, DOC, heterogeneity, hydrogeomorphology, drought, lateral connections

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