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Links between topography and the architecture of near stream zones in the Swedish Krycklan study catchment: Implications for aqueous and gaseous fluxes of organic and inorganic carbon

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The architecture of near stream (riparian) zones is increasingly recognized as a key control on a wide range of processes including e.g., solute transport from or to streams or gas evasion across the stream surface. Characterizing this architecture in terms of soils, vegetation, morphology and hydrology is, thus, a prerequisite for relating small scale processes to large scale patterns. Topographic attributes and related GIS techniques have traditionally been used for environmental prediction. Applying these tools to near stream zones, however, has only recently become more attractive with the availability of high-resolution elevation models and new computational methods suitable for the analysis of riparian zones.

In this study we present several useful metrics for predicting soil properties, hydrologic conditions and stream morphology in the riparian zone of a Swedish boreal catchment. Terrain analysis was successfully applied to predict (1) the spatial distribution of hydromorphic soils, (2) the vertical variation of dissolved organic carbon (DOC) in riparian soils, (3) riparian groundwater levels and flow pathways as well as (4) stream geometrical parameters related to carbon dioxide (CO_2) evasion from streams. Additionally, significant relations between riparian peat thickness and several terrain indices (such as slope, TWI and elevation) emerged, but were hard to interpret due to the considerable small heterogeneity of riparian peat. Some of the identified relations were found to be suitable for simulating spatially distributed riparian DOC exports and stream CO_2 evasion rates.