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Effects of vegetated riparian buffer strips on lateral sediment input to agricultural river systems and the role of man-made linear flow paths in the Fugnitz catchment, Lower Austria

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Heavily intensified soil erosion by cultivation of arable land is a main contributor to the chemical pollution of freshwater ecosystems. High loads of fine sediment are transported to the channel via overland flow pathways, furthermore man-made linear flow pathways can drain substantial parts of a catchment. Vegetated buffer strips between arable fields and the river channel are a common mitigation measure, since they are highly effective in removing suspended solids, nutrients and pesticides from runoff by trapping sediment and consequently reducing sediment connectivity. Although vegetated buffer strips alongside perennial streams are a common mitigation measure in catchment management, the role of man-made linear flow paths in delivering sediment to streams is often overlooked. This study investigates the effectiveness of existing vegetated buffer strips and the role of man-made linear flow paths in terms of sediment connectivity and fine sediment input in an agricultural intensively used catchment in Lower Austria.

Recent studies on river ecosystem condition have shown, that the Fugnitz River in the north of Lower Austria is in a poor to moderate ecological state, besides other factors, being caused by high phosphorus concentrations caused by lateral sediment-associated input from arable fields. Vegetated buffer strips alongside permanent streams are eligible for subsidy in Austria, but not continuously present along the Fugnitz and its tributaries. In order to assess the effectiveness of the existing buffer strips, the volume of the buffered sediment was measured in the field after heavy rainfall events. Afterwards the respective runoff and erosion events as well as the sediment yield rates were modelled using the Water Erosion Prediction Model (WEPP). The resulting sediment yield rates of the model were compared to the event-based in situ data. Concerning the role of man-made linear flow paths, the connectivity between these and the actual permanent streams was investigated in the field by mapping the entry-points of the man-made flow paths into the river channel system. Afterwards each subcatchment of those entry points was delineated in ArcGIS and the potential sediment input of each subcatchment was modelled with GeoWEPP.

The results show that the investigated buffer strips tend to overflow during high rainfall events, due to a too narrow fixed width. Besides the ineffectiveness of the buffer strips, the highest amount of fine sediment input into the permanent stream channel happens via the assessed entry points of the man-made linear flow paths. This shows that the assessment of anthropogenic linear flow paths is an important factor in order to understand the sediment connectivity within a catchment and to be able to create an effective sediment management in regards to erosion-related freshwater pollution.