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Structural and Functional Connectivity in Sediment Transfer in Agricultural Foothill Catchment in Poland

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Soil erosion in agricultural areas leads to permanent changes in the landscape. Eroded soil – detached from slopes – is accumulated at the base of a slope or across the bottom of a valley. Only during the most erosive rainfalls does sediment flux directly to the stream channel take place. The amount of slope sediment depends on plant cover and land use, morphology of the catchment, its area and also barriers such as extensive, flat valley bottoms separating slopes and channels. The larger the catchment area and the higher the stream order, the weaker the linkage between slope and channel system in sediment flux. Surface runoff carries eroded material from agricultural hill slopes. Soil particles as well as natural and artificial fertilizer and pesticides are carried by surface runoff and delivered directly into stream channels, which ultimately affects water quality. In this context, it is important to learn how frequently erosion events occur on hill slopes used for agriculture. It is also important to find out whether the transfer of eroded soil directly to a stream channel is possible, as this is where it would be subsequently picked up and transported by fluvial processes.

The aim of this work is to describe the role of structural and functional connectivity in sediment transfer in agricultural foothill catchment in Poland. The description of interaction between structural and functional connectivity will provide understanding hydrological connectivity, which has been defined as a transfer of water and sediment from one part of the catchment to another with special attention to slope-to-river soil transfer.

The study is based on research performed in the Dworski Potok Catchment (227–275 m a.s.l.), which has an area of 0.29 km2. The catchment is a small agricultural foothill catchment, situated in a moderate climate zone, with slopes covered with loess-like formations. The paper uses precipitation data for the period 1987–2009 and long-term field data on splash (2007–2009), slope wash (2007–2009), linear erosion (1998–2009) on slopes and sediment transport in the channel (2007–2009).