



Detection of stable and mobile channel units using biofilm analysis in cold environments

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The method of biofilm analysis, which is an established method in aquatic ecology, shall be applied as innovative technique in the field of fluvial geomorphology. Within sediment budgets of steep catchments and steep mountain streams bed load transport has a high importance. The qualitative and quantitative monitoring of bed load transport and the active / mobilized channel pavement is difficult and a big challenge. Existing approaches using for example bed load formulae and mathematical models are problematic and often do not lead to reliable estimates of bed load transport rates (Gomez & Church, 1989; Martin, 2003; Wilcock, 2001). Also the direct and indirect measurement of bed load transport can only provide very rough estimates of given transport rates, and the results are highly dependent on the special design of the used instruments (e.g. traps) as well as on the chosen intervals and frequencies for the measurements in field (Bunte, 2001; Bunte & Abt, 2005; Church et al., 1987; DeVries, 2002; Gintz et al., 1995; Hassan et al., 2006; Schmidt & Gintz, 1995; Lenzi, 2004; Vatne et al., in press; Warburton, 1992).

Different approaches from aquatic ecology postulate close relationships between habitat and substratum morphology as well as channel pavement stability on the one hand, and the colonizing organisms (Phytobenthos) on the other hand (Battin, 2000; Biggs & Close, 1989; Biggs & Smith, 2002; Cardinale et al., 2002;

Müller & Schagerl, 2003; Sailer, 2005; Stevenson, 2007; Uehlinger et al., 1998). The hypothesis within this study shall address the question: Are the relationships that have been considered from biological/ecological side also valid within geomorphologic considerations, and is it possible to get answers about frequencies of sediment mobilization and vertical extent of the active/mobilized channel pavement in steep bed load streams by the mass of biofilm on substratum.

This questions were tested in a steep cold-environment catchment "*Upper Erdalen*". The site is located in the Nordfjord (Jostedal National Park) in Norway (61.50N, 07.10E). Topography (460 – 1800 m a.s.l.) is characterized by alpine mountains and a well-defined U-shaped valley litho logically composed of gneisses. The uppermost parts of the catchment are covered by the Jostedalsbreen ice cap. Grain sizes at the pavement surface of selected channel stretches are between 40 mm and 65 mm for D_{50} , and between 65 mm and 100 mm for D_{84} . For D_{max} values of up to 4000 mm were measured (Liermann 2008).

A number of biofilm samples were collected in Erdalen. The collected stones with biofilm cover were analyzed using 2-Photonen Laser Scanning Microscopy (Zipfel & Neu, 2005). The analyze of the biofim mass and the biofilm components on the sampled surface and subsurface stones detects various amounts of biofim masses. Results show a dependence of light availability and the disturbance history of the individual stone position. The results lead to the suggestion that it is possible to detect stable unstable morphological units within the channel.