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Nature-based sealing of leaky streams - Testing a bio-degradable bentonite mat for preventing infiltration losses in alpine stream

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Deep-seated landslides can pose a serious threat to settlement areas and their assets in mountain regions across the world. An important step of a holistic landslide management is the implementation of suitable mitigation measures. However, technical mitigation measures against the impacts of natural hazards often rely on synthetic materials. Progress in materials science and development often makes it possible to replace synthetic components with renewable, bio-degradable materials that provide the same functionality. These alternative, nature-based solutions can simultaneously offer co-benefits such as environmental sustainability, less maintenance efforts and a greater societal acceptance. In this context, an experimental setup was installed in the upslope catchment area of an active deep-seated landslide in Vögelsberg (community of Wattens, Tyrol, Austria). At the chosen location the infiltration losses along the unconsolidated streambed potentially contribute to groundwater recharge, which is considered a main hydrological driver of the landslide. The goal of the experiment was to efficiently seal a 25 m long section of a stream without relying on synthetic materials. To reach this goal, a prototype of a bio-degradable bentonite mat was implemented as an impermeable layer in the subsurface of the leaky stream section. The efficacy of the mat is continuously monitored by several soil moisture probes installed below and above the layer and repeated measurements of subsurface characteristics with the help of electrical resistivity tomography. Furthermore, topographic changes due to erosion or sagging of the embankments are periodically monitored using a terrestrial laser scanner. Currently, the implemented solution must be considered a concept case to help raise awareness for this nature-based alternative to conventional engineering measures based on synthetic materials. If the experiment proves successful, it could be upscaled in the upstream catchment area of the landslide to prevent infiltration along leaky streams in the same way and reduce the hydrological forcing of the landslide.

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