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STEEP STREAMS - Solid Transport Evaluation and Efficiency in Prevention: Sustainable Techniques of Rational Engineering and Advanced MethodS

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The STEEP STREAMS (Solid Transport Evaluation and Efficiency in Prevention: Sustainable Techniques of Rational Engineering and Advanced MethodS) project consists of a collaboration among the Universities of Trento, Uppsala and Lisbon, who joined in a consortium within the ERANET Water JPI call WaterWorks2014. The aim of the project is to produce new rational criteria for the design of protection works against debris flows, a phenomenon consisting in hyper-concentrated flows of water and sediments, classified as catastrophic events typical of small mountainous basins (area <10 km2) and triggered by intense rainstorms. Such events are non-stationary phenomena that arise in a very short time, and their recurrence is rather difficult to determine. Compared to flash floods, they are more difficult to anticipate, mostly since they are triggered by convective precipitation events, posing a higher risk of damage and even loss of human lives. These extreme events occur almost annually across Europe, though the formal return period in an exposed site is much larger. Recently, an increase in intensity and frequency of small-scale storm events, leading to extreme solid transport in steep channels, are recognized as one of the effects of climate change. In this context, one of the key challenges of this project is the use of comparatively coarse RCM projections to the small catchments examined in STEEP STREAMS.

Given these changes, conventional protection works and their design criteria may not suffice to provide adequate levels of protection to human life and urban settlements. These structures create a storage area upstream the alluvial fans and the settlements, thereby reducing the need of channelization in areas often constrained by urban regulations. To optimize the lamination, and in particular to reduce the peak of solid mass flux, it is necessary that the deposition basin is controlled by a slit check dam, capable of inducing a controlled sedimentation of the solid mas flux. In order to achieve that, reliable design tools are needed. Driftwood represents another important factor increasing the risk, as clogging induced by the vegetal material represents a major problem for the operational reliability of slit check dams. Current procedures in compiling hazardous maps do not account for such effects. The STEEPS STREAMS project aims at developing structural innovative solutions and design criteria reliable to mitigate the impacts of flash floods and debris flows especially in presence of intense woody material transport, typical of mountain catchments.