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Efficiency of pilot measures to mitigate muddy floods in a catchment of central Belgium

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Muddy floods are a widespread and frequent phenomenon in the European loess belt. 79 $\%$ of the municipalities in central Belgium have reported at least one muddy flood over the last decade. The huge costs induced by muddy floods (16×10^6 - 172×10^6each year in central Belgium) justify the installation of erosion control measures.

The Melsterbeek catchment agency is a unique structure in Belgium. It coordinates the installation of measures to mitigate erosion and muddy floods at the river catchment-scale (c. 200 km^2). 120 grass buffer strips and grassed waterways (GWW), covering a total surface of 25 ha, as well as 35 earthen dams have been installed between 2002 and 2005. To evaluate their impact with hydrologic models (e.g. STREAM model; Cerdan et al., 2001), the seasonal evolution of runoff generation and erosion production on cropland and grassed areas first needs to be quantified. A heavy rainfall event (60 mm.h^{-1} during 30 minutes) has been simulated using a 0.5 m^2 Amsterdam-type simulator on fields having the 15 most observed combinations of soil surface characteristics (crop cover, surface crusting and roughness) throughout the year. Results show that farming alternative practices should aim to maintain rough soils with a dense crop cover throughout the year. Runoff coefficients of grassed buffer strips and grassed waterways (62 and 73$\%$, respectively) are rather high in comparison with the coefficients for cultivated soils (between 13 and 58$\%$).

Beside modelling, two methods are used to assess the efficiency of the pilot measures: (i) the monitoring of a well-equipped 300 ha-catchment and (ii) the study of the spatial variation of fire brigade interventions after muddy floods in the entire 200

km^2-catchment.

(i) Runoff generated in a 300 ha-catchment, locally known as 'Heulen Gracht', led to more than 10 muddy floods in the village located downstream between 1992 and 2002. Consequently, a GWW, covering an area of 12 ha, as well as three earthen dam were installed in the catchment thalweg between April, 2002 and August, 2004. To measure their efficiency, a water level logger has been installed behind each of the dams in May, 2005. A discharge measurement station has also been set up at the upstream end of the GWW in April, 2006. 22 rainfall-runoff events have been measured in 2005 and 2006. It is shown that runoff is slowed down by the control measures, preventing any flooding of the downstream village. Two rainfall events of similar intensity (25 mm in 2 hours, return-period of 5 years) recorded in June and August, 2006 show that sediment concentration in runoff is much more important in late spring when soils are not completely crusted (c. 33 g.l^{-1}) than in summer (c. 3 g.l^{-1}). Sediment concentration in runoff was dramatically reduced at the catchment outlet for both events (less than 1 g.l^{-1}), because of a high sedimentation in the grassed waterway and behind the dams. Peak discharge at the catchment outlet has also been reduced by 50 to 65$\%$.

(ii) The local fire brigade of Sint-Truiden classifies its interventions according to their nature (fire, road accident, muddy floods). Data are available since 1977. No conservation measure had been installed before 2002. The spatial location of floods for the period 2002-2006 gives an overview of the efficiency of the implemented measures in the entire river catchment.