EXTREME EVENTS AND MEASURES EFFICIENCY IN SMALL BASINS

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Response of small catchments to extreme storm events features great variability, implicit in the complexity of local natural and anthropic conditions. If we explore some Czech hilly area (basin less than 10 km^2) after a storm, we can usually find only few slopes with disruptive water erosion impact, several slopes with moderately stricken soil cover and other slopes with only slight erosion. The rate of sediment delivery from a certain slope into a water course depends first on the linkage between the slope and the channel, secondly is influenced by relief and soil characteristics, state and type of vegetative cover.

The identification of erosion threatened parts of the catchment is an important analyse task of soil and water conservation. To restrict the erosion sediment transport it is possible to interrupt the slope with a barrier or change the vegetative cover. According to specific conditions and risks there could be realized grassing (or forestation) of areas or belts, insertion of a road with infiltration belt or interceptive ditch, balks with ridges and accompanying greenery, polders and retention reservoirs in a concerned site. In the frame of the project supported by the Czech Ministry of Agriculture (MZE 00027049) we have found observation at 2 experimental basins to study efficiency of water erosion control measures in diverse natural and anthropic conditions.

Němčický stream is a small experimental basin (3.5 km^2) in Drahanská vysočina highlands. The average elevation is 606 m a.s.l. The climatic conditions are slightly warm, slightly wet, characterized by the annual average rainfall total 650 mm and the average air temperature 6°C. The geological base is predominantly formed by culm greywackes. Sandy - loamy and loamy Cambisols, Stagno-gleyic Luvisols and Planosols have evolved on this ground. Agriculture soils are intensively exploited: arable land fills 52%, forest 35%, grasses only 3% of the area.

Experimental basin Kopaninský stream represents environmental conditions of Bohemian highlands. Its area is 7 km^2, relief is hilly with average elevation 550 m a.s.l. The basin is classified as climatic area slightly warm, damp, which is characterized by average annual temperature 6.5°C and average annual total rainfall 700 mm. Loamy Cambisols on gneiss, are here typical. Arable land covers 46% of the territory, 11% grassed land, forest forms 41% of the area, 2% other.

The catchments are equipped with gauging profiles, ultrasonic probes and data loggers for discharges measurement. Discharges are derived from the water level every 10 minutes, precipitations are registered by meteorological stations in situ. Automatic samplers, built in the stream banks, collect water from rising flood waves. The water samples are analysed for suspended sediments, nitrates and phosphates content after every extreme event. The results are interpreted in time and in the relations to the actual natural and anthropic conditions.

During observed period we registered the most wasting rainfall-runoff events in the year 2005. On the 23rd May 2005 the storm at the Kopaninský basin, with the precipitation total of 86 mm in 6 hours, caused maximum discharge above 7 000 mg·dm^{-3} and the flow drifted approximately 53 800 mg·dm^{-3} of suspended matter. This event was not so expressive in the Němčický stream basin - it is distant 100 km in the east direction.

The strongest storm passed the Němčický basin on the 12th September 2005, when 77 mm of precipitations fell in 3.5 hour. Maximum discharge reached 1 100 $dm^3 \cdot s^{-1}$ and the flow transported 11 550 $mg \cdot dm^{-3}$ of suspended matter.

In both cases the water erosion intensity was not equal on all slopes in the basin. By means of the terrain reconnaissance we identified, that the sediment delivery in the Němčický stream came predominantly from one just then ploughed field near the gauging profile. Sediment delivery in the Kopaninský stream stemmed mainly from five slopes and the bottom erosion.

Detail study of one slope, which significantly contributed to the Kopaninský stream pollution, delt with rills and soil material deposits survey. We measured volume of the sediment load by a geometric method. Specific weight of the sediment was found out through the samples taken into the core samplers. Analysis of the sediment texture show that the profile is not homogenous but consists of two layers with fuzzy borders. On the whole there were eroded and than deposited 187 t of soil material on the studied field. If we stretch out the total amount of sediments on the area of appropriate micro basin 5.4 ha, we would obtain actual washing-off 35 t/ha. Overall washing-off was higher, guessingly by 20-30%, because some material was transported into the stream running through the meadow. Field data were compared to the sediment transport model outputs (software ERCN) with good compliance.

Partial results of the solved project exemplify the key role of the vegetative cover for the water erosion control. Grass or crop plants on the erosion threatened fields markedly reduce the soil washing-off. Amount of sediment delivery into the stream depends on the channel accessability. Fluvial meadows or other shore vegetation can trap bulk of transported soil particles. The main goal of the whole project is to prepare the methodics for designing and evaluation of erosion and flood control measures in the frame of the complex land use adjustment.