Assessing Torrential Endangered Areas in Bavaria - Consideration of Log Jams at Culverts and Bridges -

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INTRODUCTION

At the Bavarian Environment Agency a standardized approach for analyzing torrential hazards and designating torrent endangered areas in Bavaria is currently under development. Hazards due to woody debris in residential areas need to be evaluated. The newly developed and standardized approach aims for a systematic and transparent determination of the effects of woody debris during hazard analysis. Comparability of results is thus established and results could potentially be implemented in subsequent 2D-modeling.

PROCESS

Fig. 1 shows the systematic procedure implemented taking woody debris during hazard analysis into account. In general all wood which is being transported in-stream during an event is considered as woody debris.

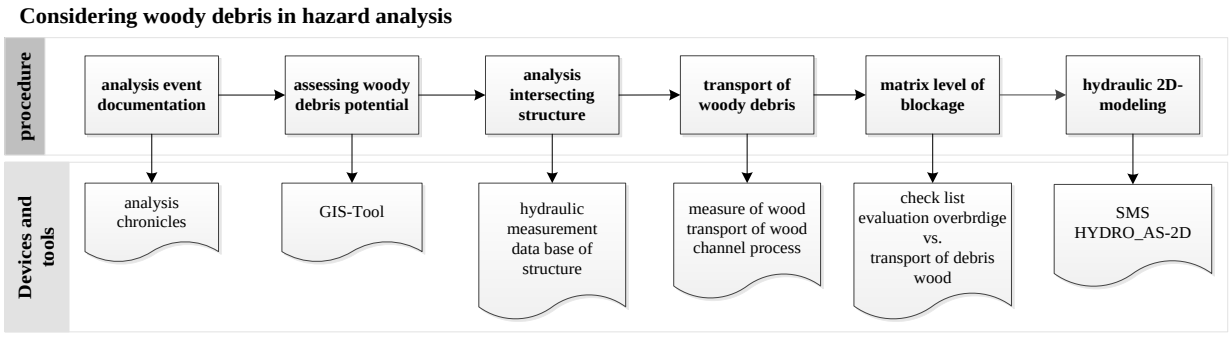

Fig 1: Overview of the work steps to assess woody debris in torrent endangered areas.

Considering woody debris comprises in general the following work steps:

- **Analysis of event documentation**: evaluation of event documentation of past events. If evidence for log jams is present these should be taken into account thoroughly.
- **Assessing woody debris potential**: by means of a specifically developed GIS-based approach (cp. Mayer & Rimböck (2014)) several input processes into the channel are considered. Based on these input processes the potential volume of woody debris in the catchment is calculated.
- **Analysis intersecting structures:** The structure of bridges or culverts has to be regarded to assess the risk of log jams. Therefore the dimensions and other influencing parameters like construction type (including existence of pillars) but also the character-istics of the river bed close to the structure should be considered. Finally the risk for the occurrence of log jams is categorized with „uncritical“, „medium“ or „critical“.

- **Transport of woody debris**: As another important parameter the transport intensity has to be assessed. Therefore parameters like flow process, dimensions of wood and the characteristics of the upstream river bed are considered. The transport intensity gets classified into “low”, “medium” or “high” accordingly.
- **Matrix level of blockage:** Finally the level of blockage is assessed, by overlaying the two classifications for the structure and the transport intensity on the basis of the matrix in **Fig. 2**. The resulting number (0/25/50/75/100) describes the percentage of the discharge section under the bridge, which has to be modelled as impermeable in the hydraulic model.

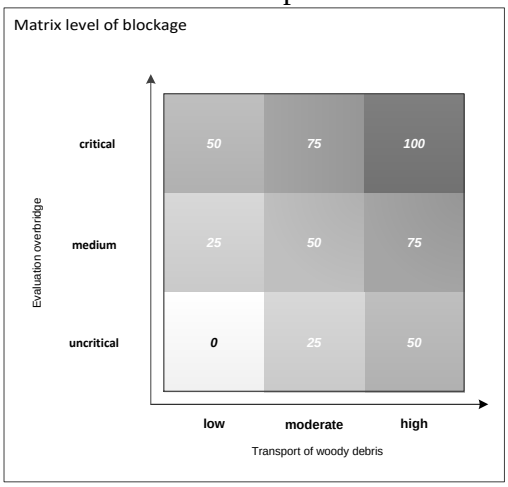

Fig. 2: Matrix level of closure for hydraulic 2D-modeling: Combination between *evaluation intersecting structures* (y-axis) and *transport of woody debris* (x-axis).

- **Hydraulic 2D-modeling:** in a final step the boundary conditions according to the assessed level of blockage at the intersecting structure (downscaling of the structures lower border) are changed in the hydraulic 2D-model (HYDRO_AS-2D/SMS (Surface-water-modeling)).

FIRST RESULTS AND CONCLUSION

First assessments of the proposed procedure show that the approach to calculate the level of blockage at intersecting structures is feasible to document the susceptibility for blockages through woody debris at bridges or culverts. As a next step the compiled parameters from literature (cp. Lange & Bezzola (2006), Imhof (2008) and Gschnitzer et al. (2014)) need to be tested and possibly modified for other intersecting structures to evaluate the applicability in practice.

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