PROPOSAL OF RISK MITIGATION STRATEGIES BASED ON AN APPLICATION OF A CONCEPTUAL PLANNING TOOL

A CASE STUDY IN THE GADRIABACH, VINSCHGAU VALLEY, ITALY

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INTRODUCTION

For centuries, the constantly active Gadriabach (South Tyrol, Italy) has been a threat for settlements, infrastructure and agricultural land alike. The majority of the 10.68 km^2 debris cone is populated and/or used by humans on a daily basis. The Gadriabach continues to be a very active channel and poses a risk for the settlement of Allitz, which is located on the upper part of the debris-flow cone. High maintenance costs are spent each year to keep the existing protection system functional.

PROBLEM SETTING AND RISK MITIGATION CONCEPT

In order to assess the risk mitigation problem in the Gadriabach, the *Concept Plan* procedure (Mazzorana, 2008) was applied. This is a structured procedure to characterize and delineate a system under investigation and to identify the most important discrepancies between the current and the desired situation. Optimal solutions were proposed based on the overall goal of developing a mitigation system that maintains a high level of protection for the settlement and infrastructure; furthermore, it should decrease overall costs, allow sediment dynamics and give protection for varying event magnitudes. There are numerous weaknesses in the current protection system, including deteriorating slope stabilization measures and check dams, an unfavorable angle at the confluence of the Strimmabch and Gadriabach and costly annual excavation of deposits (Fig. 1).
The final evaluation of solutions was based on multi-attributive utility theory (MAUT) by comparing the proposed solutions to the current situation considering the following criteria: degree of risk reduction, ecological benefit and socio-economic acceptance. In addition, we considered the costs of the system over a 50-yr period (construction, maintenance and debris removal). An evaluation with clearly defined criteria allowed for a transparent and objective selection of an optimal solution. Based on this evaluation, a ranking of solution variances was created. A schematic of the optimal solution is shown in Figure 1. This solution includes a system of roughness elements in the area of the current retention wall. The critical feature of this arrangement of roughness elements is an increase in size towards the lateral extent of the channel. This would allow sediment transport for small events, but would contain larger events within the channel. This remains, however, a hypothetical construction and is currently under further laboratory modelling. In addition, the flow course of the tributary stream (Strimmbach) should be rerouted such that the confluence angle is optimized.

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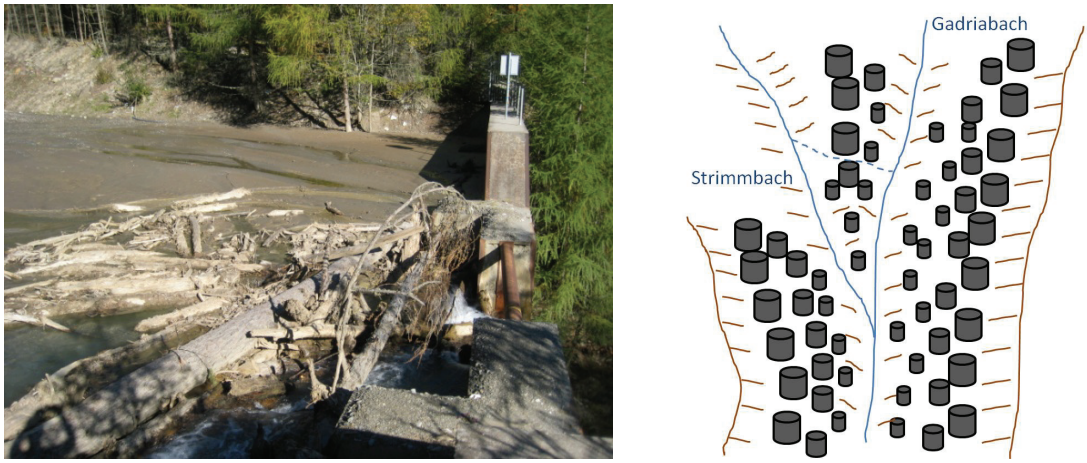

Fig. 1 The Gadriabach retention basin after a debris-flow event in 2010 and a schematic of the proposed solution

CONCLUSION

This investigation highlighted the importance of a structured and integrative approach to decision-making in natural hazard assessments. The Concept Plan tool supports the consideration of a management strategy over the lifespan of the product, a focus on functionality and low costs and a maximization of the investor benefits. A structured planning process is recommended by the European Union in many aspects of natural hazard management.

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Keywords: risk reduction, Concept Plan, decision-making, Vinschgau