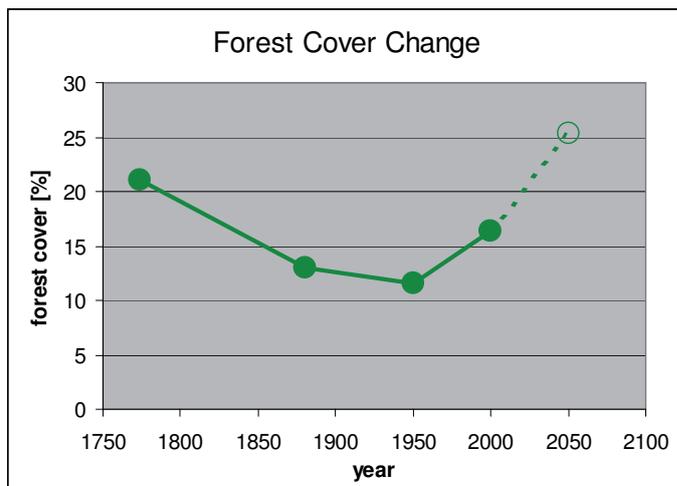


ANALYSIS AND MODELLING OF THE EFFECT OF FOREST COVER ON THE 2005 FLOOD EVENT IN THE PAZNAUN VALLEY (AUSTRIA)

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ABSTRACT

In the night before Tuesday, August 23rd, 2005, disastrous torrential precipitation triggered extreme flood disasters in Tyrol and Vorarlberg. Alongside the River Trisanna from the Paznaun valley, extreme discharges exceeding flood levels of HQ₁₀₀ by far were observed.



Due to the demand on wood for mining during the middle ages and the century old tradition of livestock farming, deforestation in the Paznaun valley locally reached an extent of up to 90 percent of the possible forest cover in the 1950s. The impact of changes in forest cover on the hydrological cycle and on floods has been investigated by many authors. Most of the scientific studies of forest impacts generally found them to be associated with reducing both flood peaks and dry weather baseflows.

Fig.1: Forest cover changes in the Paznaun valley as percentage of basin area. Prospective forest cover is understood as possibly afforestable area. Source: (Fromme 1952, Seger 2001).

Witzig et al. (2004) reported that forest cover not always protects against flooding. Their investigated forest site types contributed variably to the fast runoff formation, but there was little effect observed from the forest coverage itself.

Concerning the Paznaun valley disaster event from August 23rd, 2005, an essential question is what the influence of the recent forest cover was. The Vb weather situations, feared for their extremely high precipitation rates, may occur more frequently in and north of the Alpine region, due to climate change.

Are afforestations and melioration measures of the past 50 years inefficient?

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Or would the same weather situation having occurred in the year 1950 have caused even higher flood peaks?

Could the reconstruction of the full potential forest cover lessen or even avoid impacts and damages like in August, 2005 at a similar future event?

The Forest Technical Service for Torrent and Avalanche Control, Tyrol initiated a project to try to get to the bottom of these questions. The prospective termination of this project will be August 2007, thereupon all results will be available.

The goal of this project is a process-oriented hydrological modelling of the August 23rd, 2005, event in the Paznaun valley. Based on this model an efficient and realistic method to simulate the effect and influence of different forest cover configurations should be obtained.

For the purpose of the model setup in a first step detailed analysis of the channel network, hydro-geological survey and discharge measurements were carried out (Fig.2). In a second step land use data at the regional scale and furthermore current field investigations (forest site and stand characterisation on approx. 3000 points within the Paznaun valley) are used to define hydrological response units (HRU) attributed with hydrological parameters for modelling (initial abstraction and water storage, surface runoff coefficient and surface roughness). For each HRU, its response towards the August 23rd, 2005, event will be simulated. The third step consists of HRU mapping and interpretations on aerial photos from the 1950s and from the time just before the hazard for the whole catchment area of the Trisanna river. Additionally forest management plans from the year 1932 and 1992 will help to find transfer functions for interpretation of the hydrological response in 1950. A potential forest cover scenario will be the third scenario to undergo the hydrological modelling. The comparison of the output data will allow evaluating the quantitative impacts of forest covers onto flooding in this case study.

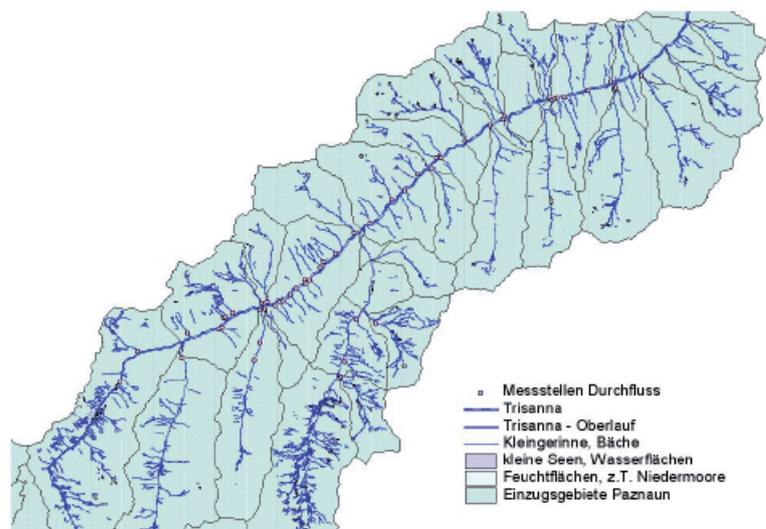


Fig.2: Discharge measurement and channel network in the Paznaun valley.

SUMMARY

Watersheds and their problems are complex, as are their solutions (LaFayette, 2002). Modelling and analysing the effect of forest cover on the 2005 flood event in the Paznaun valley in comparison with scenarios of a significantly reduced forest cover in 1950 and in comparison with a realistic potential forest cover will give a better appreciation of the role of forest cover concerning flood protection.

Keywords: flood, effect of forest cover, hydrological modelling