

# **DEVELOPMENT OF LAND USE, RELATED VULNERABILITY AND THE INTERPRETATION OF RISK MAPS BY DIFFERENT USER GROUPS**

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Over the last decades flood risk changed due to specific anthropogenic and environmental drivers. Past concepts of flood protection seem to have failed because they have not been able to prevent severe damages during extreme events. As an ex-post analysis of historic data of floods, land use and urban development the project RISKCATCH derives information how the factors of risk, hazard and vulnerability, developed over time. Focuses of the project are catchments of the Alpine environment and related forelands in Austria and Germany. The study provides information how future instruments of sustainable non-technical flood protection could be implemented. In particular, flood hazard and risk maps were evaluated by the technique of graphic semiology. This technique was used to assess the perception and level of detail provided for different stakeholder groups.

## **INTRODUCTION**

Risk is defined as a function of hazard and loss, both of which can be combined by multiplication in a first attempt. During the last years, a lot of work had been carried out with a focus on hazards research. As a result of mapping, measurements and modelling, hazards, reoccurrence intervals and related magnitudes can be predicted up to a certain extent; and design values for protection measures can be derived. Flood protection measures are by standard mainly designed for the 100 year (Germany) or 100 year and 150 year (Austria) return period. Preventive measures such as spatial planning focus in particular on such design events. However, loss, although included as one of two factors in the definition of risk, is mostly ignored so far. The analysis of loss, and in particular the underlying vulnerability, is still an open question in the risk assessment process, as shown by the development of damages due to previous events. Given climate change processes, an increase in design values for flood hazards can be expected. The project RISKCATCH addressed the issue of vulnerability and loss assessment by focussing on the risk management process. Using the results of an ex-post analysis of recent practices in dealing with hazardous events, the effects of policies, developments of land use, implementation of protection measures have been evaluated. To enhance future risk management strategies, key concepts related to vulnerability have been taken into account. In this context risk management was considered as an active reaction to dynamic factors of the environment but also to human actions and objectives.

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## **METHOD**

Project areas are three small and medium size catchments in the Alpine part of the Danube river basin and related forelands, and are tributary to the Inn and Drau Rivers discharging into the Danube. All areas show similar socio-economic developments and are typical landscapes of the Alps and related forelands. Trends such as tourism, economic growth together with urban sprawl, intensive agriculture and the development of infrastructure changed the characteristics of the catchment, river system and damage potential. Consequently, since the late 1930s serious attempts have been made to protect infrastructure, settlements and agricultural sites against flooding and torrent processes. However, land use pressure is still raising and recent studies had shown that the implementation of these protection measures led to a further increase of damage potential in the protected areas.

For all test sites flood hazard and risk maps have been derived based on data of synthetic floods derived from hydrological models in combination with stream routing and data of previous flood and torrent events. To increase the applicability of risk information on these maps, the perception of different stakeholders with varying technical and disciplinary background in flood management has been evaluated. This evaluation was based on a combination of interviews and the method of graphic semiology. Graphic semiology is based on the tracking and statistical analysis of eye movements while scanning visual information. As a result, statements on the difference between provided information and needed information were obtained.

## **RESULTS**

The temporal development of risk was assessed using different but complementary methods in Austria and Germany. The comparison of data representing time periods since 1850 from the Lower Vils region in Germany showed an increase in affected values at risk by a factor of ten and twenty, respectively, with an assumed resulting equal increase in risk. In contrast, an evaluation of damaging torrent events between 1973 and 2004 in Austria had shown no significant trend in a possible increase of losses. Considering the increase in settlement area during the same period, this might be attributed to the implementation of technical mitigation measures. Hazard prevention strategies such as restriction in spatial planning and urban development succeeded in preventing damages up to the level of design events.

The method of graphic semiology had been found to be a promising and innovative tool to assess risk perception. With respect to non-technical mitigation measures, the evaluation of risk perception resulted in recommendations for enhanced depiction of information, in particular with respect to varying needs of different stakeholders. However, since the number of test persons was limited during the study, there is a future need of further evaluation with respect to a wider application of the results to other test sites and types of hazard.

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