

## Summary

River systems all over the world are transformed in different ways by human activities, e.g. by channel regulations. These actions are necessary in many cases, but they cause a number of significant, often adverse effects in the natural river environment. Understanding the relation between human activity and the response of the fluvial system to the changes in the system itself enables not only to recognize the processes and phases of contemporary evolution of fluvial systems, but also to identify potential further directions of morphological transformations in river channels.

The investigations into the evolution of channels of regulated mountain rivers and into the associated processes are conducted worldwide, and in Poland these studies are mainly focused on the Carpathians region. In the Sudetes, however, this subject has been neglected so far. The literature lacks detailed studies which discuss geomorphological role of specific river regulation systems. This dissertation is an attempt to fill the above-mentioned gap in the knowledge of fluvial geomorphology of the Sudetes, focusing mainly on the problem of functioning and developing regulated mountain channels.

The research was conducted in the Kłodzko County where extreme floods occurred over the last two decades, during which the regulation structures had significant influence on channel morphology. Moreover, there is a well-developed river network in the study area, which is related to long-standing human activities, and thus numerous examples of the channel regulation exist. The Kłodzko County has also a rich history of changes in land use (mainly due to the socio-economic changes that have taken place in the region, including total population exchange and changes in land management). These modifications have affected the functioning of river channels.

The completed studies have shown that the main changes in the morphology of the regulated river channels of Kłodzko County are: (1) channel pattern changes as a result of regulation works, (2) channels depth increase below regulated channel sections and dam structures, (3) increase in the intensity of bank erosion process at contact places between natural and regulated river banks. The main cause of most anthropogenic transformations in the river channels are changes in the amount of sediment supply, leading to the modifications of channel load and their erosive and transport capabilities. In case of the Kłodzko County rivers, as in other regulated mountain channels, morphological transformations are most intensive immediately after the regulation works. The research has shown that the main factor affecting

morphological changes and functioning of the channel in the vicinity of training structures is their technical condition and maintenance routine.

The influence of hydrotechnical regulations on the channels, which in the Kłodzko County occurred at multiple stages, is noticeable; however, there is no clear correlation between the occurrence of anthropogenic objects and the development of channel forms. Hydrotechnical constructions are undoubtedly the elements that enforce the intensification of the creation of some channel forms (especially during extreme fluvial events) and support their development.

The level of regulation of Kłodzko County rivers is significant – nearly 30% of the length of the channels is regulated by continuous structures. In many cases such human interventions are necessary because the main process currently forming these channels in their middle and lower sections is bank erosion. There is a need to protect the river banks from destructive effects of bank erosion, especially in urbanized areas. In most cases this goal is achieved; however, in peripheral fragments of bank protection structures, the intensification of erosion process is observed, which results in the migration of the erosive zone downstream.

Very important impact on the morphology of the channels, especially on the formation of additional erosion and accumulation zones, has been noticed for dam objects which interrupt the longitudinal continuity of the channel. Below the dam structures, the rate of downcutting increases due to the retention of some portions of the transported material and because of channel load reduction. As a consequence, the erosive capabilities increase. Above these objects aggradation processes take place.

Morphological effects of training structures on the rivers of Kłodzko County are mostly local. No clear impact on the functioning of entire river systems is noticed. The highest efficiency of channel processes is observed in the direct vicinity of the objects and in peripheral fragments of bank protection structures.

The gathered material is a base to conclude that the type of morphological changes observed in the regulated channels of Kłodzko County is in most cases similar to the effects of training works in other mountain river systems in Poland and over the world; however, the scale of morphological influence is much smaller, which indicates a greater stability of the river channels of Sudetes than of the Carpathian or Alpine ones.

This dissertation does not entirely solve the problem of functioning of the mountain river channels in anthropogenic conditions in the Kłodzko County; however, it indicates the main tendencies of contemporary morphological changes in the channels and provides the basis for further detailed research.