

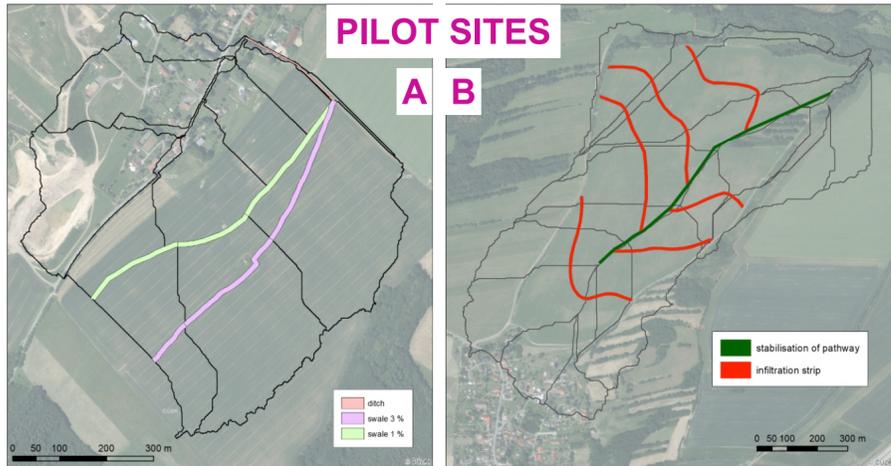
OPTIMIZING THE DESIGN OF THE SYSTEM OF FLOOD- AND EROSION-PROTECTION MEASURES

Martin Caletka, Karel Drbal, Kamila Osičková, Pavla Štěpánková

INTRODUCTION

The resilience of the landscape in Czechia to the effect of climate change – drought on the one hand and intense rainfall events on the other – is limited. Major factors include large land blocks and inappropriate agricultural practices. In an effort to improve this situation, land consolidation projects are realized, within which boundaries of plots are re-delineated and systems of flood- and erosion-protection measures are proposed. Their implementation is financially demanding. Therefore, it is always necessary to evaluate their effect on the reduction of surface runoff and associated negative consequences.

It is the aim of this contribution to provide information about the ideological concept of the optimization task and present the current state of analyses conducted at two pilot sites. The ultimate goal is to propose a methodological procedure enabling a similar method of evaluation applicable in various conditions, always taking into account the limits of a specific site.



The Husí potok (eng. Goose Creek) catchment – a left-side tributary of the Oder River – was selected as a pilot area. In this catchment, monitoring of precipitation and water levels has been ongoing for seven years. The proposed procedures for evaluating the effectiveness of measures are now being tested here at two pilot sites. They are very small (ca. 46.5 ha and 69.5 ha) and differ in the composition of the measures, which allows to work out the formulation of the optimization task.

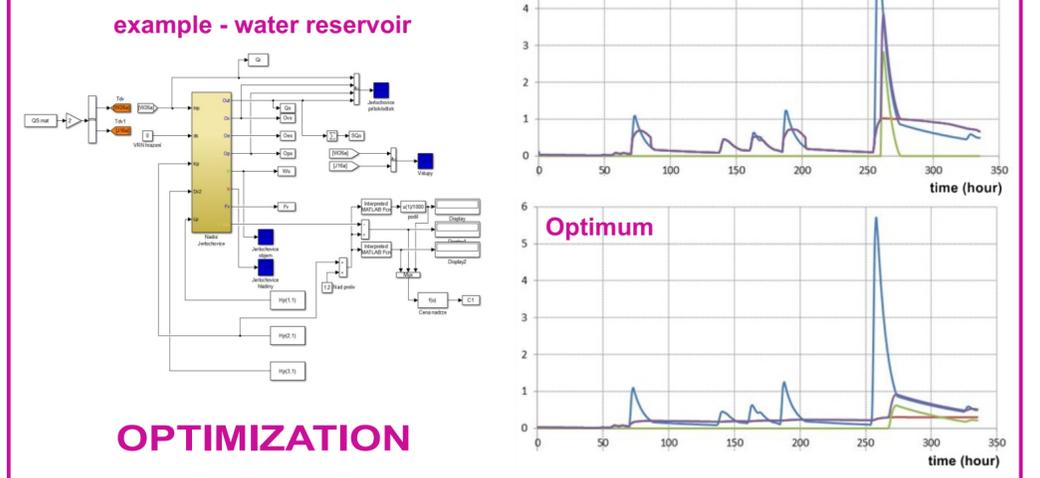
METHODOLOGY

For one design precipitation event. (duration 6 h, return period 10 years), sets of regime states of variants of partial systems of measures were processed by the HEC-HMS software for both the experimental sites:

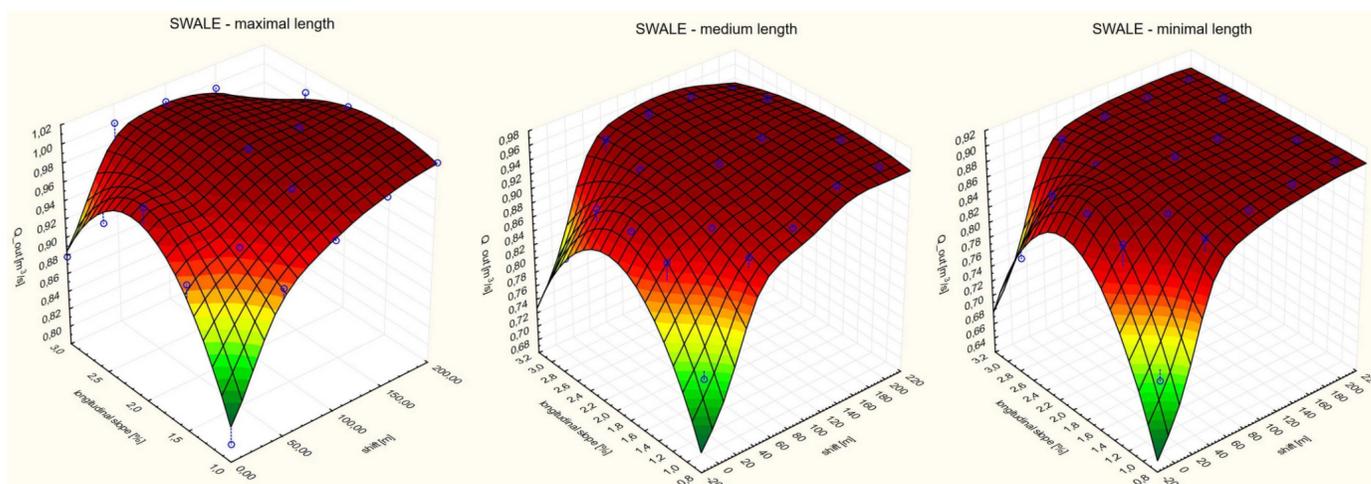
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|------------------------|-------------------------------|
| Site A: | Site B: |
| - interceptor swale | - grassed waterway |
| - ditch | - grassed infiltration strips |
| - a total of 76 states | - a total of 11 states |

Dependent variables (culmination discharge in the outlets, length/area of the measures, total cost of the measures) are related to the basic parameters of the subsystem change, namely the position and longitudinal slope of the swale, length and width of the grassed infiltration strips etc.

The evaluation of effectiveness of the proposed measures is carried out using the concept of the optimization task. The basic version of the tool consists of a combined criterion function that minimizes procurement costs for measures with maximum protective effect. The optimization tool is implemented in Matlab and Simulink (Mathworks) softwares.



The discrete states (different positions and longitudinal slope of the swale) were interpolated to create the surfaces, that characterize the effect of the swale and ditch on the discharge at the outlet of the experimental watershed. Analogical computations will be performed to characterize the measures' effect on erosion and the costs. Subsequently, it will be possible to derive the combined criterial functions for minimization of costs and maximization of the measures' effects.



Next steps

At present, a comprehensive procedure for the generation of the outflow characteristics is developed. For the actual optimization task scripts were prepared in the Matlab environment for constructing the control surfaces of the selected quantities. The effect of the measures on erosion will be processed with a similar sequence of steps.

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