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Poster · April 2011

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Monitoring of urbanisation effects on water quality in the catchment of Rák Stream, Sopron, Hungary

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Abstract

In the ancient ages settlements were founded frequently in the neighborhood of a stream or a smaller river to benefit the goodness of clean water. In the last century these neighborhood was sometimes cumbersome. The stream was regulated, dredged out or crowded with lid. This work aimed to investigate of the urbanization impact on a stream with quasi natural headwater catchment.

1. Processes in an urbanized watershed

Qualitative and quantitative hydrological conditions of urban territories can be remarkably different compared to the catchments without human impacts. Impairment of water quality has an effect on the wider environment and ecosystem, as well as leading to decreasing of biodiversity.

Increasing extent of paved, impermeable surfaces, decreasing storage capacity and surface roughness intensify the water runoff. As a consequence runoff proportion and peak discharge values will grow, while time of concentration will decline. Nowadays it is very important to investigate and to handle these processes when even more extreme precipitation events are dominant and hydrological catastrophes have happened.

Conditions of sedimentation can also alter in the streams through the settlements. As a result of these changes channel erosion can sporadically increase (e.g. the streambed will be deeper), or accumulation speed up at another places (e.g. at the upstream side of structures). Effects of urbanization on the hydrological characteristics can be revealed with comparing geometry of natural streams to the changed geometry of urban stream reaches.

2. Rák Stream pilot area

Adjusted monitoring of Rák Stream (Sopron, Hungary) has been started taking into account the mentioned principles and facts.

The data set is measured in the watershed of the Rák Stream (Figure 1). This stream is the second largest brook of Sopron. The main part of the catchment located in the Sopron Hills (Hungary) close to the Austrian border (Figure 2). The upper part of the watershed called Hidegvíz Valley is fully forest covered and the whole forested area is nature reserve. Here was established the Hidegvíz Valley experimental catchment [Gribovszki et al., 2006], where the base data for the hilly region is measured.

The lower part begins with recreational areas (urban forest) and suburban settlements. After these lightly modified areas begins the suburban area with channelized stream bed. In the city of Sopron the Stream is covered partly.

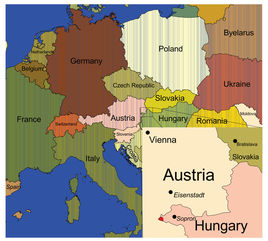

Figure 1: *Location of the study area*

Seven measuring points (Fig. 2) have been allocated. These are evenly distributed from the headwaters to the lower course of Rák Stream. These points cover partly the natural forested catchment area, partly in the urban territories.

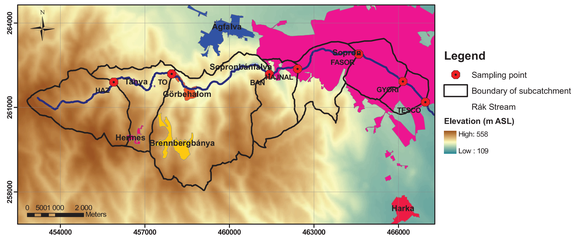

Figure 2: *Color coded DEM with sampling points*

The aim is to prepare the developing of a complex model with regular field measurements, which model is able to predict not only the water quality as a result of contamination-transport processes in the water body but it takes into account the transport of organic and inorganic polluting material from their source area to the channel. (With especial regard to the detached soil after hill-slope erosion as potential diffuse pollution of the streamwater.)

3. Examinations

In order to build this model the following preliminary examinations are necessary:

- Delineation of catchment area, assessment of rainwater and sewage-water inputs to the stream (Fig. 2);
- Estimation of urban concentration and discharge capacity of the drainage system in an experimental basin (Fig. 3);

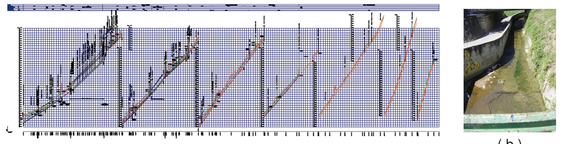

Figure 3: *Longitudinal profile of the Rák Stream (a) and a critical cross-section (b)*

- Mapping of slope conditions and classifying of slope categories (Fig. 7);
- General characterization of each sub basins (Fig. 4);

Figure 4: *Mapping in the tunnel of the Rák Stream (a, b) and surveying in Sopron (c)*

- General runoff data, automatic water stage recording, discharge measuring (Fig. 5);

Figure 5: *Discharge gauging stations in the forested area (a) and at border of Sopron (b)*

- Field measurement of simple physical and chemical water parameters (temperature, pH, electrical conductivity see Fig. 6), laboratory water analytics (COD, NH_4^+, NO_3^{2-}, TP, SO_4^{2-}, Cl^-);

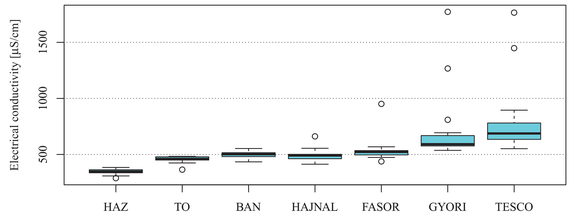

Figure 6: *Boxplots of EC (the most frequently measured parameter). See the locations of sampling points in Fig. 2.*

- Monitoring of suspended sediment concentration;
- Investigating of macro invertebrate fauna;
- Soil erosion researches, modelling and mapping (Fig. 7).

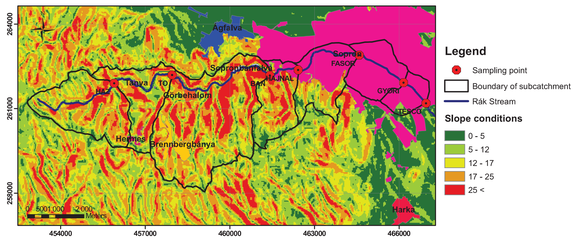

Figure 7: *Slope categories on the catchments*

The poster reports on the developed monitoring system and the previous results.

Acknowledgements

This research was partly funded by the Forest and Wood Utilization Regional University Research Centre (ERFARET), Social Renewal Operational Programme (TÁMOP 4.2.1/B-09/KONV-2010-0006). Participation of Zoltn Gribovszki was partly funded by Bolyai Fund of the Hungarian Academy of Science.

References

Zoltán Gribovszki, Péter Kalicz, and Mihály Kucsara. Streamflow characteristics of two forested catchments in Sopron Hills. *Acta Silvatica et Lignaria Hungarica*, 2:81–92, 2006. URL http://aslh.nyme.hu/.