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Hydrological and hydraulic analysis of an effect of canopy changes in watershed on runoff regime and flood hazard in downstream areas

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Floods are severe natural disasters and their magnitude and frequency increase presently with the expense of climate changes. Due to the favourable geographical features the riparian areas present a great development potential, but at the same time increase the expected flood damage. In order to reduce flood risk, passive flood prevention measures are carried out to reduce flood risk with divert water away from settlements, industrial and other areas with high damage potential into less vulnerable areas. Numerous studies on floodplain management in a way that also allows the mitigation of negative consequences of flood events show that proper land use or land cover on the extensive floodplains can increase retention capacity and decrease flood hazard in downstream areas. Similar to floodplain land use the land cover and forest structures within the catchments also have an important impact on run-off regime and formation of the flood waves. Therefore, the appropriate spatial planning of the land use in catchment areas present an active flood protection measure, whereby, with intense precipitation event, greater retention is enabled and consequently decrease the intensity of flood events .
As part of the EU project Camaro-D the impact of different land cover, forest structures, type and density of canopy in the watershed on the downstream flooding was analysed. For the pilot area of Iška River the retention capacity of the precipitation, form and propagation of the flood waves as well as the influence on flood hazard and ground water regime was analysed using a hydrological, hydraulic and hydrogeological modelling. Major part of catchment area is covered by forest and protected by Nature 2000 and as an ecologically important area. Therefore interventions in this area are very limited. In research only scenarios of climatic and precipitation changes, and natural hazards which may affect the forest structure and thus runoff conditions (e.g. afforestation, sleet, fire, wind throw) have been taken into consideration. For each vegetation structure state in the catchment area the precipitation events with different return periods were analysed. The results of the hydrological model in the form of outlet hydrographs from the catchment of Iška River were used as input data in the hydraulic model, which was used to analyse the impact of land use changes in the catchment area on flood wave propagation and flood risk along lower section of Iška River. The hydraulic model has also provided data for determination of the interaction between surface water and groundwater, and enabled further hydrogeological modelling of responses to extreme hydrological conditions (high waters, droughts). Simulations of the quantitative state of groundwater in the Iška fan bring important information for more efficient operating of the Well Field Brest system during different hydrological conditions.

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