

2<sup>nd</sup> Annual Congress on

# Soil and Water Sciences

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### Anthropogenic changes in water storage in peat deposit in intramountain Orawa-Nowy Targ basin (western Carpathians)

The aim of the presentation is to evaluate the scale of changes in water storage in peat deposit in the Orawa-Nowy Targ Basin (643 km<sup>2</sup>) off the western Carpathians (European mountain range), influenced by human activity since the middle ages till 2015. The basin is covered by fluvioglacial fans rich in groundwater and stores large amounts of water in vast peatbogs, especially raised bogs. The peatbogs occur at the altitude from 592 to 770 m a.s.l. (metres above sea level) since the middle ages the peatbogs in this basin have been degraded by human impact, mainly due to peat exploitation and drainage by dense network of ditches. After 1990 shrinkage of the limit of peatbog domes slowed down or even stopped and draining ditches are not cleaned which causes increasing irrigation of post-peat areas. Contemporary limit of individual peatbogs and their elements (i.e. reduced domes, post-peat areas, isolated peat patches) in the basin was determined based on data from aerial laser scanning LiDAR (Light Detection and Ranging) and additionally from peatbogs mapping. Former limit of peatbogs was assessed on the basis of historical maps (18th-20th centuries) and mapping of remnants of peat deposit. Using drilling methods, the thickness of peat deposit was measured within each peatbog in the period from August to October (relatively dry deposit). In order to determine the amount of water in peat, four raised bogs and four fens, assumed as representative for the area studied, were sampled in 2008-2015 from May to October (every two months). Using Kopecky's cells (0.25 dm<sup>3</sup>), 540 peat samples were taken at the profile depth every 50 cm, which were the bases to calculate capillary capacity of peat in volume version P<sub>wv</sub> [%]. Water resources in peatbogs both current and those probable existing before the beginning of the intensive human impact in the basin were estimated based on the appropriate volume of peat deposits and values of capillary water volume of peat P<sub>wv</sub> [%]. Finally, maximal amount of water which may be stored in domes (now in residual domes and post-peat areas) and fens was estimated. In the past probable total amount of water which might have been permanently stored in fens in the basin was estimated to 32 million m<sup>3</sup>, and in the raised bog domes 139 million m<sup>3</sup> (together 171 million m<sup>3</sup>). Total amount of water which is currently stored in fens in the basin is estimated to 15.1 million m<sup>3</sup>, in raised bog domes to 45.2 million m<sup>3</sup>, and in post-peat areas to 2.1 million m<sup>3</sup> (total volume of water is 62.4 million m<sup>3</sup>). In relation to the whole area of the basin, the index of water retention of peatbogs reaches 10 cm and at the end of the middle ages this index was probably 27 cm. The fastest rate of water loss in peats occurred 50-150 years ago.

#### Recent Publications

1. Raczowska Z et al. (2012) Recent Landform Evolution in the Polish Carpathians. In Recent Landform Evolution: The Carpatho-Balkan-Dynaric Region. Springer Geography. Pages:47-101. Doi:10.1007/978-94-007-2448-8\_5.
2. Lajczak A (2012) Water circulation and chemical denudation within the upper Skawica River flysch catchment, western Carpathian mountains. Zeitschrift für Geomorphologie, Supplementary Issue. 56(1):69-86. Doi:10.1127/0372-8854/2012/S-00073.
3. Lajczak A (2013) Changes in Raised Bog Relief During the Holocene. Case study: Polish Carpathian Mountains. In Soil Processes and Current Trends in Quality Assessment. IntechOpen. Pages:337-363. Doi:10.5772/54988.

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4. Lajczak A et al. (2014) Contemporary geomorphic processes in the Polish Carpathians under changing human impact. *Episodes*. 37(1):21-32.
5. Lajczak A (2014) Changes in flood risk impacted by river training. Case study of piedmont section of the Vistula river. *Annals of Warsaw University of Life Sciences – Land Reclamation*. 46(4):55-73. Doi:10.1515/sggw-2015-0006.

## Biography

Adam Lajczak (Geomorphologist, Hydrologist) is currently the Head of Research in the Department of Geoinformation and Geoenvironment at the Institute of Geography of Pedagogical University in Cracow (Poland). His research is focused on geocology of mountains and their forelands, rivers valleys and marshy areas. He is a Member of Association of Polish Geomorphologists, International Association of Geomorphologists (IAG), International Association of Hydrological Sciences (Commissions: Continental Erosion and Water Resources) and European Geophysical Union organizations respectively. He started his research in the frames of the project IAG – Anthropocene Geomorphology. In his research much attention is paid to geomorphology, hydrology and paleogeography of peatbogs, especially to anthropogenic degradation of peatbogs and decrease of their water retention. Simultaneously he is engaged in the research on causes, course and results of floods in the valleys of the Carpathians and their northern foreland and on hydrological consequences of progressive decrease of capacity of dam reservoirs due to their siltation.

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