



Impact of tree uprooting on relief changes in the Tatra Mountains, Poland.

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Tree uprooting is an important process which significantly affects forested hillslopes. The most frequently studied geomorphic effects of windthrow process are: sediment transport, changes in slope cover structure and creating pit-mound microtopography.

The aim of the research was to quantify geomorphological effects of single windthrow event, indicate their variability within the hillslope and in relation to slope inclination. The research was conducted on July and August 2015 in the small watershed (0.12 km²) in the Tatra National Park, Southern Poland. The area was affected by the windthrow event on 25th of December 2013. All trees were uprooted, excluding single undamaged and snapped individuals. Geomorphological mapping of the watershed and measurements of windthrow pits (length, width, depth, local slope inclination, occurrence of vegetation) were conducted. On the area of 0.06 km² 520 windthrow pits were identified.

The average volume of a single windthrow pit is 2.46 m³, and average surface area is 5.65 m². The volume of uplifted material, spread evenly across the area, gives a soil layer of 1.9 cm thick. The total surface area covered by the windthrow pits is 4.6 %. Both volume of the pits and their surface area are not related to the slope inclination. Number of windthrows on a given area determines the volume of pits ($R^2 = 0.54$) and the surface area of pits ($R^2 = 0.66$). Effects of the windthrow event are not uniformly distributed within the watershed. There are sites with low disturbance rate and sites significantly affected by the event. Geomorphological mapping provided the examples of an impact of uprooted trees on the relief of small landslides.