



## **The impact of forest roads on relief transformations in the Tatra Mountains**

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Forest roads in mountain areas can lead to significant slope fragmentation and cause changes in water circulation, which contribute to the development of different erosive and accumulation landforms.

The main aim of the study was to determine the relief transformations caused by forest roads, as well as to determine the main factors influencing those transformations.

The researched roads are located in the Western Tatra Mountains, in the Lejowa, Jaroniec, and Kościeliska valleys. All of the roads are located in the forest belt. The studied roads were created and transformed between 2014 and 2015, when intense salvage logging operations were conducted.

Geomorphological mapping was used to determine the extent of the relief transformations. The 6.2 km of studied roads were divided into homogeneous sections. Numerous morphometric parameters were recorded for each road section. In total 116 road sections and 10 linear erosion scars were distinguished.

In order to determine the main factors responsible for relief changes within the roads the Principal Component Analysis (PCA) was used. The t-test for two independent samples was also used to check the influence of the bedrock type on the geomorphic changes within roads.

The analysis has shown that the interception of the subsurface flow from the cutslope has the largest impact on the magnitude of geomorphic changes within the forest roads. The resilience of the bedrock also affects the extent and type of relief transformations.

The proper planning of the road's location within the slope significantly reduces the environmental impact of the road.