Trails in the Tatras

The Tatra National Park is seeing continual growth in its tourist traffic, contributing to the destruction of the soil cover along the tourist trails. This process can be reduced by applying some simple solutions.

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Poland's section of the Carpathian Mountain Range is home to six national parks, including the most popular Tatra National Park. In protected mountain regions of this sort, the greatest impact on the environment is caused by transport routes of various sorts (including roads, walking and hiking trails and ski runs). In the Tatra National Parks, walkers and hikers exert the most significant environmental influence, with a total of 275 km signposted routes at their disposal. The Park's visitor statistics (estimated based on ticket sales) show a steady growth in numbers. In 2000, the Park welcomed 2,782,629 visitors, a figure that increased to 3,348,246 in 2015 and 4,788,788 in 2020. Spatial analysis of tourist distribution pinpoints two valleys as the most popular destinations, and reveals that July and August are the busiest months.

Types of erosion in the Tatras

The impact of tourist traffic on footpaths and tourist routes in the region mainly involves trampling vegetation and damaging soil, which in turn leads to degradation of the subsoil and an acceleration of natural erosion processes. These processes have a range of effects on different slopes. Areas surrounding tourist trails are frequently stripped of plant cover, putting them at increased risk of damage by geomorphic processes such as runoff, needle ice, deflation (erosion

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Fig. 1
Deformed terrain near a tourist trail in the West Tatras

Fig. 2
Tourist trail leading among hard rocks in High Tatras

of looser material by the wind), nivation (damage to the soil caused by repeated melting and freezing), and gravitational processes. The rate of these processes varies according to elevation and is closely dependent on weather changes throughout the year. The Tatra National Park covers four geoecological elevations: montane forests, subalpine, alpine, and subnival. These are defined by the type of vegetation, climate and morphological conditions, as well as water circulation and retention. Each zone is characterized by specific natural processes, and their course throughout the year depends on air temperature, rainfall and snowfall, and wind speeds. Runoff, needle ice and gravitational processes are found at all geoecological levels. In turn, deflation (removal of sand and soil by wind) and nivation is limited to zones above the tree line.

Surface runoff is the draining away of rainwater or thaw carrying fragments of broken off or decayed rock and soil. The process may lead to the development of erosive dissections, which can only be halted by uncovering the solid undersoil. Needle ice is formed during ground frost and can push away small soil particles, which can cause soil creep or be washed away by runoff or deflation. The latter is another important process which is especially powerful in regions without permanent plant cover around tourist trails; it can give rise to such landforms as deflation niches and isolated protuberances. Nivation is a process occurring in persistent snow patches in shady areas with no permanent vegetation. The repeated thawing and freezing of the snow cover contributes to soil erosion and deepens the recesses where the snow persists. These are known as nivation niches. Natural erosion processes compounded with the impact of tourism along marked trails lead to the increasing presence of degraded zones on mountain slopes, which vary depending on the natural conditions in the given region.

Trampled under many feet

The most important factors driving degradation include the resistance of the geological subsoil, trail surface, traffic capacity, and the local orography and microclimate. Transformations of pathways and tourist routes are closely linked with the type of subsoil. Trails leading among hard or massive rocks are tough and very slow to degrade. They are mainly found in the subalpine and alpine zones of the High Tatras. However, trails that run across softer, more granular terrain are significantly more affected by erosion. Paths such as these can be found in the alpine zone of the Western Tatras. In these areas, even lightly trampled plant cover brings natural geomorphological processes into play. Another important element which has a major impact on degraded areas is the way in which trails are maintained and repaired. Trails may be impassable because the surface is difficult to walk on

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Fig. 3
"Needle ice" formed along a tourist trail in the Tatras

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Fig. 4
Biodegradable matting used to regenerate soil and plant covers near the Czerwone Wierchy peaks in the West Tatras

(large, craggy rocks), slippery (dolomite, limestone) or eroded and collapsed by geomorphological processes. Signposted paths may also have insufficient traffic capacity, many of which can be found in the subalpine and alpine zones of the Western Tatras. Major deformation of terrain is also found on paths in shady areas, especially with a northern or north-eastern aspect, since they are likely to be covered by snow for long periods. Snow covering paths may also be made denser as it is trampled down, meaning it can persist on the trail for longer. In turn, hikers walking around patches of snow expand the degraded area. Gradual degradation of a natural surface may lead to the formation of outcrops, which are inconvenient and difficult to pass, leading to the creation of alternative paths and an expansion of degraded regions.

The morphological location of trails on the slope is also extremely important, as it affects erosion. The greatest impact on terrain is made by paths running vertically along the slope, while those leading perpendicular to the incline or taking large hairpin bends are the safest. When trails make large zig-zags across the slope, the pathways are generally between one and two meters wide. When trails follow the angle of the slope, the pathways and the surrounding degraded zones may reach over ten meters across. Additionally, in an absence of a clearly marked main trail, we are likely to see numerous alternative paths running close to one another. This leads to a gradual but progressive destruction of vegetation between the paths, which can lead to even greater degradation of the slope. Such zones are mainly found in the alpine zone of the Western Tatras.

Managing tourism

Developing infrastructure and mass tourism are a major problem in managing mountain regions, in particular given that they accelerate natural geomorphological processes. This makes it essential to streamline the flow of tourists, improve the condition of existing trails and protect them against linear erosion by appropriate drainage. Additionally, rangers are increasingly using biodegradable jute matting, which helps regenerate soil and vegetation (Fig. 4). In mountain regions with high volumes of tourists, a good (if unpopular) solution is to limit the numbers of visitors, in particular in spring when slopes are covered in melting snow and are in danger of being damaged by walkers. The Slovak section of the Tatra National Park (tanap.org) is closed to tourists between 1 November and 15 January.

Protected mountain regions are highly biodiverse. This poses a major challenge to their management, since it is essential to strike a sensible balance between protecting delicate ecosystems and visitor satisfaction. Mass tourism in the Tatra National Park is a major contributor to the degradation of soil, which may in turn lead to irreversible changes to the terrain. Research conducted in different mountain regions around the globe affected by anthropogenic pressures helps us gain a better understanding how they can be managed more sustainably. ■

Further reading:

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