ANALYZING THE IMPACT OF HUMAN INDUCED TRAMPLING ON ALPINE SWARDS BY REMOTE SENSING

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ABSTRACT

In high mountains environment main stressors include too high light intensity, lack of water, changing weather conditions or trampling due to increased tourist traffic. Too much intensity of stressor causes irreversible cellular changes, sometimes leading to death of the plant cell. Studies in a non-invasive manner can be carried out by methods of remote sensing and fluorescence. During field research in August 2013 following measurements were performed: spectrometric measurements with ASD spectrometer FieldSpec 3, bio-radiometric measurements of chlorophyll content, plants surface radiation temperature (ts) and thermodynamic air temperature (ta), accumulation of photosynthetically active energy and the projection surface of the leaves. Spectrometric measurements allowed to obtain spectral characteristics of tested alpine swards species. Remote sensing vegetation indices were calculated to show various parameters of plants, including chlorophyll, carotenoids, the amount of light used in the process of photosynthesis, or the water content in the plant. Bio-radiometric measurement were used to verify information obtained from the spectrometer and to show correlation between biometric measurements and vegetation indices. Chlorophyll fluorescence informs of the state of photosynthetic apparatus and the dynamics of the processes of photosynthesis.

The aim of combining such research methods is to estimate the proportion of energy used for photosynthesis (photochemical quenching) to energy emitted in the form of heat (non-photochemical quenching) and on this basis to evaluate how effectively the energy of light radiation was consumed by PSII. The correlation of fluorescence (t1/2; Fv/Fm) with values of indices determines the state of plant and the impact of stress factors on vegetation. Studies were conducted in the area of Kasprowy Peak and Red Peaks in Tatras (UNESCO M&B Reserve and National Park). The measuring points were located in a buffer zone of 5 meters from the trail (covering areas of the most damaged vegetation)and in a buffer above 10 meters (areas of non-damaged, reference vegetation).

The study showed statistically significant differences between indices calculated for the same species in two studied buffer zones. The vegetation alpine swards in the 5 m buffer had less dense cover and poorer condition, which partially enhanced the process of erosion and destruction of the trails. In addition, it was observed that the vegetation located near the

trails produces less products of photosynthesis, however, stress has not destroyed completely plant cells. The study showed statistically significant differences in the indices between the same species in the analyzed two buffers. In addition, it was observed that the vegetation located on the trails produces less of the light reaction products, showing that influence of stress does not damage completely plant cells. State of the vegetation located 5 meters from trails can be rated as good, however stressor in the form of trampling significantly reduces its condition. The applied remote sensing and fluorimetric methods allows to analyze the state of vegetation in a multi-year period.