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Zróżnicowanie kosodrzewiny w Tatrach, w świetle Badań teledetekcyjnych

Dwarf pine differentiation in the Tatra Mountains, on the basis of remote sensing investigation

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Key words: *hyperspectral images, biophysical parameters, LAI, fAPAR, Pinus mugo Turra, Tatra Mountains, empirical model, ROSIS*

Dwarf mountain pine (*Pinus mugo* Turra) is the main component in the subalpine belt in the Tatra National Park, where the study was conducted. From the ecological point of view dwarf pine plays an important role in the sensitive mountainous area.

Until now there were no studies focused on structure of dwarf pine community and there were also no attempts to work out methodology for detailed qualitative and quantitative description of dwarf pine.

In this study for the first time it was aimed to prepare methodology of dwarf pine characterization and monitoring using hyperspectral data. Analysis involved processing of airborne and satellite images data and field measurements. Presented study evaluated linear predictive models between vegetation indices derived from radiometrically corrected airborne imaging spectrometer ROSIS, spectral field and laboratory measurements and field measurements of dwarf pine biophysical variables (LAI, f_{APAR}). Narrow band vegetation indices were computed on the basis of all possible two-band combinations of set of vegetation indices (VI, NDVI, PVI, SAVI2, TSAVI). VI based on ROSIS wavebands 510 nm and 630 nm was linearly related to leaf area index (R^2=0,48). VI and NDVI based on FieldSpec HH wavebands 886 nm and 518 nm performed better and were linearly related to LAI (R^2=0,72). TSAVI based on ROSIS wavebands 658 nm and 570 nm was linearly related to the fraction of absorbed photosynthetically active radiation (R^2=0,72). SAVI2 based on FieldSpec HH wavebands 747 nm and 703 nm was linearly related to f_{APAR} (R^2=0,81). Analysed indices of vegetation condition were correlated (R^2>0,90) with spectral vegetation indices based on FieldSpec Pro laboratory data. The study shows that for hyperspectral image data covering spectral region of visible light and near infrared, linear regression models can be applied to quantify LAI and f_{APAR} with satisfying accuracy. Models involving spectral information from sensors that have wider spectral range have better potential to linearly quantify biophysical vegetation parameters involving spectral vegetation indices.

Vegetation indices that have the best relation to LAI and f_{APAR} were based on wavebands related to spectral features.

It can be assumed that hyperspectral data contain information relevant to the estimation of vegetation biophysical parameters.

In this study it was investigated if dwarf pine community differs spectrally within study site. To assess presence and extent of the spectral differentiation the set of field and laboratory spectral measurements were used. Reflectance curves were compared visually and using the statistical test. It was demonstrated that the majority of the studied dwarf pine plots have a characteristic signature. Parts of the electromagnetic spectrum which offer greatest information content for discriminating between and identifying dwarf pine spectral types were indicated.

It was also examined if any of abiotic components of environment (altitude above sea level, aspect, slope, soil type, geology, global radiation and temperature) has an influence on the spatial distribution of LAI and f_{APAR} values. WMP (index of tie strength) and MP (tie strength) were used to assess an extent of the influence. It was found that neither of investigated abiotic factors affects LAI and f_{APAR} values.