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Drying out conifers classification employing TripleSat satellite data

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Drying out of coniferous trees (*Picea abies*) due to bark beetle infestation and other diseases leads to a high rate of conifers mortality. The coniferous forests in Belarus are largely exposed to damage by the bark beetle, the early symptoms of which are the changes in the color and loss of shine of the needles.

Purpose of the work is to identify drying out stages combining the TripleSat multispectral satellite data (spatial resolution 3.2 m MS, 0.8 m PAN, bands R, G, B, NIR) for the test coniferous forest area in Belarus (53.65419° N, 27.640213° E) with quasi-synchronous airborne photo-spectral measurements which have been used as a reference data. Airborne measurements of reflectance coefficient function of underlying coniferous trees have been carried out by employing two spectrometers (wavelength range 400-900 nm, spectral resolution 4.3 nm) and photo-camera (visible range, FOV 50°) mounted on board of Diamond DA40NG aircraft in nadir geometry.

Airborne RGB-images have been used for visual identification of the type of underlying surface and for subsequent training data set formation. Training data consist of several sets (10 – 20) of vegetation indexes for each type of underlying surface. The linear discriminant analysis (LDA) classification algorithm has been applied in this study for distinguishing the conifers drying out stages. A set of vegetation indices evaluated for each reflectance coefficient function has been applied as input data for LDA classification algorithm.

LDA classification algorithm has been employed to the TripleSat image for identification drying out stages of coniferous trees. The reference data for LDA classification algorithm of the TripleSat image included the combination of coordinates and corresponding types of underlying surface obtained from the results of the airborne experiment classification. A set of vegetation indices has been derived for each pixel of the image and used as input data for LDA algorithm; also vegetation indices calculated for the reference pixels have been applied for training data set formation.

The classification accuracy of three conifers drying out stages based on the airborne experiment is estimated to be in a range of 27 - 74%. The verification of TripleSat classification results has been performed by visual comparison with high resolution aerial images.