ESTIMATING CANOPY WATER CONTENT OF POPLAR PLANTATION FROM MIVIS DATA

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Objective of the study
Information about vegetation water content has widespread utility in agriculture, forestry, and hydrology. Remote estimation of canopy water content has ecological importance as indicator of vegetation response to drought stress and as predictor of susceptibility to wildfire. Recent studies also support the hypothesis that satellite-based water indices can be used for estimating the water scalar in calculation of light use efficiency providing information for primary production modelling. Hyperspectral imaging spectrometer data are well suited to measure canopy water content by exploiting water absorption features in the near and shortwave infrared.

This study examines the use of airborne Multispectral Infrared and Visible Imaging Spectrometer (MIVIS) data for mapping canopy water content in an intensive poplar plantation sited in the Ticino Natural Park (Italy). We show the remote sensing techniques and the results found at canopy level by using the atmospherically corrected hyperspectral reflectance computed from MIVIS data.

Materials and Methods
Leaf and plant water content have been measured in laboratory providing the amount of water in a leaf relative to the amount of dry matter (FMC), relative to its area (EWT) and relative to the turgid weight (RWC). To convert the foliar water content into canopy water content, the specific leaf area, the Leaf Area index (LAI), and the percent canopy cover were used to scale the water-content data by using different formulations.

Different remote sensing techniques, including semi-empirical approaches (i.e. spectral indices, continuum removal and multiple stepwise regression) and inversion of physically based canopy reflectance have been tested in order to retrieve canopy water content from MIVIS data.

Results
Significant correlations were found between FMC and selected vegetation indices, but statistically stronger relationships were found between NDWI_{mivis} and EWT_{canopy} using the Reduced Major Axis technique rather than the Ordinary Least Squares. Finally, we identified the canopy structure as the main source of signal variation in the reflectance indices studied. However, spectral indices sensing canopy water content appear to respond not only to canopy structure but also to the canopy water, providing a useful method for mapping the vegetation water content at the experimental site.