



## **Delineation of homogeneous management zones through EMI and multispectral data for a vineyard in northern Italy**

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Homogeneous site-specific management zones (SSMZ) used in Precision Agriculture for the optimization of water and nutrient management are usually delineated from soil electrical conductivity (EC) maps obtained through geophysical proximal soil sensors. To improve SSMZ delineation, the recent literature recommends the integration of geophysical soil monitoring data with crop information acquired through multispectral (VIS-NIR data) imaging. In non-flat areas, topography can influence the soil water condition and consequently the crop water status; in this situations SSMZ delineation may be improved by taking into account the topography (which can be investigated through VIS surveys) in addition to soil and crop data. On the other hand, it is now widely recognized that thermal infrared (TIR) can be used to produce indices, e.g. Crop Water Stress Index (CWSI), well correlated with the crop water status.

Objective of this study is the fusion of EC and VIS-NIR data to delineate SSMZs in a rainfed vineyard of 1.5 ha located in northern Italy (Franciacorta), and the assessment of the obtained SSMZ map through a TIR survey carried out in a hot and dry period of the agricultural season 2017. In the literature, the delineation of SSMZs is usually validated through a distributed crop yield map. In this study, in absence of this type of information, it is assumed that the crop water status may summarize the effect of the principal environmental factors acting on the crop production. EC data were collected in May with a multi-frequency electro-magnetic induction (EMI) sensor. The EMI sensor worked with three different frequencies, corresponding to increasing depths of exploration up to 3 - 4 meters. Data for each frequency were interpolated to obtain EC maps. VIS-NIR and TIR images were acquired in late July with multispectral and thermal cameras mounted on an Unmanned Aerial Vehicle (UAV), during two separate flights. Photogrammetric processing was performed, producing the digital terrain model (DTM), four orthophotos from VIS-NIR data (one for each channel), and one orthophoto from TIR data. After radiometric and atmospheric corrections, VIS-NIR and TIR orthophotos were used to retrieve the Normalized Difference Vegetation Index (NDVI) and the CWSI. The post processing of the different data, the data fusion procedure and the results obtained in term of SSMZ map and its assessment will be presented and discussed in the poster.

**Keywords:** geophysical data, multispectral data, thermal imaging, data fusion, homogeneous management zone, crop water stress