# Remote sensing capabilities to estimate biophysical parameters of grasslands in the Alps region of Trentino (Italy)

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Remote sensing is a valid tool for scaling up ecosystem measurements to landscape level serving a wide range of applications, such as new efforts to improve carbon-cycle models. The aim of this study was to test the suitability of airborne and satellite platform sensors in estimating grassland biophysical parameters such as LAI, biomass, phytomass, and Green herbage ratio (GR). Moreover, this study analyzes how the sensors' spatial resolution affects the inventories of these parameters in Alps ecosystems where spatial variability is very high.

Ground-truth measurements were taken on July 2003 and 2004 on Monte Bondone plateau (Italy) in grasslands varying in land use and management intensities. Airborne data were collected using the same ASPIS sensor in both years, while from satellite platforms an IRS-1C-LISS III image (18/07/2003; 25 m resolution) and a SPOT 5 image (27/07/2004, 10 m resolution) were used.

Considering both aircraft and satellite data, LAI, biomass and phytomass showed logarithmic relationships with NDVI and GreenNDVI; biomass-GreenNDVI $R^2$values were 0.83 (ASPIS 2003), 0.52 (ASPIS 2004), 0.59 (IRS 2003) and 0.60 (SPOT 2004). Index saturation occurred above approximately 100-150g $m^{-2}$ of biomass (LAI 1.5-2); GR relationships showed to be linear. While regressions calculated from ASPIS and IRS data showed significantly different $R^2$values, ASPIS and SPOT regressions showed comparable $R^2$values. Biophysical parameter frequency distribution curves derived from maps produced from the different sensors indicate that the SPOT 10m spatial resolution allows a good approximation of the grassland spatial variability. MIR-based indices performed better than NIR and red/green-based ones in estimating biophysical variables, with no saturation effect. Biomass showed a linear regression with MIR/green ratio and with NDVI calculated from MIR and green bands (IRS: $R^2$= 0.91 and 0.90, respectively. SPOT: $R^2$= 0.63 and 0.64). Similar correlations could also be found for LAI and phytomass, while GR predictability seemed to be higher with NDVI and GreenNDVI.

According to these results, GR can be estimated by remotely-sensed data using visible and NIR spectra regions and phenological status can be assessed also in high-LAI grassland ecosystems, while biomass and LAI can be well predicted using the MIR-band investigated indices. Development of new methods for estimating biophysical

parameters can be considered one of the most important targets for the improvement of grassland quantitative parameters estimation at full canopy cover. However, scale issues present a challenge for remote sensing, being the variation at a scale that is below the resolution of most of the common satellite platforms.