1-1-2011

# Estimation of plant functional biochemical traits of subalpine and alpine grasslands from airborne images of high spatial and spectral resolution

Lucie Homolova
*University of Zurich*

Zbynek Malenovky
*University of Zurich*, zbynek@uow.edu.au

Michael E. Schaepman
*University of Zurich*

Jan G. P. W Clevers
*Wageningen University*

# Estimation of plant functional biochemical traits of subalpine and alpine grasslands from airborne images of high spatial and spectral resolution


## Abstract

Abstract of presentation at the 9th Swiss Geoscience Meeting, Zurich 2011, 11-13 November, ETH Hauptgebaude & Department of Earth Sciences, ETH Zurich.





## Publication Details

Homolova, L., Malenovky, Z., Schaepman, M. & Clevers, J. (2011). Estimation of plant functional biochemical traits of subalpine and alpine grasslands from airborne images of high spatial and spectral resolution. Abstract Volume 9 th Swiss Geoscience Meeting: 16. Earth System Science related Earth Observation (pp. 359-360). Zurich, Switzerland: SCNAT.

## P 16.4

# Estimation of plant functional biochemical traits of subalpine and alpine grasslands from airborne images of high spatial and spectral resolution

Homolová Lucie[1,2], Malenovský Zbyněk[1], Schaepman Michael[1] & Clevers Jan[2]

[1] *Remote Sensing Laboratories, Department of Geography, University of Zurich, Winterthurerstrasse 190, CH-8057 Zurich (lucie.homolova@wur.nl)*
[2] *Laboratory of Geo-Information Science and Remote Sensing, Wageningen University, Droevendaalsesteeg 3, 6708 PB Wageningen, NL*

Plant functional traits (PFT) are any measureable feature that determines plants' responses to environmental factors and their effects on ecosystem processes. PFT are increasingly used to classify plants with similar function in an ecosystem, to quantify functional diversity of communities, or to parameterize e.g. dynamic global vegetation models. Even though field measurement protocols of many PFT are well established, they are time consuming and limited to discrete sampling points usually at local scale. Spatially continuous and non-destructive mapping of plant functional traits at larger areas using remote sensing methods is of interest to the plant ecology community.

Our research objective is to retrieve leaf biochemical traits, namely total chlorophylls ($C_{ab}$), water ($C_w$) content, and specific leaf area (SLA) of subalpine and alpine grasslands from high spatial and spectral resolution airborne imaging spectroscopy data. Further we are interested in interpretation of the spatial gradients of functional traits and their use for mapping of plant functional groups within the study area.

The airborne images, acquired with AISA Dual system (Specim, Ltd., Finland) during the vegetation season 2008 over subalpine and alpine grasslands in French Alps, were the main input into the physically based retrieval of functional traits.

The retrievals were based on look-up table inversion of integrated soil-leaf-canopy (SLC) radiative transfer model (Verhoef & Bach 2007). The model input parameters were adjusted to the local case study using field measurements to specify ranges and distributions of the model inputs. The ill-posed nature of the look-up table inversion, i.e. situations when different combinations of model inputs yield the same simulated top-of-canopy reflectance, was alleviated by retrieving individual traits from specific parts of the electromagnetic spectra.

Statistical analysis of field-measured leaf trait data revealed that trait variability is strongly driven by species (40-75%) and less by environmental gradients such as altitude (only less than 5% of the overall traits' variability could be explained by the altitude). Principal component analysis identified a triplet of leaf traits (Cab, Cw, and SLA) having high potential to distinguish functionally different plant groups, which is expected to be spatially revealed also at the canopy level from airborne spectral images.

## REFERENCES

Verhoef, W. & Bach, H. 2007: Coupled soil-leaf-canopy and atmosphere radiative transfer modelling to simulate hyperspectral multi-angular surface reflectance and TOA radiance. Remote Sensing of Environment, 109, 166-182.