PREDICTING PEAK ABOVE-GROUND BIOMASS IN (SEMI-)NATURAL GRASSLANDS WITH SENTINEL 2A

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INTRODUCTION

Grasslands are key ecosystems in Europe because of their:
- High biodiversity
- Large number of ecosystem services:
  ✓ Carbon storage
  ✓ Flood mitigation
  ✓ Water purification

Sentinel 2 is a recent constellation of (currently) two satellites with good temporal and radiometric resolutions for vegetation studies.

RESEARCH QUESTION

What is the potential of Sentinel 2 images for predicting peak grassland biomass?

Peak biomass = maximum in the growing season, timing depends on the study area
Biomass is important as an indicator of biodiversity

STUDY SITES

Two Natura 2000 nature reserves in Belgium (Liereman and Zwin, see map) with:
- a large number of (semi-)natural grasslands
- gradients in soil fertility and moisture,
- thus also gradients in peak biomass.

METHODS

- Peak biomass (ground truth) was measured in the field in May-July for 30 plots per study site by cutting the biomass down to mowing level (above-ground only).
- All cloud-free Sentinel 2 images from March-Oct 2016 were downloaded and preprocessed (atmospheric correction using Sen2Cor and coregistration in ENVI)
- 8 types of regression models (see table) were compared for predicting the peak biomass, per study site, ranging from simple linear regression to advanced machine learning methods (in Caret package in R)
- Models were trained using leave-one-out cross-validation (only 30 samples), the resulting R² was used to compare Sentinel 2 acquisitions and model types.
- Variable (band) importance was assessed for the best model (gbm)

RESULTS

Training accuracy throughout growing season
Boxplots of training accuracy per model type
Importance of the Sentinel 2 bands in gbm (best model)

CONCLUSION & FOLLOW-UP

- The results show that accurate peak biomass prediction of grasslands with Sentinel 2 is possible within a single nature reserve and boosted regression trees are the best model type, but the accuracy fluctuates throughout the season.
- As a follow-up, we will try to unravel the physical processes that drive the relationship between biomass and reflectance.
- For 2017, we will also test the potential of Sentinel 2 to predict the currently standing biomass (not peak only) and the transferability of the prediction models in space and time.