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Phenological studies to improve the accuracy of remote sensing data in a diverse pasture

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Remote sensing has been used widely to map nearly all types of vegetation of the Earth. This technique is excessively valuable because it can determine the distribution and the health condition of the vegetation, however it is rarely used in diverse vegetation. Remote sensing is challenged in diverse vegetation, where there is a high variability in the rate and intensity of flowering, greening/senescing among plants. We hypothesised that the interpretation of images of diverse vegetation could become more accurate if the growth and distribution of the dominant plant species are also considered.

Our first goal was to establish a monitoring protocol as how to capture the main phenological changes of a diverse (over 80 species per hectare) pasture and reveal the ratio of the production of dominant species to the total biomass production. Our second goal was to answer how flowering influences (i.e. to what extent) the correlation coefficient between airborne Normalized Difference Vegetation Index (NDVI) and biomass. To monitor the phenological changes we measured leaf area index (LAI), estimated the cover of flowers (%), and performed vegetation survey in permanent quadrates (15) during eight measurement campaigns. We also selected 20 dominant species, based on the experience of previous years, which have visually dominant flowers in the area. For these species besides the cover of plant species (%) the number of flowering individuals, the number of flowers and other plant traits were recorded in permanent plots during measurement campaigns. In these plots 10 individuals per species were selected to measure the area and biomass of their leaves, shoots and flowers in the lab. Our results from the biomass production estimations show that biomass of the five most dominant species provided 68% of the total biomass production. We analyzed the connection between the percentage of flowering coverage and the correlation of NDVI and biomass. The data indicated that after June, when many species started to bloom there was a sharp deterioration in the correlation coefficient (r^2=0.65 in early May, r^2=0.15 in mid-June). The use of remote sensing data for biomass estimations in a diverse grassland is restricted to the spring period.