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Vegetation Indices, Grassland Productivity & C Sequestration

Description of Work

A vegetation index (VI) is a combination of surface reflectances at two or more wavelengths designed to highlight a particular property of vegetation. In contrast to satellite monitoring of VIs on a global scale, near-surface remote sensing uses radiometric sensors located in the ecosystem of interest, providing high temporal resolution and spatial integration over a few metres. These measurements provide information on plant structure, leaf area and light interception (NDVI: Normalised Difference Vegetation Index) and also plant function (PRI: Photochemical Reflectance Index). We are combining measurements of NDVI and PRI with continuous CO_2 flux tower data to investigate the impact of management and climate on plant productivity and carbon uptake in a grassland ecosystem. Integrated measurements of vegetation indices and CO_2 fluxes are a tool to disentangle the drivers of C cycling and ultimately C sequestration in managed ecosystems and to help us predict the complex CO_2 flux response to climate change.

International Context

Internationally, research on near-surface remote sensing has focussed on forested areas, with croplands and grasslands receiving less attention. A few studies on phenological patterns and CO2 exchange in alpine and sub-alpine grasslands have been reported. However, there is limited information available on temperate, intensively-managed grasslands which are highly productive and have a strong potential for net C sequestration in Europe. Extreme weather can severely impact productivity, and in turn, C uptake in terrestrial ecosystems. This was highlighted by measurements and model predictions of yields and carbon fluxes in Europe during the heat wave of 2003 showing a strong anomalous net C source compared with net C uptake in previous years. For grasslands, drought is likely to have the most significant impact on the C cycle. More information is therefore required on the response of managed grasslands, in terms of canopy development, photosynthetic activity and ecosystem respiration, to meteorological drivers.

Opportunities

Combining vegetation indices with ecosystem C fluxes allows us to verify C exchange processes and climatic responses in grasslands. Empirical data can then be used to parameterise process-based models and ultimately up-scale C fluxes to a regional and national scale. If C credits are to be gained for soil C sequestration and maintenance of significant below-ground biomass pools, this information will be vital.

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