Using Sentinel satellite remote sensing data to monitor the state of grasslands across a range of management intensities

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Aim: The PhD- candidate will test the suitability of Sentinel-2 satellite optical data to spatiotemporally monitor the state of grasslands. The research will make a distinction between (1) productivity monitoring of forage swards and (2) condition monitoring of semi-natural grasslands, across a range of management intensities.
Background: Currently, ~ 40% of the world's land area is covered by grasslands, with a large part used for *pasture* farming. The remaining *natural and semi-managed grasslands* perform a range of ecosystem services and their functioning is believed to be inherently linked to the level of plant species biodiversity. There is concern about the impacts of human-induced change on grassland ecosystem functioning and estimates suggest that over 50% of the Earth's grasslands are degraded, largely due to over-grazing and inappropriate management. Being able to effectively determine the productivity and overall condition of grasslands over space and time is key for the monitoring, management and restoration of grasslands.

Management of *pasture farms*, together with weather conditions, will affect grass sward productivity and thus milk productivity. Determining grass biomass via satellite, with suitable accuracy and spatial/temporal resolution, would allow for more efficient pasture management and more profitable pasture farming. **Approach:** The first strand of the proposed research focusses on the feasibility of reliable sward productivity estimation (including height, leaf area index (LAI), and biomass) for dairy farming using high-resolution (10-60m) optical data from Sentinel-2. Optical remote sensing (RS) approaches also have the potential to provide measures of condition and plant diversity of semi-natural grasslands, based on the hypothesis that the optical spectral variation is correlated with local plant species richness and hence to grass condition. We propose that a strong link exists for measures of diversity based on vegetation structure (height, LAI) and that this link will be scale specific, hence the need for data collection at different scales (in-situ RS and vegetation data collection, unmanned aerial vehicle (UAV) RS and satellite RS). We propose to employ a holistic approach involving statistically sound sampling designs, field campaigns, RS data processing and analyses, and biophysical modelling.

Training opportunities: this PhD will involve fieldwork, data analysis and modelling. Training in remote sensing (manual instruments and UAV), in-situ vegetation sampling and monitoring, and quantitative analysis of experimental, remote sensing and radiative transfer modelling data will be provided.

Student profile: Suitable for students with a background or interest in Environmental Science, Remote Sensing, Physics, or equivalent. Applicants should hold a 1st class or upper 2nd class degree or equivalent.

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