Natural peatlands play a key role in the global carbon cycle and they serve many ecosystem and climate related services e.g. as a strong net sink of atmospheric carbon. However, they are very vulnerable with respect to climate change as warming leading to more frequent seasonal heatwaves and droughts may lead to their degradation and cause that they may act as a strong net emitter of greenhouse gases to the atmosphere. Remote sensing has been used for many years to monitor status of peatland vegetation. However, within the last decade significant progress has been made as new remote sensing platforms, high resolution sensors and novel signals (like Sun Induced Fluorescence-SIF) were developed and applied in remote sensing retrievals of foliar and canopy functional traits (e.g. chlorophyll, photosynthetic parameters) and functions (e.g. carbon assimilation). In the project we will combine and reanalyze archive (since 2011) time series of multi- and hyperspectral (including SIF), tower-based and spatial-temporal data along with biophysical parameters of canopies and carbon fluxes measured at eddy covariance tower on Rzecin peatland (52°45'N, 16°18'E) in order to: **1) estimate the heat waves and drought impact on multispectral characteristics of peatland surface; 2) estimate the effect of heat waves and drought on spectral vegetation indices (VIs) and SIF vs. gross productivity relationships and their effect on estimated values of peatland productivity; 3) estimate the plant canopy specific signatures of spectral and biophysical parameters for vegetation groups differing in relative contribution of different vascular and bryophyte plant species and their seasonal and spatial variability. P**eatlands are very heterogenous ecosystems and many different vascular and bryophytes species coexist together and their response to the same stress factors like heat stress, water stress, water table depth (WTD) fluctuations or nutrient availability on peatland might be different under the same weather condition. Hence, **our next objective is to evaluate the impact of seasonal & spatial variation of WTD, trophic status expressed by amount of freely available nutrients, and summer heat waves on remote sensing hyperspectral signatures (including SIF), biophysical parameters and other plant traits (chlorophyll content, photosynthesis) of canopies and individual plant species.** To achieve this aim, the new time series of hyperspectral and biophysical canopy and plant levels data will be generated (in 3 seasons, 2022-2024) within the new in-situ experiment established on Rzecin peatland across the transect of WTD and nutrient gradients (from the edge to the middle of the peatland). 20 measuring plots will be selected where periodic measurements of top-of-canopy SIF, reflectance and biophysical parameters as well as leaf level chlorophyll and CO_2 assimilation are planned. At the day of campaign, the UAV flights equipped with multispectral cameras will be taken to provide maps of spatial variation of multispectral vegetation indices across the measuring plots.

As an effect of the project four papers in highly ranked international journals are planned. They will be included in the PhD thesis prepared in 2025. Three papers based on the archive and reanalyzed data will be published or submitted till the end of 2023. The fourth paper focused on WTD and nutrient impact on SIF, reflectance and other plant traits (chlorophyll and photosynthesis) will be prepared in cooperation with Dr Mirco Migliavacca from Max Planck Institute Jena within the NAWA 5-months fellowship. **The proposed studies have never been done for peatlands and especially an attempt to assess the impact of nutrient availability and WTD on SIF and reflectance as well as physiological and functional traits of peatland vegetation are highly novel, innovative and will contribute significantly to the discipline and our understanding of peatlands behavior under impact of extreme weather events.**