In recent time it has been reported that peatlands are getting degraded worldwide, resulting in the release of their stored carbon, losing their value for biodiversity conservation, and decreasing water resource management capacity at an alarming rate. At the same time, peatlands are highly vulnerable ecosystems with respect to climate change. This is why the climate manipulation experiments on peatland have been started in March 2017 within the **FLUOGPP** (UMO-2016/21/B/ST10/02271) project financed **by National Science Centre of Poland (NCN)** at Rzecin peatland (52°45'N,16°18'E) in North-West Poland. This grant is funded to observe the response of a fen peatland ecosystem on manipulated conditions (increased temperature and reduced precipitation) in order to evaluate the behavior of peatland in the near future climate conditions. The project is focused mainly on the assessment of the climate manipulation experiment on the canopy scale rates of photosynthesis (expressed as Gross Primary Productivity, GPP), Sun-Induced Fluorescence (SIF) and spectral reflectances (R). Other biophysical parameters of the canopies like chlorophyll content (Chl), Leaf Area Index (LAI), and the fraction of radiation absorbed by plant canopy in photosynthesis (fAPAR) were/are also measured in order to assess the direct impact of manipulations on vegetation structure and its physiology. **Although homogenous patches of peatland were selected for the experiment, the canopy level responses of each single plots exposed for the same manipulation was/is different.** We hypothesized that different contribution of vegetation species within the plot and their different response to manipulation can be the reason behind the different response of plots, as in a heterogenous peatland, all components of the plant kingdom exist together (i.e. thallophytes, bryophytes, pteridophytes, gymnosperms, and angiosperms), and are significantly different than each other. **The experiment performed on naturally heterogenous peatland surface led us to the point where we know how peatland may react on manipulation in the short term at the canopy level, but it is still like a "black box" as we do not understand the processes behind, which regulates the variation to the overall signals. We do realize that these details are missing in our knowledge and are crucial in order to simulate future changes of this water-logged ecosystems through any process-based models. Therefore, we hypothesized that the variation in the signals could be interpreted in details when we will know the contribution of different plant species and their species-specific physiological and reflectance signatures contribution to the overall canopy level signals.**

Considering the above, the main objectives of the proposal are: **1) to evaluate the effect of warming and reduced precipitation on the biophysical and spectral characteristics of peatland vegetation exposed to climate manipulation in situ (at canopy/plant/leaf levels) 2) to evaluate the contribution of different groups of plants (vascular, bryophytes, pteridophytes) and individual plant species on GPP, SIF, fAPAR, and R estimated at the canopy level by remote sensing (RS) approaches, for the purpose to study a heterogeneous ecosystem.**

In the proposed proposal, new experiments are planned, where an extended measurement will be performed with additional instrument (acquire through this project). It is not sufficient to identify the response of each plant species, but **we need to apply Radiative Transfer Models (RTMs) to achieve our objective to understand the changing behavior of peatland with climate change**. Only through the RTMs, which will consider specific leaf biophysical-biochemical characteristic of plants and the contribution of different plants in the canopy, we can understand the overall canopy RS signals. The RTMs inversion is also needed to make RS data sufficient to understand the biophysical-biochemical characteristic of different RS signal contributing plant species. The planned work if will be successful, will change the current view of peatland scientist around the world. I would like to emphasize here, that these type of measurements has never been performed in so detail and in so comprehensive way at any peatland worldwide. The basic research planned in the proposal combined different RS, micrometeorological and ecophysiological techniques in order to answer for basic, fundamental research questions – how each individual plant species may adopt and change through climate change in the near future and if we can estimate the changes of ecophysiological parameters of peatland canopies through different proxies by understanding the relationships between different plant/canopy levels variables.