The complexity of natural ecological systems presents challenges for predicting the impact of global environmental changes on ecosystem structure and function. Grouping of plants into functional types, that is, groups of species sharing traits that govern their mechanisms of response to environmental perturbations, reduce the complexity of species diversity to a few key plant types for better understanding of ecosystem responses. Chambers were used to measure $CO_2$ exchange in grass and moss growing together in a mountain peatland in southern Germany to assess variations in their response to environmental changes and how they influence ecosystem $CO_2$ exchange. Parameter fits and comparison for net ecosystem exchange (NEE) in two ecosystem components were conducted using an empirical hyperbolic light response model. Annual green biomass production was 320 and 210 g dwt $m^{-2}$, whereas mean maximum NEE was –10.0 and –5.0 µmol $m^{-2}$ $s^{-1}$ for grass and moss, respectively. Grass exhibited higher light use efficiency (α) and maximum gross primary production [$(\beta+\gamma)_{2000}$]. Leaf area index explained 93% of light use and 83% of overall production by the grass. Peat temperature at 10-cm depth explained more than 80% of the fluctuations in ecosystem respiration ($R_{eco}$). Compared to grass, moss NEE was more sensitive to ground water level (GWL) draw-down and hence could be more vulnerable to changes in precipitation that result in GWL decline and may be potentially replaced by grass and other vegetation that are less sensitive.

Responses of $CO_2$ exchange and primary production of the ecosystem components to environmental changes in a mountain peatland