

Mountain peatlands in the temperate regions represent a small proportion of the global peatland resource, but play a unique, although less recognized role in the regional water and biogeochemical cycles. We conducted leaf and ecosystem CO₂ exchange measurements during the growing period of 2008 to investigate the effects of vapor pressure deficit (VPD) and ground water level (WL) on leaf gas exchange of two dominant herbaceous species, *Molinia caerulea* (L.) and *Carex nigra* (L.) in a mountain peatland. Implications of the leaf-level responses for net ecosystem CO₂ exchange (NEE) were examined. Fluctuations in WL influenced soil water content (SWC) within the top 5 cm of the peat profile. Although midday leaf water potential during the day (Ψ_{md}) was positively correlated ($P < 0.001$) with SWC in the 5 cm peat profile, there was no direct relationship between WL and plant water relations parameters. VPD and stomatal conductance (g_s) were negatively correlated at VPD >1 kPa regardless of the current WL status. Stomatal conductance was positively correlated with leaf assimilation (A) and root-shoot hydraulic conductance (K_{s-l}). A decline in NEE during summer was attributed to stomatal closure due to high VPD and low light utilization efficiency (α) of the vegetation. Ecosystem respiration (R_{eco}) was positively correlated with peat temperature at 10 cm depth. Our results suggest that increases in VPD, as a possible scenario of climate change, would lower the photosynthetic capacity of the herbaceous peatland vegetation, despite the high WL, and hence lower the potential of such peatlands as sinks for atmospheric CO₂.