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Effects of leaf prostration on microclimate and ecophysiology of the evergreen fern, *Polystichum acrostichoides*

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Abstract

Fronds of the evergreen fern *Polystichum acrostichoides* are oriented vertically following expansion, but bow gradually through summer and fall until fronds are completely flat against the soil by winter. Here we evaluate the physiological consequences of forcing fronds into a position counter to their natural seasonal angles. During the summer, one frond from ten plants was forced flat, while during winter, individual fronds were lifted up off the ground. Monthly photosynthetic gas exchange and maximum quantum yield of PSII (F_v/F_m) were measured for upright versus flat leaves during both seasons. Diurnal leaf temperatures and microclimate of sample plants were also monitored using thermocouples and micrometeorological sensors. Forced flattening during summer reduced F_v/F_m, but did not have significant impacts on photosynthetic gas exchange in understory light conditions. Flat leaves were cooler than upright leaves in shade, but exhibited dramatic warming during sunflecks and sunpatches, which brought leaves as high as 14 ^oC above air temperature. However, during summer when the canopy was intact, such events were rare. During winter the consequences of altered leaf angle were more severe. Upright leaves exhibited reduced photosynthesis, stomatal conductance, evapotranspiration, and F_v/F_m relative to naturally-flat fronds. Because vapor pressure deficit below flattened fronds was generally much lower than that of ambient air, and *P.*

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