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Lowered water table level decreases boreal mire NECB – a question of increased decomposition or decreased photosynthesis?

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The fundamental prerequisite for development and maintenance of mire ecosystems is a positive water balance maintaining a water table level close to the soil surface. One potential effect of climate change at higher latitudes is decreased positive water balance, i.e. increased evapotranspiration and/or decreased precipitation during the growing season leading to a lowered water table level. A lowered water table level is well known to reduce both the net ecosystem exchange (NEE) and most likely also the Net Ecosystem Balance (NECB). Most commonly a reduced NEE is interpreted as resulting from increased respiration. Therefore, a water table draw down is often viewed as a severe threat to the large long-term carbon stores occurring in high latitude peatlands. We used eddy covariance derived data on NEE from a high latitude mire in Northern Sweden during a year with severe drought during the growing season to separate the effects between photosynthesis and ecosystem respiration. The long term annual average NEE at the site is ∼59 g C m-2 yr-1 which during the year with summer drought was reduced to 17 g C m-2 yr-1 resulting in a NECB not different from zero. Detailed analyses of the diurnal variation in NEE as well as ordinary NEE-partitioning into gross photosynthesis and respiration respectively revealed a drastic decrease in daytime CO_2 uptake while the nighttime CO_2 emission hardly was affected at all. Thus, for this widespread type of mire the most significant direct effect of severe droughts is reduced photosynthesis rather then increased respiration.