We simulated the effect of prolonged dry summer periods by lowering the water table on three manipulation plots ($D_{1–3}$) in a minerotrophic fen in southeastern Germany in three years (2006–2008). The water table at this site was lowered by drainage and by excluding precipitation; three nonmanipulated control plots ($C_{1–3}$) served as a reference. We found no significant differences in soil respiration (R_{Soil}), gross primary production (GPP), or aboveground respiration (R_{AG}) between the $C_{1–3}$ and $D_{1–3}$ plots in any of the measurement years. The water table on the control plots was naturally low, with a median water table (2006–2008) of 8 cm below the surface, and even lower during summer when respiratory activity was highest, with median values ($C_{1–3}$) between 11 and 19 cm below the surface. If it is assumed that oxygen availability in the uppermost 10 cm was not limited by the location of the water table, manipulative lowering of the water table most likely increased oxygen availability only in deeper peat layers where we expect R_{Soil} to be limited by poor substrate quality rather than anoxia. This could explain the lack of a manipulation effect. In a second approach, we estimated the influence of the water table on R_{Soil} irrespective of treatment. The results showed a significant correlation between R_{Soil} and water table, but with R_{Soil} decreasing at lower water tables rather than increasing. We thus conclude that decomposition in the litter layer is not limited by waterlogging in summer, and deeper peat layers bear no significant decomposition potential due to poor substrate quality. Consequently, we do not expect enhanced C losses from this site due to increasing frequency of dry summers. Assimilation and respiration of aboveground vegetation were not affected by water table fluctuations between 10 and >60 cm depth, indicating the lack of stress resulting from either anoxia (high water table) or drought (low water table).