**Climate and hydrology control apparent rates of peat accumulation across Europe**

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Peat accumulates when there is a positive mass balance between plant productivity inputs and litter/peat decomposition losses. Here we examine apparent peat accumulation rates (aPAR) during the last two millennia from 28 well-dated European peatlands and find them to range between 0.005 and 0.448 cm $yr^{-1}$(mean = 0.118 cm $yr^{-1}$). Our work provides important context for the commonplace assertion that peatlands accumulate at ~1mm per year. We find that relationships between aPAR and climatic variables are generally weak – summer temperature is the only significant climatic control on aPAR across our European sites. aPAR tends to be higher when water-table depth (reconstructed from testate-amoeba subfossils) is within 5-10 cm of the peatland surface. When a Generalized Additive Model and Gaussian Response Curve are fitted to the data, both methods show that the optimal water-table depth for highest aPAR is ~10 cm. aPAR is generally lower when water table depths are <0 cm (standing water) or >25 cm, which may relate to a decrease in plant productivity and increased decomposition losses, respectively. These findings corroborate contemporary experimental studies which examined the relationship between peatland water-table depth, or the thickness of the aerobic surface layer (the 'acrotelm'), and the rate of peat formation. Our work suggests that for European peat bogs, an average water-table depth of ~10 cm is optimal to enable rapid peat growth and therefore carbon sequestration in the long term. This has important implications for peatland restoration and rewetting strategies, in our global efforts to mitigate climate change.

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