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Peat form and distribution – acrotelm hydrology and topographic wetness index

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Away from the divide in a peat mire, steadily increasing volumes of rainwater flowing through and over the peat can only be transported by increasing surface and water table gradient, forcing development of a domed form for a raised bog. Simple models assume either a groundwater mound in which the peat surface is defined by the water table, or a surface limited by the balance between growth and decomposition. Recognised complications to the hydrology include the observations of substantial flow both close to the bog surface and through pipes within the peat mass and the near-random heterogeneity of hydraulic conductivity values in the peat. In addition the assumptions of these end member models interact, since increases in peat depth allow more water to flow through the catotelm, thereby increasing seasonal drying near the surface and raising decomposition rates. These competing factors have been built into a model which combines TOPmodel near-surface with Darcian flow at depth, creating a dynamic oxic layer within which rates of decomposition are highest. This enriched mire model, distinguishes bogs, and regions within bogs, dominated by surface or internal flow and those that are limited by growth and decomposition. The model also helps to clarify the important role of seasonality in bog growth, provides some guidance on where peat can become established, on the basis of climate and local topography, and how this may evolve as global temperatures rise.