

Geomorphology of Upland Peat

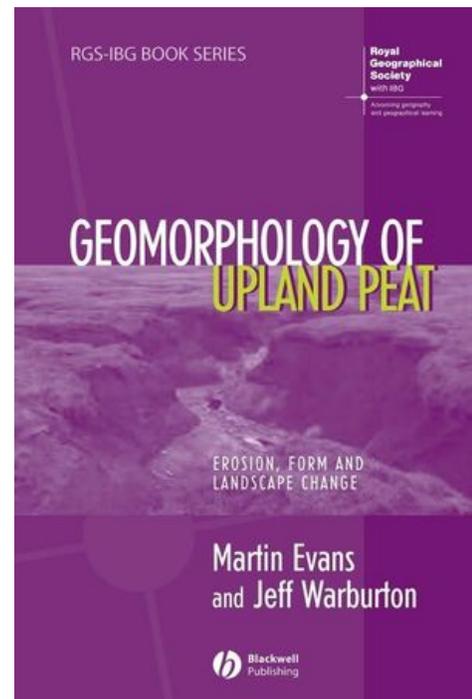
Martin Evans and Jeff Warburton (2007)

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The Book Series of RGS-IBG (Royal Geographical Society with the Institute of British Geographers) aims to provide scholarly monographs and edited collections of academic papers at the leading edge of research in human and physical geography, written in a manner accessible to the wider community of academic geographers. This volume, written by two leading UK peat geomorphologists, falls into the ‘monograph’ category; and will be of interest to all peatland researchers whether or not they are officially classified as geographers. It is, essentially, a book on peat erosion based around the authors’ extensive individual and joint investigations of upland blanket bog in Britain, mainly in the Pennine Hills—sometimes termed ‘the backbone of England’. The backbone of this thorough and very readable treatment can be found in Chapters 3–6. Chapter 3 examines what is known about the process of sediment production from bare peat surfaces, which in turn influences how rapidly the peat can be eroded away by wind and rain. Chapter 4 on fluvial processes and peat erosion follows logically. This deals with slope-channel linkages—how the sediment is washed into streams when it rains—in the gullied peat ‘badlands’ that are all too familiar to hillwalkers in Britain. A key study compares the fine-sediment budgets of Pennine gully systems glorying in the names “Upper North Grain” and “Rough Sike”. The former is actively eroding, with an annual sediment yield of some 200 t km⁻²; whereas sediment yield from the latter is only 31 t km⁻² yr⁻¹ because revegetation has almost decoupled the sediment supply from the stream system. Other impressive ingredients of this chapter

are the hill-shaded DEM of a gully system derived from two-metre LIDAR data (Figure 4.1); and the estimate that, at the maximum gully density observed, one square kilometre would contain 80,000 m² of exposed peat with losses of 4,000 m³ or 400 t yr⁻¹ (N.B. this conversion actually assumes peat dry density 0.1 t m⁻³, not 0.1 t km² yr⁻¹ as stated on page 96). Chapter 5 turns to Jeff Warburton’s speciality of slope processes and mass movements (i.e. bog bursts and peat slides) as brought into focus by the three spectacular peat failures in Ireland and northern Scotland (Shetland Islands) in 2003. The photographs of the Channerwick (Shetland) peat slide in its ‘fresh’ condition are helpful, even though not in colour, as late-comers to the scene like myself inevitably find that the displaced peat blocks tend to break down rapidly. The take-home message is the conclusion of Mills (2002) that, despite their newsworthiness, such catastrophic peat failures have been responsible for only 3 % of the total quantity of peat eroded from the North Pennines over the last 100 years. Finally, Chapter 6 gives a fascinating insight into the range of distinctive peat landforms arising from wind erosion.

This ‘meat’ is preceded by a context-setting Introduction (Chapter 1) to peat, peatlands and their geomorphology; and a review of hydrological aspects (Chapter 2). A diagram of the ‘upland peat landsystem’ clearly establishes the conceptual model with which we are working throughout the book. The final three chapters address the authors’ aspiration to establish (erosion) geomorphology alongside biology, ecology and hydrology in the range of disciplines that need to be focused on

peatland systems in an integrated way, in order to understand how they work and how they should be managed—especially for conservation. Chapter 7 considers landscape-level patterns in peat erosion forms, for which slope emerges as a dominant factor, and recognises three scales of patterning (macroscale, mesoscale and microscale). Close parallels are found between this scheme and the more familiar (eco-hydro-)morphological hierarchy of ‘intact’ peatlands originally developed in Russia and applied to UK blanket peatland by Richard Lindsay and others; Lindsay’s ‘hydro-topographical units’ having already been identified in Chapter 1 as “mire mesotopes classified geomorphologically”. The main point of divergence between these respective geomorphologies of peat formation and erosion is that the ‘ecohydrological’ classification identifies erosion gullies as microtope features (microforms), whereas from the viewpoint of ‘pure’ geomorphology they are mesoscale elements. The burning question of Chapter 8 (sediment dynamics, vegetation and landscape change) is whether or not peat erosion is catastrophic; does the onset of erosion reflect an irrevocable system shift from peat accumulation to progressive degradation? The weight of evidence suggests perhaps not, because revegetation also occurs. Although the dynamics of eroded and eroding systems are still poorly understood, this gives an encouraging prognosis for the restoration of upland peatland and its carbon storage function, the latter being prominent amongst the implications of peat erosion explored in the concluding Chapter 9.

Overall, this volume is something between a state-of-art review and a textbook, giving stand-alone treatments for some topics but requiring reference elsewhere for others. For example, Chapter 5 gives a detailed overview of the morphology of peat mass movements and I found it irritating to be referred to Warburton *et al.* (2004), on both pages 108 and 125, for information on the linkages between peat failures and hydrology; although an overview of this aspect eventually begins over the page in Section 5.5.1. On reflection, this may be just another example of several instances where the final editing appears to have been less than totally meticulous. I noted a handful of grammatical mistakes scattered throughout the book which detracted slightly from the pleasure of reading it, and it is unfortunate that Andrew Coupar’s name is mis-spelt “Couper”, albeit consistently, on page 55 and in the reference list. Also, the reference to Warburton *et al.* (2003) on page 118 is ambiguous, in that there are two candidate entries in the reference list. I could not find the label ‘4’ in Figure 1.8 (I think it should be

at the top), and I did a double-take when told that “flow is from bottom to top” in the two-part Figure 4.8 (perhaps the direction of streamflow is from the bottom towards the top of each photograph, or away from the camera). I should have liked to see more rigour in the treatment of density again on page 95 (“dry peat has a density of close to 0.1”); is this ‘relative density’, ‘particle density’ or ‘dry bulk density’ (units should be given for the latter two)? Also, I was puzzled by the figure of 1 mg m^{-3} given for the bulk density of saturated peat on page 136, as this should surely be close to the density of water (1000 kg m^{-3} ; otherwise 1 Mg m^{-3} or 1 mg mm^{-3}). And whilst on the subject of water, there is potential for reader confusion in Chapter 2 where the water balance term ΔS is defined ambiguously as ‘change in storage’ and the way it is presented mathematically means that positive values reflect decline in storage, reversing the usual sign convention ($\Delta S = \text{increase in storage}$). A positive comment on presentation is that most chapters end with a section that helpfully summarises the main points covered.

Although they create a need for critical reading, none of these faults detracts significantly from the overall impact. When I received this book, I was in the process of making first acquaintance with the extensively eroded ‘coast-to-coast’ blanket peatland of the Shetland Islands. Needless to say, I read it voraciously and found it enormously helpful in understanding and interpreting what I saw. But its relevance extends well beyond the subset of peatlands that are classified as blanket mire. The type, although present on most continents, is globally limited to the most oceanic regions (indicated in Figure 1.4, but note that the recently confirmed presence in northern Spain is not shown). The authors argue that blanket mire encompasses a range of peatland types which occur elsewhere as discrete mesotopes and simply become fused in the wettest localities. Certainly, the operation and expression of erosive processes is most obvious where peat has formed on the steepest slopes (as enabled by wet climate), but having read the book I find that they can actually be recognised in other mire types once one knows what to look for. But perhaps the most significant lasting outcome is that I realise we have to add the erosion-revegetation cycle to the suite of feedback mechanisms that contribute to maintaining the stability of peatland ecosystems. Thus, the intention of the series editors to “leave an intellectual mark and change the way readers think about particular issues, methods or theories” was—for me—fully achieved.

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