
Article:
Baird, AJ orcid.org/0000-0001-8198-3229, Evans, CD, Mills, R et al. (10 more authors) (2019) Validity of managing peatlands with fire. Nature Geoscience, 12. pp. 884-885. ISSN 1752-0894

https://doi.org/10.1038/s41561-019-0477-5

Validity of managing peatlands with fire

A.J. Baird[1], C.D. Evans[2], R. Mills[3], P.J. Morris[1], S.E. Page[4], M. Peacock[5], M. Reed[6], B.J.M. Robroek[7], R. Stoneman[8], G.T. Swindles[1], T. Thom[9], J.M. Waddington[10], D.M. Young[1]

[1]School of Geography, University of Leeds, Leeds, UK. [2]Centre for Ecology and Hydrology, Bangor, UK. [3]Department of Environment and Geography, University of York, York, UK. [4]School of Geography, Geology and the Environment, University of Leicester, Leicester, UK. [5]Department of Aquatic Sciences and Assessment, Swedish University of Agricultural Sciences, Uppsala, Sweden. [6]School of Agriculture, Food, and Rural Development, Newcastle University, Newcastle-upon-Tyne, UK. [7]School of Biological Sciences, University of Southampton, Southampton, UK. [8]Rewilding Europe, Nijmegen, The Netherlands. [9]Yorkshire Wildlife Trust, Skipton, UK. [10]School of Geography and Earth Sciences, McMaster University, Hamilton, Canada.

Marrs et al.[1] show that the managed burning of a degraded blanket peatland in northern England leads to a reduction in the abundance of the dwarf shrub *Calluna vulgaris* and an increase in cotton sedges (*Eriophorum vaginatum*) and bog mosses (*Sphagnum*). Their results also show that controlled burning reduces rates of carbon (C) accumulation in the top of the peat profile, but they recommend such management should continue because it reduces the biomass of *Calluna*, which is susceptible to burning, thus preventing greater peatland damage through wildfire. Marrs et al.[1] also suggest that controlled burning should be considered for peatlands that are not currently managed. We are concerned by this recommendation because the authors extrapolate inappropriately from a single, atypical, site to the entire northern hemisphere peatland zone where most peatlands remain in a natural state. Additionally, for peatlands that are degraded, there are alternative interventions that managers can make to reduce wildfire risk; these include re-wetting through gully and ditch blocking, and measures such as the planting of bog mosses[2,3,4,5].

Throughout their paper Marrs et al.[1] argue that their findings are applicable to peatlands beyond their study site. They further assume that all peatlands are naturally *Calluna*-dominated, and thus fire-prone, in the absence of management intervention. This is not the case; *Calluna* does not occur naturally in North America, and dwarf shrubs, more generally, rarely dominate the vegetation cover in natural peat-accumulating ecosystems. Natural peatlands are floristically much more diverse, and contain a range of microhabitats, from pools and wet hollows to hummocks[6,7,8], often with a wide range of *Sphagnum* moss species. Such peatlands do not require managed burning to maintain floristic diversity or to prevent succession to *Calluna* or dwarf-shrub dominance because they are waterlogged. Where it does occur in natural peatlands, *Calluna* tends only to occupy hummocks and ridges because of its intolerance of shallow watertables[6,9]. Indeed, over-abundance of *Calluna* is an indicator of peatland degradation[10]. In the past, the site used by Marrs et al.[1] (see below) was managed in ways that were typical of the Pennine blanket peatlands of northern England. These areas were grazed by sheep, burnt, and often ditch drained, which, together with historic air pollution, have typically resulted in less diverse vegetation communities, gully erosion, and, depending on the combination of disturbances, increased *Calluna* dominance[10,11]. *Calluna* dominance may in turn alter the structure of peat soils[12] so that they become better drained and, therefore, less likely to support more waterlogging-tolerant peatland species typical of the natural condition.

Figure 1 below shows the study site that was used by Marrs et al.[1]: the Hard Hill Plots at Moor House in the North Pennines, England. The landscape is dissected by erosion gullies that are within 15 m of the edges of some of the plots. These gullies function like ditch drains and can lower peat water tables, which may additionally explain why *Calluna* is dominant in the absence of burning. Other studies done at the same site have shown that water tables are generally deeper (at times > 50 cm below the surface[13]) than would be expected in healthy blanket peatland[7,8].

We contend that substantial human-induced modification of the ecosystem in which Marrs et al.[1] undertook their research makes any extrapolation to the wider northern peatland area unjustified: it involves the transfer of findings from a degraded site to natural systems, and from one very small experimental site to over three million km^2 of northern peatlands. This is analogous to a physician prescribing a treatment based on a clinical study of one disease-sufferer to the population of a large city who do not have the disease.

Figure 1. The Hard Hill Plots used by Marrs et al.[1] at Moor House in the North Pennines, northern England. The image clearly shows a degraded, gullied, landscape that is typical of this area but atypical of northern peatlands more generally. Image reproduced from Google Earth (© Infoterra Ltd and Bluesky).

Finally, we note that, in recommending managed burning to reduce *Calluna* dominance and the risk of greater damage by wildfire, Marrs et al.[1] do not consider the mechanism that causes *Calluna* or shrub dominance – a peatland that is too dry. Drained and degraded peatlands are inherently more fire prone than naturally wet peatlands[14,15]. Naturally wet and rewetted peatlands do not experience deep burning because a suite of ecohydrological processes and bog moss traits maintain a surface with a high moisture content[2,3], thereby increasing the energy required to ignite peat, and restricting burn depth if fires do occur.

1. Marrs, R.H., Marsland, E. –L., Lingard, R., Appleby, P.G., , Piliposyan, G.T., , Rose, R.J., O'Reilly, J., Milligan, G., Allen, K.A., Alday, J.G., Santana, V., Lee, H., Halsall, K. & Chiverrell, R.C. Experimental evidence for sustained carbon sequestration in fire-managed, peat moorlands. *Nature Geoscience*, https://doi.org/10.1038/s41561-018-0266-6 (2018).

2. Price, J. Soil moisture, water tension, and water table relationships in a managed cutover bog. *Journal of Hydrology* **202**, 21–32 (1997).

3. Granath, G., Moore, P.A., Lukenbach, M.C., & Waddington, J.M. Mitigating wildfire carbon loss in managed northern peatlands through restoration. *Nature Scientific Reports* **6**, 28498 (2016).

4. Rochefort, L. & Lode, E., in *Boreal Peatland Ecosystems* (eds Wieder, R.K. & Vitt, D.H.) 382–423 (Springer-Verlag, Berlin, 2006).

5. Website: http://www.moorsforthefuture.org.uk/moorlife2020

6. Averis, A.M., Averis, A.B.G., Birks, H.J.B., Horsfield, D.Thompson, D.B.A. & Yeo, M.J.M. *An Illustrated Guide to British Upland Vegetation* (Pelagic Publishing, Exeter,2004).

7. Lindsay, R.A., Charman, D.J., Everingham, F., O'Reilly, R.M., Palmer, M.A., Rowell, T.A. & Stroud, D.A. *The Flow Country: The Peatlands of Caithness and Sutherland*. (Interpretive Services Branch, Nature Conservancy Council, Peterborough, 1988).

8. Boatman, D.J. The Silver Flowe National Nature Reserve, Galloway, Scotland. *Journal of Biogeography* **10**, 163–274 (1983).

9. Bannister, P. The water relations of certain heath plants with reference to their ecological amplitude. III. Experimental studies: general conclusions. *Journal of Ecology* **52**, 499–509 (1964).

10. (JNCC) Joint Nature Conservation Committee. *Common Standards Monitoring Guidance for Upland Habitats*, online version July 2009, ISSN 1743-8160 (2009).

11. Noble A, Palmer S.M., Glaves, D.J., Crowle, A., Brown, L.E. & Holden J. Prescribed burning, atmospheric pollution and grazing effects on peatland vegetation composition. *Journal of Applied Ecology* **55**, 559–569 (2017).

12. Holden, J. Piping and woody plants in peatlands: Cause or effect? *Water Resources Research* **41**, W06009 (2005).

13. Clay, G.D., Worrall, F., Clark, E. & Fraser, E.D.G. Hydrological responses to managed burning and grazing in an upland blanket bog. *Journal of Hydrology* **376**, 486–495 (2009).

14. Turetsky, M.R., Donahue, W.F. & Benscoter, B.W. Experimental drying intensifies burning and carbon losses in a northern peatland. *Nature Communications* **2**, Article 514 (2011).

15. Wilkinson, S.L., Moore, P.A., Flannigan, M.D., Wotton, B.M. & Waddington, J.M. Did enhanced afforestation cause high severity peat burn in the Fort McMurray Horse River wildfire? *Environmental Research Letters* **13**, 014018 (2018).

Author contributions

All authors designed and wrote the paper.

Competing interests

This contribution was not funded and is not sponsored by any organisation. All authors are involved in peatland research and conservation. Between them they have received money from a range of governmental and non-governmental organisations and companies for research into fundamental peatland processes and conservation and restoration methods and impacts. Governmental organisations include the Department for Environment, Food, and Rural Affairs (UK), Natural Resources Wales and its predecessors, Natural England, Natural Resources Canada, the Natural Environment Research Council (UK), the Canadian Natural Sciences and Engineering Council, and the Scottish and Welsh Governments. Non-governmental organisations and companies include the Dutch Foundation for the Conservation of Irish Bogs, the Canadian Sphagnum Peat Moss Association, FP Innovations, Global Water Futures, the National Trust, Peat Resources Ltd., Premier Tech Ltd., Canadian Natural Resources Ltd., Syncrude Canada Ltd., Pattern Energy Ltd., the Quaternary Research Association, and The Royal Society. M. Reed is the Research Lead for the IUCN-UK Peatland Programme which promotes the conservation and restoration of peatlands.