Peatland Catchments and Natural Flood Management

Report to the IUCN UK Peatland Programme’s Commission of Inquiry on Peatlands Update

Tim Allott¹, Jorge Auñón², Christian Dunn², Martin Evans¹, Jill Labadz³, Paul Lunt⁵, Michael MacDonald⁶, Tom Nisbet³, Roger Owen⁵, Mike Pilkington², Sarah Proctor⁶, Emma Shuttleworth¹, Jon Walker¹⁰

¹University of Manchester, ²Moors for the Future Partnership, ³Bangor University, ⁴Nottingham Trent University, ⁵University of Plymouth, ⁶Royal Society for the Protection of Birds, ⁷Forest Research, ⁸Scottish Environmental Protection Agency, ⁹IUCN UK Peatland Programme, ¹⁰Swansea University

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Natural flood management (NFM)

*Managing flood risk by protecting, restoring and emulating the natural regulating function of catchments and rivers,* [with] the potential to provide environmentally sensitive approaches to minimising flood risk, to reduce flood risk in areas where hard flood defences are not feasible, and to increase the lifespan of existing flood defence

(NERC, 2017)
Conceptual basis for NFM in peatland catchments

Diagram showing discharge over time for degraded peat, intact peat, and restored peat, with a community at risk of flooding.
Can peatland restoration and management help reduce downstream flooding?

“We know we can reduce flooding”
(CEO of a Wildlife Trust, September 2019)

“Before we can properly invest in upland NFM we need to know just how much reduction there’ll be in the flood peak [for the 1:100 year event] at the downstream communities at risk, and how much the restoration will cost to achieve that”
(Flood Risk Manager, March 2019)
Glossop catchment, South Pennines
Review contents

- Introduction and context for the review
- The process-based case for peatland restoration and natural flood management
  - The potential for NFM in peatland catchments
- Peatland catchments and communities at risk from flooding
  - West Pennines case study
- Peatlands, restoration and NFM: the evidence base
  - Peatland drainage and drain blocking
  - Restoration of bare peat
  - Gully blocking
  - Sphagnum re-introduction to degraded peatlands
  - Forestry and restoration of afforested peatlands
  - Moorland burning and peat restoration following wildfire
- Evidence gaps and priorities for future research for policy
- Conclusion and recommendations
Key Findings 1
Peatland surface and vegetation cover represent key controls on storm runoff and peak flows in peatland catchments. Changes in roughness (surface cover) will retard flow and attenuate hydrographs.

Storage vs attenuation processes

(a) Storage effects
No change in lag time
Reduced peak flow
Reduced flow volume

(b) Attenuation (roughness) effects
Increased lag time
Reduced peak flow
No change in flow volume
Key Findings 2
There is increasing evidence from both field and modelling studies that peatland restoration can alter catchment runoff regimes, reduce peak flows and contribute to NFM at the small (<20 km²) catchment scale, with some evidence that peak flow reductions could extend into larger catchments.
### Key Findings 3
Evidence base for impacts of peatland restoration on peak flows

<table>
<thead>
<tr>
<th>Restoration Measure</th>
<th>Impact on Peak Flows</th>
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<tr>
<td>Re-vegetation of bare peat</td>
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<td>Re-introduction of Sphagnum</td>
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<td>Gully blocking</td>
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<td>Restoration after severe fire</td>
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<td>Ditch blocking</td>
<td>Variable</td>
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<td>Commercial forest removal</td>
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Key Findings 4
Modelling approaches are now available for upscaling and more comprehensive catchment scale assessments

e.g.

Pilkington et al 2015
• Restoration of 12% of a 9km$^2$ catchment associated with a 5% reduction in peak discharge

Gao et al 2016
• At c.10km$^2$ catchment scale, *Sphagnum* planting can reduce peak flow by up to 13% for the 20 mm h$^{-1}$ event
But...

**Key findings 5 - Uncertainties**

- Lack sufficient (field) data on several types of restoration, and on responses over longer (>5 year) timescales
- Still lack full quantification of the NFM impact of peatland interventions at scale of communities at risk (for flood events and catchments of different types and sizes)
- Catchment geometry matters
  - Sub-catchment synchronisation effects
  - Spatial patterns of intervention
  - Channel orientation effects (e.g. ditches)
- Ongoing projects and modelling will help!
Evidence gaps and priorities: outputs from the Inquiry Workshop

- Need to consolidate and expand evidence base, including delivery of ongoing projects
- More effective presentation of the evidence to focus on policy needs
  - Meaningful translation of hydrological impacts to return periods
- **How long does peatland restoration take to deliver NFM benefits?**
  - *e.g.* *Sphagnum* reintroduction
- **Establishing cost-benefit of NFM interventions**
  - Costs available, benefits need more complete quantification
- More effective management and communication of the uncertainties
  - Presenting levels of uncertainty
Optimising NFM benefits from Upland Restoration