



UNDERSTANDING GULLY BLOCKING IN DEEP PEAT

EVALUATION OF EXISTING EXPERIENCE AND STRATEGIC PLANNING OF FUTURE WORKS

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INTRODUCTION



Creation of gullies in blanket peat, causes the peat to dry out, resulting in accelerated peat decomposition, leading to discolouration of local water sources and the release of greenhouse gas emissions into the atmosphere. Substantial sediment transport in streams (up to 500kg sediment/yr per km² in some catchments) and water discolouration are of increasing concerns for water companies. These processes lead to serious degradation of Peak District moors.

Large-scale restoration works by blocking erosion channels are planned by Moors for the Future to aid the long-term recovery of the Bleaklow Massif.

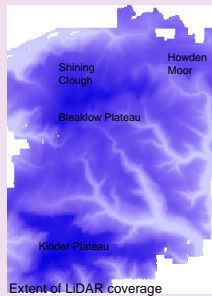
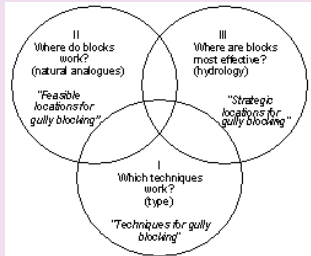
Aims of gully blocking

- to control and prevent further gully erosion, reducing sediment loss from peatlands
- to promote re-vegetation
- to reduce water discolouration of streams
- to raise the local water table, increasing saturation of peat domes

Research Objectives

- to assess and predict the hydrological and geo-morphological impacts of existing and planned blocks in the Dark Peak
- to aid decision making on where and how to place gully blocks on MFF sites on Bleaklow
- to develop a decision making process for prioritising sites & materials to lead to successful re-vegetation and effective moorland erosion control.

METHODS



Extent of LiDAR coverage

Project 1 – Techniques for gully blocking (Moors for the Future, National Trust, PDNPA)
Formalisation of practical experience with gully blocks in the Peak District pioneered by the National Trust (decision making process, logistics, costs).

Project 2 - Feasible Locations for gully blocking (University of Manchester, M Evans et al)
Exploration of feasibility of gully blocks by derivation of parameters from naturally re-vegetated gullies as well as technically blocked gullies subject to restoration works (clear recommendations for feasible gully block locations & materials).

Project 3 - Strategic locations for gully blocking (University of Leeds, J Holden et al)
Investigation of spatial distribution gullies and assessment of peat hydrology by analysis of LiDAR topographical data (DTM, flow accumulation map, gully block GIS modelling tool for 130km² area, see map above).

NATURAL ANALOGUES (II)

5 modes of natural re-vegetation of gully floors

Colonisation of re-deposited peat surfaces by

1. *Eriophorum angustifolium* behind natural gully blocks
2. *E. angustifolium* in zones of reduced stream power in broad gullies
3. *E. angustifolium* on peat flats
4. Colonisation of bare peat floored gullies by *E. vaginatum*
5. Colonisation of bare mineral floors

Sites where natural revegetation has occurred have low local gully floor slopes and a thin covering of re-deposited peat sediments. Therefore, MFF works should focus on blockage of sites with slopes less than 0.11 m/m (6°).

ARTIFICIAL BLOCKS (II)

Material: maximum sedimentation rate behind wood and stone dams. Plastic dams are less efficient sediment traps (50% of wood & stone), create water pools.

Sediment supply: bare gully walls important for supply of sediment to deposit behind the artificial dam.

Dam Spacing: < 3m spacing required to ensure adequate sediment supply.

Target dam height: ca 45cm (min. 25cm) to maximise sediment accumulation behind dams.

Stabilisation: Artificial dams could be further stabilised by planting cotton grass *E. angustifolium* behind successful dams. (see MFF Cotton Grass project)

GULLY FACTS

Natural Gully Blocks

Natural re-vegetation is extensive across the Kinderscout and Bleaklow Plateaux
Gully blocks are an important trigger for natural re-vegetation but not the only one

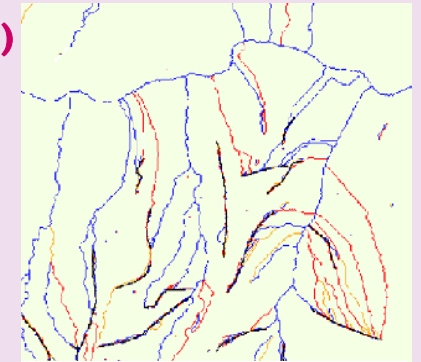
Artificial Gully Blocking

The National Trust have installed over 1,000 dams on Kinder Scout and Withins Clough, helping to protect peatlands into the future

GIS MODELS (III)

Using high resolution GIS techniques (LiDAR and Aerial Imagery)

- Identification of gullies that have biggest impact on local hillslope saturation and stream runoff
- Prediction of effects of gully blocking by artificial infilling of gullies, generating a new map of flow saturation
- Hence, prediction of management impacts on downstream discharge and local saturation. The new map can be used to identify areas where gully infilling has positive impact on local saturation



GIS modelling tool for assessing effects of potential gully blocks

- Blue areas indicate a clear reduction of downstream flow when blocked. Water will spread out across the hillslope and re-saturate it.
- Red lines indicate where flow direction may change to a focussed flow when blocked. A new gully is liable to form if the present one is blocked. Reduction in erosion & flow is not expected.
- Gullies are shown in black

Therefore, gullies followed by blue areas should be targeted for blocking. Clicking on a blue part of the map will indicate the magnitude of flow reduction expected following blocking. This allows us to strategically assess the most effective gullies to block

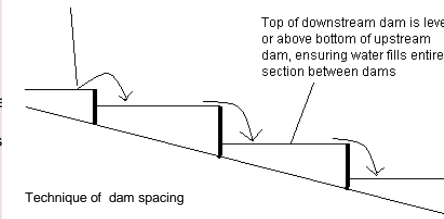


TECHNIQUES (I)

Techniques for gully blocking

The National Trust has pioneered this restoration approach. Experimental gully blocking has been carried out on Withins Clough, Kinder Scout and Upper North Grain. Dams of heather, wool, wood, stone and moulded plastic have been employed. After only 12 months, there has been up to 40cm of sediment accumulation!

Water flowing over top of dam runs onto water, not peat or mineral reducing risk of undercutting



Materials

Wooden and stone dams on Kinder appear to be the most effective material at trapping sediment, wooden dams also hold puddles of water. Plastic dams, used extensively on Withins Clough hold deep pools of water and may help raise local water table levels and may provide important local microhabitats for invertebrates.

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