Blanket Bog Track Trial

Moor House NNR

The Moorland Association

NORTH PENNINES
Area of Outstanding Natural Beauty

NATURAL ENGLAND

in Partnership


Courtesy of Alistair Crowle

Fig 1. Braiding and rutting damage to peatland with no protective surface.

Context

Blanket bog is a wetland habitat that requires specific conditions to develop: more than 160 "rain" days per year, low evapotranspiration, relatively low fluctuations between annual summer maximum and winter minimum temperatures and underlying geology that allow the peat to spread and "blanket" the landscape.

Not surprisingly, these conditions are not common on a global scale which is why this habitat is globally rare. The UK holds roughly 15% of the world's blanket bog and the importance of this habitat for plants and animals has been known for a long time. More recent research has shown that this habitat can influence raw drinking-water quality, freshwater invertebrate communities and the setting down/release of carbon into the atmosphere.

We are unsure how a warming climate will impact upon the carbon stored within blanket bog. However we know from studies of the peat cores that blanket bog has the ability to withstand some changes in climate as a result of individual plant and moss species different responses to water saturation, with for example, species that prefer drier conditions dominating in periods of reduced rainfall. The less damage that occurs to blanket bog hydrology on any given site through anthropogenic effects, the greater the likelihood that the area in question will be in a condition to respond naturally to changes in temperature and patterns of rain-fall that are expected under a warming climate.

The importance of deep peat as a carbon store and potential to sequester further carbon if in good health has become a major agenda item in the English uplands. The Moorland Association (MA), Natural England (NE) and peatland partnerships like North Pennines AONB Partnership have been working to improve peatland functionality by repairing oxidising and eroding bare peat, blocking gullies and grips to raise the water table and reduce erosion as well as filter the water for free and slow the flow off moorland to attenuate peak flows and mitigate flooding. This work across blanket bog habitat improves eco-hydrology, but also makes the moorland wetter and more fragile and prone to damage with use.

Red Grouse

The uplands have multiple uses and are managed for sheep grazing, grouse shooting, and other leisure and visitor activities such as fell running, walking, mountain-biking and orienteering. Vehicle access is often required for day to day shepherding and grouse moor management activities like predator control, vegetation management, putting out grit for grouse to aid digestion and getting shooting visitors and their equipment to areas of the moor on shoot days. Access is also required to work on peatland restoration areas.

Routes and tracks created and maintained for land use are often subsequently also used by leisure visitors as they provide an easier aid to navigate otherwise difficult Open Access terrain. They can also facilitate emergency services to reach casualties in inhospitable places as well as to get wildfire fighting personnel and equipment out to hard to reach places. Vehicle access across blanket bog is therefore essential for land use. However, stone constructed tracks on deep peat have been found to result in compression and compaction of the peat impeding natural hydrological flow.

It is in no ones' interests to damage peat bog surfaces or their properties and a pragmatic solution to help balance the conservation, economic and social land use needs of these areas is required. With increased knowledge of the hydrological function of deep peat and factors that affect its health, a partnership of MA, NE and North Pennines AONB Partnership investigated novel track technology including wooden and mesh surfaces to help prevent damage.

Plastic mesh track trial with the Argocat (but also suitable for quad bikes)

The Mesh and Wooden Track Trial

The MA, NE and North Pennines AONB sponsored a research project carried out by a PhD student from the University of Leeds on the Moor House - Upper Teesdale National Nature Reserve.

The site is deep peat with healthy functioning blanket bog in favourable condition. Its Water Table Depth (WTD) is typically at or within 10cm of the surface for more than nine months of the year which supports a representative assemblage and abundance of blanket bog plant species.

Given the sensitivity of the site it is perfect for testing new approaches to and measuring the impact of vehicle track design on blanket bog.

The experimental design included:

- Plastic mesh track laid and driven on by an argocat (but also suitable for quad bikes)
- A heavier duty wooden construction suitable for heavier vehicles such as 4x4s

This track was constructed from hardwood planks spaced to leave a gap the same width as the plank connected together with folded steel links which also act as the main running surface. A plastic grid was spread on the cut vegetation to spread the load of the plank construction laid on top. John Carrick designed, supplied and laid the track free of charge for which the project partners are very grateful.

- A section that remained unsurfaced which was also driven on (albeit light use) by the argocat.

The tracks were laid in Summer 2013 and allowed to settle in, on the advice of the track manufacturers, before driving started in Spring 2014.

Vehicle use of the tracks followed a variable driving schedule until Autumn 2015, incorporating five different sections, each representing a different intensity of track use. These were designed to mimic use for moorland management on a working driven grouse moor. This included sections of 10 passes per week, both loaded and unloaded from July to October. A range of peat physical and hydrological properties, and vegetation characteristics were measured before and after the tracks were laid and then during the driving.

Fig 2 (opposite top) shows the layout of the tracks, level of use and topographical positions over the contours.

Table 1 (opposite bottom) shows the mesh track divided into five sections and the different rates of driving.

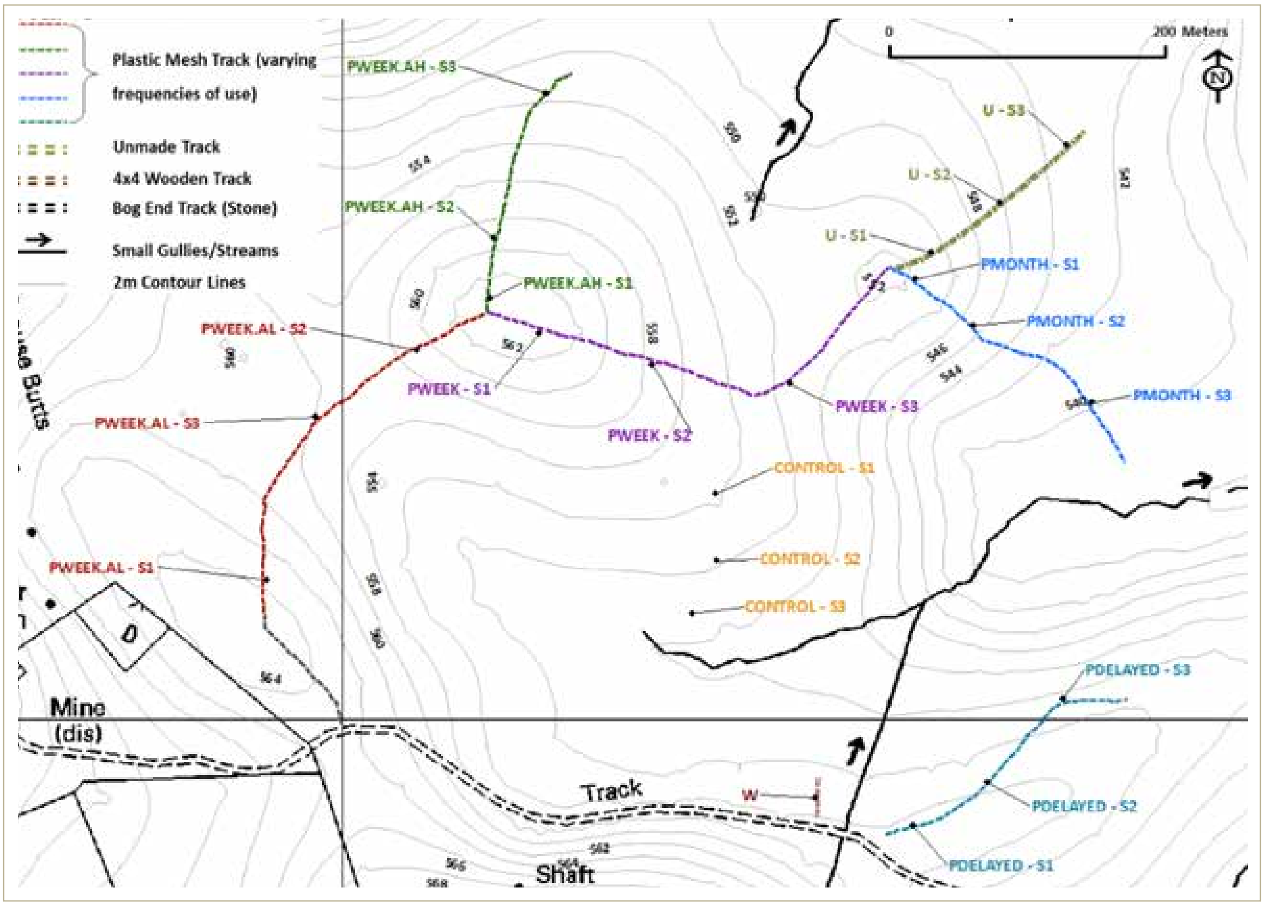

Fig 2 shows the layout of the tracks, level of use and topographical positions over the contours.

Table 1 Information on treatments included in the intensive study at Moor House.
Topographic position coding; **S1** – Top-slope, **S2** – Mid-slope, **S3** – Bottom-slope.

Treatment	Weekly Usage (passes over track per week)	Total No. Passes	Topographic Positions	Track Type	Vehicle Type	Additional Information
PWEEK.AL	2 (April - End July, October - April) 10 (End July - October)	412	S1,S2,S3	Plastic Mesh	Agrocat	
PWEEK.AH	2 (April - End July, October - April) 10 (End July - October)	412	S1,S2,S3	Plastic Mesh	Agrocat	Vehicle Weighted (End July to October)
PWEEK	2	156	S1,S2,S3	Plastic Mesh	Agrocat	
PMONTH	0.5	38	S1,S2,S3	Plastic Mesh	Agrocat	
PDELAYED	2 (from February 2015)	76	S1,S2,S3	Plastic Mesh	Agrocat	
U	0.5 (stopped April 2015)	24	S1,S2,S3	Unsurfaced	Agrocat	Driving over vegatation, no surface track
W	10	780	S3	Wooden Beams	4x4 Vehicle	30m length of track
C	0	0	S1,S2,S3	Unsurfaced	None	No driving or track, Undisturbed hillslope control

Site Preparation for laying of track surfaces

Photos courtesy of A. Lockett and K. McKendrick-Smith (2013).

Fig 3. Route of mesh track was cut.

Fig 4. Brash was collected and blown to the side.

Fig 5. Mesh was rolled out.

Fig 6. Mesh was pinned in place with 300mm steel U shaped pins.

Fig 7. Wooden track being laid after vegetation was cut and removed and plastic grid rolled out.

Table 2. Track surfaces

Characteristics	Plastic Mesh Track	Articulated Wooden Track
Total Length	~1.5 km	~0.3 km
Manufacturer	Terram	John Carrick
Material	UV Stabilised HDPE	Oak Planks (n = 94), Steel Links (n = 186), HDPE Underlay
Dimensions	2.5 m x 15 m (section size) 0.0145 m (thickness)	3.2 x 0.15 x 0.1 m (single plank) 0.45 x 0.28 x 0.1 m/thickness - 0.05 m (single steel link)
Weight	2 kg m^{-2}	184 kg m^{-2}

Table 3. A range of peat physical and hydrological properties, and vegetation characteristics were measured before and after the tracks were laid and then during the driving.

Properties Measured	Importance to blanket bog functions
Water Table Depth / surface moisture	WTD within 10cm of surface supports bog pant species and maintains anaerobic conditions in peat allowing peat formation.
Bulk density of peat/permeability	Compression has the potential to reduce or restrict flow of water through peat interrupting functionality leading to probable drying and peat structural change
Vegetation/bare peat %	Blanket bog plant assemblage perpetuates blanket bog function ensuring moisture is retained and no oxidation at the surface occurs. Bare peat should be avoided.
Overland flow	Roughness of the surface created by healthy vegetation, especially mosses, slows flow so erosional force of water and mobilisation of carbon is minimised. Drowning of plants should not occur. Moorhouse has natural overland flow which increases with rainfall.

Fig 8. May 2014 10 months after track installation (K. McKendrick-Smith, 2014)

Results

WTD – little effect

Hydrology is central to the functioning of peatlands. The water table up to a distance of 10m from either side of the track edge shows little change after mesh and wooden track installation and use. Therefore carbon storage is unlikely to be affected in the short term. The trial covered a year with wetter conditions and a year with drier conditions. Peat soil moisture content varied only slightly.

Driving Frequency

The mesh track at heaviest use tolerated 10 passes per week for three and a half months (End July – Oct) loaded with 225kg to mimic carrying guns and equipment to butts compared to the unsurfaced track which was subject to two passes per month protected only by its dwarf shrub layer. Even at this rate of use, driving had to be stopped on the unsurfaced section due to damage to the turning area – a key consideration for vehicle use.

Vegetation

Vegetation re-growth will depend to a degree on the original vegetation composition and abundance and site preparation technique used prior to laying. However, the recovery rate of bryophyte (mosses) compared with vascular plants was found to be faster. Driving frequency did not affect re-growth or abundance of key species on the mesh track but vegetation height decreased on the unsurfaced section probably due to flattening by vehicle use.

Compression

There was natural variability in peat bulk density across the site but compression of the peat following track installation and use was not evident with bulk density actually decreasing overall after driving. There was a small compression impact of the 4x4 track but this may be a result of it being laid at the outset with a normal tractor not low pressure equipment which was used for the mesh site preparation.

The peat surface did not remain even after track laying and was sometimes lower where the wheels of the vehicle passed. Increased driving frequency did not influence the extent of peat surface lowering. (Max. average drop measured was 6cm) This may have led to small scale changes in peat structure and the formation of channels for overland flow of water which could be problematical in some situations.

Surface peat demonstrates natural variability of permeability with horizontal flow typically known to be faster than vertical flow. The effect of the mesh track on permeability showed variability but generally vertical flow slowed and horizontal flow speeded up. However, neither trend was related to driving frequency and they were generally insignificant from a statistical point of view.

Sphagnum Moss

Small Heath Butterfly

Fig 9. October 2015 2 years 3 months after track installation (K. McKendrick-Smith, 2014)

Fig 10. April 2017 3 years 9 months after track installation (K. McKendrick-Smith, 2014)

Results continued

Rutting

Both track surfaces offered protection from damage to the peat surface. Rutting did occur on the lower section and turning area of the no-surface route section after 24 passes. This had very light use during the trial (twice per month) and was stopped early (12 months not 18) due to the damage being caused. It is precisely this damage that practitioners and conservationists seek to avoid by finding a pragmatic solution.

Bare Peat

No vegetation survey was carried out immediately after the tracks were laid and compared to the survey of vegetation before preparation started. It is therefore not clear what caused bare peat but it could be:

a) the natural result of removing the canopy revealing patches with no moss layer. However, only 1-2% cover (after driving) of bare peat was evident in the unsurfaced treatment where no vegetation removal took place and there was no evidence of bare peat recorded in the vegetation survey before site preparation on the track routes.

b) mechanical scalping during site preparation and/or

c) the effect of driving coupled with overland flow.

The lowest percentage of bare peat was in the most frequently used section. This suggests that the track prevented rutting and braiding that occurs on non-surfaced tracks.

Overland flow

There was less overland flow in the control area where vegetation was disturbed least i.e. no site preparation or driving. Frequency of use or track type did not affect overland flow but naturally occurring overland flow was seen to channelize, especially where the track was at the bottom of the slope and at times of higher rainfall. Diverting overland flow down the mesh surface is not desirable and a balance between preparing track route before laying and leaving enough vegetation roughness is important.

__N.B. For more detail, please see the inside back cover for the full scientific report reference.__

Cotton Grass

Golden Plover

Fig 11. April 2017 3 years 9 months after track installation (K. McKendrick-Smith, 2014)

Conclusion

Both the wooden structure for 4x4 use and the plastic mesh had little effect in the physical and hydrological properties of the peatland within the timescale of the trial. Hydrological properties remained intact even with increased driving frequency and loading of vehicles.

Driving seemed to have little negative impact on blanket bog vegetation community on both types of track surface which showed signs of recovery since site preparation even with frequent use. The unsurfaced route had a very high density of possibly cushioning vegetation coverage, yet showed evidence that vegetation height was lowered with a suggestion of a wheel rut profile forming across the track cross-section even with light use.

Consent

From the results, Natural England (NE) is content to continue to give and renew time-limited consents (typically five years) for mesh tracks on designated blanket bog sites as a pragmatic solution to the balance between required access and conservation objectives.

NE consent does not give planning permission and each local planning authority may interpret mesh surfacing differently. Each local planning authority should be contacted in advance of any track installation.

The 4X4 track also proved successful for not interrupting hydrological function to any great extent within the timescale of this trial but there is some vegetation loss beneath the structure.

However, the trial was only short term and therefore long term effects are still unknown and may be the subject of future research.

A review of the hydrological impact of existing stone tracks on deep peat in The North Pennines and Cheviots was also undertaken as part of this collaborative work. Although caution is needed in interpreting the results, moisture content around older stone tracks (15 years or more) was lower implying that there could be an increasing impact on the hydrological function (connectivity) over time/age of the track. When the track runs parallel to the contours – cutting across flow pathways – the effect is seen to be greatest on the downhill side of the track.

Lapwing

Sundew

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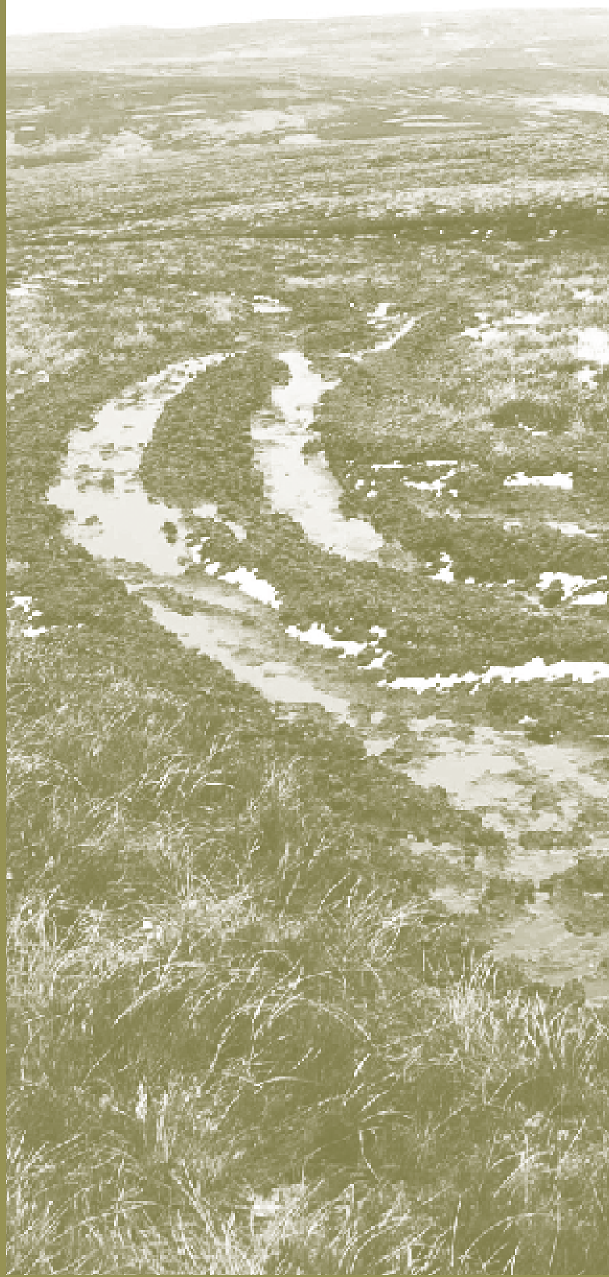
We would also like to thank the MA members who allowed Kathryn to access and study some of the existing tracks on sites around the North Pennines.

Cloudberry

Emperor Moth Caterpillar

For further reading on this study see:

McKendrick-Smith, K., Holden, J., and Parry, L. (2017) The Impact of Tracks on Blanket Peat Ecohydrology – Summary Report, University of Leeds.



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