Moorland Management Guiding Principles

National Trust High Peak Estate & Natural England

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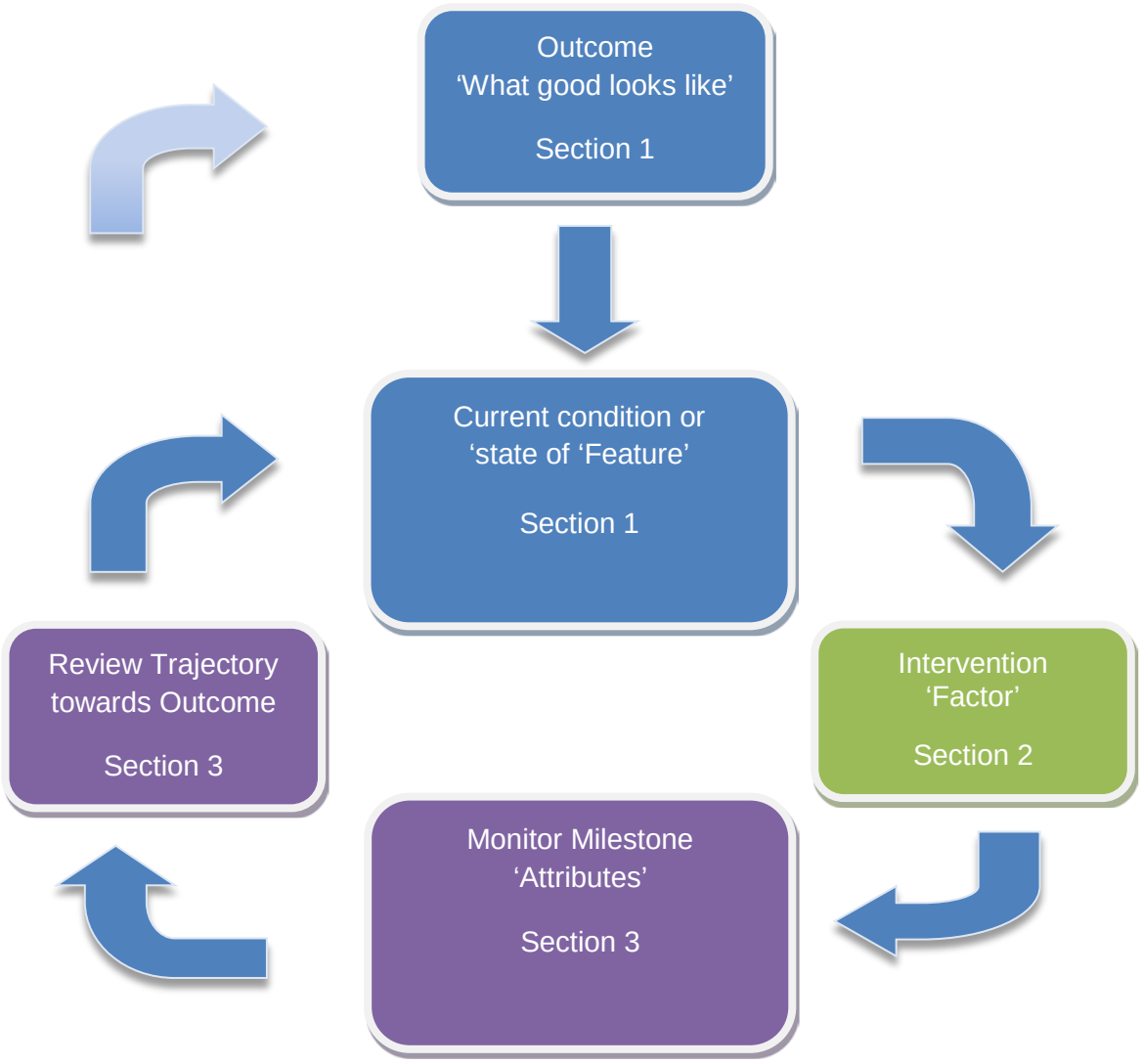
Preface

This document details the principles by which moorland management should be conducted. It is supported with a time limited Moorland Management plan for each moor which will include associated locations, quantities and deviations from the following principles. Failure to comply with these principles could constitute a breach of SSSI consent and may also affect agri-environment payments.

The Guiding Principles, in conjunction with the individual Moorland Management plan for each NT moor, form the context and delivery parts of a Section 7 Agreement with Natural England. This is an agreement made under sections 7 and 13 of the Natural Environment and Rural Communities Act 2006. The Section 7 agreement provides permission for the activities within it and therefore provides consent, unless otherwise stated (section 2). An additional Section 28E consent is not required. It provides for amendments to be made to the agreement (as agreed by all parties) without the need for modification under Section 28E, Wildlife and Countryside Act, 1981 (as amended).

The principles follow an outcomes based approach which aims to clearly define success and ensure all stakeholders work together to achieve that success. An outcome does not exist in isolation; each outcome's success is linked to the success of the other outcomes.



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Section 1: Outcomes

1.0 The Outcomes Approach

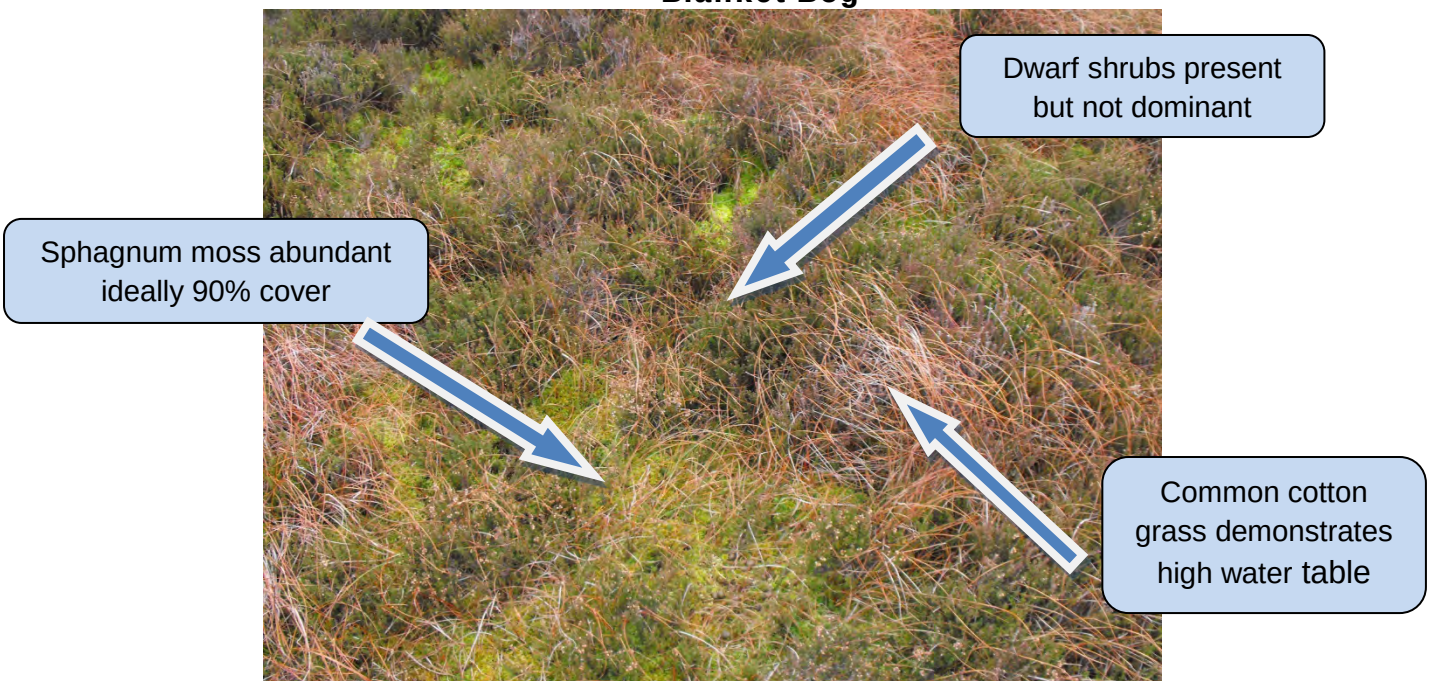
The outcomes approach is about delivering better long-term outcomes for the environment, taking into account the needs of stakeholders and working towards a shared vision.

NB: For notified features, favourable SSSI condition is an integral part of "what good looks like" and is used with other attributes (eg. water table) to determine the status of the feature.

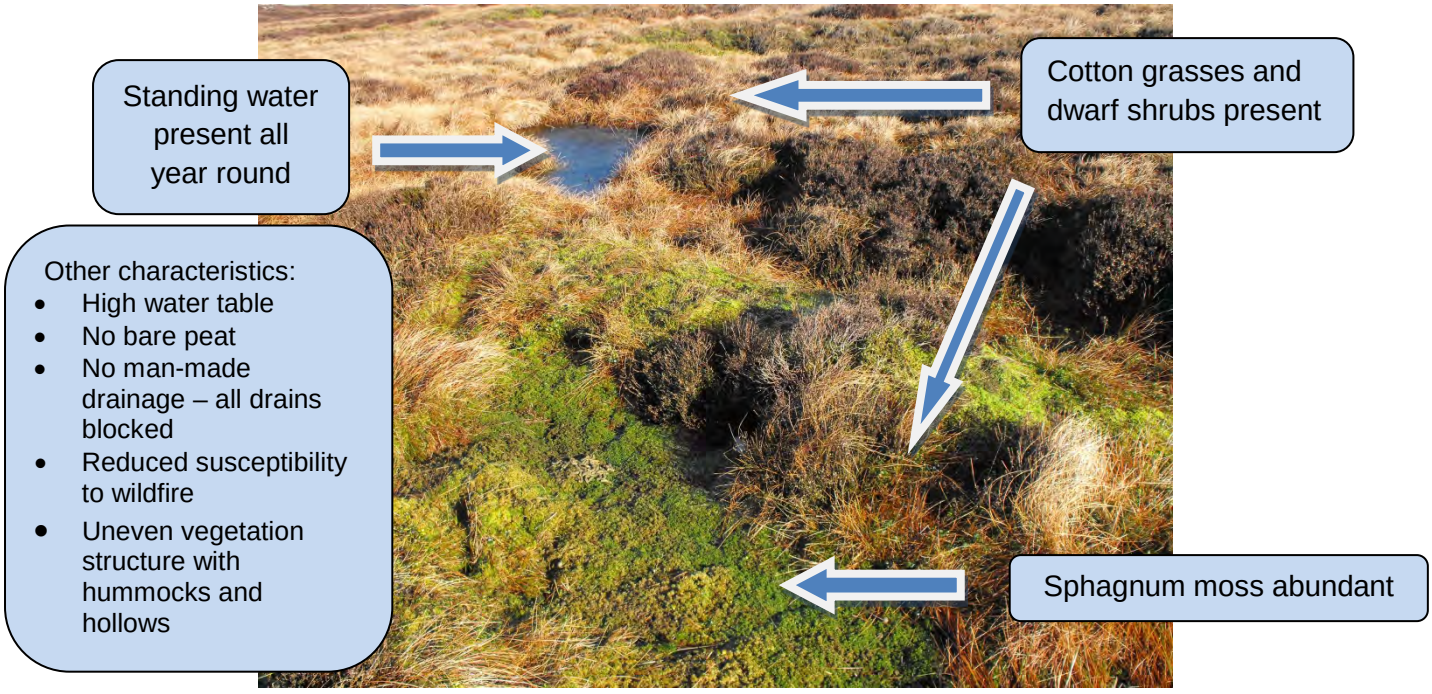
1.1 What Good Looks Like

Currently we have described what good looks like for: Blanket Bog, Wet Heath, Dry Heath and Clough Woodland. It is proposed to include the other features detailed in the Moorland Management plans in due course.

Blanket Bog

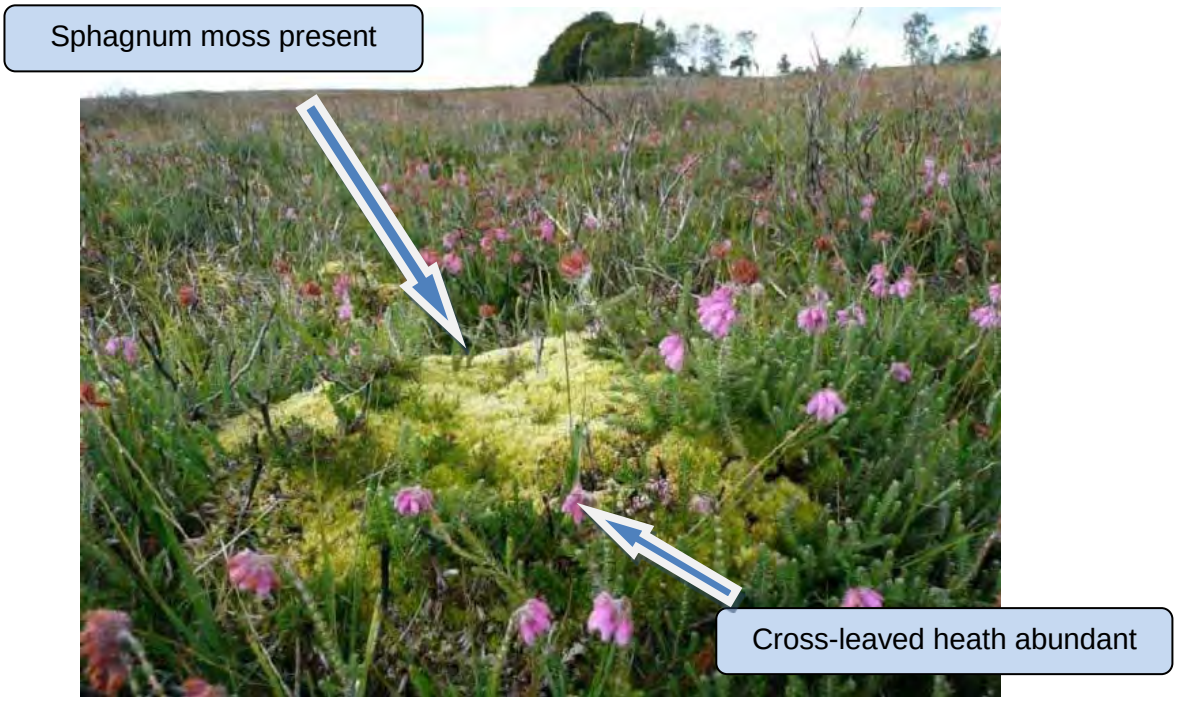


An example of 'healthy habitat' on deep peat areas, featuring cotton grass, dwarf shrubs and abundant *Sphagnum*. Unit 198 (2013)

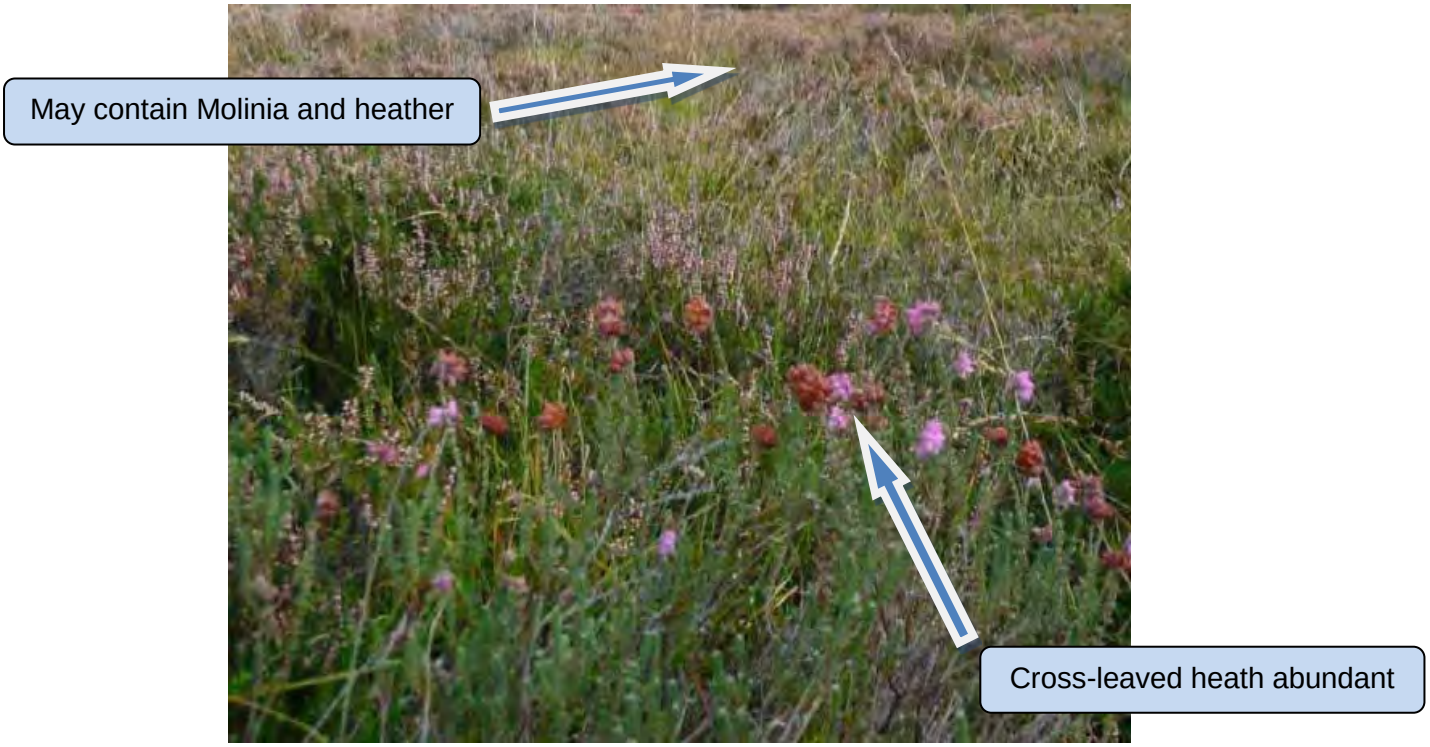


An example of 'healthy habitat' on deep peat areas, featuring cotton grass, dwarf shrubs and abundant *Sphagnum*. Unit 194 (2014)

Wet Heath



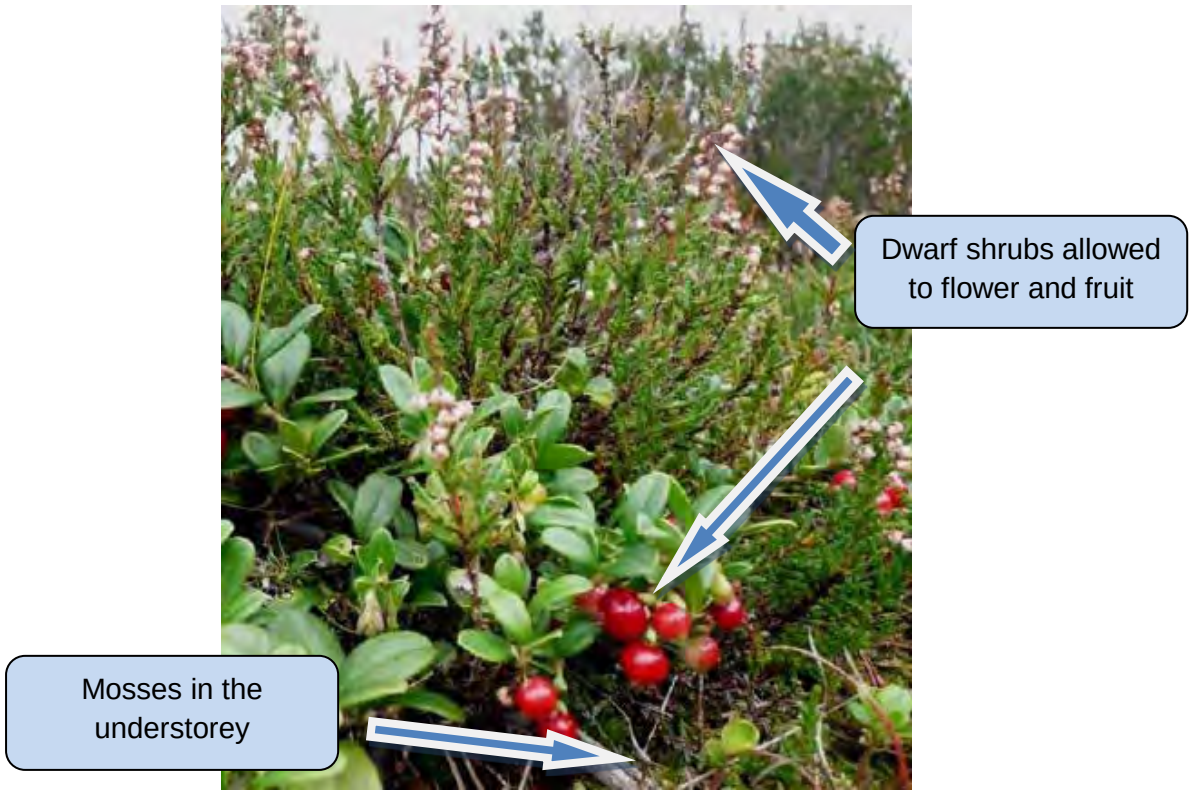
An example of ‘healthy wet heath habitat’, featuring abundant cross-leaved heath of varied age with abundant mosses including *Sphagnum* in the understorey.



An example of ‘healthy wet heath habitat’, featuring abundant cross-leaved heath of varied age with abundant mosses including *Sphagnum* in the understorey.

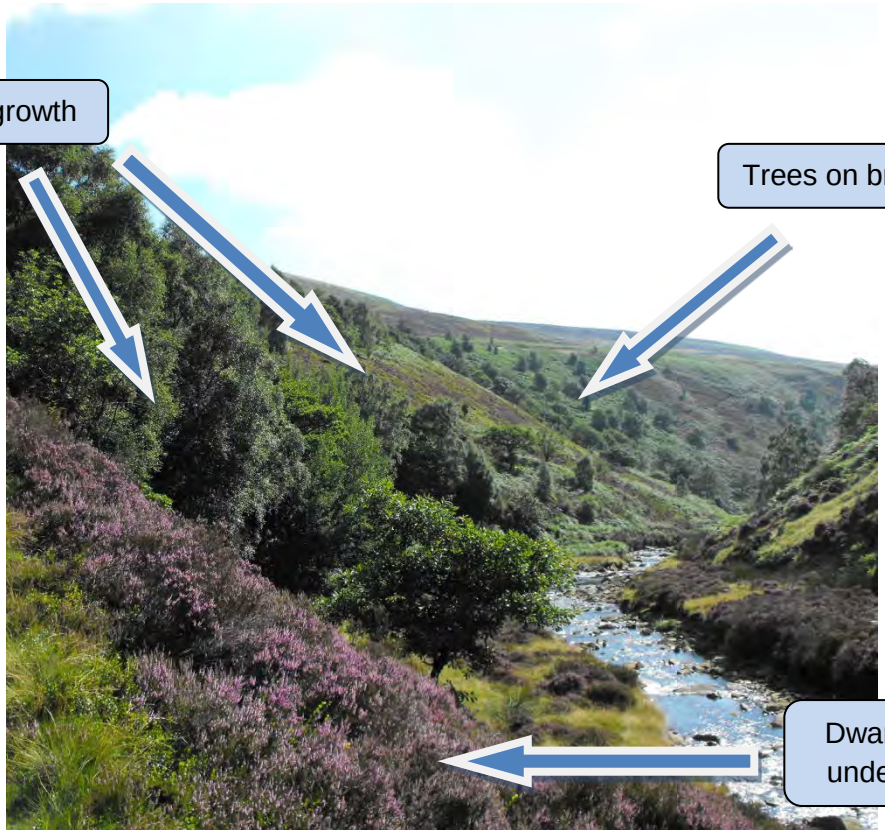
Dry Heath

An example of ‘healthy dry heath habitat’, featuring several dwarf shrub species such as bilberry, heather and bell heather of varied age with abundant mosses in the understorey. Unit 128 (2013)



An example of ‘healthy dry heath habitat’, featuring several dwarf shrub species such as bilberry, heather and bell heather of varied age with abundant mosses in the understorey.

Clough Woodlands



An example of Clough Woodlands, featuring a mix of denser woodland and open habitats with native trees and several dwarf shrub species of varied age in the understorey. Unit 128 (2013)

An example of Clough Woodlands, featuring open, native trees with several dwarf shrub species of varied age in the understorey. Unit 219 (2014)

1.2 Delivery of the Outcomes

Currently an outcomes approach has been developed in detail only for blanket bog. It is proposed to develop a similar outcomes approach for other moorland features as covered by the Moorland Management plan. The section 7 agreement will be amended to accommodate this.

1.2.1 How 'Good' blanket bog delivers the Outcomes

Of all the upland features listed above, there has been the most focus on the restoration of blanket bogs due to the severely degraded state of much of England's blanket bog resource, and the impact on a wide range of environmental outcomes.

Crucial for delivering better long-term outcomes for the environment, and working towards a shared vision is the awareness that for blanket bogs "plants", "water", and "peat" are very closely connected and mutually interdependent as shown below (figure 1). The plants determine what type of peat will be formed and what its hydraulic properties will be. The hydrology determines which plants will grow, whether peat will be stored and how decomposed the peat will be. The peat structure and the relief determine how the water will flow and fluctuate. These close interrelations imply that when any one of these components changes, the others will change too. Not necessarily at once, but in the long term.

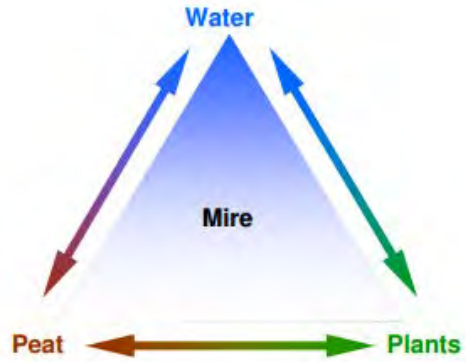


Figure 1 (Taken from Schumann & Joosten, Global peatland restoration manual (2008) http://www.imcg.net/media/download_gallery/books/gprm_01.pdf)

A peat bog is a wetland in which the peat soil is likely to have a moisture content of greater than 95% in the undisturbed state. Bog surfaces often have areas of standing surface water. This water-logging is what creates a peatland and allows it to function.

Actively-growing bogs consist of two layers – a thin living surface layer of peat-forming vegetation (the acrotelm), generally between 10 cm and 40 cm deep, and the relatively inert, permanently-waterlogged peat store (the catotelm) which may be several metres deep. Water, in a bog, travels from the living canopy downwards into the permanently waterlogged peat. The acrotelm supplies plant material which then forms peat in the catotelm. Without an acrotelm a bog cannot accumulate peat or control water loss from the catotelm. In a fully functioning natural bog only the acrotelm is visible because the catotelm peat beneath is normally shielded from view by the living acrotelm. (http://www.iucn-uk-

peatlandprogramme.org/sites/www.iucn-uk-peatlandprogramme.org/files/1-10%20Peatland%20Briefings%20-%205th%20November%202014.pdf)

Species such as common cotton grass and *Sphagnum* mosses are found on healthy bogs. *Sphagnum* mosses are particularly good at increasing the surface roughness or texture of the peat surface which slows water flow, reducing the severity of flooding, as shown below (figure 2).

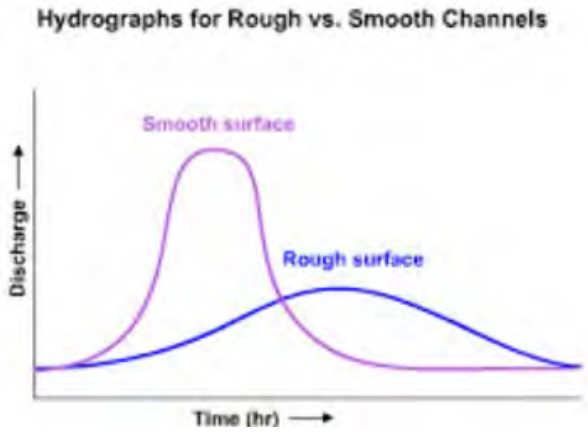


Figure 2: Runoff Processes: International Edition MetEd - University Corporation for Atmospheric Research

1.3 Six States of Blanket Bog

The Strategy for the Restoration of Blanket Bog in England (2015) defines 6 states of blanket bog. The condition of blanket bog varies throughout the country and this approach is a helpful means of assessing the condition of this key habitat. Blanket bogs in the Peak District have been modified by a range of historical processes and management activities. It is important to recognise that these six states are not on a continuum i.e. there is not a stepwise improvement from State 1 to 6. Also, these descriptions are broad and local circumstances may be categorised further, in more detail. For example, in the NT High Peak Estate extensive areas of bare peat (State 2) have been re-vegetated and stabilised as part of the restoration process, but do not meet the criteria for State 3. They are now in a transition phase (or "State 2a").

1. **Afforested bog** (inactive) Bogs which have been planted with trees, usually for commercial reasons, and are not functioning as blanket bog. (There are no instances of afforested bog on the National Trust High Peak Moors).

2. ***Bare peat bog***: Little or no vegetation with areas of exposed bare peat and extensive gullying and hagging. Unlikely to support representative peatland communities. Small patches of dwarf shrubs (heather) may exist. This also includes recently restored bare peat.

2a. ***Revegetated Bare Peat***: A phase of restoration has established a nurse crop (combination of moorland species and lowland grasses). Bare peat is stabilised but lacks typical blanket bog community. Sphagnum generally absent.

3. ***Dwarf-shrub dominated blanket bog with other species scarce or absent (largely inactive)***: largely inactive, severely modified bogs where dwarf shrub cover exceeds 75% of the canopy and other typical mire species such as bog mosses and even cotton grass are rare or absent. It may have moderate to severe gullying and hagging. Occurs often on 'drier' peats and the more easterly moors of the UK.

4. ***Grass and/or sedge dominated blanket bog (potentially active)***: May be active or have potential to become so. Vegetation is dominated by graminoids such as purple moor-grass, cotton grass or deer grass with *Sphagnum* bog mosses scarce or absent. Does not include the post-burn grass or sedge dominated areas of modified bogs of state 5 below. Unlikely to be extensively drained and usually with few gullies or haggs.

5. ***Modified blanket bog with high dwarf shrub cover but with Sphagnum and other mire species (active):*** Dwarf shrub cover is high, often reaching 50-75%, and *Sphagnum* cover tends to be lower. Cotton grass is abundant or frequent as an understorey and becomes dominant in the years following fire. Moderately active, with peat formation likely to be slower than in state 6. It may be drained, but usually with few gullies or haggs. Characteristic of much of the Pennines for example.

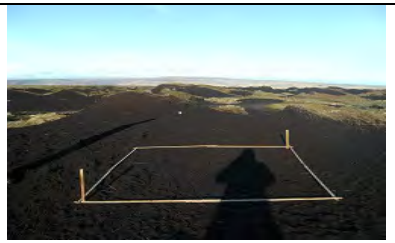
6. ***Active hummock/hollow/ ridge blanket bog (active):*** This is un-modified or little modified, *Sphagnum*-rich blanket bog, which is peat-forming (active) often with hummocks and hollows. There may be basin or valley mire

components. Typically neither heather nor cotton grass achieve high abundance and there is usually a good *Sphagnum* understorey. It meets, or is close to meeting favourable condition attributes.

(*A Strategy for the Restoration of Blanket Bog, An Outcomes Approach*, 2015)

The Upland Management Group has recently published “Blanket Bog Outcomes Approach Land Management Guidance 2017” and the tables below follow this guidance, tailoring them to the NT moors. The Land Management Guidance should be referred to for more supporting information.

STATE 2: Bare Peat

Characteristics	Example photo	✓ Description/ ✓ characteristics	Effect of bare peat on delivering the six outcomes						Intervention	Monitoring
			Biodiversity	Grouse	Sheep	Carbon	Water	Wildfire		
Drainage features Water is not held on the moor and runs off freely		✓ No drainage features present. ✓ Drains/gullies present, unblocked, eroding. ✓ Drains/gullies present, unblocked, naturally re-vegetating. ✓ Drains/gullies present, blocked. ✓ Obvious peat pipes or cracks	Reduced hydrological functionality and presence of blanket bog species.	Chicks get lost in drains. Fewer invertebrates.	Limited grazing potential. Risk of loss of sheep in drains.	Carbon lost by sheet wash, windblow and decomposition, especially from eroding gullies and haggs.	Water is focussed into channels, high dissolved (DOC) and particulate (POC) carbon. May lead to siltation in reservoirs, increased treatment costs.	Damage from wildfire likely to be variable dependent on location and adjacent vegetation types. Dry peat is combustible and if ignited can burn for significant periods. Wildfire is often responsible for the initial creation of bare peat. Wildfire may undo restoration attempts or make restoration more difficult.	✓ Re-wetting – see section 6.0 ✓ Re-vegetating – see section 7.0 ✓ Diversifying – see section 3.1	✓ Monitor changes in water table ✓ Monitor vegetation establishment and repeat as required
Areas of bare peat Areas of bare peat more than 25% of any given area		✓ The area is not naturally re-vegetating. ✓ The area is continuing to erode.	Bare peat areas support very little biodiversity.	No nesting or feeding habitat.	No food. May get stuck.	Carbon lost, especially from eroding gullies and haggs	Water moves freely across any bare peat surfaces but readily forms channels. High dissolved (DOC) and particulate (POC) carbon.			

Water table Low water table		✓ Even after a wet period the peat surface is dry, friable and crumbly ✓ *Sphagnum* mosses are sparse or absent ✓	Poorly functioning bog with limited wetland species. Depressed invertebrate numbers.	Low invertebrate numbers, reduced food for young grouse.	Diversity of food limited.	Carbon lost, especially from eroding gullies and haggs.	Water table often 0.5m or greater lower than vegetated surfaces. Hydrophobic surfaces of dry peat make it difficult to re-wet.			
Vegetation structure Absence of significant vegetation results in poor or no structure		✓ Fragmented vegetation structure that lacks continuity. ✓ Vegetation often as islands in large areas of flat bare peat surfaces or on the tops of eroding haggs	Poor nesting habitat, viewing points or shelter. Poor for most moorland birds. Limited diversity in vegetation.	Poor nesting habitat, viewing points or shelter.	Grazing pressure concentrated due to localised vegetation patches, limited food sources in winter.	Limited opportunities for carbon sequestration.	Water movement not constrained by surface roughness. May increase surface flow in peak rainfall events.			
Vegetation composition Generally species poor		✓ Limited vegetation present. ✓ Poor species diversity ✓ Often lacking wetland species ✓ Often acrocarpous mosses (carpet moss) present ✓ Includes recently re-vegetated peat where a nurse crop is present	Limited diversity in vegetation and range of associated species. Vegetated areas largely support heath or acid grassland species.	Limited feeding opportunities due to restricted cover and range of species.	Limited feeding opportunities due to restricted cover and range of species.	Limited opportunities for carbon sequestration.	Lack of bog vegetation may increase infiltration rates into the peat.			

STATE 3: Dwarf-shrub dominated blanket bog with other species scarce or absent (largely inactive)

Characteristics	Example photo	Description/ characteristics	Effect of dwarf shrub dominated bog on delivering the six outcomes						Intervention	Monitoring
			Biodiversity	Grouse	Sheep	Carbon	Water	Wildfire		
Drainage features Water is not held on the moor and runs off freely. Presence of drainage is variable across this state.		✓ No drainage features present. ✓ Drains/gullies present, unblocked, eroding ✓ Drains/gullies present, unblocked, naturally re-vegetating ✓ Drains/gullies present, blocked. ✓ Obvious peat pipes or cracks	Reduced hydrological functionality and presence of blanket bog species.	Chicks get lost in drains, fewer invertebrates due to dry conditions.	Risk of loss of sheep in drains. Foraging area has reduced connectivity in areas where hagging is prevalent. Haggs and gullies can provide shelter.	Carbon lost due to eroding peat from gullies and hagg edges.	Where gullies exist, water is focussed into channels, high dissolved and particulate carbon. May lead to siltation in reservoirs, increased treatment costs. Peat pipes may increase flow into watercourses.	Damage from wildfire likely to be extreme. Heather dominated swards have high fuel loadings and ignite readily. Dry peat is combustible and if ignited can burn for significant periods. The highest risk of long-term damage occurs in this state. Often this state will have developed because of previous wildfire or too frequent managed burning. Further incidents will make restoration more difficult. Wildfire is detrimental to all five outcomes.	✓ Re-wetting – see section 6.0 ✓ Re-vegetating – see section 7.0 ✓ Diversifying – see section 3.1	✓ Monitor changes in water table ✓ Monitor vegetation establishment and repeat as required ✓
Areas of bare peat Areas of bare peat less than 25% of any given area.		✓ The area is not naturally re-vegetating ✓ The area is continuing to erode. ✓ Gullies and haggs may be present ✓ Peat surface whilst not exposed may have thick layer of acrocarpous mosses	Limited/no blanket bog vegetation. Extensive bare peat areas support very little biodiversity.	Nesting or feeding habitat may be reduced. Small patches of bare, open areas are important for drying wet birds.	Reduced foraging area.	Carbon lost especially from eroding gullies and haggs.	Water moves freely across any bare peat surfaces. High dissolved and particulate carbon. May lead to siltation in reservoirs, increased treatment costs.			

Water table Low water table		✓ Even after a wet period the peat surface is dry, friable and crumbly ✓ *Sphagnum* mosses are generally absent ✓ Peat pipes usually associated with dense heather ✓	Poorly functioning bog with few wetland species. Low invertebrate numbers so reduced food availability for birds.	Low invertebrate numbers, reduced food for young grouse. Limited drinking water.	Diversity of food limited. Limited drinking water.	Carbon lost through erosion and oxidation of the peat.	Water quality poor due to oxidising surface layer. Average water table 40-60cm below surface. Hydrophobic surfaces of dry peat make it difficult to re-wet.			
Vegetation structure Lacks structure due to single species dominance		✓ Limited variation in the height or structure of the vegetation, often a dense canopy which shades other vegetation ✓ No or limited understorey of mosses	Single-species stands of heather produce conditions that are poor for other plant species due to drying of peat and shading. No variety in habitats for insects or other moorland birds.	Visibility reduced, more difficult to defend territories and observe predators, few areas for birds to dry out. Some tall heather provides shelter and a food source during periods of snow.	Grazing pressure concentrated on the edges due to restricted movement through dense heather stands. Some tall heather provides a food source during periods of snow.	Limited opportunities for carbon sequestration as shading and umbrella effect of canopy stops peat-forming species from growing. (Rainwater does not reach peat surface to make it moist).	Surface water movement not significantly constrained by surface roughness as shading reduces the number of species able to survive under the heather. Dominant heather can lead to peat pipe formation.			

Vegetation composition Tends towards single species, heather domination		✓ Heather dominant, can often be 100% cover. ✓ Poor species diversity. ✓ Understory dry and usually only represented by sparse feather mosses. ✓ Often a deep litter layer present	Vegetation takes on the appearance of dry heath and not blanket bog. Wetland species generally sparse or absent. Vegetation does not support diverse moorland fauna.	Single stands of heather provide less diverse food sources (eg limited/no cottongrasses in the spring) and may be too dry to provide abundant insects for young chicks.	Poor variety of food choices, especially a lack of cottongrass, an important food supply in the spring and other grass and sedge species.	Carbon will be released from dry peat soils under heather and capture will be limited due to the absence of significant peat-forming species. Peat piping and increased porosity of the peat will increase losses of DOC and POC.	Water movement not significantly constrained by surface roughness provided by a more diverse range of wet-loving species. Water draining these areas likely to be high in DOC and POC.			

STATE 4: Grass and/or sedge dominated blanket bog (potentially active)

Characteristics	Example photo	Description/ characteristics	Effect of bare peat on delivering the six outcomes						Intervention	Monitoring
			Biodiversity	Grouse	Sheep	Carbon	Water	Wildfire		
Drainage features Presence of drainage is variable across this state		✓ No drainage features present ✓ Drains/gullies present, unblocked, eroding ✓ Drains/gullies present, unblocked, naturally revegetating ✓ Low water table ✓ Drains/gullies present, blocked	Where drains are absent , wetland vegetation species may be present, though sphagnum absent or sparse.	Risk of loss of chicks in drains where present. Wet areas potentially have more invertebrates and provide feeding areas for chicks.	Risk of loss of sheep in drains, where present.	Where peat is vegetated loss of carbon through DOC and POC is reduced but methane emission may be high. Overall effects on carbon balance uncertain.	Water flow rates affected by drainage and/or surface vegetation roughness. Reduced levels of dissolved and particulate carbon.	Purple moor-grass dominated swards ignite readily and so there is some risk from wildfire, especially in the spring before new growth appears. However, the swards do not have high fuel loads and fire is likely to pass through quickly though there are risks if there are adjacent habitats with high fuel loads. As there are high water tables the peat surface is generally damp or wet and unlikely to ignite. Wildfire is detrimental to all five outcomes.	✓ Re-wetting – see section 6.0 ✓ Re-vegetating – see section 7.0 ✓ Diversifying – see section 3.1 ✓	✓ Monitor vegetation establishment and repeat as required ✓ Monitor changes in vegetation ✓
Areas of bare peat Areas of bare peat less than 10% of any given area		✓ Extensive areas of bare peat generally absent ✓ Any bare areas likely to be naturally re-vegetating. ✓ Little sign of active erosion	Biodiversity generally unaffected by the presence of large areas of bare peat.	Small patches of bare, open ground are important for drying wet birds.	If present may restrict foraging area.	Carbon will be lost where there is sparse vegetation cover. However this is likely to be of limited extent in this peatland state.	Only limited impact on water as a result of the restricted extent of bare peat.			
Water table High water table		✓ Unless subject to drainage, water tables are generally high ✓ The peat surface may feel wet ✓ Small pools of water may exist in hollows ✓ *Sphagnum* mosses are sparse or	Good conditions for wetland species, and high potential for *Sphagnum* inoculation. Abundant invertebrates, though diversity may be limited.	Abundant invertebrate numbers providing food for young grouse. Presence of drinking water.	Presence moist vegetation and drinking water. After rainfall grass dominated areas may be very wet.	Possibility of carbon being sequestered in areas with high water table.	Improved water quality as reduced levels of dissolved and particulate carbon with a high water table (average 10-30cm from surface, often at surface in winter)			

		absent ✓								
Vegetation structure		✓ Not much variation in the height or structure of the vegetation due to single species dominance ✓ In ungrazed or lightly grazed situations the structure may be very tussocky ✓ In heavily grazed areas surface structure is lacking ✓ Shrubs generally absent	Tall, dense vegetation may be important for invertebrates, reptiles or amphibians due to stable microclimate Limited habitat diversity for moorland birds.	Where heather is completely absent - reduced areas for nesting and shelter.	Area accessible for sheep providing the ground is not too wet or tussocky.	Carbon may be sequestered where cottongrass and/ or purple moor-grass present. Generally a dense cover in grassy swards - limited surface oxidation of peat.	Water movement may be constrained by surface roughness, particularly in tussocky swards, less so in heavily grazed swards.			
Vegetation composition		✓ Vegetation dominated by grasses and sedges. ✓ Shrubs generally absent ✓ Some mosses may be present but largely feather mosses ✓ *Sphagnum* absent or sparse	The peat, with a high water table is able to support wetland species. However grass dominated swards tend to have limited diversity.	Diversity of food sources required by grouse restricted, cottongrass may be present but heather absent. May be abundant insects for young chicks.	Cotton grass provides good forage for sheep especially in spring. Purple moor-grass areas poor for sheep. Grass areas favoured in the summer.	Carbon capture limited due to absence of significant *Sphagnum* cover, opportunities to diversify through inoculation.	A more diverse sward, particularly with *Sphagnum* will improve surface roughness.			

STATE 5: Modified blanket bog with high dwarf shrub cover but with *Sphagnum* and other mire species (active)

Characteristics	Example photo	Description/ characteristics	Effect of modified blanket bog on delivering the six outcomes						Intervention	Monitoring
			Biodiversity	Grouse	Sheep	Carbon	Water	Wildfire		
Often has extensive drainage networks (grips)		✓ Drains/gullies present, unblocked, eroding ✓ Drains/gullies present, unblocked, naturally re-vegetating ✓ Drains/gullies present, blocked ✓ Peat pipes or cracks may be present ✓ No drainage features (gullies or haggs) present	Reduced hydrological functionality and presence of blanket bog species. Vegetation near drains may resemble dry heath.	Chicks get lost in drains, fewer invertebrates.	Risk of loss of sheep in drains.	Carbon likely to be lost as DoC and PoC due to extensive drainage networks.	Where drains exist, water is focussed into channels, high dissolved and particulate carbon. May lead to siltation in reservoirs, increased treatment costs.	Damage from wildfire likely to be significant. Heather dominated swards have high fuel loadings and ignite readily. Peat that is not protected by wetland species can ignite and burn for significant periods. Often this state will have developed because of too frequent managed burning favouring heather dominance. Further incidents will make restoration more difficult. Wildfire is detrimental to all five outcomes.	✓ Re-wetting – see section 6.0 ✓ Re-vegetating – see section 7.0 ✓ Diversifying – see section 3.1 ✓	✓ Monitor impact on vegetation ✓
May have small areas of bare peat but not extensive (less than 10% of any area) and often in small patches		✓ Isolated areas of bare peat that are small in size, and represent a low proportion of the moor. ✓ Some man-induced erosion ✓ Some areas may be naturally re-colonising from surrounding vegetation	Mostly a vegetated peat surface though small areas of bare peat can be present especially on the highest ground.	Habitat is broken up, but not significantly.	May be some reduced foraging area, but not significant.	Carbon will be lost from bare or eroding areas.	Water moves freely across any bare peat surfaces, resulting in dissolved and particulate carbon.			

Water table variable, but can be low due to presence of drains and high heather cover		✓ Extensive drainage networks often present ✓ Peat pipes often associated with abundant heather cover ✓ *Sphagnum* mosses usually present though not abundant	Poorly functioning bog with limited wetland species though with significant potential from drain blocking. May have reduced invertebrate numbers.	Reduced invertebrate numbers, reduced food for young grouse.	Diversity of food may be more restricted due to drier surface with heather dominance.	Low water tables will result in loss of carbon.	Water table on average 10-40 cm below peat surface, sometimes at surface in winter months.			
Good diversity in vegetation structure.		✓ Good variation in the height and structure ✓ Most areas have a shrub canopy with an understorey of mosses ✓ Shrub canopy may shade out *Sphagnum* if it becomes too dominant	Often has good structure though micro-topographical features often absent. Diversity of habitats for moorland birds.	Good diversity of nesting habitats, as well as viewing points, drying areas and hollows for shelter.	Variable structure generally good for sheep. Some tall heather provides a food source during periods of snow.	Limited opportunities for significant carbon capture due to dominance of heather and limited *Sphagnum* / cottongrass cover.	Water movement may be retarded by surface roughness. Water draining these areas likely to be high in DOC and POC.			
Heather usually the dominant species		✓ Heather often the dominant species (50-75% cover) ✓ Less diverse than very active bog, usually less than six indicator species ✓ *Sphagnum* mosses usually present though not abundant	Limited diversity in vegetation, wetland species present but often with low cover frequency. Heather often dominant. May be some areas of better quality bog.	Provides a variety of food throughout the year though heather dominated stands may be less diverse (eg limited/no cottongrasses in the spring).	Whilst food is available throughout the year heather dominance may restrict choice, with limited availability of grass and sedge species.	Carbon will be released from dry peat soils under heather and capture will be limited due to the absence of significant peat-forming species. Peat piping and increased porosity of the peat will increase losses of DOC and POC.	Water movement may be retarded by surface roughness provided by a more diverse range of wet-loving species.			

STATE 6: Active hummock/hollow/ ridge blanket bog (very active)

Characteristics	Example photo	Description/ characteristics	Effect of Active hummock/hollow blanket bog on delivering the six outcomes						Intervention	Monitoring
			Biodiversity	Grouse	Sheep	Carbon	Water	Wildfire		
Few man-made drainage features – any active drains blocked		✓ No active drainage features (gullies or haggs) present ✓ Any drains/gullies will have been blocked	Good hydrological functionality.	Chicks not lost in drains. Wet areas will provide feeding areas for grouse chicks.	Sheep and lambs not lost in drains.	Carbon retained as limited loss of dissolved and particulate carbon through drains - the lowest of any peatland type.	High water tables limit flood attenuation capacity except in dry weather.	Lower likelihood of ignition, or damage in the event of a wildfire.	✓ No action required, blanket bog functioning naturally	✓ Monitor vegetation
Very little bare peat		✓ No/minimal areas of bare peat. ✓ Peat mass usually continuous and stable ✓ No man-induced erosion	Natural blanket bog surface.	Continuous habitat.	Foraging areas not limited by areas of bare peat.	Peat depths over 1 metre, typically storing over 500 tonnes of carbon per hectare with ongoing capture of carbon.	Surface flows moderated. Reduced loss of dissolved and particulate carbon.			
High water table		✓ The peat surface is wet and bouncy ✓ Pools of water exist in hollows ✓ *Sphagnum* mosses are abundant ✓ Peat pipes may be present but not of any significant consequence	Abundant invertebrates, important food source for nesting moorland birds. Optimal conditions for *Sphagnum* growth and diverse blanket bog vegetation.	Abundant invertebrates providing food for young grouse. Presence of drinking water.	Drinking water available.	Possibility of carbon being sequestered. High water table limits losses through oxidation.	Water table on average 5-10cm from surface and often at surface in winter. Improved water quality as less oxidation of the peat.			

Very variable vegetation structure		✓ Diverse vegetation structure ✓ Moorland vegetation provides both a canopy and understorey ✓ Vegetation is growing at different heights ✓ Hummock and hollows can be seen on surface topography	Natural blanket bog surfaces. Diversity of nesting habitat, hummocks provide viewing points/drying areas, hollows provide shelter. Generally good for most moorland birds.	Diversity of nesting habitat, hummocks provide viewing points/drying areas, hollows provide shelter. Diverse structure helps maintain grouse territories.	Good accessibility for sheep, grazing pressure should be dispersed.	Hummock-forming *Sphagnum* species best for carbon sequestration.	Complex surface topography and high *Sphagnum* cover slows passage of surface water.			
Diverse, *Sphagnum*-rich and not heather dominated		✓ Diverse vegetation composition (more than six indicator species) ✓ Both dry- and wet-loving species. ✓ High cover of *Sphagnum* ✓ Lower cover of heather and grasses ✓ Abundance of hummock-forming *Sphagnum* moss	More natural blanket bog communities with the full range of associated species. Supports stable populations of typical moorland bird species and high populations of invertebrate species. Cranefly larvae are a key bird food source.	Heather and *Sphagnum* grow in balance producing abundant young heather shoots. Other important food sources include cottongrass and invertebrates.	Provides a variety of food though productivity is low with limited winter grazing potential.	Peat-forming species (*Sphagnum* and cottongrass) abundant. Optimal conditions for carbon sequestration.	Abundant *Sphagnum* maintains high water tables			

Section 2: Interventions

This section of the Guiding Principles considers a range of interventions that can be used to deliver the outcomes described in Section 1. Each of the following points covers the appropriate application/employment of each intervention as part of this Agreement. This includes principles, and detailed methodologies where this is relevant e.g. gully blocking, sphagnum inoculation.

2.0 Livestock Grazing

2.1 Stocking

Sustainable grazing and stock management can contribute to the moorland management outcomes by:

- Creating structural diversity in vegetation
- Consuming combustible biomass
- Encourage re-vegetation
- Prevent scrub encroachment

Sheep have thin mobile lips and move slowly over the sward nibbling the grass. They can graze very close to the ground which can result in tight 'lawn-like' vegetation. Sheep are very selective grazers and will target flowering plants which can have a negative impact on species diversity. Sheep can push their way through scrub and can browse saplings preventing new growth. However, they find it harder to graze longer vegetation which is often trampled instead.

Cattle use their tongues to pull tufts of vegetation into the mouth. This means that they do not graze vegetation too close to the ground and often leave tussocks of grass which are used by insects and small mammals. Because of their wide mouths cattle do not graze selectively and as a result do not target flower heads and herbage which is important for botanically diverse habitats. Cattle are able to create their own access into rough areas and the trampling of these areas can be an important way of controlling scrub. (Taken from The importance of livestock grazing for wildlife conservation http://publications.naturalengland.org.uk/file/612038)

Stocking rates are prescribed as Livestock Units (LUs).

Animal	**Livestock unit**		
	Small	Medium	Large
Ewe (including lambs at foot)	0.08	0.1	0.15
Ewe followers and store lambs	0.06	0.08	0.1
Dairy cow row	0.8	1.0	1.1
Suckler cow (including calf at foot)	0.7	0.9	1.1
Other cattle >24months	0.6	0.7	1.0
Weaned cattle <24 months	0.5	0.6	0.7
Equine	0.8	1.0	1.2
Other ruminants	lwt/650	lwt/650	Lwt/650

Large ewe (>70 kg)	Bluefaced Leicester, Border Leicester, Cambridge, Charollais, Dorset Horn, Dorset Down, Greyface, Hampshire Down, Lleyn, Masham, Mule, NC Cheviot, Oxford, Scotch Halfbred, Suffolk, Texel, Lincoln longwool, Leicester longwool, Devon and Cornwall longwool, Dartmoor Greyface, Romney, Wiltshire Horn, Cotswold, *Cheviot, Hill Radnor, Whitefaced Woodland,* Devon Closewool,
Medium ewe (50 kg - 70 kg)	Jacob, Southdown, *Beulah Speckled Face,* Derbyshire Gritstone, Whitefaced Dartmoor, Norfolk Horn, Ryeland, *Lonk,* Kerry Hill, Llanwenog, *Scottish Blackface, Brecknock Hill Cheviot,* Clun Forest, *Rough Fell, Welsh Hill Speckleface*
Small / Hill ewe (>50 kg)	*Dalesbred,* Exmoor Horn, *Herdwick, Swaledale, Welsh Mountain,* Portland, *Balwen, Badger Faced Welsh, Hebridean, Hill Radnor, Manx Loghtan, North Ronaldsay, Shetland, Soay, Black Welsh Mountain*
Large Dairy cow (> 700 kg)	Holstein, Friesian, Ayrshire, Dairy Shorthorn
Medium Dairy Cow (500 kg - 700 kg)	Guernsey
Small Dairy Cow (< 500 kg)	Jersey
Large beef cow (>700 kg)	South Devon, Salers, Limousin, Simmental, Charolais, Sussex, Beef shorthorn, Lincoln, Hereford (regular)
Medium beef cow (500 kg - 700 kg)	Hereford (traditional), Gloucester, North (Ruby) Devon, Whitebred Shorthorn, A Angus (ordinary), Longhorn, Luing, Sussex, Welsh Black, *Blue-Grey*
Small beef cow (< 500 kg)	*Galloway,* Dexter, *Highland, Belted Galloway,* Aberdeen Angus (original), Irish Moiled, Shetland

Each habitat has a stocking rate based on the growth rate of the typical vegetation, these are used to calculate the maximum stocking rate for a moor and are as follows -

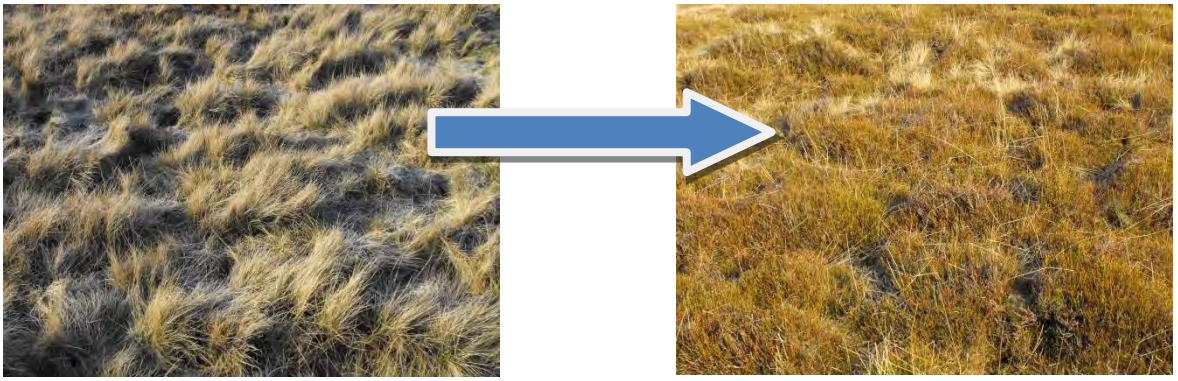
- Favourable dry heath supports 0.101 LU/ha
- Recovering dry heath supports 0.051 LU/ha
- Favourable blanket bog supports 0.035 LU/ha
- Recovering blanket bog supports 0.018 LU/ha
- Favourable upland valley mire, springs and flushes support 0.035 LU/ha
- Recovering upland valley mire, springs and flushes support 0.018 LU/ha
- Favourable wet Heath supports 0.044 LU/ha
- Recovering wet Heath supports 0.022 LU/ha
- Favourable grass moorland supports 0.15 LU/ha
- Recovering grass moorland supports 0.075 LU/ha

Taken from *TP0033:* Revised Calculation of Livestock Units for Higher Level Stewardship Agreements (Natural England Information Notes (TINs))

2.2 Shepherding

To deliver the outcomes stock should be regularly shepherded to ensure that they rake out over all the land and ensure that stock do not spend too much time in one place which causes damage to the vegetation by heavy grazing or trampling, unless required to break up dense bracken. Light grazing encourages diversity in the structure, avoids single species dominance and benefits water quality and carbon storage. Shepherding should also seek to ensure stock do not stray/trespass on to neighbouring land and be used to heft the flock/herd to agreed land.

Below are some examples of how shepherding can restore habitats that deliver multiple outcomes.



Shepherding will be carried out in accordance with good husbandry practice and particular care should be taken when moving/gathering animals in late pregnancy or with young at foot.

Supplementary feeding can have a negative effect on moorland vegetation so is restricted to loose hay on bracken beds during periods of extreme weather and in late pregnancy. Extreme weather, as defined in the ELS fourth edition handbook, is more than two consecutive days of snow cover or continuous hard frost, prolonged drought or prolonged heavy rainfall.
Stock feeding should be rotated to avoid damage to the moorland vegetation and never consistently applied to the same place. Feeding should avoid areas where bracken has been subject to control measures (eg, spraying). The stock manager should actively shepherd stock away from these areas to prevent further damage and allow re-vegetation to occur. In the event that shepherding is not effective in this situation then livestock exclusion should be considered. Any visible feed remains left in April should be removed to avoid damage to the moorland vegetation. Historical features should be avoided (these are mapped in the management plan).

Activities relating to grazing, including stock numbers will be subject to an annual review. The annual review should involve Natural England, The National Trust and the grazing tenant.

3.0 Diversification of habitat

Diversification of species composition and structure may be required where a habitat is dominated by a single species, or key indicator species are absent/under represented.

Where vegetation on deep peat lacks key blanket bog species, particularly sphagnum, and may be dominated by single species such as heather (Blanket Bog State 3) diversification of the sward will be required. Stands of heather provide less diverse food sources (eg limited/no cottongrass in the spring) and may be too dry to provide abundant insects for young chicks. Carbon will be released from dry peat soils under heather. Carbon capture will be limited due to the absence of significant peat-forming species. Peat pipes and increased porosity of the peat will increase carbon loss, reduce water quality and increase flooding risk.

Diversification would typically involve removing the heather canopy through cutting (where present) and then introducing *Sphagnum* and possibly other indicator species. It is expected, wherever feasible, that diversification is undertaken once re-wetting works have been undertaken.. The following sections 'cutting' (3.1), '*Sphagnum* inoculation' (3.2) and 're-wetting' (6.0) describe the current agreed techniques.

Diversification of other habitats where the outcome is to achieve good quality dry heath, e.g. mat grass and bilberry dominated areas, can be achieved by varying the grazing regime. Any changes to HLS grazing prescriptions must be separately consented by Natural England.

Techniques used to diversify include cutting, sphagnum inoculation, introduction of other indicator species and management of trees and shrubs. The following sections describe the agreed principles and methodologies whenever these interventions are deployed.

3.1 Cutting

Cutting is the Trust's preferred method of heather management. In 2015 the National Trust made a decision to stop regular rotational burning on blanket bog. This step was taken due to mounting evidence that regular burning as a method of heather management damages peat and also prevents its hydrological, structural and biological restoration. The Trust continues to allow rotational burning on heath as detailed in section 10.

Cutting can contribute to the moorland management outcomes by:

- Reducing the dominance of a single species such as heather
- Facilitate the inoculation with *Sphagna* and other blanket bog indicator species
- Reduce wildfire risk and intensity

Cutting must avoid sensitive areas and non-target areas, these include:

- Non-heather dominant areas
- Flushes and mires including areas around springs, pools, wet hollows and those rich in bog mosses with abundant and or almost continuous cover of *Sphagnum* species, other mosses, liverworts and or lichens, where it is likely to damage the interest. Areas that contain species which often occur only at a small scale.
- Haggs, erosion gullies and areas of bare peat.
- Areas where soils are less than 5 centimetres deep or ground made up of scree or where there is high incidence of exposed rock.
- Archaeological features.

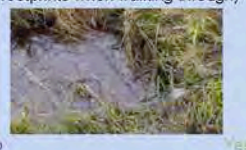
- Areas where it is agreed there should be no intervention.

Cutting will only be carried out from 1st August to 31st March. No works to be completed from 1st April to 31st July inclusive.

The following decision tree outlines the agreed approach to cutting on deep peat habitats within this agreement and should be used to determine how and where cutting is appropriate.

Cutting on deep peat decision tree

Is the ground dry (un-saturated)? (water doesn't make pools in footprints when walking through)



No — Yes

Heather more than 50% or bilberry more than 75% or molinia more than 75% in potential cut area?

No — Yes

Cotton grass less than 25% of potential cut area?

No — Yes

Heather is building or early mature, with a uniform canopy (no degenerate heather)?

No — Yes

Cutting not appropriate
Potentially suitable for sphagnum inoculation. Where molinia present, other treatments could be appropriate.

Refer to section 3.2

Slope less than 1 in 3?

Yes — No

Outside a low-intervention area (see map)?

Yes — No

Typically not less than 2m from a watercourse/peat hagg?

Yes — No

Less than 10% bare ground/bare peat?

Yes — No

Cutting not appropriate,
but potentially suitable for gully blocking and bare peat restoration

Refer to sections 6 and 7

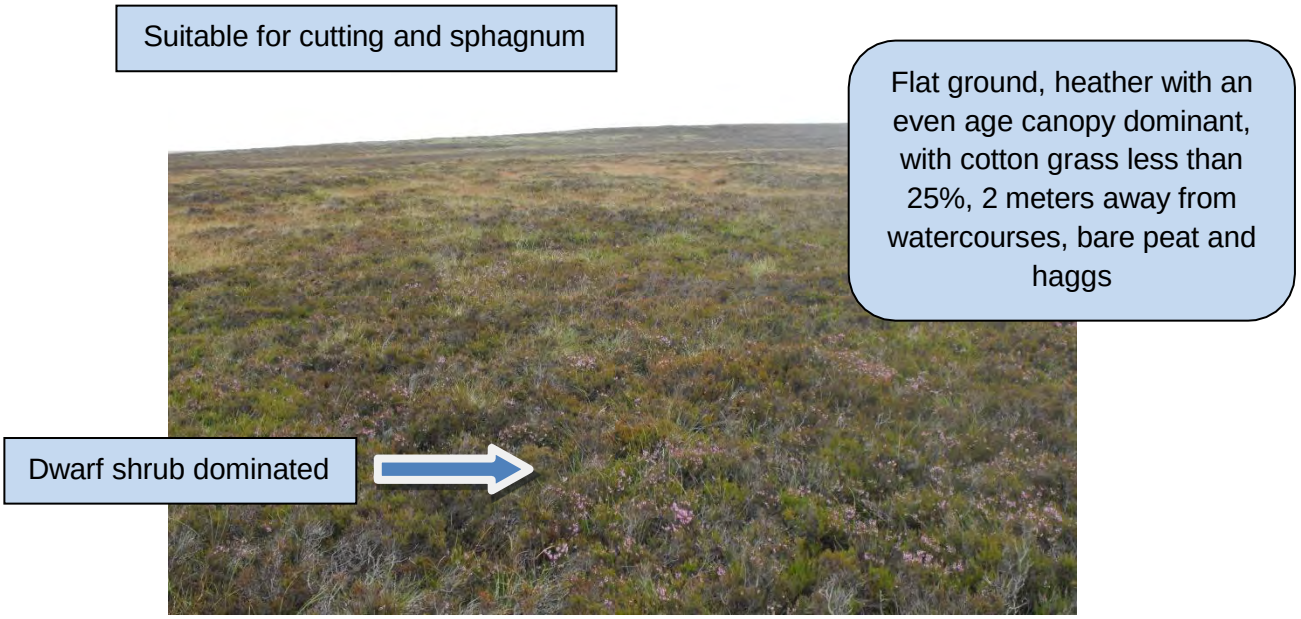
Cutting not appropriate
Minimal management area for birds of prey

Refer to section 11

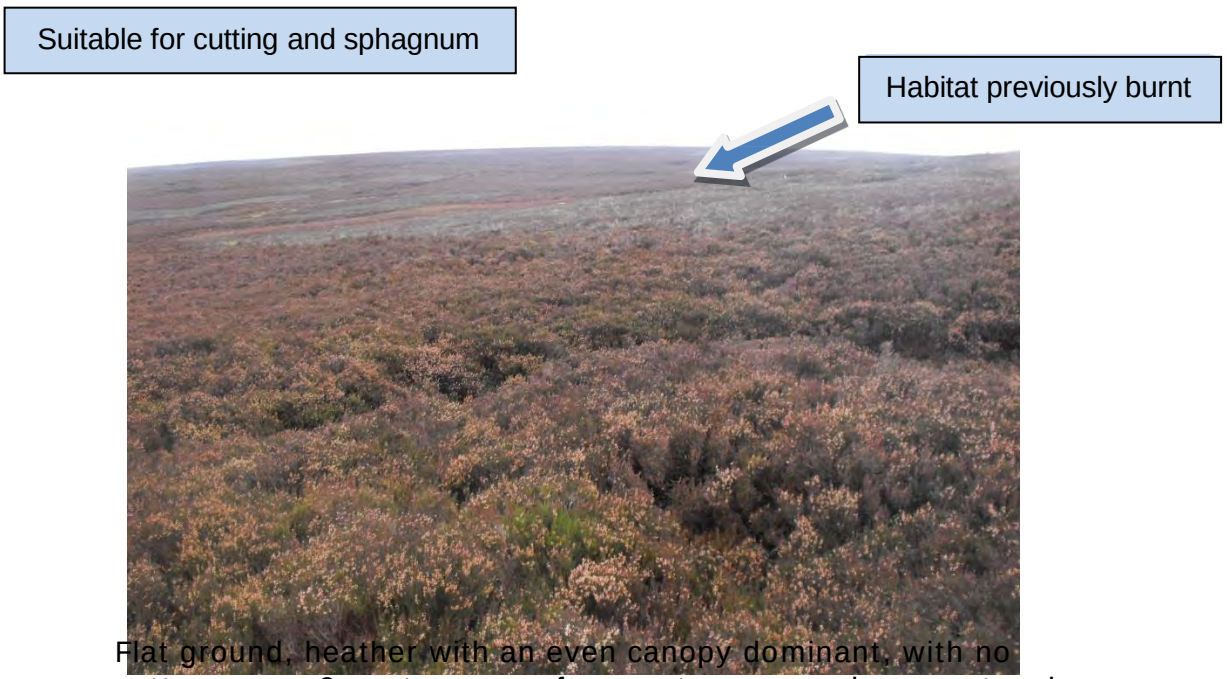
Cutting appropriate

- Use a low ground pressure vehicle/equipment or hand equipment.
- Consider archaeological features.
- Set cutting height so that there is no scalping of the moss layer.
- Cutting will only be carried out from 1st August to 31st March.
- Cutting for brash should be done during the autumn (mid-October to the end of November) when the seed is ripe and before the peat becomes too wet.
- Cut material can be baled or gathered and removed. Alternatively a double-chop forage harvester can be used, which chops the material finely.
- Bales, bags or heaps of cut heather will not be stored on the moorland, as this kills the underlying vegetation.

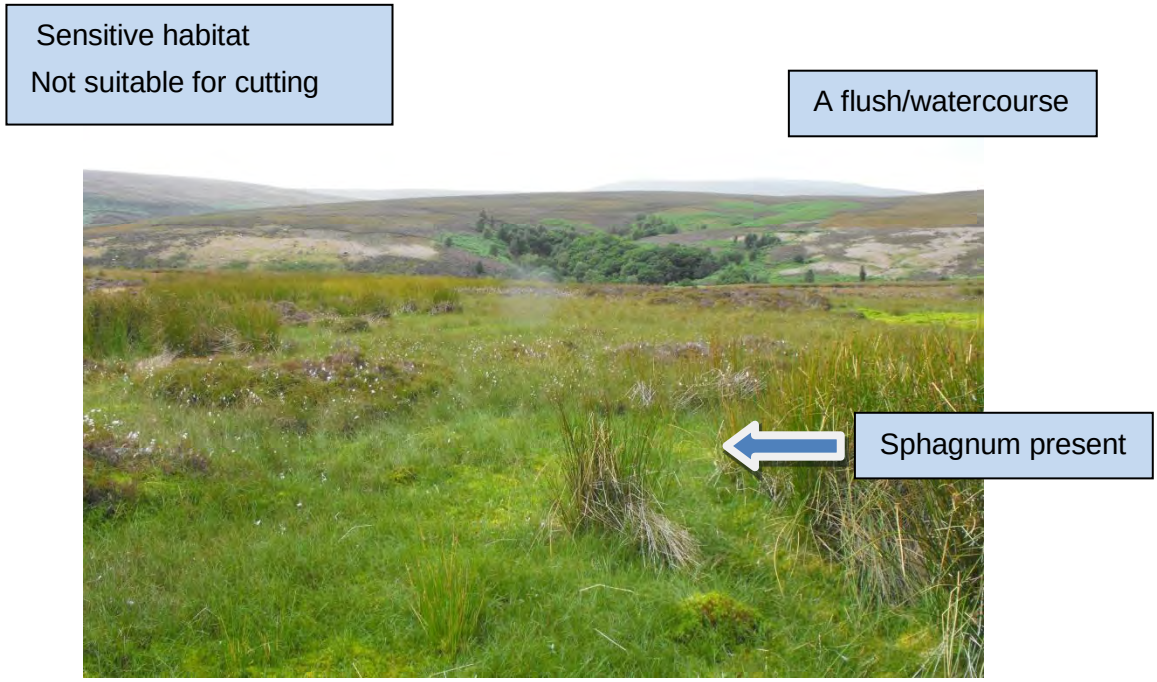
The following images describe typical sites where cutting should and should not be employed:



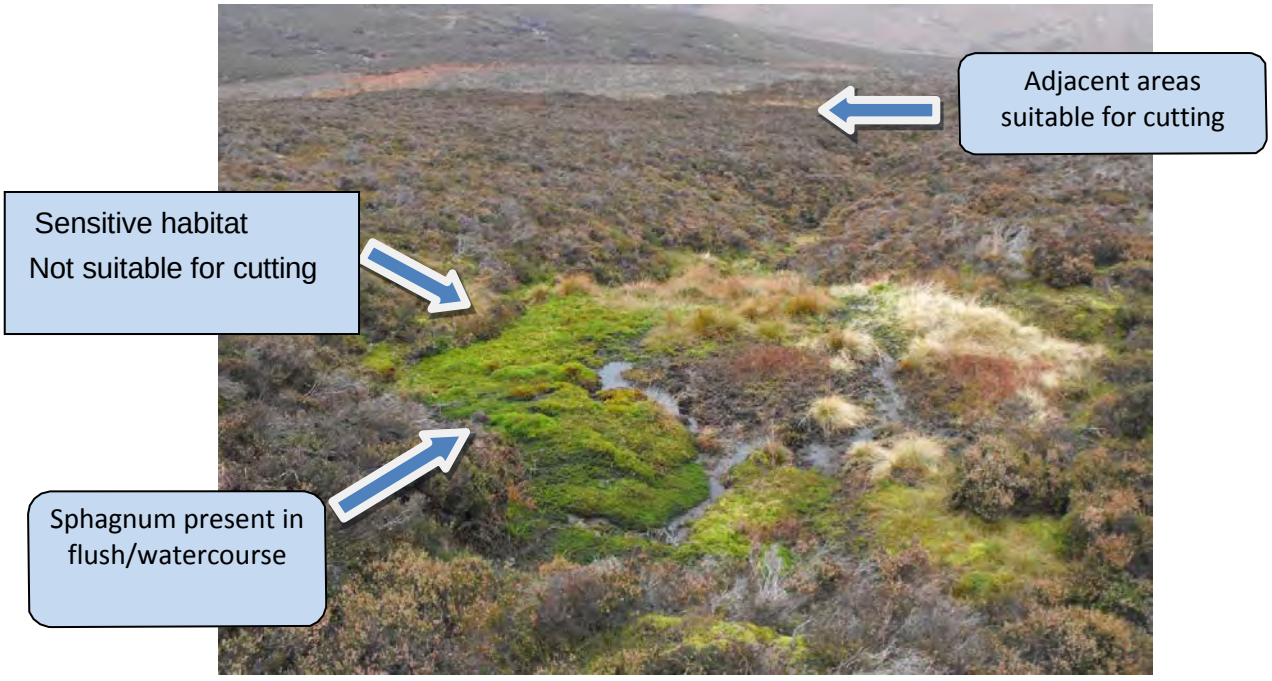
Unit 125 (2012)



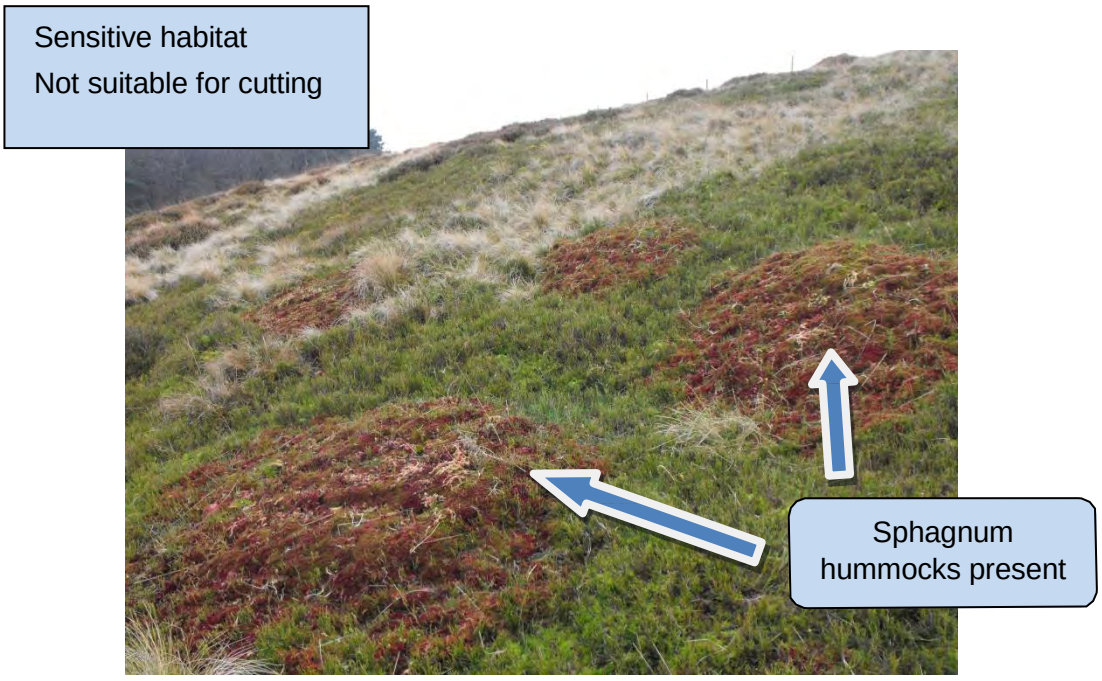
Flat ground, heather with an even canopy dominant, with no cotton grass, 2 meters away from watercourses, bare peat and haggs. Suitable for cutting. Unit 195 (2012)



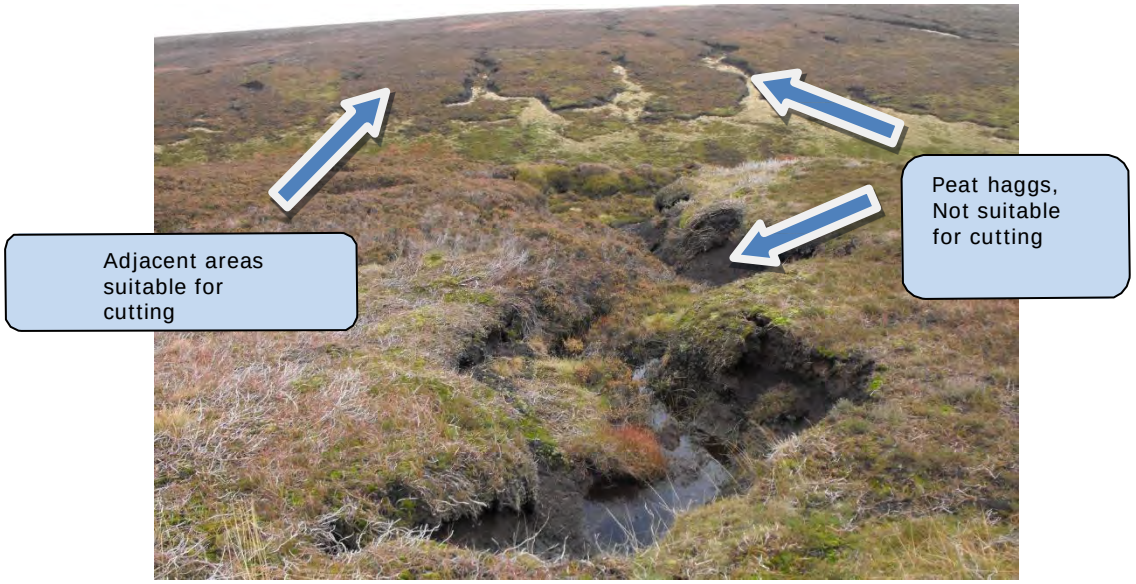
Example of a flush, note sphagnum present. Not suitable for cutting. Unit 127 (2013)



Example of a flush, note sphagnum present. Unit 198 (2013)

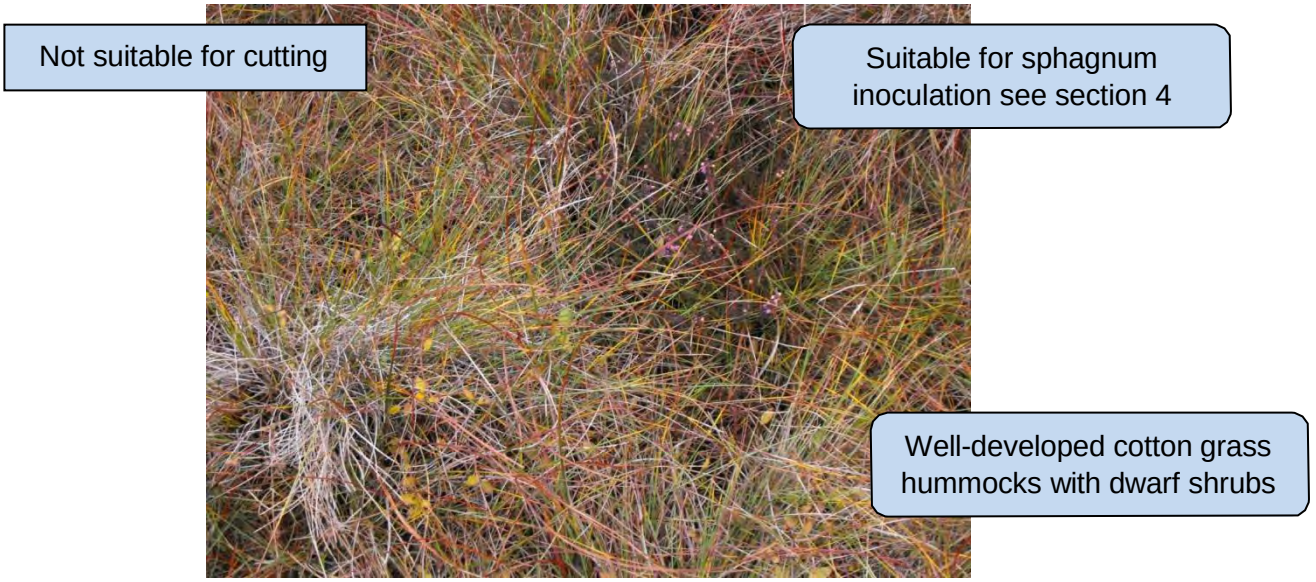


Large sphagnum hummocks. Not suitable for cutting. Unit 152 (2014)

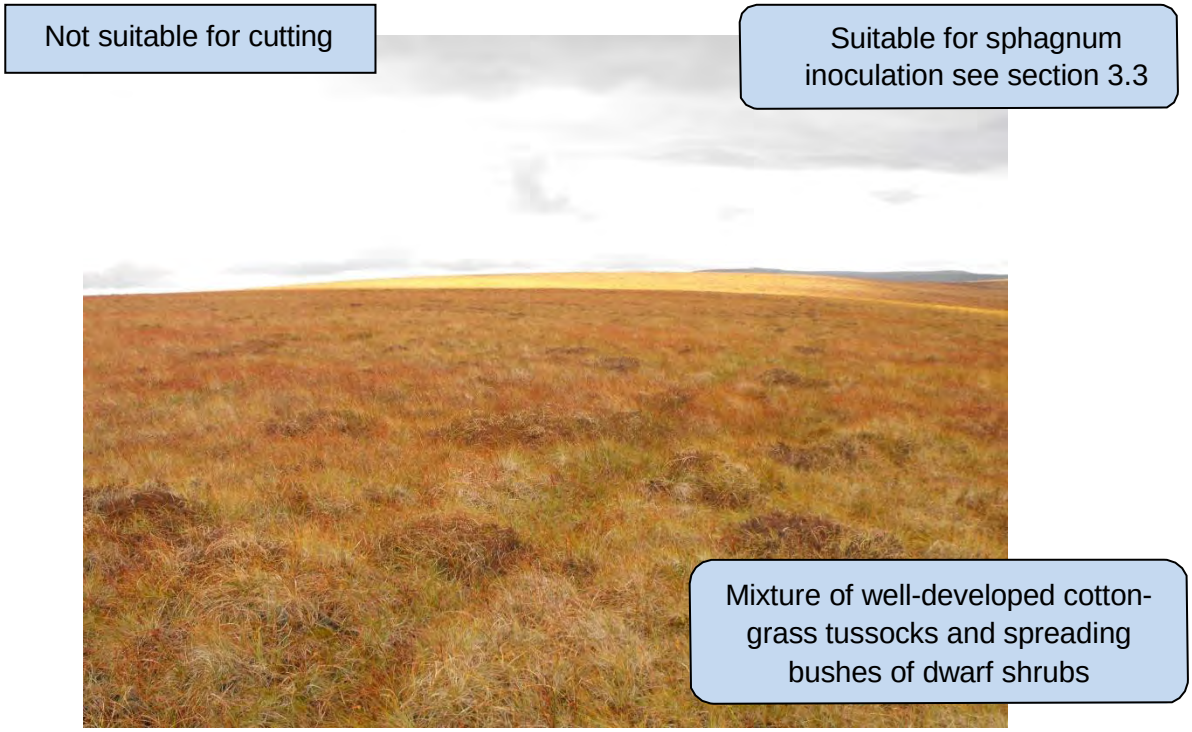


Example of Peat Haggs. Unit 137 (2013)

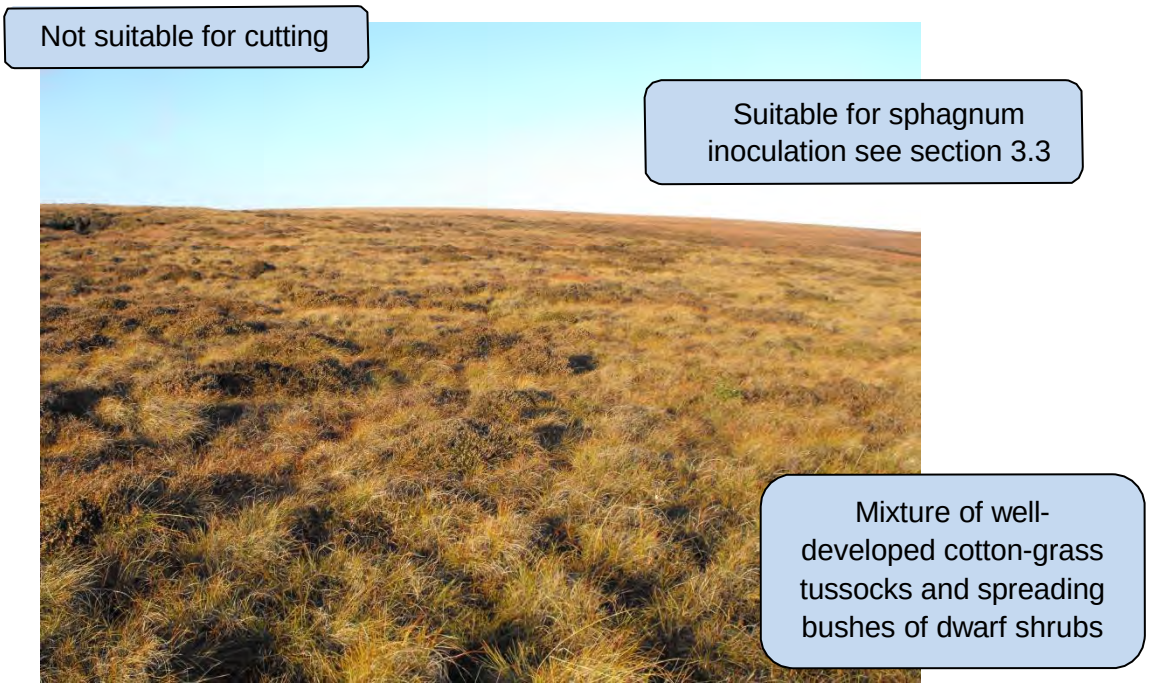
Unit 132 (2013) Unit 191 (2012)



Well-developed cotton grass hummocks. Suitable for *Sphagnum* inoculation, unsuitable for cutting. Note presence of dwarf shrubs including heather. Unit 191 (2012)



Mixture of well-developed cotton-grass tussocks and spreading bushes of dwarf shrubs. Suitable for *Sphagnum* inoculation, unsuitable for cutting. Unit 191 (2012)



Mixture of well-developed cotton-grass tussocks and spreading bushes of dwarf shrubs. Suitable for *Sphagnum* inoculation, unsuitable for cutting. Unit 180 (2013)

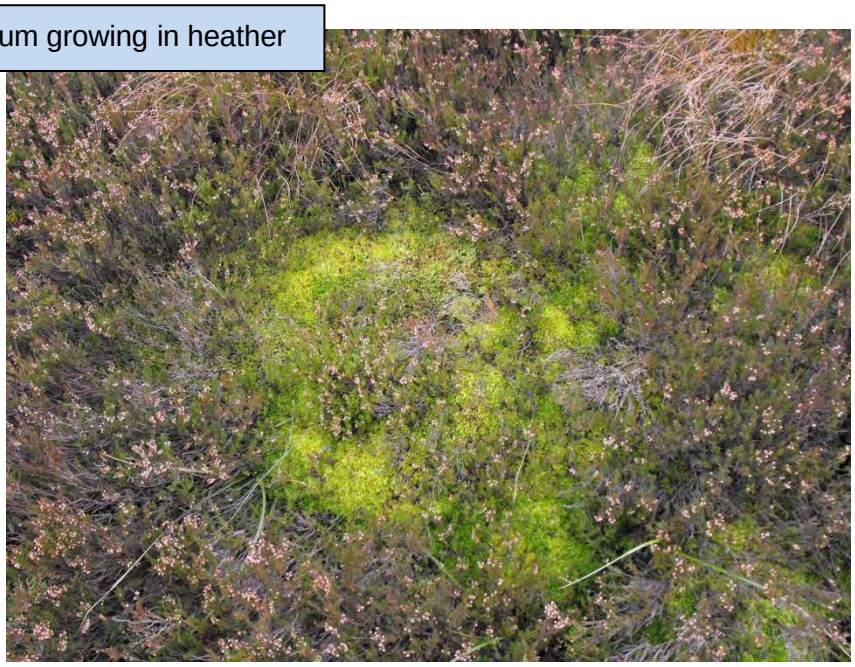
3.2 *Sphagnum* Inoculation

Sphagnum species are a critical component of a healthy, functioning blanket bog. Their spread and diversity has been reduced throughout the Dark Peak through a variety of historical processes including pollution.
Natural colonisation by remaining plants is likely to be very slow but should be encouraged. As well as natural recolonisation, which is being observed in parts of the Peak District, the active reintroduction of *Sphagnum* species will be a key means of accelerating restoring blanket bog and wet heath habitats and delivering the outcomes.

Introduction into heather dominant areas will normally be preceded by cutting to remove the canopy. Introduction into cotton grass dominated areas can be done directly between cotton grass tussocks.

Sphagnum growing in Heather with cotton grass. Unit 195 (2012)

Sphagnum growing in heather



Sphagnum growing in Heather. Unit 198 (2013)

3.2.1 Sphagnum inoculation methodologies

Methods for establishing *Sphagnum* are being developed all the time. This section provides information on the currently available and recommended methods. Decisions around which method is most appropriate will depend on the specific situation and site characteristics, resources available and targets for *Sphagnum* establishment. Natural England welcomes the opportunity to discuss which method may be the most appropriate for specific sites. The trialling of new techniques, in agreement with Natural England, is also welcomed. Further, Moors for the Future Partnership (MFFP) has a compendium of trials and techniques if additional information is required.

3.2.2 Site selection

When choosing a site for *Sphagnum* application, aim for sites with:

- at least 50% heather cover;
- little or no *Sphagnum* present.

Within sites, prioritise those areas where the water table is high for a significant part of the year.

3.2.3 Site preparation

- Cutting is the preferred method to remove the heather canopy and create a finely chopped mulch.
- Allow the brash to “weather”, i.e. settle and become wet. The time this will take will vary depending on the weather.
- Where it is not possible to cut, cool burning may be used

to remove the heather canopy, being careful to ensure there is no damage to any existing bryophyte layer or the peat surface.

- Allow the burned surface to weather. For example, if burned in autumn, leave over the winter before applying *Sphagnum*.
- Burning on blanket bog is not consented in this agreement and additional consent will be required on a case by case basis.

3.2.4 *Sphagnum* application methods

3.2.4.1 Leca pellets and *Sphagnum* gel, e.g. BeadaCoat

Leca clay pellets may be impregnated with a range of blanket bog species (heather, cross-leaved heath, cottongrasses) and also fragments of dry *Sphagnum.* They are available from Geoff Eyre in 15kg bags.

To deliver sufficient amounts of *Sphagnum*, the pellets are used in conjunction with concentrated *Sphagnum* gel, e.g. BeadaCoat supplied by Micropropagation Services (see below for more information and species mix).

Application rate of *Sphagnum* pellets: 45kg/ha, i.e. 3 x 15kg bags/ha

Application rate of BeadaCoat (concentrated *Sphagnum* gel): 3L per 15kg bag of pellets, i.e. 9L/ha

Spreading methods:

The pellets and Beadacoat are supplied separately and transported to site. The BeadaCoat is supplied with the gel and *Sphagnum* separated in sealed bags. Once on site, the gel and *Sphagnum* is mixed manually, e.g. in a bucket by hand/mixing spoon, and applied using one or more of the methods below:.

a) By hand. Mix the combined *Sphagnum* gel (BeadaCoat) with the pellets using 3L of gel to each 15kg bag of pellets. Mix in batches to ensure an even coating of the pellets. Distribute the coated pellets by hand to the relevant areas at as close to 20 pellets/m^2 as possible.
b) Using a spinner on a quad bike (or similar). Mix the pellets and *Sphagnum* gel in batches into the spinner using a spade/shovel. Apply at a rate of 20 pellets/m^2

3.2.4.2 Sphagnum gel, e.g. BeadaGel and BeadaCoat (Micropropagation Services)

BeadaGel is a gel that contains *Sphagnum* "plantlets". BeadaCoat is a more concentrated version of BeadaGel. Gel needs to be stored in a cool, shaded place prior to application and applied within 5 days of being supplied.

Application rate for gel:

Application of **BeadaCoat** (concentrated gel)

- In combination with Leca pellets (see above)

Application of **BeadaGel (**30-35L/ha)

- Backpack application

The *Sphagnum* BeadaGel is applied using a backpack sprayer, modified to administer four x 2mm diameter "blobs" through a lance. The recommended application rate is 5-10 blobs/m^2. Neal at BeadaMoss has 3 kits which may be borrowed.

Using the backpack applicator, *Sphagnum* can be applied at a rate of 2ha per day.

- The "groove machine"

This is being developed by MFFP. As it moves over brash/moss/peat, the machine creates two grooves into which the gel can be applied. Application into the grooves ensures that the *Sphagnum* is applied in a wet area suitable for its growth.

The groove machine requires a soft-track or similar vehicle to tow the machine and is best used in recently cut areas.

3.2.4.3 *Sphagnum* beads, e.g. BeadaMoss

Sphagnum beads (BeadaMoss) have been developed by Micropropagation Services in conjunction with MFFP and contain very small fragments of *Sphagnum* material. Consequently, establishment takes longer than for other methods, something that needs to be accounted for in relation to the agreed outcomes and timescales/trajectories.

Application rate for BeadaMoss: 20 beads/m^2 (the equivalent of 35L per ha)

The beads should be targeted to suitable areas, rather than a blanket application across the treatment area. One person should be able to apply 150L per day.

The beads can contain a mix of species as appropriate to the site. The species mix should be agreed with Natural England and will depend on site conditions. Obtaining a tailored species mix may require a longer lead-in time between ordering and receiving the beads.

3.2.4.4 *Sphagnum* plugs, e.g. BeadaHumok

Plugs of *Sphagnum* containing different species have been developed by Micropropagation Services. The species mix should be agreed with Natural England and will depend on site conditions.

Application rate for BeadaHumock: individual circumstances will influence the application rate, the suggested minimum rate is 1250/ha. 4-5000 plugs/ha could achieve 50% cover in 5 years. 1250 plugs is achievable for one person in a day's work.

Materials: the *Sphagnum* plugs will be delivered in bundles of 20, wrapped in cling film to ensure the individual plugs are kept separate prior to planting. The MFFP Sphagnum Plug Planting guide can be found on the MFFP website.

Planting Technique:

1) Unwrap the bundle of *Sphagnum* plugs until you reach the first loose plug.
2) Gentle tease the *Sphagnum* plug apart so it is no longer squashed.
3) Using your thumb gently push the *Sphagnum* plug into the ground, ensuring the top of the plug is just ground level (approximately 1cm proud of the surface).
4) If the ground is firm, use a dibber of 1cm diameter to make a hole and push the plug in by hand.
5) Using your fingers, gently firm the soil around the *Sphagnum* plug to ensure it is securely established in the ground.

Location:
Each *Sphagnum* plug requires shelter from wind and direct sunlight. Therefore, plugs should be planted in the peat, amongst other vegetation or within brash arisings from cutting.

Establishment - We have seen establishment rates of 90-95% and the plugs will start growing as soon as they are planted.

3.2.5 Species mix for Micropropagation products:

The mix of Sphagnum species is influenced by individual site conditions – different species like different levels of wetness e.g. S. *cuspidatum* requires open water, S. *palustre* is a flush species and S. *papillosum* and *capillifolium* are bog surface hummock builders.

At this early stage in the development of methods, Natural England would like to be consulted on the species mix used on individual sites – it is possible for bespoke mixes to be made up.

Currently the recommended species mix is (amendments to be agreed with Natural England):

	***Sphagnum* species**	**% of mix**	
1	*S. capillifolium*	~20%	Tolerant of dry-ish conditions. Probably a peat builder, but less significant than papillosum.
2	*S. cuspidatum*	~5-10%	Wettest, pool-dwelling species
3	*S. denticulatum*	~1%	More associated with pools and acid flushes
4	*S. fallax*	~30%	Tolerant of relatively broad range of moisture/nutrient conditions. Flushes, pools and bog surface
5	*S. fimbriatum*	~10%	Pool edges, bog surface
6	*S. magellanicum*	~1%+	Very few records in the peak. Peat builder. Hummock former.
7	*S. palustre*	20-30%	More associated with damp flushes, but does occur on modified bog in the peak. Probably a peat builder.
8	*S. papillosum*	~20%	Bog surface. Hummock- forming peat builder.
9	*S. squarrosum*	~1%	More associated with damp flushes with some water movement & some nutrient enrichment.
10	*S. subnitens*	~5-10%	Seems to tolerate degraded bog in the peaks & therefore the wide range of hydrological conditions.
11	*S. tenellum*	~1%	Bare peat colonist, but appears to need wet conditions. Near absent in the peaks.

All species except *S. magellanicum* and S. *tenellum* are sourced from the Peak District.

The application of a mix of species allows the species most suited to the habitat to thrive in the area you apply the *Sphagnum*, i.e. the flush species will dominate in the wetter areas.

The above mix is designed to comprise a higher component of the more tolerant species, with smaller amounts of more specialist species.

Additional species available:

12	angustifolium		Under recorded, but a species of more mineral-rich flushes.
13	fuscum		Very scarce in England. Restricted to relatively intact mires. Probably intolerant of pollution & dryness.
14	Austinii (imbricatum)		Very scarce in England. Restricted to relatively intact mires. Probably intolerant of pollution & dryness.
15	inundatum		Flushes, associated with more base rich conditions than *S.fallax*.
16	russowii		More a species of damp heath, especially on north- facing slopes.

3.2.5.1 **Translocation of *Sphagnum* hummocks**

Application rate for *Sphagnum* hummocks (handfuls): 625 handfuls per ha.

Materials: Harvested Sphagnum will be stored in woven sacks to allow water to drain out and the sphagnum to breath. The storage on the moor can be for up to 3-4 weeks without affecting the sphagnum plant.

Harvesting and planting technique:

The methodology of translocation follows the RSPB Dovestone Guide to *Sphagnum* planting and is summarised below:

- Donor sites will be agreed with Natural England prior to works taking place.
- A maximum of 10 handfuls of *Sphagnum* will be taken from a square metre of the donor site within a 2 year period. A handful will be approximately 10–15 cm of material.
- Harvested *Sphagnum* will be stored in sacks and used within 5 days.
- *Sphagnum* will be introduced into newly cut/burnt areas at an average of 1 handful per 16 m^2 with an emphasis on introduction into wetter areas to improve initial success.

Sphagnum harvesting and translocation as per RSPB Dovestone Reserve methodology

Left: Planting Sphagnum papillosum.

- Take a plug
- ALL the brown, dead material underneath the living capitula will be planted into the peat, as if it were roots
- The living capitula will be above the peat
- All sphagnum species can be planted in this way, except for S. cuspidatum, which should just be placed in the pool (around the edges but in permanent water if the pool is very large, to protect against wave action).

- Sphagnum should be planted into a habitat that closely resembles the original habitat
- Flush species should be planted into very wet places, ideally behind gully blocks, in sphagnum free vegetated gullies, and into seepage lines, where there is a constant flow of water (though not enough to wash it away!)
- Aquatic species should be placed into permanent pools

Left: Make sure that the divot goes through the vegetation and into the peat.

- Hummock and other “drier” sphagnum species should be planted into wet vegetated peat pans, the wet vegetated edges of bare peat pans and wet intact but species poor blanket bog. Seepage lines, very shallow gullies and other wet features should be targeted preferentially.
- Sphagnum established best when planted into very wet, vegetated peat.
- Once Sphagnum is established into wet areas, it will grow out into drier areas by itself.

Left: Plant the Sphagnum as a proto hummock.

- Make sure the capitulae are tightly packed together
- Make sure all the dead, brown material is below the peat surface
- It is important to plant the dead material for several reasons: it anchors the Sphagnum into the peat; it keeps the proto hummock tightly packed; if the peat dries out in the summer, it will wick moisture from under the surface of the peat and keep the Sphagnum growing.

Translocated Sphagnum should be planted into a habitat that closely resembles the habitat it was harvested from:

- Flush species harvested from flush areas should be replanted into very wet places, e.g. behind gully blocks, in Sphagnum-free vegetated gullies and into seepage lines.
- Hummock and other “drier” Sphagnum species should be planted into wet vegetated peat pans and wet intact but species poor blanket bog.

Establishment - As with the plugs establishment rates should be in the region of 90-95% and the hummocks will start growing as soon as they are planted. Growth rates are approximately 75-80% year on year when planted in suitable growing areas. The growth rates will decrease if the conditions are less suitable.

Above: A new Sphagnum hummock!

Above: Sphagnum, two years after planting. Healthy, established, and growing well.

The introduction of *Sphagnum* as part of the restoration process is an emerging technique. While several monitoring trials are underway, the species can be slow to establish from small fragments so the evidence for best techniques to employ will need to continue to be reviewed to guide the approach taken.

As a guide to its application, *Sphagnum* introduction is likely to be possible when conditions will support its growth: only after some rewetting of the blanket bog, peat stabilisation and the establishment of vegetation. Ideally some taller blanket bog species (cottongrass or dwarf shrub heath growth) colonising wetter areas should be present to protect the *Sphagnum* plants from drying out (by wind or sun) while they become established. Matching the *Sphagnum* species to the ideal location within the restoration area is key, with carpet forming species introduced to wetter areas and pools, and hummock-forming forms to drier zones.

Sphagnum application will only be carried out from 1st August to 31st March. No works to be completed from 1st April to 31st July inclusive, including flying unless otherwise agreed with Natural England.

3.3 Introduction of other indicator species

Introducing indicator species can speed up habitat recovery and delivery of the outcomes.

Indicator species can be introduced by seed or by plug planting and may require the dominant sward to be cut first (see section 3.1). Care should be taken to ensure seed and plugs are applied to areas where they are
likely to succeed. Consideration should be given to the potential impact of livestock grazing as fencing may be required to reach the required outcome.

Species to be used are listed below:

Blanket bog species	Heath species
Cranberry Cloudberry Cross-leaved heath Common cottongrass Hares tail cottongrass Sphagnum Sundew Bog asphodel Bog rosemary	Bilberry Cross-leaved heath Crowberry Cowberry Bearberry Bell heather

On areas not suitable for cutting the same species can be introduced by hand or aerial applications.

Targeted planting of plug plants is a currently accepted and effective form of introduction. The root mass of the plant helps support successful establishment. Plugs can also be employed on suitably wet bare peat areas within gullies and peat pans. Cottongrass plugs establish well on stable peat within gully bottoms and along gently sloping gully sides. Planting at a low density a year or more after gully blocking can be effective since dams will have established and peat sediments are building. Cottongrass species help to stabilise peat soils, their roots spreading through the wet peat, further reducing erosion and trapping sediments.

Recently developed inoculated Leca clay pellets (section 3.2.4.1 developed by Geoff Eyre) have the potential to be a very efficient way to diversify moorland. They can be inoculated with a mix of species targeted to the site, easily handled and spread by machinery. They can also be used in conjunction with sphagnum gel. Their weight can help them find their way to the ground between the growing vegetation. However, their current use is

restricted for trial purposes until their effectiveness can be evaluated. The use of these pellets is consented for trials with effective monitoring, and these results will continue to inform their use.

Seed application and plug planting will only be carried out from 1st August to 31st March. No works to be completed from 1st April to 31st July inclusive, including flying unless otherwise agreed with Natural England.

3.4 Native trees/scrub

There may be scope to undertake native tree/shrub planting and/or retain existing trees/shrubs, e.g. in areas of dense bracken and/or steep slopes and gullies. This may provide an important woodland habitat for upland birds (such as black grouse, cuckoo, whinchat and ring ouzel), improve water quality and flood alleviation and provide winter shelter for grazing animals. Any future tree planting should be planned and consented with Natural England separately and follow the Clough Woodland Guiding Principles or any agreed amendments to them.

3.4.1 Creation of successional areas/scrub

Some clough sides are managed under the HC17 option in the current (2013-2023) Higher Level Stewardship (HLS) scheme. The aim of this option is to create habitat mosaics and help to protect soils and watercourses. The intention is to allow the vegetation to develop naturally where possible, but may require inventions such as sparse tree planting. Tree cover should not exceed 10% of the area and is limited to those areas under HC17 HLS option. These areas are mapped in the Moorland Management Plan.

4.0 Accidental fires and management of fire breaks

A wildfire is an unplanned and uncontrolled fire which may require action to extinguish or prevent spread. Naturally occurring wildfire is rare; the major cause of wildfire is man either through accidental or deliberate ignition or as a consequence of another activity, for example recreational activities or managed burning getting out of control. Many incidents are minor but some can become major events which threaten or damage public health, the environment or property.

It is good practice for land managers to assess wild fire risk and, if appropriate, put in place procedures to facilitate an appropriate response and reduce the risk.

4.1 Managing Fire Risk

Vegetation vulnerability to wildfire will be mitigated primarily through re- wetting and the re-establishment of typical blanket bog vegetation communities which will have a high resilience to wildfire. In addition, the vegetation fuel load will be managed in the long term through a suitable grazing regime with regular review. Prior to successful re-wetting of the peat, and in drier heather dominant areas, managed fire breaks and cutting may be required to a wildfire.

4.2 Fire breaks areas / zones

The term 'fire break' is open to different interpretations. In this agreement a fire break is a **'strategic fire risk management area'**, an area or zone where the vegetation is managed in such a way as to help reduce the impact of wildfire. It will not necessarily prevent fire or stop a fire but will slow the advance of a fire and also facilitate firefighting at strategic points. This strategic approach uses natural topographical features such as ridges, deep gullies and major breaks of slope together with changes in vegetation type to help reduce the impact of wildfire. The arrangement of these zones is mapped in the management plan. Sub dividing the moor in this way helps to protect adjacent areas of moor. The main features used to site strategic fire breaks are identified as follows:

- Ridges as identified from main watershed catchment areas as derived from LiDAR and a Digital Terrain Model (DTM) [1].
- Major gullies and valleys as identified using surface drainage networks (stream networks derived from a DTM).
- Major breaks of slope as identified using a combination of altitude contour lines and aerial photography.

[1] LiDAR – Light Detection and Ranging. In principle similar to Radar but uses a laser to determine ground height from a fixed altitude. This system can collect highly accurate data on ground height which can then be used to produce Digital Terrain Models (DTM).

- Major changes in vegetation type (ie, cotton grass to heather dominated ground) as derived from aerial photography.
- A model for fire break structures using an offset pattern has been proposed by PAA (Options for Fire Risk Management on Derwent and Howden Moors (2011)), using a 100m wide linear corridor with stepped fire breaks of approximately 30x100m as shown in figure 3. The management plan shows the suggested locations of fire break zones.

The principals behind the design are:

- to avoid a continuous firebreak that could become another footpath;
- to provide overlapping firebreak blocks so that the habitat is not significantly fragmented;
- to provide a wide enough barrier to help control/stop any fire; and
- to provide access for firefighting.

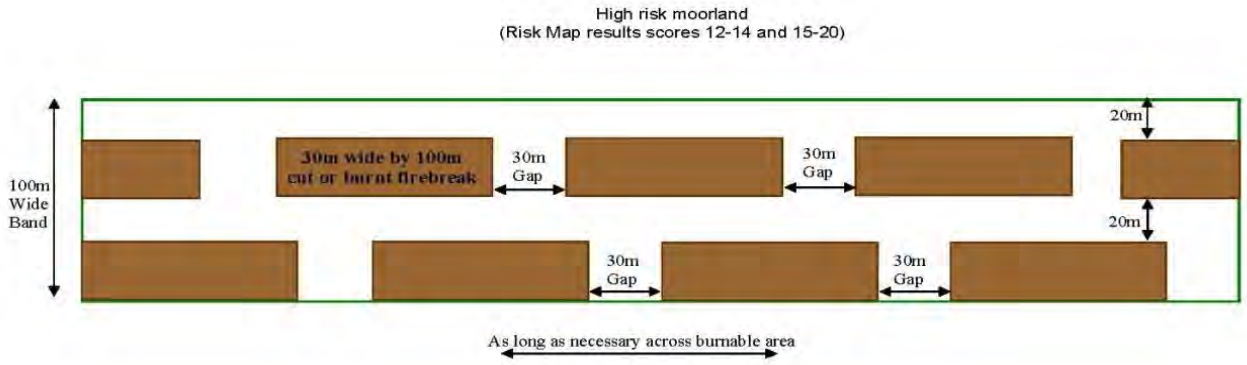


Figure 3. Potential fire break structure (taken from PAA (2011) Options for Fire Risk Management on Derwent and Howden Moors).

The development of fire break zones is part of a long term programme of heather management and links with diversification work. The Trust has committed to a minimum annual cutting target based on the HLS supplement for management of heather (HL12) over the remainder of the current HLS period (to 2023), as detailed in the Moorland Management plan, at which point this approach will be reviewed.

4.3 Fire Risk Awareness

The Moors for the Future Partnership has produced materials to help raise awareness of fire risk on the moors. “Be Fire Aware” is a web page highlighting wildfire risk and provides resources to learn about wildfire and how to prevent it http://www.moorsforthefuture.org.uk/be-fire-aware. During the spring, summer and autumn months the fire risk on the moors is high, the best way to prevent moorland fires starting is to educate

people about the risks.

An awareness campaign is implemented annually through the Fire Operations Group (FOG), utilising the resources available from the Moors for the Future Partnership. In addition fire risk warning signs are used at strategic locations (main foot access routes, gates and stiles) as a reminder to people to maintain vigilance for wildfire and provide emergency information.

5.0 Managing invasive species

5.1 Scrub and tree species

Where scrub/trees is not desired such as rhododendron or conifer, or is becoming too dense to deliver the outcomes, control may be required and should be agreed prior to any work being undertaken. Techniques for removing scrub include flailing, using a chain saw and clearing some species (e.g. birch or pine) by hand.

Cut scrub/trees down to ground level without disturbing the soils and leaving no protruding stems. Cut stems of coppicing species should be spot treated with glyphosate to retard any regrowth. Cut material should be disposed of by removing it from the site where practical to do so, this is essential for species that will regrow from fragments (eg. Willow). If this is not the case then cut material may be left on site to rot down. Regrowth should be controlled where the aim of the work is scrub reduction or eradication and be achieved by mechanical methods such as flailing or livestock grazing, or by chemical (herbicide) spot treatment. In cases where herbicides are applied to control regrowth the requirements of current legislation and the manufacturer's guidance on application rates and safety requirements will be followed.
Herbicides must be applied with extreme care to ensure the moorland vegetation is not affected.

Rhododendron sapling

For rhododendron, a glyphosate based herbicide (eg. Roundup ProBiactive) of 20% solution in water should be used when spraying smaller bushes and regrowth. Use of a suitable adjuvant (High Trees Mixture B) is also recommended. A knapsack sprayer or spot sprayer should be used and care taken to avoid herbicide making contact with other plants. Follow up spraying of regrowth should take place within 18 months of cutting, before the new leaves develop a waxy cuticle layer which reduces the take-up of herbicide.

Adjuvants will only be used beyond the recommended 10m buffer zone from permanent watercourses and 20m from standing water (including wet flushes). Within these zones apply a solution of glyphosate only, or glyphosate with a plant-based adjuvant safe to

use near water. In all cases refer to manufacturer's recommendations for application rates and buffer distances.

Invasive species control will only be carried out from 1st August to 31st March. No works to be completed from 1st April to 31st July inclusive, including flying unless otherwise agreed with Natural England.

5.2 Bracken control

Bracken is a natural component of the upland landscape and might be expected to occupy woodland and open land that was once wooded such as acid grassland and dry heath. Bracken favours soils with high levels of acidity and will thrive in deep loams and sands. Rhizomes (creeping stems lying usually horizontally, at or under the surface of the soil) spread underground allowing the stand of bracken to increase in size.

Left unchecked, bracken can quickly shade out and destroy more ecologically valuable habitats, restricting the natural regeneration of other moorland plants (Heather Trust). In the Dark Peak this is an issue across areas of dwarf shrub heath, acid grassland and dry blanket bog areas. Bracken growth is generally checked by wet conditions. It is unpalatable to stock and as a result can flourish in areas such as cloughs where historical overgrazing has given it a chance to outcompete other dwarf shrubs or grasses.

Despite its effects on other habitats, bracken can be an important habitat in its own right. Stands of bracken are unproblematic when restricted to relatively small patches or with an understorey of dwarf shrub or acid grassland species. Bracken is known to support over 40 species of invertebrate, is an important breeding habitat for moorland birds, in particular whinchat, ring ouzel, hen harrier and merlin. It may also be used as cover by warblers, tree-pipits and nightjars. Reptiles and mammals can benefit from the shelter provided by bracken. In some areas bluebells and other woodland plants grow under bracken. There is evidence that bracken dominated areas were previously most recently woodland, and bracken beds can form a good starting point for the restoration to woodland.

Control methods to stop bracken spreading can be effective, but require continual follow-up and in some cases further restoration work. The guiding aim for any control undertaken is for the restoration of bracken dominated areas to more ecologically valuable habitat types: dwarf shrub heath, grassland/heath mosaic or clough woodland. Bracken will be prioritised for control according to the National Trust's bracken control policy.

A mixture of grassland, heather and bracken provides the best conditions for Ring Ouzels.
http://easternmoorsblog.blogspot.co.uk/2015/05/the-ring-ouzel.html

5.3 Control methods

Where it is agreed that bracken control is undertaken, the methods used will depend on the extent of coverage and the nature of the understorey growing beneath. Areas of bracken should be surveyed to categorise, and then treated as outlined below.

Category	Description	Treatment
A) Dense	Dense bracken beds with full canopy cover, underlain largely by dead bracken litter. Little or no grasses or dwarf shrub growth beneath.	Only commence treatment if there are the resources and commitment to complete the work, which could take several years. Exclusion of stock is essential for successful restoration, which is likely to require fencing. Treat chemically (aerial or ground spraying with Asulox) when in full leaf (August/September). Dead bracken litter should be scarified to speed up decomposition process and open up the ground. Seed with dwarf shrubs and acid grassland species. Spot spray emergent bracken fronds as required until restoration of desired ground vegetation is complete. Conversion to woodland by stock exclusion or tree planting is an alternative option (following the Clough Woodland Guiding Principles). Steps must be taken to avoid the risk of soil erosion.
B) Open	Bracken with an open canopy, with very little bracken litter and a good understorey of grasses or dwarf shrub heath species. Bracken may be becoming denser or spreading in these areas.	If ground is accessible and <25 degree slope, physical disturbance by machine: cutting or rolling July-August may be viable. If ground is inaccessible by machine: hand bash with sticks / metal rods July-August. Monitor and repeat as required annually If inaccessible or over large areas: aerially spray with Asulox or spot/ground spray if close to water. Monitor year after and follow up by spot spraying as required. Potential to use mob grazing by cattle May-June where possible to disturb rhizomes and emerging fronds where this will not cause long term damage to understory/ground flora. Conversion to woodland by stock exclusion or tree planting is an alternative option (following the Clough Woodland Guiding Principles).

C) Sparse	Bracken is sparse, with no underlying litter, and forms a valid component of the habitat. No detriment to habitat.	Monitor extent and density - if stands are becoming denser (towards condition B) or encroaching onto sensitive areas, treat by physical disturbance (rolling, cutting, hand bashing) or spot/ground spray. Monitor and repeat as required. Conversion to woodland by stock exclusion or tree planting is an alternative option (following the Clough Woodland Guiding Principles).

Great care must be taken if vehicles are used, as detailed in section 8 below.

If the control methods outlined above are followed, bare ground is unlikely to develop. In the event that bare ground does develop it will be necessary to apply re-vegetation treatments following sections 7.1 and 7.2 (brash and re-seeding). These methods are agreed under this agreement. If fencing is needed to enable revegetation, additional consent will be required.

Examples of the 3 bracken categories

‘A’ bracken

‘B’ bracken

‘C’ Sparse bracken

6.0 **Re-wetting**

Restoring or maintaining hydrological integrity of moorland habitats is critical to deliver all the outcomes. It is therefore agreed that there will be no new drainage works or gripping carried out on the land.

Unconsented new drain

Unconsented new drain. Unit 137 (2013)

The maintenance of drains along walls or established tracks (surfaced tracks where drains currently exist) can be maintained but not deepened, widened or improved. These will be defined and mapped.

As described in section 1, a high water table is critical for the restoration of blanket bog, wet heath and the delivery of the outcomes. Gully and grip blocking is a key component of raising the water table and rewetting the peat.

Gully block holding water close to surface

Sphagnum colonising

Cotton grass colonising

An example of successful gully block with high water table, with cotton grass and
Sphagnum colonising. Unit 125 (2012)

Gully and grip blocking can also -

- Reduce further erosion, and trap peat washing down the gullies
- Encourage sedimentation of peat behind dams, providing a substrate within which vegetation can establish.
- Slow the flow of water draining down erosion gullies from the moorland which reduces flood risk down stream
- Protect existing areas of intact peat

This work and the techniques employed will in time encourage peat to be retained behind the dams and deposited on the gully bottoms, into which vegetation can eventually become established. Once established, this vegetation can spread, further stabilising bare peat substrates, slowing run-off and trapping eroding peat particles.

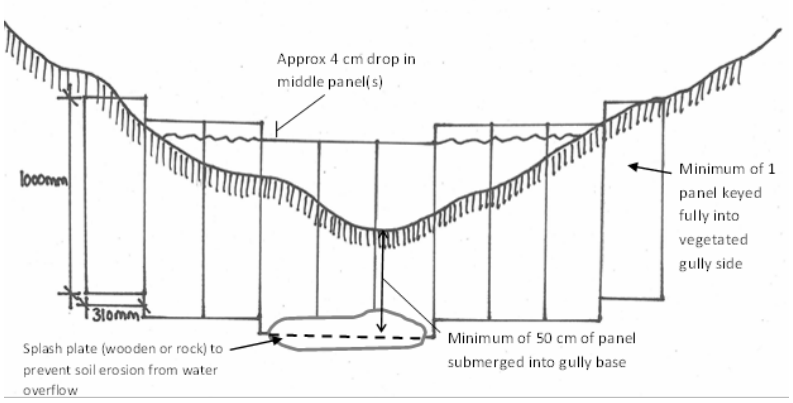
A further objective of gully and grip blocking work is to extend the habitat suitable for breeding waders and red grouse, achieved through the revegetation and rewetting of degraded blanket bog. The pools that form behind dams, particularly those of less-permeable materials (plastic piling or overlap fencing) established within peat gullies, form an important breeding site for invertebrates which in turn are a food source for moorland birds.

Gully blocking also encompasses bunds around peat pans. Peat pans are generally wider, flatter, areas of exposed bare peat that undergo regular flooding and drying. Regular and dramatic change in water level prevents moorland species colonising the area. A bund or block regulates the water and allows colonisation.

An example of a peat bund

The following table describes the agreed methods for creating dams and bunds, and the approach that should be adopted in different circumstances.

Image	Specification / details	Where to use
 Typical plastic piling dam	**PLASTIC PILING** **Materials** Non-skinned 310mm plastic extruded panels, coloured brown with tie back lugs Panel lengths: 1.25m, 1.0m and 0.75m. **Workmanship** Panels driven into peat using rubber maul or machine, at least to 50cm depth, (40cm on 0.75m panels) Each panel connected to adjacent panel(s) using lugs. A typical dam will consist of 2x1.25m panels in centre, 2x1m panels either side of central panels and 2x0.75m panels at either end keyed into the vegetated side of the gully by at least on panel width. Dams may vary from this to suit width but should use panel	In areas where peat depth is greater than 0.5m depth. Where the outcome of the work is to retain water to raise the water table locally to assist in re-wetting the moor and/or to slow the flow of water



sizes to suit gully shape.

Middle panel or suitable panel driven 2-4cm below adjacent panel as overflow slot

One panel driven at 90° to dam face at middle or most suitable position for structural reinforcement. Panel connected using lug

Splash should be used unless the water of the dam downstream backs up to the base of the overflow - ‘heel to toe’.

TIMBER OVERLAP

Materials

1.8m x 150mm chamfered 22mm-15mm overlap panels;

1.68m x 150mm fencing posts;

3 inch galvanised nails

Workmanship

Post driven into peat to minimum depth 600mm.

Lowest panel dug full depth (150mm) into base of gully including keying into both sides of gully and nailed to posts

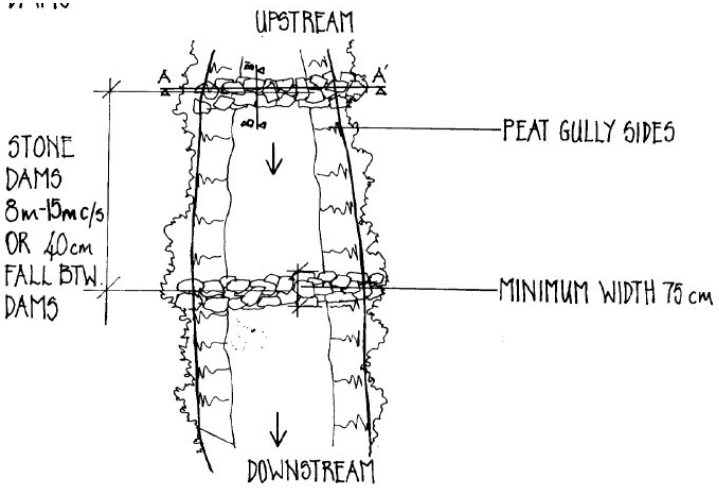
Panels added in overlap (typically to half depth of board below) to build required height, keying in the side of each panel into the gully side, fixed to post using nails.

150mm x 4cm slot cut into centre, or appropriate position, in top panel as overflow

In areas where peat depth is greater than 0.3m depth.

Where the outcome of the work is to retain water to raise the water table locally to assist in re-wetting the moor and/or to slow the flow of water

Typical stone dam



STONE

Materials

Clean, angular, loose gritstone of 200mm in any one dimension

Workmanship

Approx 500-750kg of stone placed by hand or tipped into gully

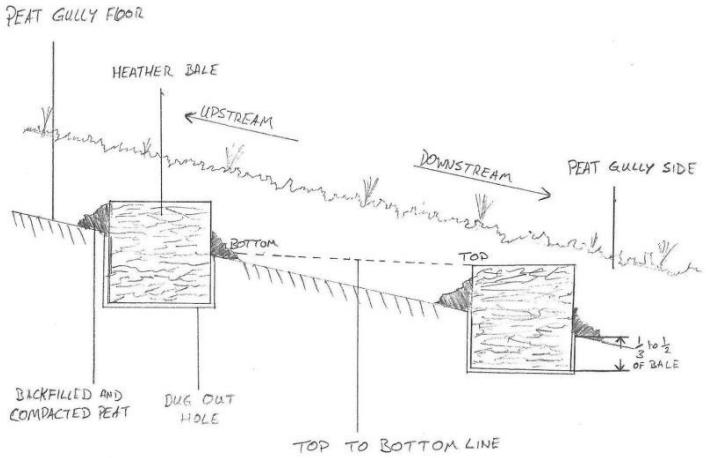
Dams to be minimum 50cm high but should not exceed 1m. Dam depth (front to back) at least 75cm. Front and back slopes between 45-60°

Dam should span full width of gully and be keyed into and built up the gully sides.

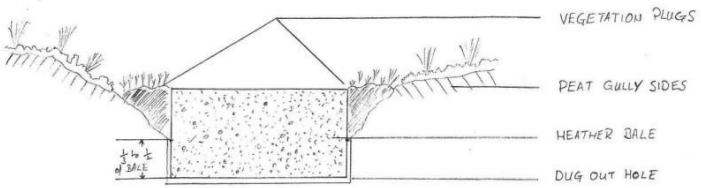
Dam sculpted by hand to form crescent in profile. Lowest point at central position, or most appropriate position, to form overflow

Where gully base is down to mineral or minimal covering of peat (up to 200mm)

Where the outcome is to trap sediment and/or reduce water flow



Sketch of section through part of heather bale dam system



Cross section of typical dam

HEATHER BALES

Materials

Previously cut heather, baled and secured with twine

Any bales not cut from the immediate area (moor) should be clear of pests and diseases including but not limited to tick, heather beetle and *Phytophthora*. Biosecurity measures both at the donor site and also in transportation and storage are to be maintained.

Workmanship

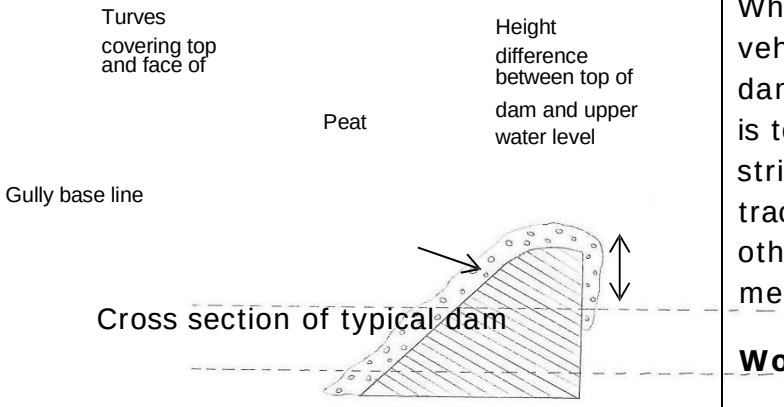
Excavate slot for bale in chosen position to one-third-to-one-half of the bale height

Place bale in slot, heather stalks lying up/down stream twine lying across stream. Butt up and/or keying into gully edge.

Backfill either side with arisings

Where gully is down to mineral or on deep peat; where water flow is slow enough to prevent washing away

Where the outcome is to trap sediment and/or reduce water flow

	from excavation. Plug gaps between and at end of bales with water tolerant local vegetation	
 Cross section of typical dam  Typical peat dam	**MACHINE (PEAT) BLOCKS** When transporting plant and vehicles to and from the site damage to the ground surface is to be minimised by using strictly low ground pressure tracked vehicles, bog mats and other agreed mitigation measures. **Workmanship** A low ground-pressure (tracked) excavator works from the gully sides. Strip vegetation in immediate area upstream of dam to max 2m and retain Create notch in dam position 0.5m wider than grip/gully either side and 0.2m deeper than grip/gully Excavate peat from grip/gully upstream of dam position and	Where the gully/grip width is less than 2m and/or the depth is less than 1m and where there is a base layer of peat at least 0.5m deep. Where the outcome of the work is to retain water to raise the water table locally to assist in re-wetting the moor and/or to slow the flow of water 'Borrow pits' may be required if the gully contains insufficient humified peat to construct the dam. Any borrow pits have vegetation returned and no bare peat visible

 Typical peat dam	plug gap. If necessary use local borrow pit. Firm with excavator bucket Dam size front-to-back should be twice the width of the grip/gully Revegetate all exposed peat reusing saved material. Create depression at the side of the dam as overflow or build higher than surrounding area to allow overflow into surrounding area. If the latter aid overflow with vegetation lined spillways or depressions. Dam should be constructed higher than surrounding area to allow for 'settling'. Care should be taken to ensure both sides are 'keyed' in and now water travels through or under the dam.	

Any works are expected to take place in the period 1st August to the following 31st March. No works to be completed from 1st April to 31st July inclusive, including flying to avoid disturbance to upland birds unless otherwise agreed with Natural England.

Access to site will be by 4x4 vehicle on approved tracks to nearest point and then on foot for the remainder of the distance to site. All equipment and materials flown by helicopter should avoid wet or vulnerable areas.

7.0 Re-vegetating

Bare peat can erode at a rate of 2.5cm per year. This highly mobile surface limits the establishment of vegetation. The atmospheric pollution of the past (especially sulphur dioxide emissions from industrial processes) had reduced the pH to as low as 3.5 in places, conditions which most plants, even moorland plants, cannot tolerate. In order to 'break the cycle' a layer of heather brash is applied to act as protective 'skin'. Lime is applied to raise the pH, seed applied to create firstly a
nurse crop which then allows more typical species to establish. Fertiliser is applied to encourage the nurse crop which is intended to die away after 2- 3yrs once treatments stop.

Areas of bare peat restoration should be identified in the management plan. The following techniques are agreed in this agreement.

7.1 Brash

Heather brash contributes to bare peat restoration in two ways. First, the brash itself helps to reduce the impact of wind and rain and hold friable peat in place. Secondly, seed available from the brash acts as a source of new growth.

It is estimated that one bag (0.73m^3 dumpy bags) of double-chopped heather brash will make a layer 1cm thick over 48m^2. Brash should be applied evenly across the entire bare peat area ensuring it links with existing vegetation. Steep gully sides, over 45°, should be avoided. Care should be taken to ensure empty dump bags are secure and stored appropriately until removed in a timely manner.

Donor sites should be above 200 metres in height and preferably from within the Peak District National Park, to reduce the potential importation of sheep ticks and other pests and diseases. The brash may be cut from August. However, if a high proportion of seed is desired then cutting should be done during late autumn/ winter, when the seed would set naturally, in order to ensure the highest amount of heather seed is present and spread onto the ground as quickly as possible. Various techniques for cutting can be used (section 3.1) but care should be taken in selection of site and machinery as brash collection often requires the use of two vehicles (section 8).

Brash (bagged or baled), along with other materials, may require storage on site for a limited time before being flown off site or spread. This should be done in a manner that does not have a detrimental effect to the vegetation. Wet and sensitive areas should be avoided. Consideration should be given to the onset of the bird breeding season, when access will be restricted and possible interaction from the general public. Extra care should be taken with machinery and fuel which should be stored for the least amount of time.

Brash application will only be carried out from 1st August to 31st March. No works to be completed from 1st April to 31st July inclusive, including flying.

7.2 Lime, seed and fertiliser

As part of bare peat restoration, lime and fertiliser will be applied at the following rates over a hectare:

- Granulated lime fertiliser 1000 kg per hectare
- Granulated N:P:K fertiliser maintenance (14.5:21.5:21.5) 280kg per hectare
- Granulated N:P:K fertiliser initial (10:30:15) 400kg per ha Actions in event of a spillage should include:
- Spill kit is available on site
- Material is granulated and therefore any spilt material will be cleaned up using a shovel and placed back into the storage hopper ready for application

Preventative measures should include:

- No material is to be stored on site
- Double lined water proof bags to be used
- Application will not occur during rain minimising the risk of material leaching in to the water course
- Application will not occur during strong wind so material will not be blown in to the water course

Seed should be applied at the following rates per hectare:

- Sheep's fescues (Festuca ovina and F. longifolia) 24.0kg/Ha
- Perennial rye grass (Lolium perenne) 8.0kg/Ha, 7.0kg/Ha and 6.0kg/Ha
- Browntop bentgrass (Agrostis castellana) 4.0kg/Ha
- Wavy hair-grass (Deschampsia flexuosa) 1.0kg/Ha
- Ling heather (Calluna vulgaris) 0.32kg/Ha
- Cross-leaved heath (Erica tetralix) 0.03kg/Ha

7.3 Re-profiling

Where gully sides are steep or undercut with overhanging vegetation, the hags may be re-profiled to a more stable slope to encourage re- vegetation. These operations will normally be carried out via specialist excavators.
Vegetation on the top of the hag should be "rolled" back or undermined with the root structure intact to enable the underlying peat to be removed to create a 33-45º sloping bank from the top of the hag to the base. The vegetation should then be rolled back and compacted to cover the newly profiled slope.

Where the vegetation does not completely cover the newly re-profiled slope and natural re-vegetation is deemed unlikely, further treatment will be needed following the guidance in sections 7.1 and 7.2.

Re-profiling will only be carried out from 1st August to 31st March. No works to be completed from 1st April to 31st July inclusive, including flying unless otherwise agreed with Natural England.

8.0 Vehicles

Vehicles should not cross the 'sensitive areas' and HER features (section 3.1 and 10). Outside these areas the use of vehicles is restricted to low ground pressure vehicles and must not result in significant rutting or damage (visible after 12months) to the surface vegetation and special care should be taken to avoid wet and boggy areas.

During the bird breeding season 1st April to 31st July vehicles will not be driven off established routes and tracks.

8.1 Tracks/access routes

The location of existing consented tracks/access routes can be seen as mapped in the Moorland Management plan. They conform to the following criteria:

- Tracks are considered to be defined, longstanding features in the landscape and have a suitable (often mineral) surface and drainage (cross drains) which require regular maintenance. They are usually suitable for 4x4 access and will have regular use. They are defined as Tracks on the Ordinance Survey 1:25000 (as shown on the definitive map https://www.derbyshire.gov.uk/leisure/countryside/access/rights_of_way/faqs/definitive_map_and_statement/default.asp).
- Routes are not surfaced and may be historic. They are for occasional use and only with Low Ground Pressure Vehicles.

The creation of new, or the improvement or upgrade of existing tracks/access routes may require planning permission and if not will require separate consultation with Natural England.

Maintenance is permitted within the existing footprint of the track and cannot alter its route or widen the track or path.

Maintenance operations agreed within this agreement:

- Maintenance and replacement of cross drains – essential for long term sustainability and to reduce extensive track re-building
- Filling in of ruts and potholes, re-stoning (using gritstone), pitching and re-vegetating (seeding)
- Removal of central ridges (scraping off) and levelling of the existing surface.

Operations not agreed within this agreement:

- Widening or re-routing of existing tracks
- Upgrading of tracks (ie, change from peat wheelings to mineral surface)
- Creating new tracks

9.0 Shoot management

9.1 Gritting

Natural quartz grit and medicated grit may be used. Non-medicated grit can be placed directly on the ground while medicated grit must be stored in portable lidded trays, or portable partitioned blocks to allow a 'withdrawal' period. The need to use medicated grit should be based on worm burden. BASC have produced a good practice guide to the use of medicated grit which should be followed https://www.gwct.org.uk/advisory/guides/medicated-grit-best-practice/.
The placing and removal of grit receptacles and grit will not cause rutting or damage to the peat or vegetation. No other structures (eg raised turfs) should be created. Where possible, existing features, such as using natural high points (e.g. – boulders) should be used. Historical features should be avoided.

The general spacing throughout the majority of the moor should be no closer than a grid spacing of 250 metres between points. Small discrete areas, where a natural grit supply is low, or localised grouse numbers are particularly high, may have a denser network of 150 metres apart. Any alteration to this specification will require a further separate consultation with Natural England and consent.

Operators 'servicing' gritting stations should take in mind issues such as the possible disturbance to nesting moorland birds as well as ground conditions, to avoid rutting, etc (section 8).

Good example of grit station. Unit 180 (2013)

9.2 Predator and Pest Control

The lawful and legitimate control of predators and 'pest' species may be carried out as outlined in any tenancy agreement or by the Trust. Where non-native species or species of no conservation concern are contributing to overgrazing and erosion, Natural England may support a programme of control to maintain lower population levels. General licences may be required for certain species and/or at certain times of year (eg, breeding bird season) https://www.gov.uk/government/collections/general-licences-for-wildlife-management.

Certain species will not routinely be consented for control by the Trust. These include (but are not restricted to) Raven and Mountain Hare. Individual tenancy agreements give more detail on the accepted 'pest' species.

The Trust has issued new rules and a licensing system for the lawful use of trail hunting and terrier men, for more information: https://www.nationaltrust.org.uk/features/our-position-on-trail-hunting
This system or any amendments to it will be implemented.

9.3 Grouse butt management

Grouse butts are traditional landscape features and some are listed as archaeological features across the National Trust's High Peak estate on its Sites and Monuments Record (SMR). As such, there should be no evidence of damage to the HER features and their maintenance must be sensitively managed (these are mapped in the Moorland Management plan).

The following principles must be adhered to:

- There must be no burning up to or over butts
- Drainage of the surrounding moorland close to butts is not permitted
- No removal of stone or spoil from the surrounding area for butt maintenance
- The cutting of peat turves for use to repair (build up walls of) grouse butts is not permitted. An alternative method includes the use of filled bags: untreated hessian sandbags filled with peat free compost can be used to reconstruct grouse butt walls. Once stacked in place, a suitable seed mix containing dwarf shrub species can be applied directly to the sacks to encourage the establishment of suitable vegetation (section 7).
- Repairs to wooden butts must be undertaken using materials suitable for use within a SSSI. Unsuitable practices include the use of limestone chippings or tanelised timber.
- No creation of new butts or replacement of old without additional consent. Consent would only be given if there was no damage to the features of interest.

10.0 **Managing dry heath**

Stocking (section 2.0), shepherding (section 2.1) and cutting (section 3.1) are important tools in the management of dry heath, and as with any other interventions, should follow the guiding principles set out above. In addition, dry heath, as mapped in the Moorland Management plan, can be managed by burning. Dry heath is a different habitat to blanket bog, in some areas degraded blanket bog can look similar, but dry heath does not have the deep peat underneath and functions differently. The current evidence suggests that managing dry heath on an appropriate cool burning rotation can deliver the required outcomes. Cool burning leaves tall 'stick' behind while burning off the finer branches. A cool burn does not affect the bryophyte layer or damage the soil surface.

The aim should be to create a mosaic of stands of heather of different ages across the area managed by burning or preferably cutting. Within this area, patches of heather should be allowed to reach the late mature / degenerate stage to provide a network of potential nesting sites for birds (e.g. merlin, kestrel, twite and curlew). Low intensity fires are best for wildlife because they favour a range of species other than grouse. Some areas of old heather should be left un-burned/un-cut. At least 20% of the heather dominated vegetation across the dry heath should be permanently outside the burning/cutting rotation and must remain unmanaged. Areas of unburned mature degenerate heather are important for the lichen and bryophyte flora they support and also provide valuable nesting habitat for merlin and short-eared owl.

No area of dry heath will be burnt on a rotation of less than 12 years. Burning should only take place in areas where the heather cover reaches 50% or more in the proposed burn area and where the heather is not less than 30cm/1ft in height.

10.1 Sensitive areas

Sensitive areas must not be burnt (as described in section 3.1 cutting). In addition the following are considered outside of the burning rotation:

- Areas with a noticeably uneven structure, at the spatial scale one metre square or less. In heathland this unevenness is most commonly found in very old heather stands, often comprising large and spreading dwarf shrub bushes. The dwarf shrub canopy will not be completely continuous and some of its upper surface may be twice as high as other parts. This unevenness can also be characterised by *Sphagnum* hummocks, lawns and hollows or mixtures of well-developed cotton-grass tussocks and spreading bushes of dwarf shrubs.
- There should be no burning within 5-10m either side of a watercourse, from the edge of the watercourse where the following apply:

- to protect those that have a well-developed bankside structure/cover;
- to protect those where bankside erosion is an issue;
- to protect those, including active grips, that have a significant hydrological function taking water off the moor.

NB: Burning up to the edge of these watercourses may significantly increase the runoff. Securing a buffer of unburnt ground immediately
around these watercourses should reduce the impact of runoff.

- Steep slopes and gullies greater than 1 in 2 on dry heath.
- Areas of heather moorland, as agreed between Natural England and the agreement holder as not obviously recently burnt, so as to conserve fire-sensitive species that might be lost by a resumption of burning.
- Areas in which rare, fire-sensitive species occur.
- Bracken-dominated areas - no burning within 15 metres of bracken dominated areas, unless as part of an agreed bracken management programme.
- Areas of grassland and rush dominated areas.
- Features listed on the Historic Environment Record (these are mapped in the management plan).

All burning will follow the Defra 'Heather and Grass Burning Code' (2007 version) and Regulations and any amendments to these unless these documents or any amendments contradict other agreed management in the Guiding Principles and/or Management Plans, as the latter will take precedence. The Heather and Grass Burning Code and Regulations can be found on the DEFRA website www.defra.gov.uk. http://www.fire.uni-freiburg.de/programmes/natcon/UK-DEFRA--Heather-Grass-Burning- Code-2007.pdf

In addition burning will not take place after 31 March to prevent disturbance to birds prospecting for nest sites and/or settling to breed early.

11.0 **Low intervention areas**

Within areas of heather dominated heath and blanket bog, patches of heather should be allowed to reach the late mature / degenerate stage to provide a network of potential nesting sites for birds such as merlin, kestrel, twite and curlew. These are called low intervention areas. Heather management should be limited within these areas, although gully blocking and *Sphagnum* inoculation may be appropriate. A proportion of heather dominated ground (20%) will not be managed to allow the development of tall and degenerate heather which will favour these species. Appropriate areas will be mapped to guide the management in these areas.

The National Trust is working with Natural England, RSPB and the Peak District Raptor Monitoring Group to set out agreed management criteria to benefit birds of prey on the High Peak Moors. This information will be fed into these Guiding Principles and also the detailed Management Plans as it develops.

12. Monitoring

Monitoring protocols are still in development and the Guiding Principles, and Agreement, will be amended to incorporate these. The initial focus will be blanket bog and the impact of restoration interventions.

Monitoring is needed to ensure that the restoration works are successful and in line with the relevant trajectory. Restoration works include gully blocking, re-vegetation of bare peat, diversification of sward structure and composition with particular reference to sphagnum inoculation. The results of monitoring will identify any further management requirements or amendments. Both the National Trust and Natural England will have responsibilities for the monitoring, the results of which will inform the annual review.

In preparation for the monitoring programme the following has been agreed:

What the National Trust will do:

- Mark all cuts on blanket bog with a handheld GPS; record whether it was for restoration or firebreak and record which restoration technique was carried out in each.
- Record the restoration work done to all areas managed using cutting or burning (i.e *Sphagnum* inoculation - type and rate of application)
- Record all other restoration works such as gully blocking and bare peat revegetation.
- Implement a monitoring programme that will be developed with Natural England.

What Natural England will do

- Undertake comparative monitoring of cuts and burns in line with the agreed monitoring programme.

What both parties will do

- Monitor progress of the management plan using appropriate counts of birds, including grouse, and collecting other data from partners on short-eared owl and other notified breeding bird species counts.
- A set of base readings should be taken as soon as possible (within a year of the cut/burn and *Sphagnum* inoculation) to establish a start point from which to measure future progress and then annually from that date.

13. Trajectories

A trajectory for each blanket bog state will be established setting out the steps towards favourable, functioning blanket bog. The end point is the same whatever the starting state is, but the steps will be different. Milestones will be established e.g 5, 10, 20 years.

14. Terms and Conditions