



MOORS FOR THE FUTURE RESTORATION MONITORING

INTRODUCTION

Geo-textiles used to stabilise peat slope



We are re-vegetating vast areas of degraded and damaged moorland habitats of **bare, eroding peat** by sowing a fast growing grass nurse crop to stabilise the peat surface.

Additionally, **lime** and **fertilizer** applications are being sprayed onto the treatment sites to help the nurse crop species to establish.

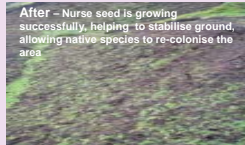
The aim is to establish a nurse crop root mat, which stabilises the burned peat, creating a more favourable environment for native species to colonise.



Heather brush acts like garden mulch, keeping the peat moist and creating a micro-climate which protects the nurse crop seedlings



Other treatments help to stabilise the peat and prevent further erosion include the spreading of **cut heather**, and laying down of **geo-textiles** over bare areas, especially steep slopes



After - Nurse seed is growing successfully, helping to stabilise ground, allowing native species to re-colonise the area

OBJECTIVES

- To assess effect of lime, fertilizer & seed application (seeded sites vs control sites)
- To assess effect of different covering (geojute, heather bales, heather brush)
- To assess effects of micro-topography (aspect & inclination)
- To assess effect of site location (spatial & temporal differences)
- To assess germination rate of different nurse crop species
- To assess colonisation of native flora (moss, dwarf shrubs, cotton grass etc.)

METHODOLOGY

Two surveys were carried out in 2003 and 2004. A specialist survey assessed species germination rates with 120 **fixed quadrates** (25x25cm²). A broad survey assessed overall success of the nurse crop with 348 **random quadrates** on 6 restoration and 3 control sites. Quadrates were positioned on the top, bottom, north facing and south facing slope in each treatment type on each of the 9 sites (3 repeats for broad survey). Parameters assessed included:

- % cover of vegetation in 25x25cm² quadrates and in extended 4x4m² quadrates
- frequency of sown grass & heather seedlings and naturally colonised species
- average nurse crop height
- aspect, inclination, elevation
- GPS location, photograph, field notes

We welcome further investigations regarding soil properties (current collaboration with Leeds University) and invertebrates by interested research institutions. Our database is freely available.

ACKNOWLEDGMENTS

Many thanks to Nadine Eickenscheidt and Leif Nett for conducting the broad survey as volunteers and to Claire Cornish and to Penny Anderson Associates for the good collaboration with the specialist survey.

WHY MONITOR?

Do treatments work?

Aid Decision Making

Identify appropriate locations for treatments
Identify best treatment type for locality

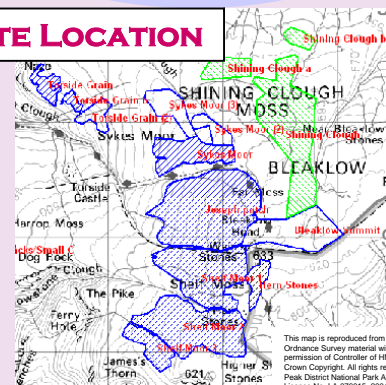
Advise on Best Practice

Changes in nurse crop constituency
Methodology & timing of treatments

Assess Success of Treatments

Are restoration works having the desired effect?

SITE LOCATION



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RESULTS

Effect of seed, lime and fertilizer

On all three control sites (Far Moss, Bleaklow Head and Between SK & SC), not subject to lime, fertiliser & seed application, bare peat dominates. Quadrates were devoid of vegetation except for a few instances of bilberry on peat hag tops.

Effect of inclination

Slope angle only had a significant effect on plant cover at one site (Shelf Moor2). Elsewhere, there was a general trend of moderate slopes (11°-25°) to have the highest plant cover, decreasing with shallow (<11°) and steep (>25°) slopes (unimodal relationship).

Effect of treatment

On some sites, geojute treatment has produced similar or worse results than sites where no covering has been placed. Heather bales produce the best results in stimulating growth of the nurse crop species. Of sites treated in 2003, heather brush sites had higher nurse crop height and % cover. Some quadrates with heather bale cover had low % vegetation cover, this is probably a result of brush being spread too thickly. *Calluna vulgaris*, although component of the seed mix, was with few exceptions only recorded on sites treated with cut heather. This may have served as seed source or enhanced the microclimate needed for germination. Moss species occurred frequently under heather and geojute treatments, but were scarce on sites with no covering. Hypnum species are developing on the heather itself, and in some places spreading to the bare peat. No sphagnum species were recorded during either survey.

Effect of aspect

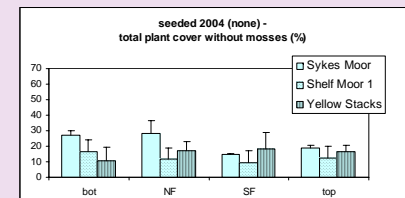
There was a significant difference between 'bottom' and other aspects of peat dunes regarding plant cover on all sites seeded in 2003. There, overall vegetation height was greatest and often dominated by naturally occurring *Deschampsia flexuosa*. Aspect had a significant effect on % cover on the three 2003 seeded sites, but varying or no effects on 2004 treated sites. Sites seeded in 2003 had a higher % cover on north-facing slopes, whilst vegetation height on peat hag tops was the lowest.

There were no significant differences between aspect and treatment on nurse crop cover except on Joseph Patch and Shelf Moor2.

Seed constituency

Deschampsia flexuosa was abundant in the bottom of many gullies across all sites, despite not being present in the 2004 seed mix and making up only 6% of the 2003 mixture. It is thought *D. flexuosa* is able to flourish naturally in wide, mineral bottomed gullies and is perhaps encouraged by lime and/or fertilizer application.

Fine leaved species are more abundant on sites seeded in 2003 than broad leaved species: Joseph Patch and Shining Clough were dominated by *A. castellana* and *Festuca* species (in addition to *D. flexuosa*). Sites seeded in 2004 follow a similar pattern. *Lolium* species were significantly contributing to total % cover in 2004 sites, notably on geojute sites.



seed constituency (%)

species	2003	2004
<i>Deschampsia flexuosa</i>	6	---
<i>Agrostis castellana</i>	39	40
<i>Festuca ovina</i>	9	10
<i>Festuca longifolia</i>	9	10
<i>Lolium (romark prg)</i>	10	8
<i>Lolium (rio ir)</i>	6	7
<i>Lolium (westernworld)</i>	6	---
<i>Festuca rubra rubra</i>	3	13
<i>Calluna vulgaris</i>	12	12

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