BeadaHumok™ plug-planting in *Molinia caerulea* on Cadishead Moss

Report by 'The *Sphagnum* Squad', December 2024

Background

Cadishead Moss (centre point SJ 69869 95161) is an 8-ha lowland peatland owned and put under restoration measures by Lancashire Wildlife Trust (LWT) since 2009, and part of the original extensive Chat Moss complex. The site was previously cut for peat, mostly domestically but partly mechanically in more recent times, leaving a series of drainage ditches across the site. There are also remnants of peat removal processes on baulks such as rail tracks and sleepers and an area of hard standing where peat was processed.

On acquisition, LWT removed extensive scrub, blocked drainage, and created a series of bunds, effectively rewetting the site and providing protection from agricultural runoff from surrounding farmland. *Molinia caerulea* and *Calluna vulgaris* developed on higher ground, *Eriophorum angustifolium* on lower ground, and areas of open water remained in ditches and in the lowest areas of the site.

A full survey in 2010 showed most of the existing *Sphagnum* on the site was along ditch edges and species seen were *S. cuspidatum*, *S. fallax*, *S. fimbriatum*, *S. palustre*, *S. papillosum*, *S. subnitens* and *S. squarrosum* (Figure 1). A second full survey in 2017 (Figure 2), after introduction of *Sphagnum* by various methods using material sourced from within the site and elsewhere (with permission), including some BeadaMoss trial plots, showed wide proliferation across the site which remained, for the most part, associated with old ditches and wetter, *E. angustifolium*-dominated areas. The dominant species were *S. cuspidatum* and *S. fimbriatum*, with good colonies of *S. subnitens* in drier areas, and 7 species were seen (*S. fallax* in 2010 was replaced by *S. cuspitatum* as the area was permanently flooded). Areas of dense *Molinia caerulea* remained, for the most part, lacking in *Sphagnum*.

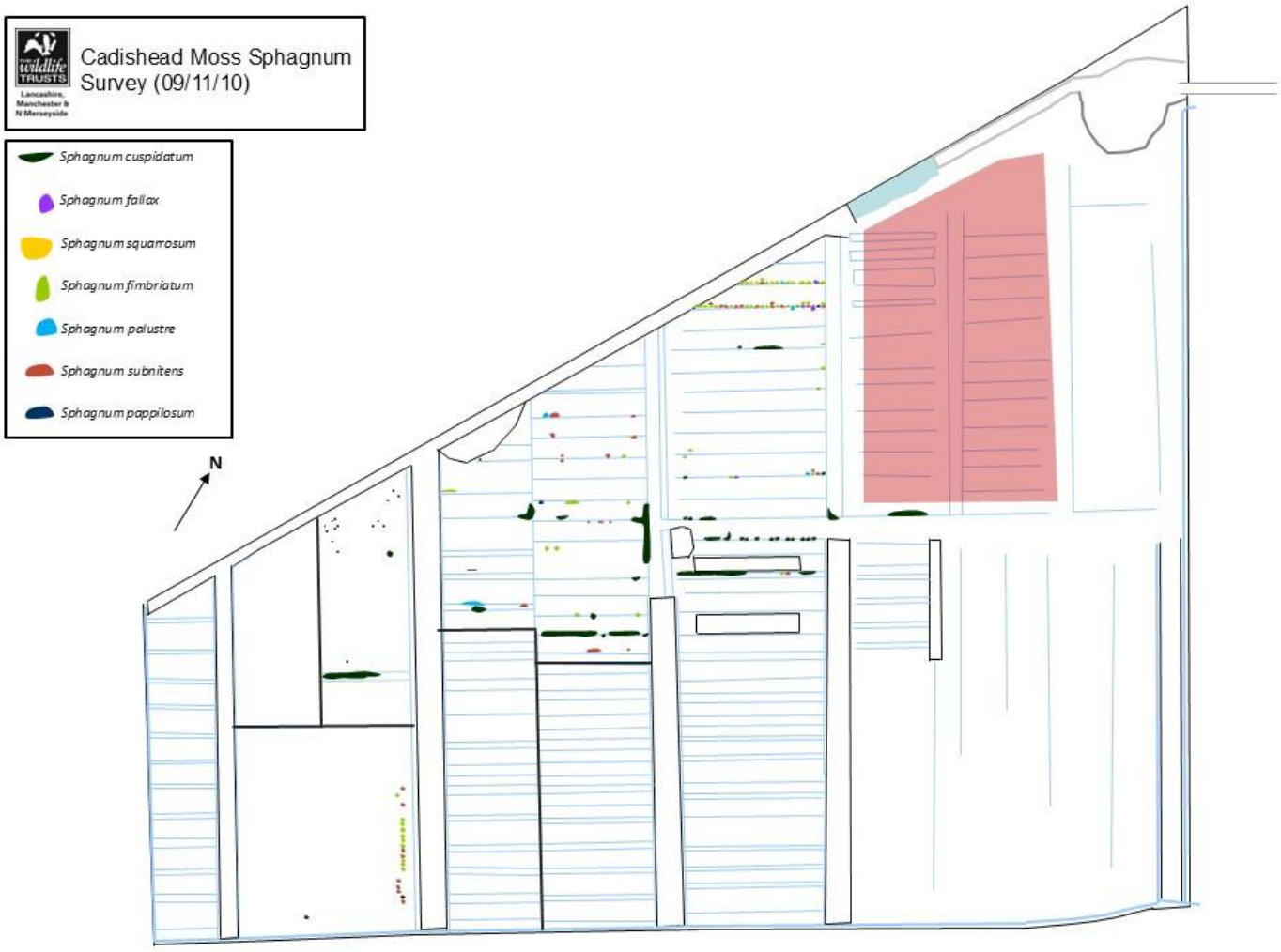

Figure 1. First full survey of *Sphagnum* presence on Cadishead Moss in 2010 (LWT).

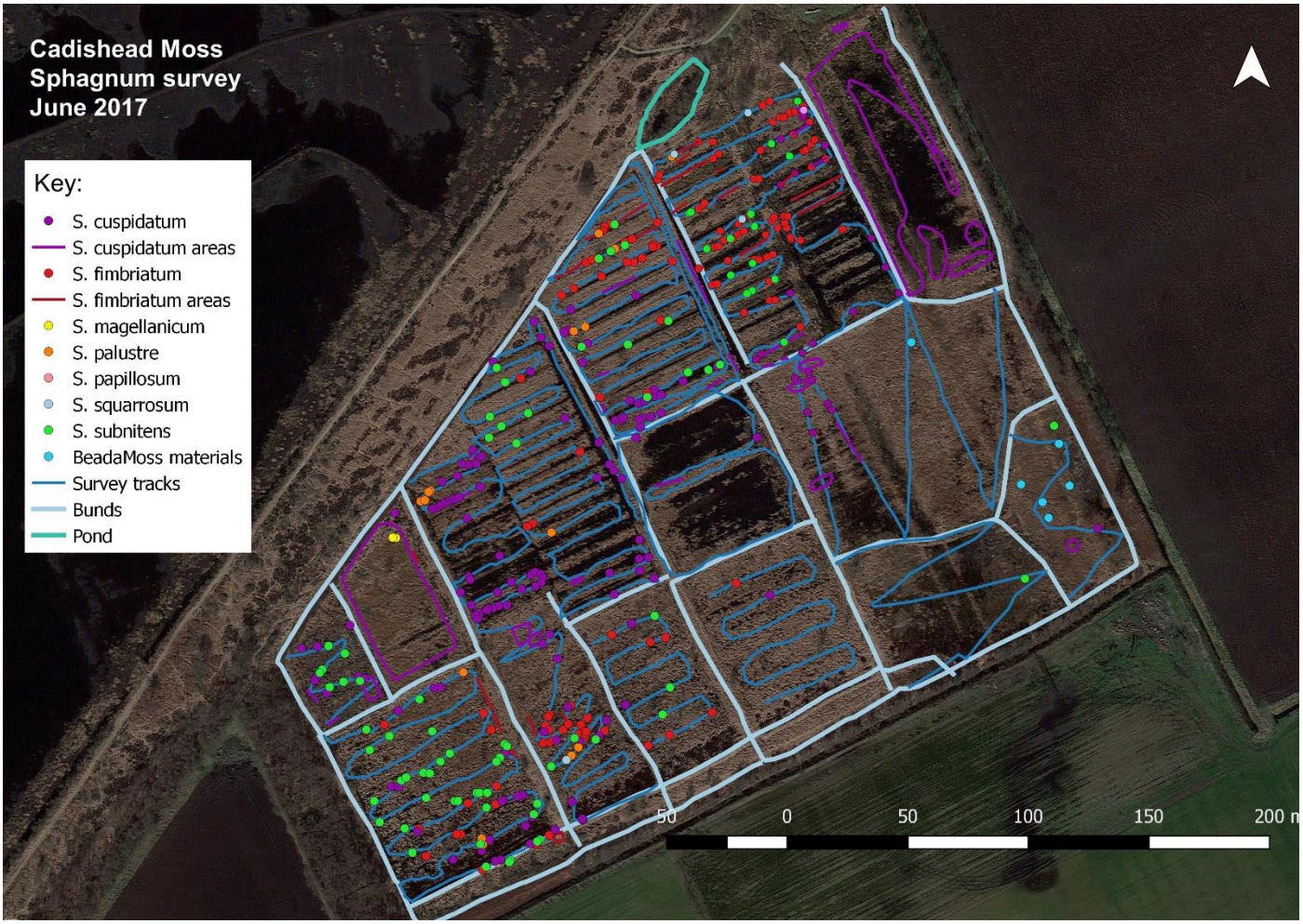

Figure 2. Second full survey of *Sphagnum* presence on Cadishead Moss in 2017 (The *Sphagnum* Squad).

Methods

BeadaHumok™ plugs (produced by Micropropagation Services Ltd, trading as BeadaMoss®) containing various combinations of *Sphagnum* species have been planted extensively by LWT across their sites in areas where other vegetation had generally established and could provide environmental protection to promote *Sphagnum* establishment. In this trial, the plugs ('Moorland Mix') were comprised of 11 species, originally chosen as likely to establish in a range of peatland micro-habitats, and moisture and nutrient levels (Table 1). *S. magellanicum* is now separated into *S. divinum* and *S. medium* in the northern hemisphere but was still colloquially known by the former name at the time of planting, and it is not known which of the two variants was in the mix. Additionally, *S. capillifolium* appears likely to be subsp. *rubellum* (now called *S. rubellum*).

Table 1. Species composition in BeadaHumok™ plugs at planting time and the approximate percentage in each plug.

Species	approximate % of plug
S. capillifolium	~10%
S. cuspidatum	~10%
S. denticulatum	~1%
S. fallax	~25%
S. fimbriatum	~10%
S. magellanicum	~1%
S. palustre	~20%
S. papillosum	~10%
S. squarrosum	~1%
S. subnitens	~5%
S. tenellum	~1%

An area of dense, continuous *Molinia caerulea* measuring 12 x 3 m, where the dead plant material had been raked up and removed, was marked with canes (SJ 69869 95269). The plot was orientated NW/SE on the length, bordered by a ditch on the NE side, a lower, wetter area on the SW side, and bunds on the NW and SE ends. There were two water-filled runnels within the length of the plot, which may have been old vehicle tracks. Plugs x 65 were planted in random locations within the plot by 'The *Sphagnum* Squad' on 19 April 2019. No Control plot was established. Dead plant material was removed/disturbed so that measurements could be made on each measuring visit, and this may have affected continued growth of *Sphagnum*, potentially favourably. Areas of existing *Sphagnum* (*S. fimbriatum*) were measured on each monitoring visit.

Baseline *Sphagnum* measurements were made at planting, and further measurements in June 2019, November 2020 and November 2024. *Sphagnum* plug/patch area was calculated by measuring the length and width, and estimating the % cover of an oval within those measurements: π x (length/2 x width/2) x % cover.

Peat depth and depth of *Sphagnum* were measured within the plot in November 2024. Peat depths were measured using 6 mm diameter threaded rods. *Sphagnum* depths were measured using a blunt-ended short rod inserted into the patches at high, middle and low patch height, until a solid base was reached.

Results and Discussion

On 19 April 2019 20% of plugs were randomly measured as a baseline. On 23 June 2019, a random 20 plugs were measured, and all 65 plugs planted had survived. In November 2020 all of the *Sphagnum* material was measured and it appeared likely that all plugs had survived but due to the large size of some patches some had probably merged, hence only 61 measurements were made. In November 2024, as the plot had continuous areas of *Sphagnum*, the final survey of the whole plot estimated areas with no *Sphagnum* in m^2 and subtracted these from the plot area to give total *Sphagnum* cover (Table 2). Areas of existing *Sphagnum* were located, measured and included in data analysis. Most of the areas with no *Sphagnum* were those with standing water. Further bunding to the north of the trial plot over winter 2023/24 by LWT is likely to have raised standing water levels but was not observed directly.

Table 2. Total areas of *Sphagnum* calculated on each monitoring visit.

Survey date	Months after planting	Total Plug area (m^2)	Total Plug cover (%)	Exisiting *Sph.* area (m^2)	Existing *Sph.* cover (%)	Total *Sph.* area (m2)	Total *Sph.* cover (%)
Apr 2019	0	0.15	0.40	0.18	0.49	0.32	0.89
Jun 2019	2	0.50	1.39	0.18	0.49	0.68	1.88
Nov 2020	19	3.16	8.77	0.44	1.23	3.60	10.00
Nov 2024	67	25.29	70.25	0.71	1.97	26.00	72.22
Exisiting *Sphagnum* presumed the same for Jun 2019 as Apr 2019							

On planting, the mean plug size was 22.3 ± 9.1 cm^2 (Mean ± St. Dev.). Two months later this had increased to 77.0 ± 33.0 cm^2. The estimated plug growth rate across the trial period of 67 months, or 6 growing seasons, based on the area cover at planting and on the final measurement, is 57.74 cm^2 per month.

Remaining *Sphagnum* species seen in November 2024 were *S. fallax*, *S. fimbriatum*, *S. magellanicum*, *S. palustre*, *S. papillosum* and *S. rubellum*. The dominant species was *S. palustre* and sub-dominant was *S. fallax*, although the other species were seen regularly throughout the plot.

Sphagnum depth measured at 14 points within the plot in November 2024 was 14.5 ± 3.6 cm^2 and peat depth measured randomly at 10 points was 219.6 ± 38.4 cm (Mean ± St. Dev.). The surface peat was soft throughout, several measurements ended in something solid, probably wood; most ended in impenetrable material that felt grainy, likely sand and clay.

Full data available here: https://www.dropbox.com/scl/fi/42c9xblvpdmx7f7j2m09q/MPS-Plugs-in-Molinia-monitoring-April-2019.xlsx?rlkey=zzcnw9onq4wxwunpejtzwm8b3&st=vjrki5vt&dl=0

All images available here: https://www.dropbox.com/scl/fo/w2l3z2b8ya4lvxlmje14z/ALQpiy-8UM7fBrEL3azNhwE?rlkey=3z6llis3ga9cnzhj3ln4my4q4&st=bpfc8rq3&dl=0

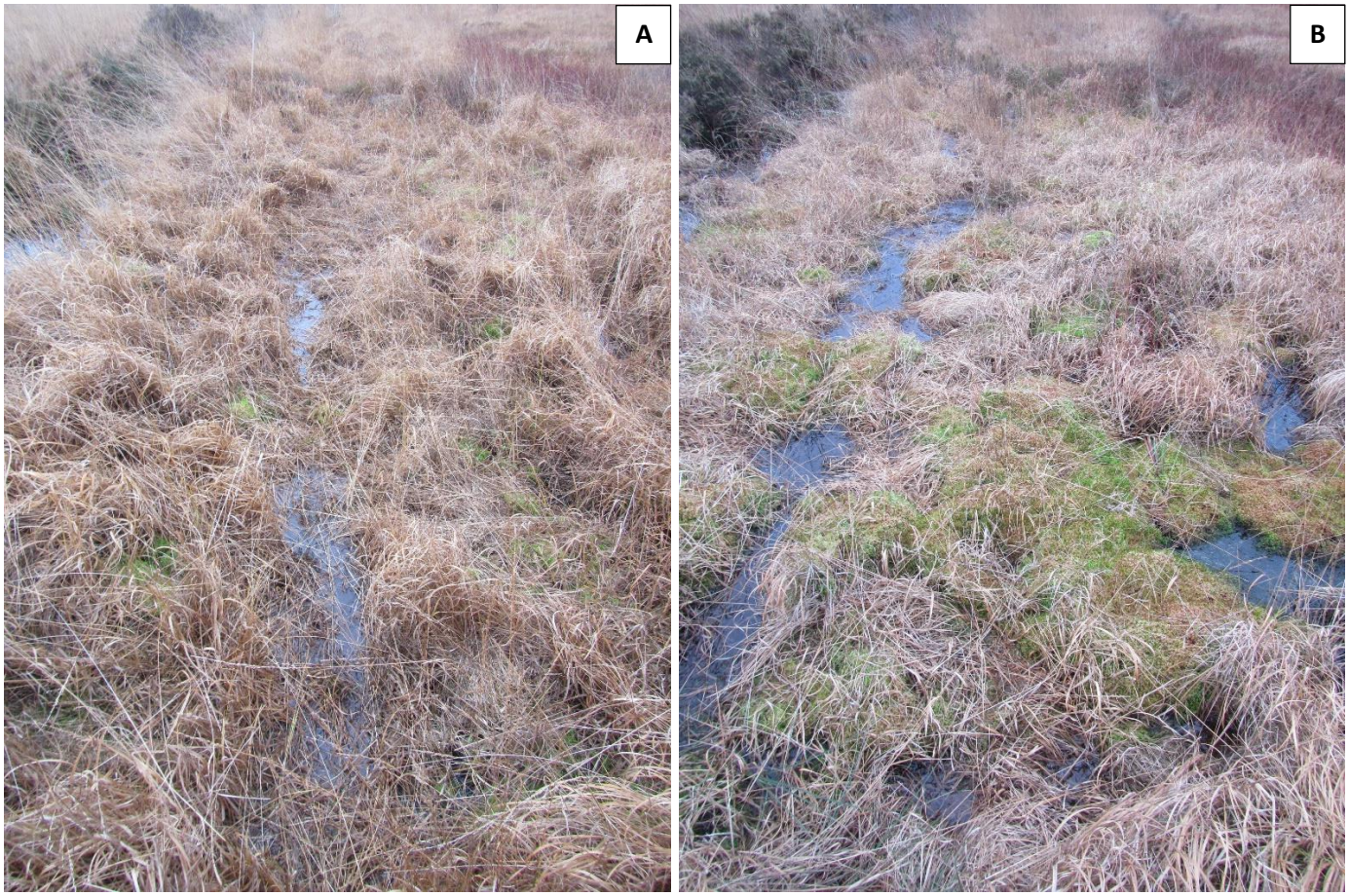

Figure 3. Images of the trial plot taken from the NW end in November 2020 (A) and November 2024 (B).

Conclusions

There was an impressive increase in *Sphagnum* cover through application of BeadaHumok™ plugs from 0.4 to over 70% in six growing seasons, and the depth is a healthy 14.5 cm, likely to be resistant to dry periods. Raking the *Molinia caerulea* straw prior to application, giving the *Sphagnum* contact with the peat surface between tussocks but providing environmental protection from standing material, may have promoted plug establishment and growth more rapidly than otherwise, but there are no Control plots to allow comparisons. In other areas close to the trial plots, a similar method has been employed, with the raked material thrown into nearby ditches to form thick floating mats of *Molinia* straw, which was also planted with BeadaHumok™ and with other peatland vascular plant species. *Sphagnum* has proliferated in these areas (not measured), both terrestrial and aquatic, and it is possible that planting *Sphagnum* in the floating mats will have reduced emissions of methane often associated with peatland ditches. There is potential for several areas of research to support the ongoing recovery of this site and in wider peatlands restoration efforts for biodiversity gain and climate crisis mitigation.

This trial was on deep peat which remains generally wet due to nearby water bodies. It is not clear how the localised recent bunding may have affected *Sphagnum* proliferation, and it is surprising that *S. cuspidatum* is generally absent in standing water areas. *Molinia caerulea* continues to be the main vascular plant despite the presence of nearby *E. angustifolium*. However, *Sphagnum* has generally proliferated well, and the survival of other species in the BeadaHumok™ mix than the dominant *S. fallax* and *S. palustre* suggests that a diverse full carpet will develop in the near future, with each species growing in its preferred niche as intended.

Anna Keightley 2 December 2024
For 'The *Sphagnum* Squad' (AK, Andy Osborne, Tony Rogers)