Harvesting *Sphagnum* from donor sites

Benson, J., Crouch, T., Chandler, D. & Walker J. (2019)

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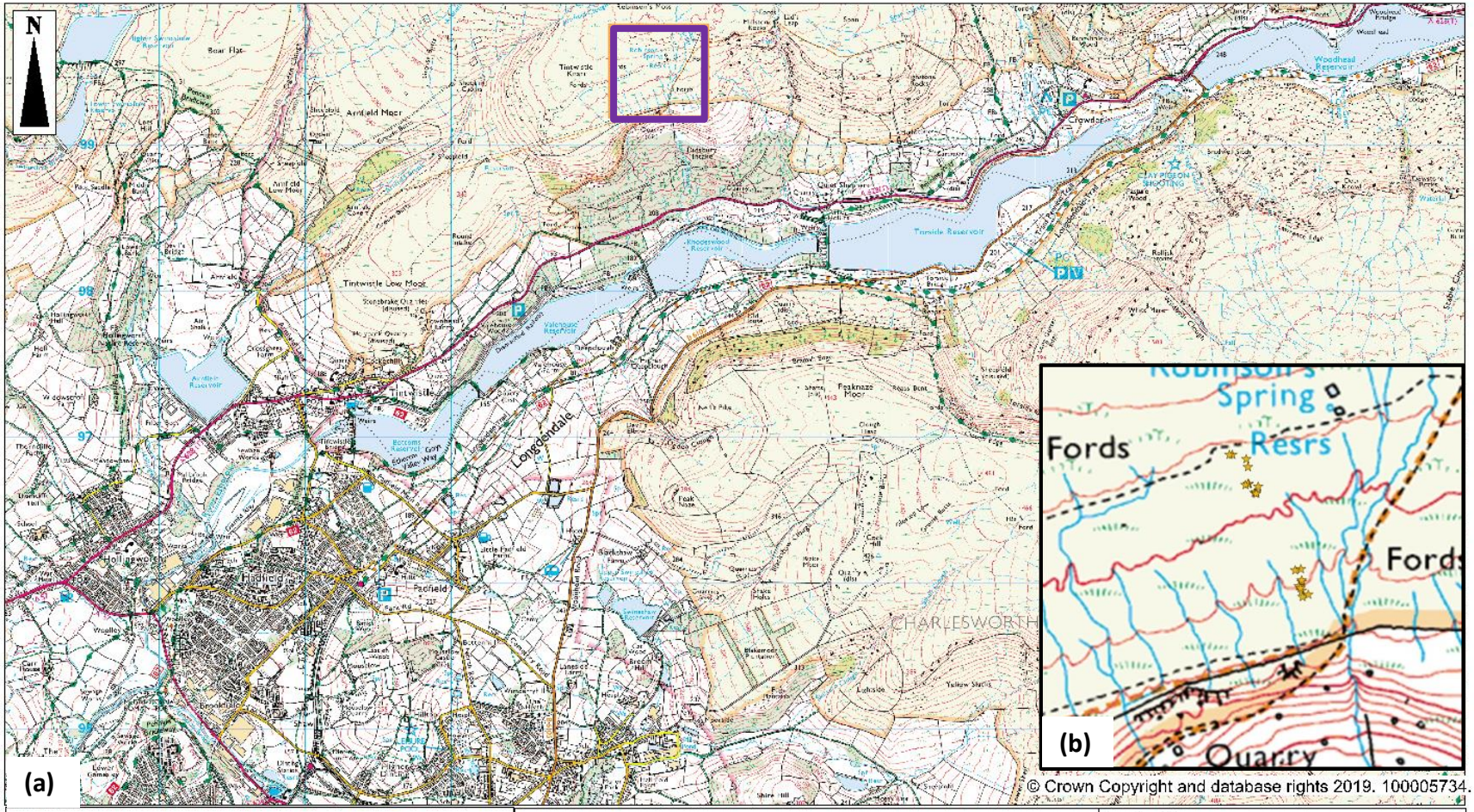
Introduction

Sphagnum restoration works are essential to re-build the peat on the moors, towards a sustainable blanket bog habitat. Re-introduction of *Sphagnum* can halt the loss of erosion of peat on the moors and in turn the loss of carbon to the atmosphere. This is important in the context of climate change: in the Peak District alone, 20 million tonnes of carbon is stored in the peat (Moors for the Future Partnership website). *Sphagnum* restoration works also importantly create a wetter environment on the moors which is beneficial for water quality, reducing flood risk and the risk of wildfires.

This pilot project supports SSSI favourable condition by monitoring the recovery of *Sphagnum* following harvesting from donor sites for translocation. The purpose of this project is to increase knowledge of the recovery of *Sphagnum* hummocks following harvesting. Firstly, this pilot project aims to evidence whether hummock forming species recover from a 10 % harvesting rate.

Study site

A suitable site, Robinson's Moss, was identified on United Utilities / RSPB land for this trial. This site has extensive areas of *Sphagnum palustre,* a hummock forming species that is found in sites that are moderately enriched with nutrients, for example wet woodland, ditches, stream margins and flushes (Atherton et al., 2010). The site is located in the Peak District, approximately 6 km north of Glossop (Figure 1).



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Drawing Name:
Location of Robinson's Moss

Drawn by: JB

Date: 25/04/19

Figure 1: (a) Location map of the monitoring site on Robinson's Moss (purple square) and insert (b) location map of NESD quadrats on Robinson's Moss site (orange stars)

Methodology

The monitoring methods we considered for the pilot study were those that are non-destructive to assure only minimal damage to the site: capitulum density measurements, area measurements and fixed point photography.

Twenty 1 x 1 m quadrats were set up in March 2016. In five quadrats ten handfuls of *Sphagnum* were harvested evenly across the quadrat and the *Sphagnum* around the hole was patted back together (treatment 1), as per the best practice guidelines. In ten quadrats, ten handfuls of *Sphagnum* were harvested evenly across the quadrat and the *Sphagnum* around the hole was not patted back together (treatment 2). In five quadrats no *Sphagnum* was harvested and these quadrats provided a control. All quadrats were set up on vegetation dominated by *Sphagnum palustre*.

A vegetation survey was carried out for each quadrat before harvesting in 2016; this recorded the percentage cover and dominant species for the following four vegetation categories: dwarf shrub, cotton grass, other grasses and bryophytes. The approximate distance to the nearest standing water was also noted. The vegetation survey was repeated in the November-December 2018 survey.

Results

Sphagnum capitula counts

Whilst both T1 and T2 quadrats contained significantly fewer capitula in 2018 compared with the pre-harvesting count in 2016 (Paired t-test(49) = 8.7, $p < 0.0005$; Wilcoxon S-R (69) Z = -7.02, $P < 0.005$) (Figure 2), the results showed some promise: an average recovery of 64 % towards the original density was recorded in the T1 quadrat grid squares, whilst an average recovery of 50 % of the original density was recorded in the T2 squares, half way towards a full recovery (Figure 3).

Control quadrats also contained significantly fewer capitula in 2018 compared with 2016 (Paired t-test(49) = 8.7, $p < 0.0005$), equating to 56 % of the original count (Figure 3).

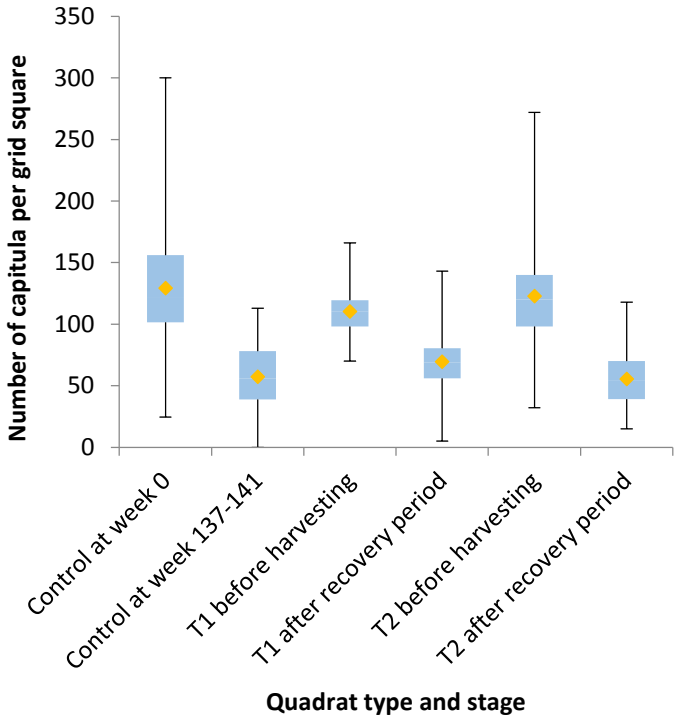

Figure 2: Box plots to show change in capitula counts for the three quadrat types before harvesting at week 0 and following a period of recovery, 137-141 weeks after harvesting

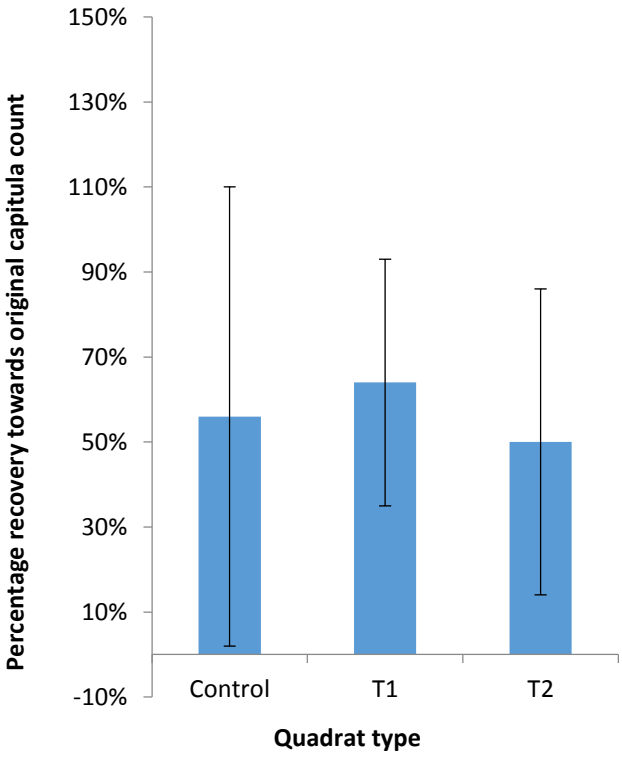

Figure 3: Bar chart to show percentage recovery of capitula for the three quadrat types, after a period of recovery at 137-141 weeks following harvesting (T1 and T2) and for the same time period with no intervention (Control). Std. deviation error bars.

The T2 quadrat *Sphagnum* percentage recovery is similar to that observed for the control quadrats and the T1 quadrat result exceeds that for the control quadrats, when change over time is expressed as a percentage of the original count for each quadrat type (Figure 3). These results suggest that harvesting *Sphagnum* at a 10 % rate as per the methodology in this pilot study, yields a similar outcome to no intervention (control).

In summary, the T1 and T2 quadrats showed recovery over time, in both assessments: (i) towards the original density count values before harvesting at 0 weeks, and (ii) towards the lower threshold average observed in the 'control' density count data.

Results

Hole measurements

Sphagnum capitula were present in 100 % of the grid squares in all three quadrat types. There were only four grid squares with a hole remaining after the period of recovery following *Sphagnum* harvesting. In all cases the remaining holes were notably smaller than the original hole left behind at the time of harvesting and before patting back took place at week 0.

Vegetation cover changes

There was no significant difference between bryophyte percentage cover before and after harvesting (with/without patting back the hole) (Paired t-test(11) = 1.8, p = 0.094). This result is an indicator of *Sphagnum* recovery, assuming that the bryophyte species composition did not change. The dominant bryophyte species before harvesting was *Sphagnum palustre,* and this was still the case after the period of recovery.

Fixed-point photography

In the 2018 repeat fixed point photography survey, the surveyor noted that the vegetation and *Sphagnum* continued to look to be in good condition.

T1Q1 at 0 weeks following harvesting (March 2016)

T1Q1 at 137-141 weeks (Nov-Dec 2018)

T2Q1 at 0 weeks following harvesting (March 2016)

T2Q1 at 137-141 weeks (Nov-Dec 2018)

Conclusion

This pilot study has yielded evidence to suggest that *Sphagnum palustre*, a hummock-forming species, recovers from a 10 % harvesting rate.

Based on the observed recovery rate of the treatment quadrats (ten handfuls of *Sphagnum* was harvested evenly across each quadrat), which averaged 57 % recovery towards the original density over three annual 'growing seasons' (over 141 weeks), we estimate that full recovery could be achieved in less than twice this amount of time: in around 250 weeks, or five annual 'growing seasons'. This assumes (i) that growth following harvesting is linear over time and (ii) growth isn't limited due to any interspecific competition for space, nor due to the spread of invasive species e.g. thistle spp. However, a repeat survey is recommended after five annual growing seasons (March 2021) to test that the above assumptions hold true. Harvest frequency could increase (more than once every five years) if weather following harvest is warm and wet.

The pilot study also indicates that harvesting *Sphagnum* at a 10 % rate produces similar outcomes to no intervention (control) over three annual growing seasons: *Sphagnum* was present in all treatment and control quadrat grid squares after the recovery period. Whilst there was an observed reduction in the number of capitula in the control quadrats over the study period, partial recovery was observed following harvesting, indicating growth.

A faster recovery rate was achieved when patting-back the holes immediately following harvesting, as per the best practice guidance; as opposed to leaving open spaces (holes) in the hummock.

A detailed discussion is provided in the full report which is available at http://www.moorsforthefuture.org.uk/

Future recommendations

Other questions that have been raised, which are not within the scope of this pilot project include:

- Does the size of the patch from which *Sphagnum* is harvested affect how it recovers?
- Does the spatial pattern of harvesting affect *Sphagnum* recovery?
- When harvesting from 'carpet' forming species; how much can be harvested / how little can be left?

References

Atherton, I., Bosanquet, S. & Lawley, M. (2010) Mosses and Liverworts of Britain and Ireland – a field guide, *British Bryological Society*