Back On Our Map

Sundew Survey, Propagation and Reintroduction Methods

heather.marples

Contents

1. Introduction to BOOM

Back on Our Map (BOOM) aimed to engage communities in South Cumbria with their natural environment, by restoring the landscape and reintroducing and reinforcing locally threatened or extinct native species. National Lottery players supported the £2m project, alongside several other public, private and charitable sector organisations. Led by the University of Cumbria, BOOM worked closely in partnership with Morecambe Bay Partnership, and lead partners Cumbria Wildlife Trust, Natural England and Forestry England.

The project a network of protected areas including Sites of Special Scientific Interest (SSSIs), National Nature Reserves (NNRs) and Arnside and Silverdale Area of Outstanding Natural Beauty (AONB). It covered an area of 600km2, extending along the lowlands of Morecambe Bay from Barrow-in-Furness in the west to Arnside and Silverdale in the east and Ambleside in the north (Fig 1.1).

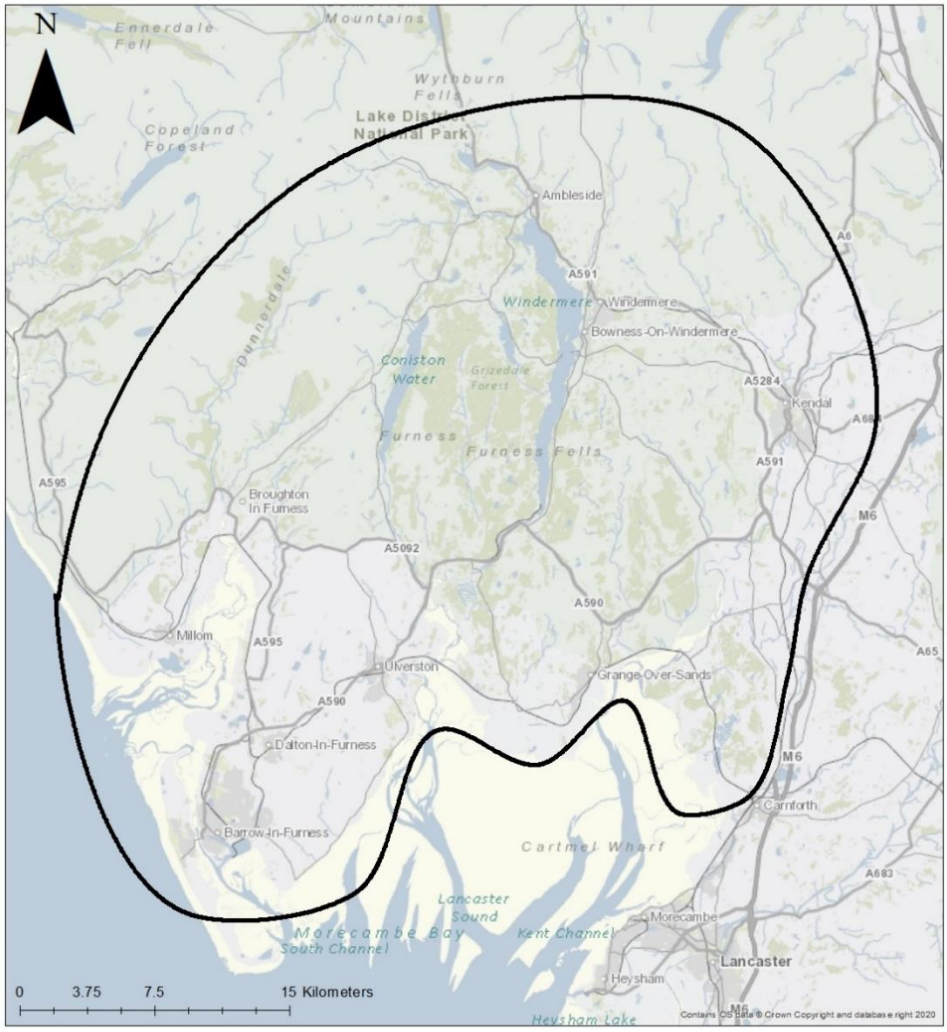

Figure 1.1: Map of the BOOM working area.

BOOM reintroduced and expanded the range of the hazel dormouse, small blue butterfly, goldilocks aster, great and oblong-leaved sundew, green-winged orchid, maidenhair fern, spiked speedwell, and aspen (table 1.1). A reinforcement of a Duke of Burgandy population was carried out on the Graythwaite Estate. The pine marten community-based feasibility study identified suitable locations for future reinforcement. For the Corncrake, public engagement sound walks raised awareness of the species.

Table 1.1: Species included in the BOOM project.

Common Names	Scientific Name	BOOM Objectives
Aspen	*Populus tremula*	Reintroduction
Corncrake	*Crex crex*	Public Engagement and Interpretation
Duke of Burgundy	*Hamearis lucina*	Reinforcement
Goldilocks Aster	*Galatella linosyris*	Reintroduction
Great Sundew	*Drosera anglica*	Reintroduction
Green-winged Orchid	*Anacamptis morio*	Reintroduction
Hazel Dormice	*Muscardinus avellanarius*	Reintroduction
Maidenhair Fern	*Adiantum capillus-veneris*	Reintroduction
Oblong-leaved Sundew	*Drosera intermedia*	Reintroduction
Pine Marten	*Martes martes*	Feasibility Study
Small Blue	*Cupido minimus*	Reintroduction
Spiked Speedwell	*Veronica spicata*	Reintroduction

Across south Cumbria, the project engaged a wide range of community groups, volunteers and members of the public. Social activities and training events helped communities get involved with the BOOM species reintroductions.

This document covers the work BOOM did on the great sundew and the oblong-leaved sundew, including the propagation techniques, reintroduction methods and community engagement events.

2. Species Background

Sundews are insectivorous plants found on mires and bogs (Millett *et al*, 2015). They have evolved to derive most of their nutrient requirement from captured insects to compensate for a nutrient-poor peatland habitat. Afforestation, draining for agriculture and atmospheric nitrogen deposition have all contributed to the decline and degradation of the UK's peatlands, leading to loss of habitat for many unique species, including sundews (Cris *et al*., 2011).

There are three sundew species in the UK: the round-leaved sundew (*Drosera rotundifolia*), great sundew *(Drosera anglica*), and oblong-leaved sundew *(Drosera intermedia*) (Stace, 2019). On many peatlands today, only the round-leaved sundew can be found as it able to withstand the drier conditions created following degradation (figure 2.1). Great sundews and oblong-leaved require much wetter habitats, including bog pools.

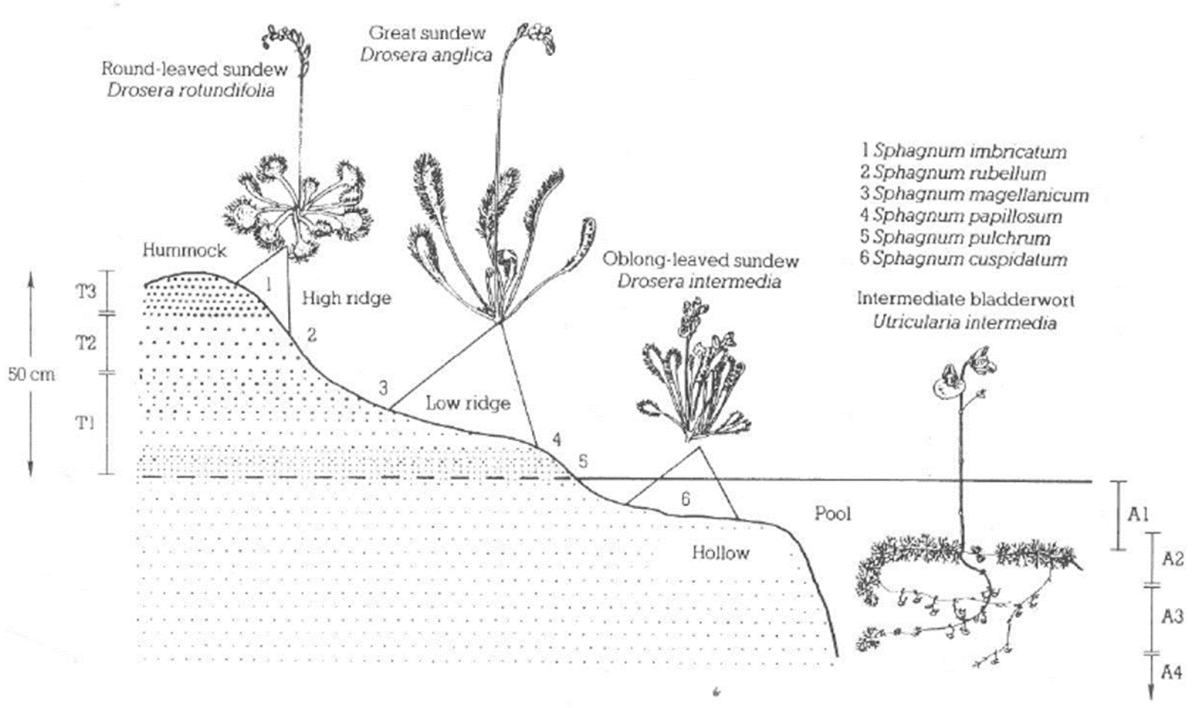

Fig 2.1: Zonation of UK sundews

In recent decades, extensive restoration work has improved the condition of many of our peatlands so that they may now be able once again to sustain their previous rich and unique floral assemblages (Westguard-Smith *et al*., 2007). However, many of these species are poor colonisers and only exist in remote and fragmented pockets, therefore BOOM has reintroduced great sundews and oblong-leaved sundews back into the Witherslack Mosses in south Cumbria.

3. Reintroduction Objectives

The BOOM project aimed to propagate and reintroduce oblong-leaved and great Sundews back into the Witherslack Mosses in south Cumbria. It also aimed to raise awareness of both species and get volunteers from the local community involved in surveys, planting, and propagation.

The project aimed to do this by:

- Surveying donor populations for great and oblong-leaved sundews to monitor the number of sundews at each site.
- Collecting leaves from donor populations to propagate new sundews for reintroduction.
- Propagating sundews with volunteers through the “Bog in a Box” initiative.
- Reintroducing sundews at two new sites in south Cumbria.
- Raising awareness of sundews at community talks, conferences, and social media posts.
- Educating the public about peatland habitats and sundews through engagement walks at Foulshaw Moss.

3.1. Project Locations

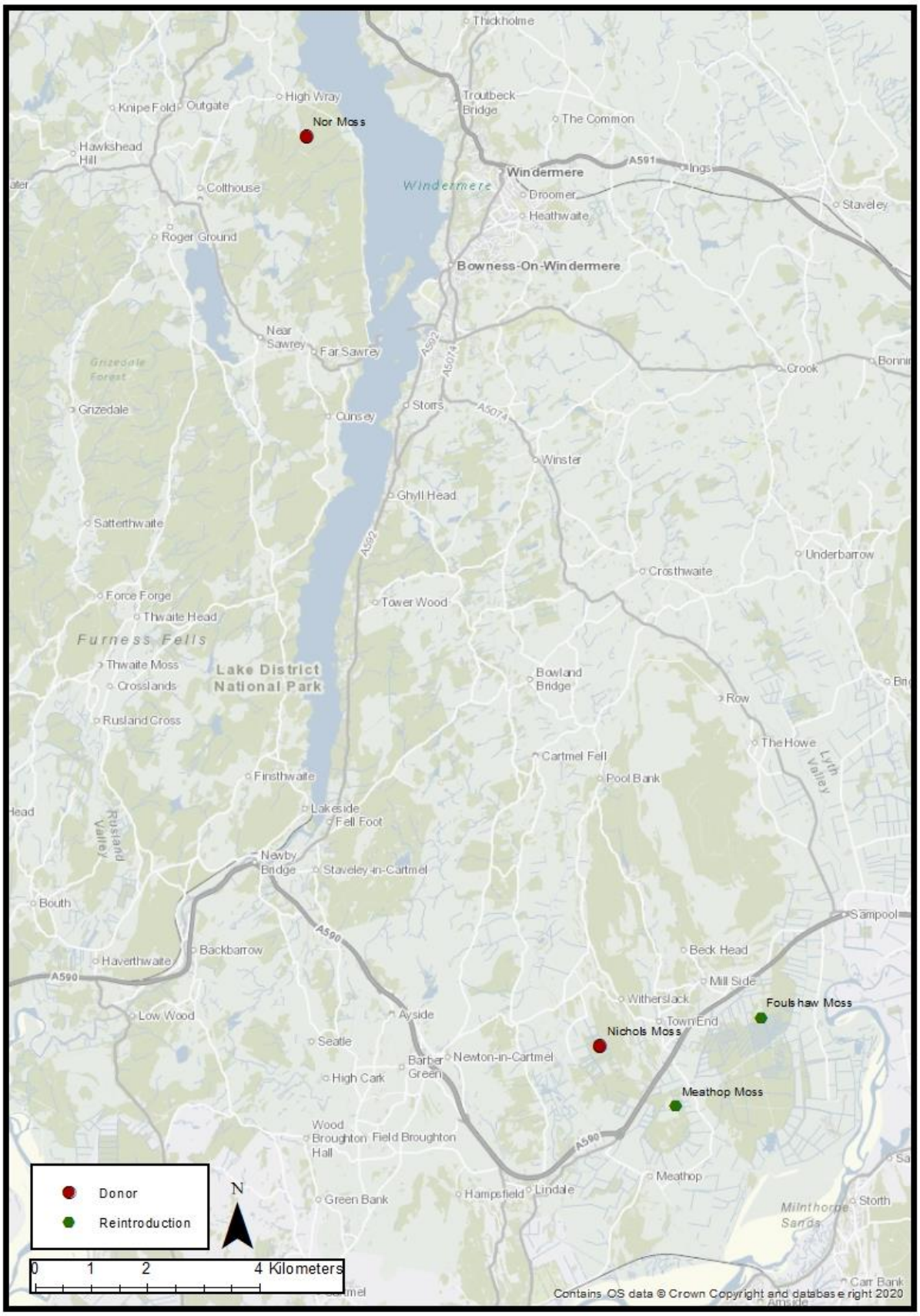

Figure 3.1: Donor and reintroduction sites for sundews

Donor Sites

Nor Moss and Nichols Moss were identified as suitable donor sites for the great sundew and oblong-leaved sundew respectively (location in figure 3.1).

Nor Moss is owned by the National Trust and is managed by the South Lakes Ranger Team. It is a valley mire with a central pool surrounded by bog vegetation including sphagnum, sedges, and sundews (fig 3.2a). Great sundews, oblong-leaved sundews and round-leaved sundews can all be found within the sphagnum mosses.

Figure 3.2: a) Nor Moss; b) Nichols Moss

Nichols Moss is a raised bog which is owned and managed by Cumbria Wildlife Trust (fig 3.2b). The habitat is dry, dominated by heathers and some woodland regeneration is apparent. The old drainage ditches have been blocked and are full of bog asphodel (*Narthecium ossifragum*) in summer. The moss has both round-leaved sundews and oblong-leaved sundews, however the latter is found in the lower, wetter parts of the bog.

Reintroduction Sites

Foulshaw Moss is a 330-hectare raised bog which was forested in the 1950's. It was purchased by Cumbria Wildlife Trust in the 90's and has undergone extensive restoration. The trees have been felled and the area cell bunded to raise the water level. After nearly 20 years of restoration, the peatland had been identified as a suitable reintroduction site for both great and oblong-leaved sundew.

Meathop Moss is also a raised bog, west of Foulshaw (fig 3.1). Historically Meathop, Foulshaw and Nichols Mosses will have been connected as one bog. However, due to development and peat cutting they are now fragmented. Meathop Moss was designated as a Nature Reserve by Charles Rothschild in 1919 and therefore was never forested, unlike Foulshaw. It is now owned by Cumbria Wildlife Trust, who have cell bunded the bog to raise the water table. It was an ideal site for the reintroduction of the oblong-leaved sundew.

3.2. Partners and Consents

The BOOM project worked closely with various organisations. Firstly, Cumbria Wildlife Trust and National Trust are the landowners of the four mosses and permission was requested to gain access to the site, survey sundews and harvest or reintroduce sundews into the moss. The peatland team at Cumbria Wildlife Trust has also provided advice on the reintroduction sites and methodology.

Permission was granted from Natural England to collect two leaves from 10% of the total population. Detailed plant counts were required to ensure that the BOOM project did not overharvest from Nor or Nichols Moss. Permission was also granted to take a 20x20x20cm section of peat from each of the four mosses, to be used in the propagation of sundews.

Josh Styles from Northwest Rare Plants Initiative (NWRPI) gave propagation training on how to harvest the sundews (section 3.4), propagate them (section 3.5) and provided advice on how to identify suitable reintroduction locations. Josh had previous experience of reintroducing sundews into the Manchester Mosses.

Table 3.1: Summary of partners involved with the sundew reintroductions.

Partner	**Person**	**Consent or Training Given**	**Role**
Cumbria Wildlife Trust	Paul Waterhouse	Consent Training	Own Nichols, Foulshaw and Meathop Mosses. Granted permission to harvest and reintroduce sundews Advised on where and how to reintroduce sundews.
National Trust	John Hooson	Consent	Own Nor Moss and granted access permission to survey and harvest great sundews.
Natural England	Jacqui Ogden	Consent	Granted SSSI permissions for harvesting sundews. Granted SSSI permissions to reintroduce sundews. Granted SSSI permissions to collect peat to propagate the sundews on.
NWRPI	Josh Styles	Training	Delivered sundew propagation training.

3.3. Site Surveying

Nor Moss Surveys

Nor Moss is a valley mire with a central pool surrounded by bog vegetation including sphagnum, sedges, and sundews. Great sundews prefer wetter conditions, therefore, the 3m of vegetation next to the pond was surveyed in transects with 3 people, each covering a metre width. Each surveyor counted the number of great sundews in their line and were able to communicate with the next to ensure that sundews weren't missed or counted twice. The total number between the three surveyors was added together to get a total for that section.

Each section of suitable habitat was recognised as a new transect. The north and east sides of Nor Moss were identified as suitable habitat for the great sundew and were surveyed. The island in the middle of the bog wasn't surveyed due to access issues, so the total number of sundews counted may be less than the total number on site. This also ensured that BOOM stayed below the 10% threshold and did not overharvest.

Nichols Moss Surveys

The oblong–leaved sundews on Nichols Moss are mainly found on the main path into the moss. They were spread out across the bare peat and wetter patches. This required a different survey method to the great sundew. Here, 3x3metre quadrats were marked out where the sundews were at their greatest densities. The GPS location was marked and the total number of oblong-leaved sundews were counted in each quadrat. Each surveyor had their own quadrat so there was no double counting. The numbers in each quadrat were added together to give the total number of oblong-leaved sundews on site.

As this method involved counting within 3x3 metre quadrats of high-density sundews, some areas with fewer oblong-leaved sundews will have not been included in the overall total. This ensured that the BOOM team did not overharvest, and the quadrats gave a representative total on the site. The same quadrats can be used in subsequent years to monitor the existing population.

Recommendations

- Ensure accurate GPS data. The waypoint should be taken from the same point on each 3x3m quadrat. For the transects at Nor Moss a track should be marked to show the transect walked. This data and information should be accessible to everyone.
- Ensure sundews aren't counted twice by:
    - Using a clicker to keep track of sundews counted.
    - Having one person assigned to a 3x3m quadrat or 1m width in the transect.

- Survey after a dry spell as the water table will be lower and a larger area of the bog is accessible.

3.4. Seed/Material Collection

Great Sundew Leaf Collection

Once the total number of great sundews on site was established, it was possible to calculate how many leaves could be taken. In 2021, two leaves from 12 plants were taken. For each plant, a GPS location was taken and a 50x50cm quadrat was marked out with each plant at the centre. In each quadrat a vegetation survey was conducted, identifying each species and the % coverage, as well as taking note of the amount of bare peat and open water (Fig 3.3). This data was then used for determining reintroduction site suitability in section 3.6.

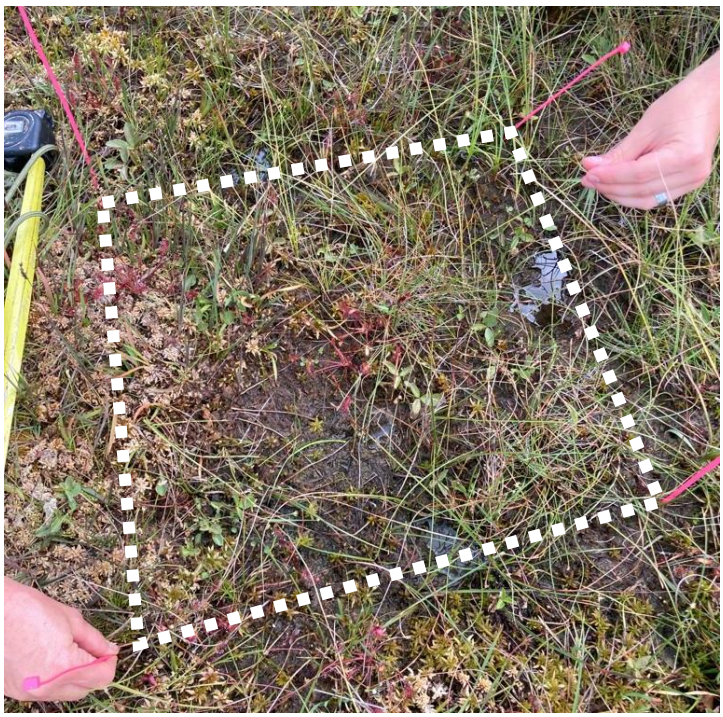

Fig 3.3: Quadrat around a Great sundew at Nor Moss

Each sundew has two sets of leaves: the ones from last year and the new ones produced this year. The best ones to collect are the new leaves as they contain more meristem cells (unspecialised plant cells that can develop into the new plantlets). The newer leaves are found closer to the middle of the plant and are often greener due to the fresher chlorophyll. Larger leaves will have more nutrients to produce more plantlets. The optimal leaf is identified and tweezers are used to peel off the the plant at the base of the leaf stem. If the leaf is correctly removed from the base of the stem, it can produce another plantlet. If the stem accidently snapped, the leaf was removed, and the remainder of the plant left *in situ*.

Whilst in 2021 we collected the leaves on the 26th July, the optimum time to collect the leaves is the end of May/ early June. This gives the plants enough time to come out of dormancy and grow the new leaves for the year. In 2022, we collected the leaves earlier on the 8th June. This has proved to be more successful as the leaves start the propagation process (Section 3.5) earlier and are then larger going into dormancy over winter. In 2023, leaves were collected from 30 plants on the 29th June. This was done in conjunction with Cumbria Wildlife Trust's peatland team. BOOM taught the peatland team how to survey for the great sundew at Nor Moss as part of the legacy. The peatland team will be able to continue monitoring and harvesting great sundews from Nor Moss for future plantings schemes, subject to them acquiring SSSI consent from Natural England.

Oblong-leaved Sundew Leaf Collection

Oblong-leaved sundew collection was very similar to the great sundew leaf collection. However, as there were more oblong-leaved than great sundews a quadrat was not located around each individual plant. Instead, leaves from multiple plants in one 50cm^2 quadrat were collected. For each quadrat the GPS location, plant species and % bare peat was noted to create the same data as the great sundew surveys. In 2021, the leaves were collected on the 27th July which was too late. Therefore, in 2022, they were collected on the 10th June which meant the leaf cuttings had more time to produce plantlets large enough for winter dormancy. In 2023, the leaves were collected on the 5th July.

Recommendations

- Collect leaves in early June to allow for a longer growing period in section 3.5.
- Aim to remove the whole leaf and leaf stem.
- Take the two newer leaves (greener) to get more plantlets (see section 3.5). Choose the larger leaves to have a larger leaf lamina for the new plantlets to grow on.
- If you're unsure of sundew numbers, then underharvest rather than overharvest

3.5. Propagation

Propagation training was given by Josh Styles who runs the Northwest Rare Plants Initiative (NWRPI). He has been propagating all three UK species of sundew and has successfully reintroduced them into some of the Manchester Mosses.

Stage 1: Deionised Water

The sundew leaves need to be transferred into a bottle with deionised water. Bog water can be used but deionised water is the clearest allowing the best light penetration as well as reducing the risk of contamination in the bottle. Deionised water is water that has been filtered to remove ions and other impurities. This can be produced in the lab using water deionising

machine. Alternatively, it is often used in car engine cooling systems and can be bought from most supermarkets or Halfords in 2.5litre bottles.

The bottles were placed on a windowsill which received the most sunlight (Fig 3.4).

Fig 3.4: Great sundew leaves in deionised water

All the bottles were left for a month and lightly shaken occasionally to allow different leaves to have more access to direct sunlight. The plantlets started growing on the leaves and it was advised to wait until till they had developed at least two leaves with the beginnings of the red spikes which they will use to trap insects. For great sundews this took about a month, and they produced up to eight plantlets on one leaf and one on the leaf base (Fig 3.5). The oblong-leaved needed two months to produce just one or two plantlets per leaf.

Fig 3.5: Great sundew leaf with eight individual plantlets

In 2022, BOOM trialled placing some of the leaves in an environmental growth cabinet with 24-hour sunlight and warmth (20ºC). The idea was to shorten the length of time the sundews require to produce plantlets, so that they can be transferred onto peat earlier and have a longer growing season over summer. This did not work, and the ones left on the windowsill in direct sunlight proved to be the most successful. This may have been due to the strength of light or the temperature of water as the ones on the windowsill were able to fluctuate much more.

Stage 2: Planting on Peat

Once the plantlets were large enough on the original leaves, they were transplanted onto peat. BOOM obtained permission from Natural England to collect peat from the Witherslack mosses to transfer the sundews onto. Natural peat has been found to be the best substrate to grow the plantlets on, however Josh Styles has managed to use non peat alternatives but with lower success rates.

A small seed tray was filled with peat and placed into a larger tray to retain water. The original leaf was cut using a sharp knife so that each plantlet was separated (Fig 3.6a). The plantlets were transferred onto each and the leaf was gently buried, whilst ensuring the new leaves were above the peat so they could continue growing and catching insects. The plantlets were spaced so they had enough room to grow and the two species were kept separate (Fig 3.6b).

Figure 3.6: a) Separating the plantlets; b) Plantlets transferred onto peat and in a tray of water.

Both species of sundews need to be kept outside in the sunniest part of the growing area. The tray that holds water needs to be topped up regularly in drier periods. Use rainwater, or water from a bog, rather than tap water as tap water contains chlorine and other additives. If possible, if you have any flies then you can feed them to the sundews by sticking them to the “dew” on the leaves. This is especially helpful as the plants get most of their nutrients from insects because peat is so nutrient poor. Not all the cuttings will survive, but in some cases, some do well and when their leaves die, new leaves grow from the old. In the space on one year the oblong-leaved sundews were large enough to come into flower (Fig 3.7).

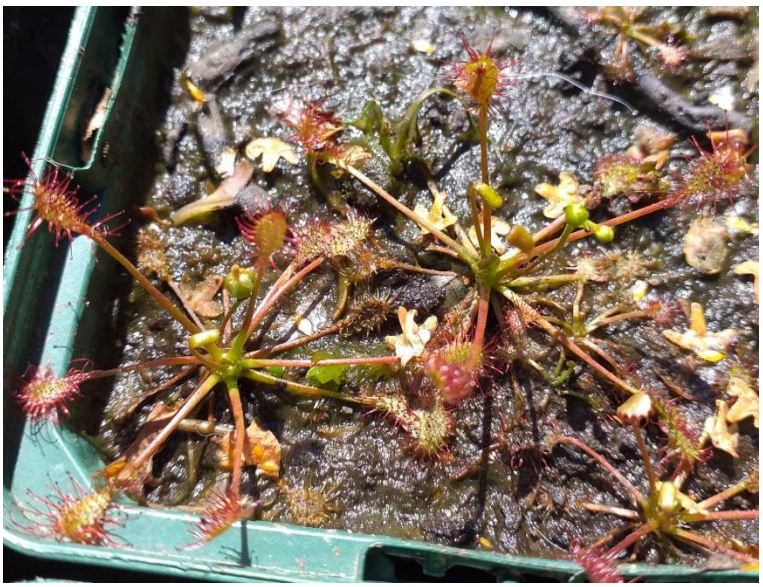

Figure 3.7: Oblong-leaved sundews after one year of growth, about to flower.

In 2021, a small experiment was set up to see whether growing the sundews inside or outside over winter would be most successful. The plants that were kept inside were placed onto a

south-west facing windowsill that received the most sunlight. As this was in a domestic setting the temperature will have fluctuated on average between 17-21 degrees Celsius. The sundews that were kept in the garden were also placed facing the same south-westerly direction and received a similar level of sunlight. However, they were exposed to the winter weather with an estimated temperature range of 12-14 degrees Celsius.

Individual sundews were planted into a celled tray. The tray contained both great and oblong-leaved sundews which were clearly labelled. This ensured that the sundews could easily be counted to monitor survival success.

Both the indoor and outdoor plants went into dormancy but the indoor ones started coming out of dormancy quicker. However, once they both came out of dormancy the outdoor plants did much better as they grew quicker with ready access to flies. This could be due to a couple of factors: 1 – the ones outside had access to more flies and 2 – sundew seeds need a cold snap during winter for them to germinate, and therefore the adult plant may also need the cold snap to induce growth when it starts to get warmer. The indoor plants lacked both these factors and did not grow as large as the outdoor ones. Overall, whilst there was a difference in growth rates after dormancy, there was no difference in survival rate. Therefore, it is recommended to grow them outside and this was the case for all the sundews in 2022 and 2023.

Recommendations

- Great sundews should be left for ~6 weeks, until red hairs can be seen on the new plantlet leaves. Oblong-leaved sundews should be left for 8-10 weeks.
- Use a sharp knife to ensure clean cuts of the original sundew leaf. If two plantlets are extremely close to each other, plant them onto peat as one plant.
- Grow the sundews outside.
- If they get too wet and are underwater, place a propagation lid over the top to stop them getting washed away.
- Keep them in a gravel tray to ensure a high-water table.
- Feed them flies in the summer months if they are looking like they need more nutrients.
- Keep them in a sunny patch in the garden to mimic the openness of a bog habitat.
- If they are looking dry, fill the water reservoir up in the gravel tray with rainwater or bog water – not tap water.

3.6. Reintroduction Methods

Surveying

Foulshaw Moss and Meathop Moss are part of the Witherslack Mosses group. They had been identified as suitable reintroduction sites as part of the development stage of BOOM. Both

sites required surveying to find suitable specific reintroduction locations. Using the plant species lists, open water, and bare peat cover percentages (determined during the donor site quadrat surveys), it was possible to go out onto both mosses and identify new locations for sundew reintroduction.

Meathop Moss

Around the main boardwalk, there were numerous sites with areas of large bare peat and important plant species such as the white-beaked sedge (*Rhynchospora alba)*. A shortlist of six sites were determined on Meathop Moss that were ideal for oblong-leaved sundews (Appendix 1). As there are no official bog pools on Meathop, it may still need more restoration work before great sundews will be able to survive there.

Foulshaw Moss

As this moss is extremely large and at various stages of restoration, the reintroduction sites have been suggested by Paul Waterhouse (Reserve Officer) and Simon Thomas (Peatland Conservation Manager) from Cumbria Wildlife Trust. In 2022 the great sundew was reintroduced here. Four planting locations were initially identified: two next to the boardwalk where it was wetter and contained species such as white-beaked sedge and *Sphagnum* mosses, and two locations next to bog pools. In 2023, two sites were planted; both were next to the boardwalk where there was bare peat and sphagnum growing. As Foulshaw is a large site, it is best to reintroduce the great sundew into multiple different areas to allow for maximum coverage across the site.

The oblong-leaved sundew was introduced into Foulshaw in 2023. Following the success of their reintroduction to Meathop in 2022, sites were identified based on areas of bare peat. Six locations were identified: three under an old boardwalk and three next to the main boardwalk where there is bare peat.

Planting

After the sundews had been growing for a year, they were ready to be reintroduced into the receptor sites.

Great Sundews

In total, 88 great sundews were planted at Foulshaw Moss during 2022 and 2023 (Table 3.2). The sundews were planted within a 50x50cm quadrat placed over the area identified for the reintroduction. A GPS location and a picture of the quadrat were taken after the planting as a record as to where the sundews have been planted. This proved to be vital during the monitoring process (see section 3.7).

Table 3.2: Great sundew planting locations

Quadrat Number	Grid Reference	Number Planted	Date Planted
FS1	SD 4587 8357	15	15-08-2022
FS2	SD 4587 8352	16	15-08-2022
FS3	SD 4580 8343	16	15-08-2022
FS4	SD 4604 8386	17	15-08-2022
FS5	SD 4587 8532	12	13-09-2023
FS6	SD 4587 8362	12	13-09-2023

In 2022 the great sundews were planted on small clumps of peat and nestled within the sphagnum (Figure 3.9a). This enabled the sundew to establish roots in the substrate and to be kept moist by the surrounding sphagnum.

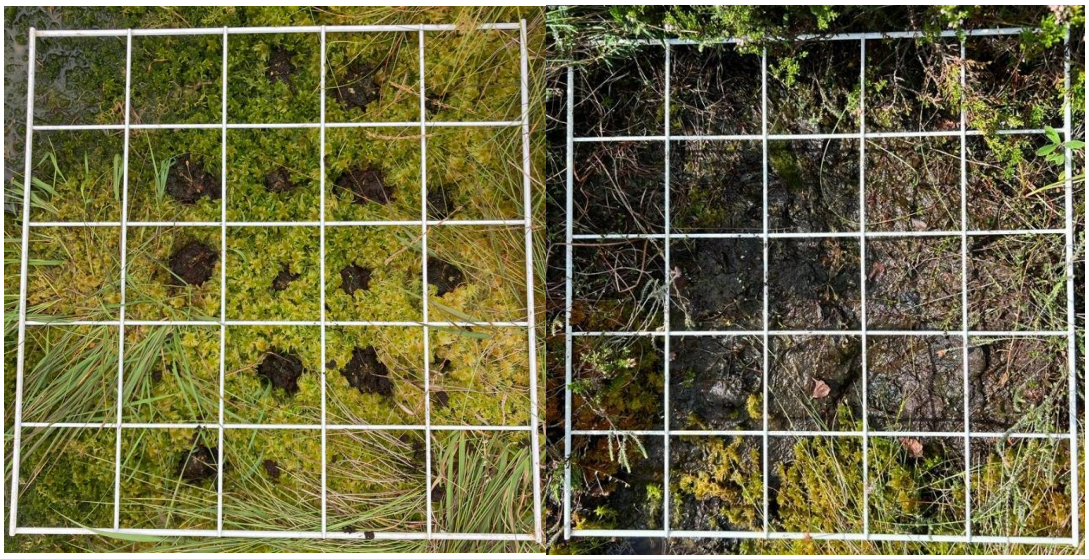

Figure 3.9: a) Great sundews on peat nestled in the sphagnum; great sundews on bare peat.

In September 2023, the great sundews that had been propagated during the 2022-2023 season were also introduced into Foulshaw Moss, in to two separate quadrats. After the method of planting within the sphagnum proved to be unsuccessful, this time the sundews were planted onto bare peat next to pools of sphagnum (Figure 3.9b).

Oblong-leaved Sundews

118 oblong-leaved sundews were reintroduced as part of the BOOM project: 34 at Meathop Moss in 2022 and 84 at Foulshaw Moss in 2023 (Table 3.3). Similarly, to the great sundew

planting, the oblong-leaved sundews were planted within a 50x50cm quadrat and a GPS location and photo taken for monitoring purposes.

Table 3.3: Oblong-leaved planting locations

Quadrat Number	Location	Grid Reference	Number Planted	Date Planted
MH1	Meathop Moss	SD 4436 8189	17	15-08-2022
MH2	Meathop Moss	SD 4433 8209	17	15-08-2022
Q1	Foulshaw Moss	SD 4583 8359	10	13-09-2023
Q2	Foulshaw Moss	SD 4584 8358	16	13-09-2023
Q3	Foulshaw Moss	SD 4584 8358	13	13-09-2023
Q4	Foulshaw Moss	SD 4586 8364	17	13-09-2023
Q5	Foulshaw Moss	SD 4586 8364	20	13-09-2023
Q6	Foulshaw Moss	SD 4586 8364	8	13-09-2023

On 15th August 2022, 34 oblong-leaved sundews were planted in Meathop Moss (Appendix 3). Two locations were selected from the six identified and 17 individuals were planted at each location (Figure 3.10a).

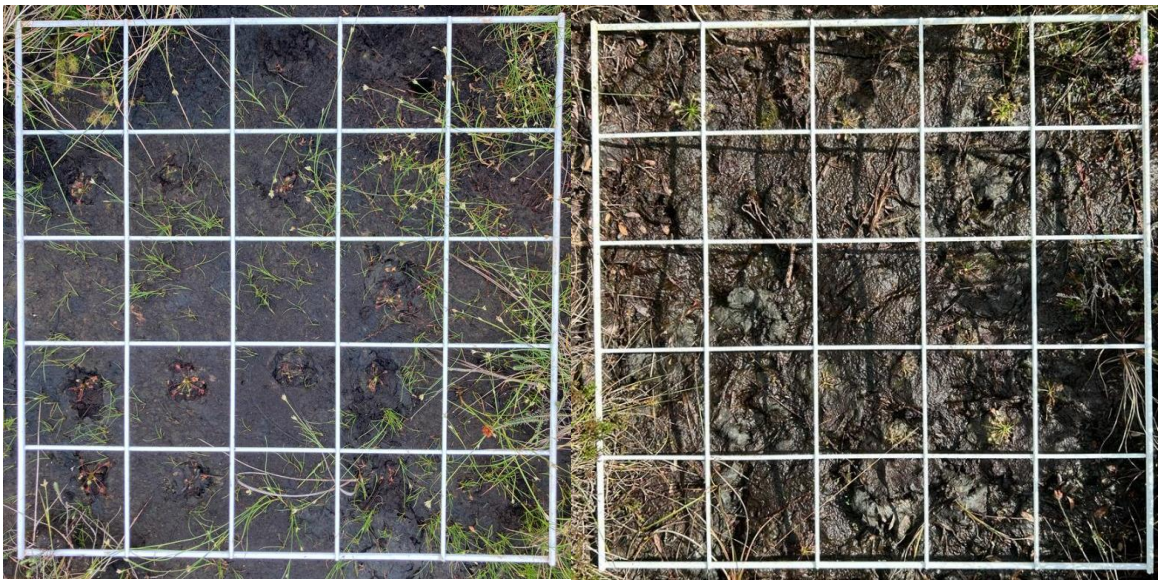

Figure 3.10: a) Oblong-leaved sundews on Meathop Moss; b) Oblong-leaved sundews at Foulshaw Moss

In September 2023, 88 oblong-leaved sundews were reintroduced into Foulshaw Moss (Appendix 4). The same methodology of planting on the bare areas of peat was used as it had proved successful at Meathop Moss in 2022 (figure 3.10b).

Recommendations

- Plant oblong-leaved sundews on sections of stable bare peat.
- Ensure the plants are large enough for reintroduction.
- Plant on a drier day in summer will give you easier and greater access to the bog.
- Plant within a quadrat and take pictures after planting so you have a record of which ones were planted and which ones are new sundews.
- Plant in areas with white-beaked sedge.

3.7. Monitoring and Results

Monitoring

Counting individual plants was the easiest ways to monitor survival of the sundews. The quadrat was placed over the original planting location and the number of individuals were counted. By using the picture taken during the planting session, the originally planted sundews can be accounted for and new individuals were also identified. Change in abundance over time was used to estimate the rate of population growth or decline.

The sundews were counted one month after planting during both 2022 and 2023, before going into dormancy in late October. The sundews planted in 2022 were counted in July the following year to assess survival rate but also to count how many sundews had produced flower heads. Flower heads were a good indicator of whether the sundews were thriving in their habitat, as the plants must catch enough prey to obtain enough energy to produce the flowers. The flowers were checked to see if they opened fully or whether they remained closed but self-fertilise (cleistagomy). Cross pollination increases genetic diversity and produces more plants via seeds than by vegetative spreading.

Future monitoring should include the individual counts in each quadrat, in addition to any counts of individuals that may have established around the quadrat; this will indicate if the population is expanding. Counting the number of plants flowering will also continue to show how the condition of the population is doing. The counting of individuals and flowers can be done at the same time if the monitoring is a scheduled for July.

Results

After one year of monitoring, the oblong-leaved sundews at Meathop Moss have survived better than the great sundews at Foulshaw Moss (Table 3.4). The high survival rate of oblong-

leaved sundews was expected as the donor population came from a raised bog, directly across the A590 and therefore the habitat was similar.

Table 3.4: Survival of both sundews at their planting locations after one year.

Location	Species	Number Planted	Number Survived	% Survival	Number Flowered
Meathop Moss	Oblong-leaved sundew	34	28	82.4	17
Foulshaw Moss	Great Sundew	64	3	4.7	0

The nestling of the great sundews in sphagnum did not work as a planting technique as only 3 survived. This could have been due to the water level rising in winter and washing away the peat surrounding the sundew, therefore, the sundew had nothing to root into and couldn't survive.

The donor population for the great sundew came from a valley mire rather than a raised bog. On Nor Moss they were predominantly found on the edge of bog pools and in the sphagnum flushes where the water runs into the bog from the surrounding land. This habitat is not replicable in Foulshaw Moss and could have been a key reason for the lack of survival.

Recommendations

- Count numbers at both donor and reintroduction sites to monitor population changes after harvesting and reintroduction.
- Count the sundews within one month of planting.
- Check to see if they are catching flies.
- Once they have gone dormant, leave them for winter before restarting survival count checks in May.
- Plant sundews on peat, not nestled into sphagnum, to allow for their roots to be stable in the peat.
- Count the sundews and flowers in July as only one monitoring day will be required.

4. Community Engagement Objectives

4.1. Public Engagement

BOOM has delivered various engagement activities throughout the project. In lockdown in 2021 Steven Lipscombe gave an online presentation for Morecambe Bay Partnership's "Sunset Series". Here he spoke about the plans for the sundews, maidenhair fern and green-winged orchids to various members of the public. A benefit of digital online events is the ability

to engage larger audiences with this species (over 100 people have viewed the online talk about sundews) without putting pressure on delicate bogs habitats that would be negatively impacted by large numbers of people visiting.

A sundew darts game was created by a University of Cumbria student, Sammy Haddock, whilst on placement with BOOM. The game uses metallic darts which represent flies, and they are thrown at a painted sundew on a metal board (Figure 4.1). The player has 3 darts, and the aim is to hit the sundews and get the most points. The leaves are worth one point and the flowers two points. This has been taken to “BOOM comes to you” events and has been a success. It provided a focal point to talk about the sundews in more detail with the community.

Figure 4.1: Sammy’s sundew game at our Barrow Event in September 2021

BOOM’s project officer Heather Marples has given Peatland Walks at Foulshaw Moss alongside Cumbria Wildlife Trust’s Paul Waterhouse and Keziah Taylor. At each walk ten people have been taught about the importance of peatlands and what CWT is doing to restore these habitats. BOOM explained the work we have been doing with the great and oblong-leaved sundew and were able to show the reintroduced great sundews during the walk in 2022. Providing some guided walks with very limited numbers, to reduce disturbance of the habitat, worked effectively as part of the community engagement with this species. The walk was attended by people who lived locally to the area and mainly attended by people over 45+. This type of engagement provided the opportunity for in-depth explanations and the opportunity for attendees to ask questions.

Foulshaw Moss was an ideal location to take Beaumont College and Mind in Furness as the boardwalk provides easy access for disadvantaged groups. Both groups thoroughly enjoyed the trip and learnt about sundews and the importance of wider peatland habitats.

Table 4.1: Summary of community engagement for sundews

Activity	Date	Number of Attendees
Online Talk – Orchids, Sundews and Ferns	25/02/2021	150
Foulshaw Moss Walk - 2021	18/08/2021	10
Foulshaw Moss Walk - 2022	17/08/2022	10
Bog In a Box Session & Aftercare	19/08/2022 to 13/09/2023	6
Foulshaw Moss Guided Walk for Mind in Furness	26/06/2023	7
Foulshaw Moss Guided Walk for Beaumont College	06/07/2023	10
Foulshaw Moss Walk - 2023	16/08/2023	10
Sundew Planting	13/09/2023	4
Total		**203**

Recommendations

- Undertake a variety of community engagement activities to reach out to a wider range of people in the community.
- Minimise taking people directly onto bogs as it is a sensitive habitat and excessive disturbance can have a negative impact of the biodiversity. Bog habitats can also be difficult to navigate, due to the water-logged nature of the sites and large pools of water.

4.2. Propagation and Planting

Propagation

The main volunteer engagement activity was the “Bog in a Box” initiative in 2022. The leaves were collected by BOOM staff and students and left in deionised water until the plantlets were large enough to be transferred onto peat. Then a session was held on campus on 19th August, where volunteers came and helped plant the sundews into peat. The volunteers placed 20 oblong-leaved sundews into each box (figure 4.2) and were able to take the box away to look

after them in their own garden. A WhatsApp group was established so people can discuss how their sundews were getting on and to swap hints and tips.

Figure 4.2: A Bog in a Box

This type of community involvement was an effective tool to engage with a new type of volunteer on the project. It was an opportunity for people with accessibility needs, who wouldn't otherwise be able to attend many other conservation tasks in the field, to still play an active part in this species reintroduction. It was also more suited to people that worked full time or had other commitments as it only initially required one session before returning home to look after their very own "bog in a box".

Planting

Volunteers planted out their sundews in September 2023. Of the 11 "bog in a box's that went to volunteers, seven boxes survived and were large enough to plant out at Foulshaw Moss. Four volunteers came and planted their boxes (Figure 4.3). The volunteers enjoyed being able to propagate the sundews and were "sad to see their babies go".

Figure 4.3: Volunteers planting their sundews at Foulshaw Moss

Recommendations

- Have a small number of people in the bog in a box group.
- Use the same volunteers who have been growing the sundews when planting out.
- As well as the bog in a box, send the volunteers home with an information sheet about sundews and a care guide.

5. Conclusions and Summary

The BOOM project worked with a wide variety of organisations and volunteers to successfully propagate and reintroduce great sundews and oblong-leaved sundews. A total of 206 sundews have been reintroduced to Meathop and Foulshaw Mosses: 88 great sundews and 118 oblong-leaved sundews. The oblong-leaved sundews at Meathop Moss had a successful first year of growth with 82.4% surviving and over half producing flowers.

At least 203 people have been educated about sundews, either through online talks, guided walks or by being involved with propagation and planting. The BOOM project engaged various community groups who all enjoyed learning about sundews and discovering the importance of peatland habitats.

Future work on the propagation of sundews will continue through the “Bog in a Box” initiative with Cumbria Wildlife Trust. The Witherslack Educational Officer will take the bog in a bog into local schools for the children to take care of over winter, before being reintroduced by the CWT Peatland Team into suitable sites that they have been restoring.

Further work would be identifying the best way to introduce the great sundew and maintain a high survival rate. Whilst BOOM has tried in 2022, it was relatively unsuccessful, and the sundews planted in 2023 will need to be monitored in 2024 for survival. Ongoing monitoring of donor and reintroduction sites will be vital for determining the success of the reintroduction of great and oblong-leaved sundews in south Cumbria.

6. References

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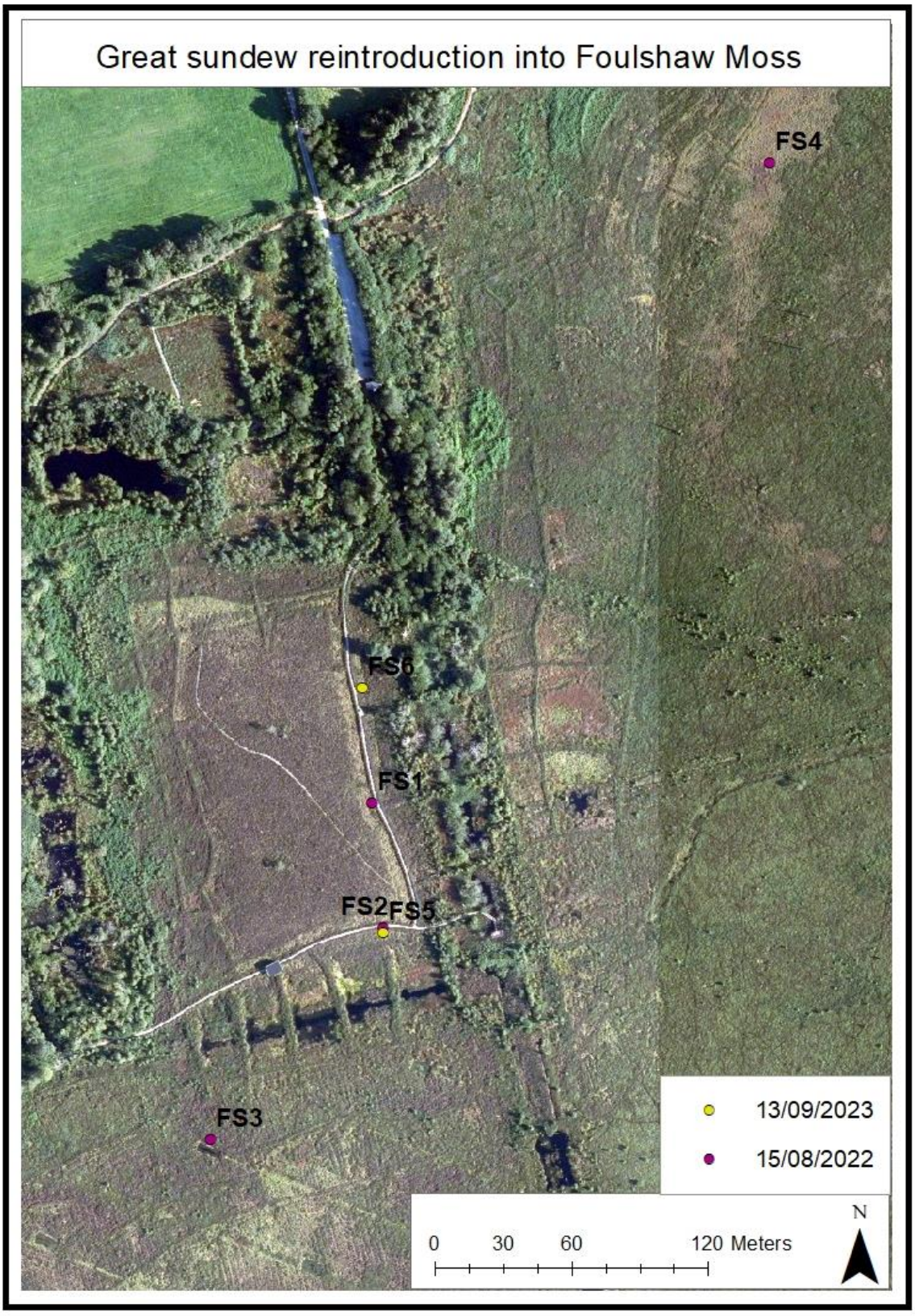
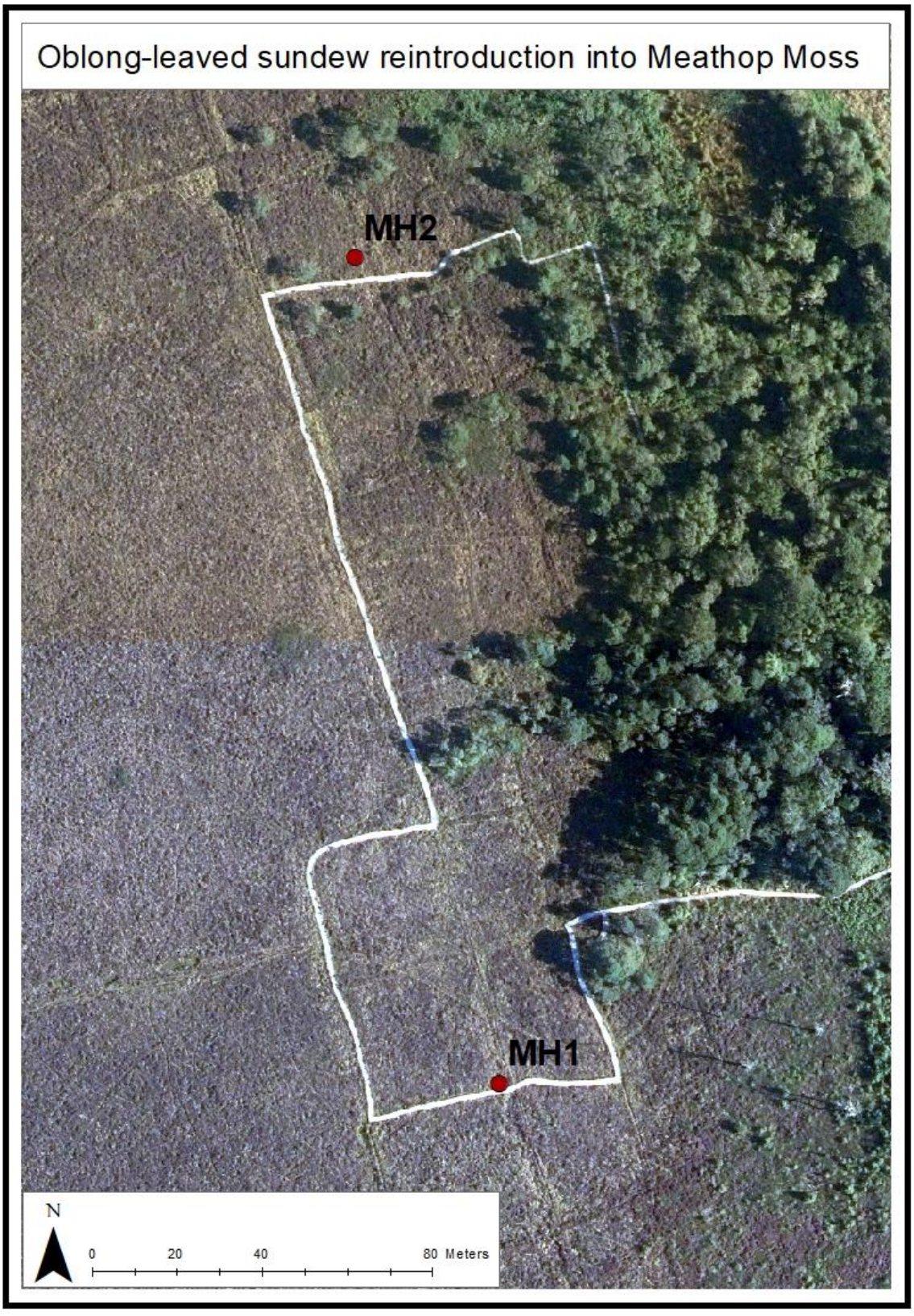
Sundews							
Activity: detailed description	**Target Audience**	**Benefits for people**	**Outcome**	**Resources**	**Timetable**	**Targets & measures of success**	**Method(s) of evaluation**
Planting out at suitable locations on Cumbria Wildlife Trust reserves and other places where micro habitat is suitable	All	People will have experienced natural heritage and seen good quality bog habitats. People will have learnt about heritage through learning about bogs. People will have had an enjoyable experience and participated in a species introductions.	Environmental impacts have been reduced – biodiversity has been enhanced. People will have learnt about heritage	CHO to liaise with CWT reserves officer – Paul Waterhouse as to timing and access 3 days	2021, 2022 - May	How many people volunteered. How many plants planted out. How many people engaged. Volunteers: 5 days	Count numbers attending and feedback forms.
Surveying for suitable receptor sites on the Witherslack Mosses CWT reserves and other sites as recommended by National Trust and natural England	Anyone who would like to learn survey skills. Communities of Interest.	People will have learnt about surveying habitats and survey protocols.	People will have had an enjoyable experience. Heritage will be better recorded. People will have gained skills.	CHO Liaise with Paul Waterhouse for access and possible CWT volunteers, also safe timings. EO to provide volunteers if none coming forward from CWT	2019, 2020 July/Aug	5 people surveying each site. Volunteers: 5 days	Head count Feedback forms
Collection of rare sundew plants and seed from Claife Mosses with permission of National Trust and Natural England, as stock to take cuttings from, and grow from seed	CHO only due to sensitivity of bog habitat. Could take along 1 or two volunteers	Rare plants will have been collected to provide propagation material for community growers and to enhance biodiversity on nature reserves.	Heritage will be better managed	CHO to visit moss with John Hooson (NT Wildlife Adviser) to collect plants in early / high summer. 1 collection day x 3 years plus prep time = 6 days over 4 years	2019, 2020, 2021 if required June	Sufficient plants collected for propagation. Volunteers: 2 days	Counting plants collected

Appendix 2: Foulshaw Moss Reintroduction Locations



Appendix 3: Meathop Moss Oblong-leaved Reintroduction Locations



Appendix 4: Foulshaw Moss Oblong-leaved Reintroduction Locations