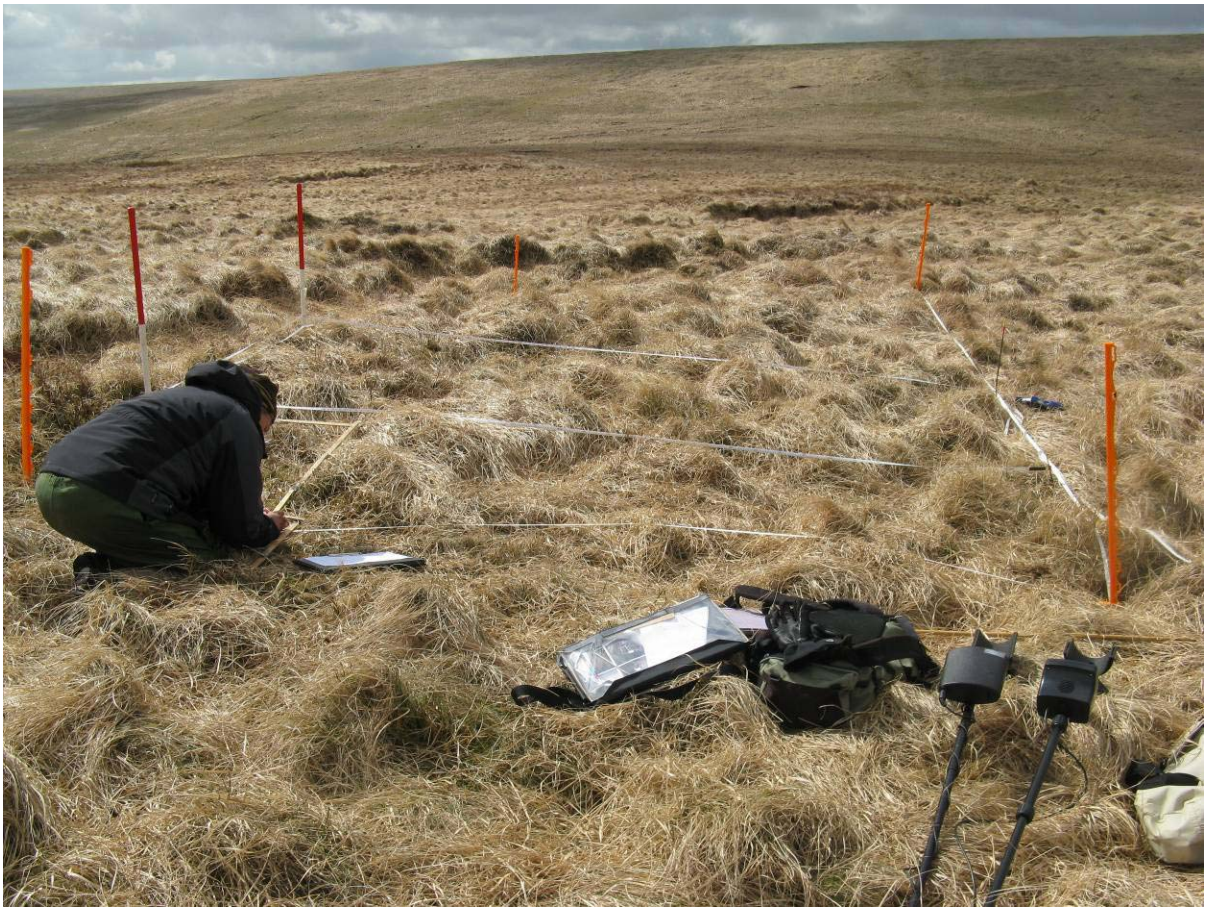
Resurvey of Dartmoor Forest vegetation plots and heather transects (Contract Ref. – SAE03-02-305); brief comments on the fieldwork and findings.

Belinda R Wheeler[1] and Philip J Wilson[2]

December 2010



[1]Cloudstreet, Brentor Road, Mary Tavy, Tavistock, Devon. PL19 9PY
Email: ecology@belindawheeler.co.uk

[2]Pennyhayes, Shute, Axminster, Devon. EX13 7QP
Email: philipjohnwilson@aol.com

Contents

1.0 Introduction

1.1 Project – Resurvey of Dartmoor Forest vegetation plots and heather transects

During 2010 Belinda R. Wheeler and Philip J. Wilson were awarded the contract SAE03-02-305) by Natural England to resurvey 25 permanent plots within Dartmoor Forest ESA, with the assistance of their survey team. The 2010 survey followed the previous surveys carried out by ADAS in 1994, 1997 and 2003. For further details refer to the contract specification and references cited in SAE03-02-305.

1.1.1 2010 Survey team details

(Contract Manager: David Glaves for Natural England, Exeter.)

Project Management: Belinda Wheeler and Phil Wilson.

Survey Team: Mark Darlaston, Nick Stewart, Marian Reed, Robin Webb, Belinda Wheeler (team leader), Phil Wilson (team leader).

Grazing Index assessment team: Mark Darlaston (team leader), Robin Webb and Belinda Wheeler.

Data entry: Belinda Wheeler and Phil Wilson

1.2 Report Brief

To provide brief comments on the fieldwork and findings including identification of issues encountered during fieldwork (e.g. in relocation of plots, etc.).

Comments have been provided on; time constraints to note for future consideration in repeat surveys, plot relocation including problems encountered; issues relating to accidental fires; data collection; individual permanent plots; and data entry.

2.0 Time constraints for future consideration in repeat surveys

2.1 Off-road vehicle capability

A vehicle with off-road capability is essential for this survey if the survey is to be completed within a reasonable timeframe. A Land Rover Defender/Discovery, Toyota Land Cruiser or other equivalent vehicle is ideal; a Subaru Forester used for part of this survey could get to most places e.g. Hangingstone Hill, but the track to Amicombe Hill would have been beyond it. Although there were some

very long walks to some of the more remote plots, the distances involved were shortened considerably by the use of a 4WD. This was particularly so on North Dartmoor where army tracks allow vehicle access as far as, for example, Dinger Tor, Hangingstone Hill, Amicombe Hill. Any repeat surveys without the use of such a vehicle would require more time and single plots may not be completed within one day unless the number of surveyors per plot were to be increased.

2.2 Weather

We were extremely lucky during the March–May 2010 survey window that the weather was largely dry and relatively warm, with little snow fall. Inclement weather can either increase the time it takes to survey a plot or prevent survey altogether in the case of severe gales, heavy rain or snow. Provision for poor weather should be considered in the future.

3.0 Plot relocation

3.1 Equipment/skills required for relocation

The relative ease with which each of the 25 Dartmoor permanent plot sites selected for resurvey in 2010 was relocated was variable. Relocation of plots required the use of the following:

- Orienteering skills of the survey team to locate the general area of the plot, using a 1:25,000 OS map and a GPS unit.
- The sketch map provided in previous surveys – sometimes several sketch maps were used (1994, 1996 and 2003).
- Photographs of the origin and the plot.
- The GPS reading provided from the 2003 survey of the origin (a recognisable landmark which had been permanently marked with a metal pipe, from which distances and accompanying bearings to the stand had been made).
- Ranging poles and 100-m tapes to mark the origin–stand line.
- The GPS reading of the stand.
- Metal detectors to locate the metal pipes marking the origin and the four corners of the stand. New Viking VK30 metal detectors were purchased for this contract. These British-made detectors have both Motion and Non-motion detection modes; Motion mode is used to generally home in on the rough location of the metal pipe, whilst the Non-motion mode is extremely useful for the last stages of locating the exact location of the pipe.

- A strong metal screwdriver c. 30cm in length to probe the ground for the metal pipe (the pipes were deeply buried in many cases).

3.2 Problems encountered with relocation

3.2.1 Sketch maps

Most sketch maps were accurate and detailed and proved invaluable. However, some were vague, showing, for example, the origin on a heather covered mound when the area in question was made up entirely of heather covered mounds. It is appreciated that Dartmoor is often a very featureless landscape with a lack of obvious landmarks, but perhaps any further surveyors should be encouraged to make as many notes on location as possible. With the advent of new Wide Area Augmentation System (WAAS) enabled, highly accurate (±2–3m) GPS units, in practice this may become less important.

3.2.2 GPS readings

The 2003 survey took place prior to the availability of WAAS enabled GPS units and so grid references supplied could be ±8m. This is a wide margin of error, at that time beyond the control of the survey team, but certainly added time to the relocation process and on occasion, prevented the relocation of the stand marker pin.

3.2.3 Origin location selection

In one particular case the origin was positioned next to a recognisable landmark in the form of a bog pool. Unfortunately the position of the origin marker pin was placed too close to the bog pool and the inevitable occurred – the metal pin in the intervening years has sunk without trace into the highly waterlogged, soft and still growing peat on the margins of the pool.

A second origin was located on the edge of the army road, adjacent to an off-road track. This track has since been closed off to army traffic, and the bank at the side of the road built up to prevent access. The location of the origin pin was somewhere under the new 1m high bank and never found. Luckily there were further marker pins along a line from the origin to the stand but considerable time was used up trying to locate this second pin from approximate locations of the original origin.

Two points for future reference are.

1. Origins should be selected in places where they are likely to be permanent, i.e. away from waterbodies where the size/area fluctuates

with precipitation, away from soft peat areas, away from structures used by people and therefore likely to be altered or removed.

2. New origin marker pins should be positioned if the plot can be relocated using other means, to assist future surveys. In both the above cases the stands were eventually found using the other aids available (photos, GPS readings etc) but had the survey team carried extra metal pins new origin markers could have been positioned in more appropriate locations to prevent a repeat of the above rather long-winded searches.

3.2.4 Featureless landscapes

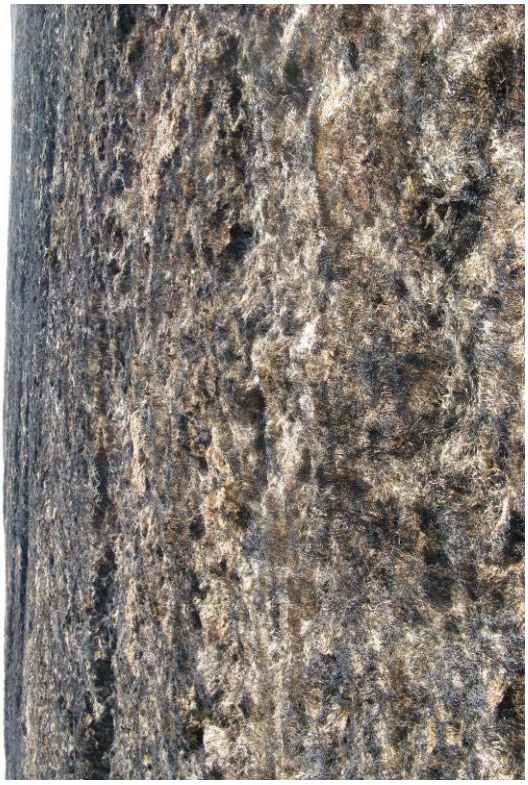
As mentioned above, Dartmoor can be a very featureless landscape with vast areas of open moorland with no rocks, pools or other landscape features. In a couple of cases despite the very best efforts of the previous survey teams to describe the location of a stand, and the very best efforts of the 2010 survey team to relocate it, the stand could not be found. Again the advent of new Wide WAAS enabled, highly accurate GPS units should really aid relocation in such habitats in future.

4.0 Issues relating to accidental fires

4.1 Fire hazard in relation to carrying out survey work

The survey team encountered accidental fires on Dartmoor on two occasions during the 2010 survey. On the first occasion the survey team was turned back by the fire brigade on arrival at the end of the 5 or 6 km track to Kitty Tor because Amicombe Hill (where several plots were located) was on fire. Valuable survey time was lost due to this as the survey team had to retreat and select another plot on a different part of the moor to survey.

In a second incident the survey team were surveying on the south moor near to Naker's Hill when the leading front of a mile-wide fire was noticed advancing towards them approximately 1 km to the east. The survey team withdrew (quickly) back to their vehicle 3km westwards. The vegetation survey had already been completed but the heather transects and sampling had yet to be completed. The site was revisited several weeks later and the heather sampling part of the survey successfully finished but further survey time was lost due to this incident and it also highlighted the danger from accidental fire events and the speed with which they can threaten surveyors. For your interest, on return the burnt area from this fire stopped c. 100m from the survey plot – a near miss.



Above: Accidental fire damage on Amicombe Hill affecting plot 117.

Below: The accidental fire on Ter Hill to Naker's Hill that destroyed plot 4 and required swift evacuation from plot 39.

4.2 Destruction of plots through accidental fire

The first fire mentioned above on Amicombe Hill severely burnt one of the survey plots (plot 117), including land for several hundred m in all directions and narrowly missed two further plots (plots 44 and 118). Plot 117 could therefore not be surveyed during 2010.

The second fire on Naker's Hill severely burnt plot 4, which could also not be surveyed during 2010, but narrowly missed plot 39.

5.0 Data collection

5.1 Duplicate plot numbers

In more than one site folder (DEFRA brown foolscap folders containing paper copies of previous survey data provided by Natural England) there is data relating to two different plots, both with the same number. Details of this are provided in the plot-by-plot notes below, but for example, plot (old stand) 97 in the 2003 survey was located at SX62754.89573, which is Metheral Hill on the north moor. However, at the back of the folder is a form containing site data for site number 97, at SX6236.6773; this corresponds to an area on the south moor some miles distant. Caution should be exercised when comparing data from previous years, taking care that the data surveyed is indeed from the same plots, by comparing grid references and not just plot numbers.

5.2 Old stand numbers and new PSU codes

There is potential for confusion, when looking at the data collected in 2010 or previous years, with regard to plot or stand numbers. The original or old stand numbers ranged from Stand No. 1 to Stand No. 121, but apparently were not numbered consecutively, or some stands were removed at some point for reasons unknown. For example, it appears there is no old Stand No. 25, 43, 53–79 or 102–109. For data analysis the stands were renumbered (presumably by Natural England or by the data analyst, BioEcoSS), consecutively from 1–83 (the total number of stands or plots remaining) and given a new Primary Sample Unit code accordingly (PSU 1 to PSU 83). A stand conversion chart is provided in Table 1 (source: Simon Poulton, BioEcoSS).

Table 1 Stand conversion chart.

Stand Conversion Chart									
Use this to convert the Stand Numbers provided by NE into the PSU (Primary Sampling Unit) Codes required for data input									
Old Stand Number	New PSU Code		Old Stand Number	New PSU Code		Old Stand Number	New PSU Code		Old Stand Number	New PSU Code
1	1		26	25		51	49		110	73
2	2		27	26		52	50		111	74
3	3		28	27		80	51		112	75
4	4		29	28		81	52		113	76
5	5		30	29		82	53		114	77
6	6		31	30		83	54		116	78
7	7		32	31		84	55		117	79
8	8		33	32		85	56		118	80
9	9		34	33		86	57		119	81
10	10		35	34		87	58		120	82
11	11		36	35		88	59		121	83
12	12		37	36		89	60			
13	13		38	37		90	61			
14	14		39	38		91	62			
15	15		40	39		92	63			
16	16		41	40		93	64			
17	17		42	41		94	65			
18	18		44	42		95	66			
19	19		45	43		96	67			
20	20		46	44		97	68			
21	21		47	45		98	69			
22	22		48	46		99	70			
23	23		49	47		100	71			
24	24		50	48		101	72			

5.3 Heather sampling transect

5.3.1 Data form

The data form for the heather monitoring transect was redesigned during 2010, for the 2010 survey, by Simon Poulton of BioEcoSS, after some discussion with Belinda Wheeler of WEA on the data collection methods and variables to be recorded. The aim of this exercise was to ensure that the data collected was in an appropriate format for the subsequent entry of the data in the 'Dartmoor Worker' (see below) to be used to analyse the data. The new data form was introduced early on in the 2010 survey but not from the very beginning as it was not available at that time. The new data form is shown in Appendix 1.

The new data form shows both a quadrat code 1–48, for the identification of quadrats sampled along transects 1–8 (see below), and most importantly, so that the heather samples collected could be accurately labelled with a quadrat number. However, the data form also shows a Fixed Sampling Unit (FSU) code,

in this case 145–192. This is because the quadrat data and heather samples from the 2010 survey represent (up to) 48 new fixed samples in addition to the (potential) 144 fixed samples (quadrats) recorded in the previous surveys. For greater elucidation on this point please refer your questions to Simon Poulton at BioEcoSS.

5.3.2 Transect method

All survey methods during the 2010 survey followed the specification provided in the Contract Specification SE03-02-305.

Number of transects

The number of quadrats and transects has varied in previous surveys. The methodology calls for four 60-m transects on random bearings radiating out from the plot origin post, along which six quadrats are placed on randomly generated distances from the origin. Within each quadrat, in addition to the various variables recorded, up to four heather stems were to be collected. This gives a maximum possible number of heather samples of 24 per plot (4 samples × 6 transects). However, heather within each quadrat, or even transect is unlikely, so to achieve a minimum sample target of 12 heather samples in previous years further transects were set up and sampled. There was some discussion during the training day whether a fixed number of six transects should be sampled instead of four to achieve the minimum target of 12 heather samples. However, on balance, it was agreed by Natural England and WEA that four transects should be the starting point, with up to four additional transects recorded if heather samples were less than 12. Transects recorded in the 2010 survey were therefore, either 4, 5, 6, 7 or 8 in number.

Random bearings

New random bearings were generated (using a simple random number generation program) for the positioning of each transect, but unlike previous years, these bearings were stratified. One bearing number was generated for each 90° angle (1–90°, 91-180°, 181-270° and 271-360° respectively), with the aim of sampling the entire surroundings of the plot location, rather than over-sampling one direction or area only due to clumping in the random numbers generated. This method was repeated for the optional additional four transects. It was also hoped that if heather was not spread across the entire area of the plot surrounding, this method would be more likley to 'hit' heather along a number of quadrats. Random bearings generated are shown below; this information is shown in the heather sampling form in Appendix 1 that was carried by all survey staff.

New random distances were generated (using a simple random number generation program) for the positioning of each quadrat along each 60-m transect. Six numbers were generated between 1 and 60 for each transect; the

random distances for quadrat positioning are shown below and in the heather sampling form in Appendix 1 that was carried by all survey staff.

Table 2 Random bearing and distances generated for the 2010 survey.

Transect and Quadrat Locations								
Transect	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Bearing (º)	48	123	249	300	172	28	356	194
Quadrat Numbers:	**1-6**	**7-12**	**13-18**	**19-24**	**25-30**	**31-36**	**37-42**	**43-48**
Distances (m)	18	8	7	27	10	4	6	19
	20	25	19	32	27	21	19	26
	26	39	26	35	38	29	20	27
	28	40	38	36	39	37	27	30
	54	56	40	50	48	47	36	36
	60	59	43	53	53	55	49	47

Vegetation cover

Percentage cover of *Vaccinium myrtillus, Calluna vulgaris* and Dwarf Shrub combined) was recorded in whole numbers, with the exception of cover values of less than 1%. On the paper copies of the forms some surveyors recorded to one decimal place (e.g. 0.5%), whilst others recorded <1%. This was standardized to <1%, but it later transpired that the 'Dartmoor Worker' for data entry only accepted whole numbers for cover, with the lowest cover value being 1%. Since 1% cover of a 1×1m is 10×10cm, and in practice there is frequently much less than this area covered by any of the vegetation variables mentioned above, a measure of <1% is considered far more accurate and useful as a measure than simply assigning all 1% and below cover values to 1%.

6.0 Notes on individual stands / plots

4 (PSU 4) NW of Naker's Hill SX63246916

This plot was entirely burnt during the accidental fire that swept across Naker's Hill on 15 April 2010. The plot was visited on 04 May 2010 and the only unburnt area within 400m of the plot was the area of pits and boulders to the east of the plot where the origin pipe was located (and easily relocated in 2010). The origin pipe is in an area of short acid grassland in small (quarry?) pits, with thin soils and is boulder strewn with no shrubs or peat, and therefore escaped burning. The surrounding area is blanket bog over deep peat (where the plot is located) and did not escape the fire. No survey took place, and there were no unburnt areas within 400m of the plot so no heather samples were taken.

This plot was also burnt in 2003 and unsurveyed during that year.

6 (PSU 6) NNE of Wild Tor SX62408810

This plot could not be located in 2003 nor during this survey. The origin is located with reference to the remains of a tinner's hut and a large boulder. Both landmarks were easily refound, but no pipe could be found at the origin or at any subsequent point. An attempt was also made to relocate the plot with reference to the two most appropriate range posts. These range posts may have been moved since the original survey.

7 (PSU 7) East of Greena Ball SX56997788

No grid reference was provided for the origin of this plot although the large mound indicated was found. Peat erosion has affected the site of the origin pin and no metal pin was relocated, a situation made harder by the presence of many shell cases that gave false readings on the metal detector used. However, the plot was relocated and all marker pins were present. A new, more appropriate origin was recorded at SX57016 77869; a large rock to the SE of the plot. This origin requires a new pipe.

The pot is located in U5 grassland as indicated by the previous surveys. *Calluna* was absent in the nested plot but present at low cover in the surrounding area of rough acid grassland.

8 (PSU 8) Vergyland Combe SX59408680

This plot is in an area of M15d degraded blanket bog and was relocated using the grid reference provided in 2003 for the plot marker pin in the corner of quadrat nest 4. There was little *Calluna* in the plot and little in the surrounding area. The 1994 survey noted that most heather in the area was dead.

33 (PSU 32) S of West Dart Head SX60008120

Note/ The grid reference provided for this plot in the contract specification for 2010 (SAE03-02-305) was incorrect. The grid reference provided was that of plot 34, not plot 33. We can confirm that we searched the correct location (SX60008120) for this plot, provided in the 1994 field survey notes.

As with 2003, plot 33 could not be relocated during 2010 despite an extensive search by 3 surveyors. The plot is located in an extensive area of M17 blanket bog with many peat bogs, runnels and peat hags. There were no obvious

features to use as an origin in 1994 and the bearings provided to nearby tors did not prove precise enough to relocate the metal pipe. Heather transects were carried out using the 1994 plot grid reference as a starting point. *Calluna* was quite frequent in this area, with some dead heather due to heather beetle damage, but this was mild in comparison with other plots surveyed during 2010 on other parts of the moor.

Empetrum nigrum was located in the vicinity of this plot at SX59966.81190 – cover approximately 3% of a 1 x 1 m quadrat.

34 (PSU 33) SE of Winney's Down SX62578230

Note/ The grid reference provided for this plot in the contract specification for 2010 (SAE03-02-305) was incorrect. The grid reference provided was thought to be that of plot 35, not plot 34. We can confirm that we searched the correct location (SX62578230) for this plot, provided in the 1994 field survey notes.

The mound indicated as the origin point was located but no metal pin was found. However, the plot marker pins were relocated using the mound located with the bearing and distances provided. The plot was located in an extensive area of M17 blanket bog. The area was dominated by *Eriophorum* sp. with little *Calluna.*

39 (PSU 38) NW of Swincombe Head SX63316985

This plot was easily relocated, with the origin pipe and all four quadrat pipes located. The plot is in an area of dry acid grassland in a boulder zone adjacent to the River Swincombe. The original NVC community of U4e provided still appears correct. There was some dispute in this plot as to the abundance of *Deschampsia flexuosa* which was recorded more frequently in previous surveys.

Plot 39 narrowly missed being burnt following the accidental fire that swept across much of Nakers Hill on 15 April 2010 – the day of the survey. This plot was abandoned during the fire (having already completed the vegetation survey) and the surveyors returned on 04 May 2010 to complete the heather transect. The fire had stopped short of the plot by *c.* 100m. There was much dead *Calluna vulgaris* in the vicinity of this plot, apparently from heather beetle damage.

40 (PSU 39) S of Great Kneeset SX58918453

Plot 40, which was not relocated during the previous survey in 2003 was relocated in 2010. The problem of relocation was due to the absence of a marker pipe at the origin; the pipe had been positioned on the margins of a deep

bog pool and presumably subsequently sank without trace in the peat/pool vegetation. The plot was relocated using the bearings and distances provided. Three of the plot marker pipes were found, although they had sunk very deep into the peat. No pipe was found at Q29 (NW corner).

The plot is located in an area of M17 blanket bog with bog pools. *Sphagnum, Molinia* and *Eriophorum* dominate, but *Calluna* is frequent within the stand and occasional in the locality.

This pot requires a new marker pin and origin.

41 (PSU 40) E of Wild Tor SX62608770

Plot 41, the origin and the intervening pipe were located with relative ease. The origin is a trio of boulders (Wild Tor Well) as described in 1994, with the pipe buried at the north-west of this. The 60m pipe is at the base of the steep, boulder strewn slope. The plot is on the gentler, but still boulder-covered slope above this in a stand of H12, below the transition to U5 grassland. Only the south-eastern corner of the plot is marked by a pipe due to the density of boulders. This pipe is in a small triangle of vegetation between three boulders. The south-eastern corner can be more easily located by taking a bearing of 41.6m at 92^0 from a large isolated boulder visible from the plot on the horizon in the U5 grassland above. This bearing also passes directly through the north-west corner of the plot.

Much of the heather in this plot is recently dead, probably from the effects of heather beetle.

44 (PSU 42) SW of Amicombe Hill SX56588560

Plot located surprisingly easily using diagram from the 1994 survey. The origin is within a trio of boulders at the western end of a prominent peat scar, and the pipe is located by the eastern corner of the westernmost of the three. The plot was located by taking a bearing from the origin. It is located in dry, degraded M15d blanket mire, the vegetation consisting largely of *Molinia* litter and *Hypnum jutlandicum*.

45 (PSU 43) SE of East Okement Farm SX60809090

The origin pipe is situated on the south-eastern trackside to the south of the junction with a small side-track, to the north of two boulders and 10m north of a range pole. A bearing of 115m at 124^0 finds the NW corner of the plot. The midway pipe at 50m is located just before a slight depression with boulders.

There is a boulder to the south of the SW corner of the plot. The north-east corner of the plot is not marked by a pipe, and is 10m from a pair of boulders to the east. The plot is located in tussocky grassland with abundant *Agrostis curtisii* probably closest to U4e. Any *Calluna vulgaris* present is heavily pruned.

49 (PSU 47) W of Plym Ford SX60906850

As with 2003 no origin marker pipe was found but the pipe at 11m along the location-transect was easily found. *Calluna vulgaris* was constant within the plot in 2003 but has seriously declined since. This plot is recorded as in H12a/c heath but the community in 2010 was more akin to the grass-rich H12c transitional to bent-fescue grassland (U4e) with *c.* 30% *Vaccinium myrtillus* and very little *Calluna vulgaris*. There was much dead heather in the vicinity of the plot, attributed to heather beetle damage.

94 (PSU 65) N of Quintin's Man SX62098433

This plot is reached from the end of the forestry track immediately to the east of the former Teignhead Farm. It is situated in M15d degraded blanket mire dominated by a dense mat of *Molinia* litter. The approximate location can be found by sighting the observation posts to the south and Sittaford Tor to the south-east. There is an isolated large boulder 54m from the plot to the north-west, while the origin is a similar boulder 70m from the plot at 100m. The origin pipe and the plot corner pipes were easily refound.

95 (PSU 66) Brown House SX61377915

This plot is reached from the information centre car park at Postbridge, and is situated on the western slope of Lower White Tor in U4e grassland dominated by *Festuca ovina*. This slope has scattered boulders, and the plot is located between two large boulders, 16m from the origin to the east, and 14m from the other to the west. There are smaller, partially covered boulders on either side of the plot. The origin and corner pipes were all easily located.

96 (PSU 67) Black Hill SX60738482

This plot is situated on the east-facing slope of the East Dart valley in vegetation dominated by dense *Molinia* litter. It can be approximately located 40m below a a large boulder with a temporary pool. To the east of this boulder is a large, flat rock, and the origin pipe was easily found at the southern end of this. These are the only large boulders in the vicinity. The plot is at a bearing of 36m downhill

to the east from the origin with intervening pipes at 10m and 25m. All corners of the plot are marked with pipes.

97 (PSU 68) Metheral Hill SX62738959

Plot 97 in the 2003 survey was located at SX62754.89573, which is Metheral Hill on the north moor. However, at the back of the folder is a form containing site data for site number 97, at Black Hill SX6236.6773; the grid reference corresponds to an area on the south moor some miles distant, but does not correspond with Black Hill which is the location of plot 96. Caution should be exercised when comparing data from previous years, taking care that the data surveyed is indeed from the same plots, by comparing grid references and not just plot numbers. The 2003 plot location (SX62738959) was resurveyed during 2010. The plot was easily located using the information supplied but a new sketch map of the location of the origin was made.

The NVC data supplied for plot 97 was H8b. However, there was very little *Calluna vulgaris* and no *Ulex gallii*. The stand is located a rough acid grassland / wet heath mosaic more akin to U4e / M15d.

98 (PSU 69) Riddon Ridge SX66587575

The NE folder containing site details for this plot includes plot information relating a different location to this – it refers to a plot 98 at SX64336947. This is some miles away near Nakers Hill on the South Moor. The plot surveyed in 2010 (and in 2003) was the pot indicated in the specification provided at SX66587575.

The stone at the origin was located very easily and the marker pin found. The two *Ulex europeus* bushes that stand either side of the stone had escaped a recent burn in the area. The plot itself was also easily relocated. The plot consisted of very tall *Ulex gallii* 80–>100cm in height, making the marking and recording of the plot very difficult (and uncomfortable). The 2003 photographs show the plot as more open with shorter *Ulex* and greater species diversity. There was no *Calluna* within the plot and none in the transects with the exception of 3 small 1–2 yr pioneer plants located in a recent burn area.

99 (PSU 70) Broad Down SX63328060

Origin pipe found easily near gateway as indicated in sketch map but pipe at 25m along location-transect could not be found. Transect was abandoned in favour of using the GPS grid reference provided and a nearby landmark – a bog

pool – shown on the photographs. The plot was then easily relocated in M15d wet heath with frequent *Calluna.*

100 (PSU 71) E of Dinger Tor SX59568834

The track and prominent stone that were used to locate the origin for this plot in 1994 have subsequently been destroyed. The track has been closed off with a bank construction of earth and granite blocks, and the location of the origin matker pipe buried or dug over. A marker pin at the 15m mark along the location-trasect was eventually relocated and from this the plot itself relocated in an area of M15d wet heath. There were many false positives in relocating the marker pins using a metal detector due to the presence of many shell cases and shrapnel in the area. The GPS reading for a new origin was made.

Calluna was frequent in this area.

101 (PSU 72) SE of Fernworthy Forest SX67008176

Plot 101 was selected for the Training Day with the survey team and representatives from natural England. The origin, plot and all marker pins were easily relocated (since there were 7 team members to look for it) in an area of H12c heath with frequent to abundant *Calluna*.

114 (PSU 77) East Dart Head (MoD) SX61178565

This plot is to the south-west of Hangingstone Hill at a bearing of 231^0. This gentle south-west facing slope is dissected by small gullies leading into the source of the East Dart River. There are no obvious landmarks. The origin is on the southern bank of one the larger gullies approximately 1.5m deep, immediately to the east of an easy crossing point, approximately 40cm from the low peat cliff. The plot is marked by pipes in all corners, and in 2010 the two southern corners were still marked by partly buried yellow poles.

116 (PSU 78) Cranmere Pool (MoD) SX60108540

There is no origin for plot 116, which is located in an area of featureless blanket bog (M17a) over deep saturated peat. This plot is located in an area where some of the deepest peat on Dartmoor is believed to be located (Hangingstone Hill vicinity, peat depth >7m, Forest of Dartmoor Trustees, pers. comm.). A small bog pool marked on the 2003 sketch map was found (although there were obviously other pools in the area) and the plot marker pins found following this using the grid references and metal detectors. No pipe was found at nests Q1,

and the pins at Q29 and Q32 were lying horizontally in the waterlogged peat. GPS grid references were taken for all four corners to aid future relocation.

Calluna was frequent to abundant. The blanket bog habitat was some of the best noted during this survey with much *Drosera rotundifolia, Narthecium ossifragum, Eriophorum* spp., *Sphagnum* spp. and *Erica tetralix.*

117 (PSU 79) Amicombe Hill (MoD) SX57038609

A survey of this plot was attempted on 14 April 2010 but the survey team were sent away by the Fire Brigade at the top of the Rattlebrook Track because Amicombe Hill was on fire (due to an accidental burn). The team returned to the plot on 22 April but the plot and the surroundings for several hundred metres in all directions were burnt. No vegetation survey or heather transect could be carried out but the location of the origin was checked, and the stone used to locate the origin was still clearly visible.

118 (PSU 80) S of Amicombe Hill (MoD) SX56998464

Plot 118 is located in an area of M17c blanket bog with high *Eriophorum* and *Sphagnum* cover with varying cover of *Calluna* over the plot, but much in the locality which appeared little grazed. The origin was relocated using the sketch map despite the large number of similar raised mounds in this hummock/hollow area. All four plot marker pins were relocated although pipes were becoming less upright in the deep peat. The area has been burnt in the recent past, evidenced by the presence of a melted yellow pole along the location-transect.

This plot narrowly missed being burnt in the accidental fire that swept across Amicombe Hill to the NE and destroyed plot 117 in 2010.

119 (PSU 81) SE of Great Mis Tor (MoD) SX56667681

The recent remains of a dead sheep (too decomposed to move) across nests 1, 5 and 9 rendered these nests unsurveyable in part (particularly cells 1–8 in nest 5). The data from this plot is therefore less accurate. This plot is still located in *Nardus stricta* dominated U5 grassland although no *Calluna vulgaris* was located within the plot and very little in the surrounding area, thus affinities with U5a/c is more appropriate than U5d.

Table 3 Updated table of details of Forest of Dartmoor permanent plot sites.
Y indicates that a plot was surveyed in a particular year. (Y) refers to plots that were not relocated and therefore have incomplete (heather only) data. N indicates that the plot was not relocated, and no heather samples collected. (burnt) indicates plot destroyed by fire during 2010. (MoD) indicates sites that have been surveyed for MoD. Where sites have been upgraded to Tier 2B during the agreement this is indicated by (2B). The two grid references in bold have been corrected from the table in the contract specification provided (SAE-03-02-305).

Plot	Site name	Grid ref	Tier	Suppl.	SSSI	Unit no.	NVC	1994	1997	2003	2010
4	NW of Naker's Hill	SX63246916	2B		South Dartmoor	40	M17b	Y	Y	N (burnt)	N (burnt)
6	NNE of Wild Tor	SX62408810	1E	WC	North Dartmoor	25	M15d	Y		(Y)	*N
7	East of Greena Ball	SX56997788	1E	WC			U5b	Y	Y	Y	Y
8	Vergyland Combe	SX59408680	1E	WC	North Dartmoor	36	M15d	Y	Y	Y	Y
33	S of West Dart Head	**SX60008120**	2B	WC	North Dartmoor	31	M17b	Y		(Y)	(Y)
34	SE of Winney's Down	**SX62578230**	1E (2B)	WC	North Dartmoor	48	M17a	Y		Y	Y
39	NW of Swincombe Head	SX63316985	1E	WC	South Dartmoor	40	U4e	Y	Y	Y	Y
40	S of Great Kneeset	SX58918453	1E	WC	North Dartmoor	29	M17a	Y	Y	(Y)	Y
41	E of Wild Tor	SX62608770	1E	WC	North Dartmoor	24	H12c	Y	Y	Y	Y
44	SW of Amicombe Hill	SX56588560	1E	WC	North Dartmoor	18	M15d	Y	Y	Y	Y
45	SE of East Okement Farm	SX60809090	1E	WC	North Dartmoor	51	U3	Y	Y	Y	Y
49	W of Plym Ford	SX60906850	1E	WC	South Dartmoor	28	M25a	Y	Y	Y	Y
94	N of Quintin's Man	SX62098433	1E	WC	North Dartmoor	27	U5d			Y	Y
95	Brown House	SX61377915	1E (2B)	WC	North Dartmoor	47	M25a			Y	Y
96	Black Hill	SX60738482	2B		North Dartmoor	29	U4e			Y	Y
97	Metheral Hill	SX62738959	1E	WC	North Dartmoor	25	H8b			Y	Y
98	Riddon Ridge	SX66587575	1E	WC						Y	Y
99	Broad Down	SX63328060	1E (2B)	WC	North Dartmoor	46	M15d			Y	Y
100	E of Dinger Tor	SX59568834	1E	WC	North Dartmoor	36	M15d			Y	Y
101	SE of Fernworthy Forest	SX67008176	1E	WC	East Dartmoor	1	H12c			Y	Y
114	East Dart Head (MoD)	SX61178565	2B		North Dartmoor	28	M17a			Y	Y
116	Cranmere Pool (MoD)	SX60108540	2B		North Dartmoor	28	M17a			Y	Y
117	Amicombe Hill (MoD)	SX57038609	1E	WC	North Dartmoor	19	M15d			Y	N (burnt)
118	S of Amicombe Hill (MoD)	SX56998464	1E	WC	North Dartmoor	18	M17c			Y	Y
119	SE of Great Mis Tor (MoD)	SX56667681	1E	WC			U5d			Y	Y

7.0 Data entry

7.1 The Dartmoor Worker (BioEcoSS) - EMD v1.0

Simon Poulton of BioEcoSS Ltd was awarded the contract by Natural England to carry out the analysis of the data collected during the 2010 survey (contract SEA03-02-063). To aid in the analysis of the data a 'worker' was designed by BioEcoSS for the entry of the data, both (1) plot [Grassland ADAS plot] data and (2) heather grazing [biomass utilization] transects.

The resulting worker is a MICROSOFT ACCESS based database, developed for use with ACCESS 2007, named EMD v1.0. At the request of Belinda Wheeler, two workers were created so that two members of the 2010 survey team could each enter data they held into separate workers (since the team is spread across two offices in Devon). It should be noted that EMD v1.0 works with the earlier version ACCESS 2003, but functionality is reduced. The spreadsheet is small in ACCESS 2003 and cannot be resized, which makes data entry harder. It is recommended that ACCESS 2007 is used wherever possible.

It is not the intention to fully describe EMD v1.0 here, but to provide comments on its useage only.

7.2 Using EMD v1.0; Dartmoor ESA – Heather 2010

7.2.1 Grassland ADAS plot

The botanical data collected for each permanent monitoring plot (32 nested quadrats within each plot, each with 10 cells) and entered onto the ADAS PLOT METHOD – CUSTOM FIELD FORM, was entered into this spreadsheet within the FSU Temporal Data of the Catalogue within EMD v1.0.

A single spreadsheet with one dataset was used for each plot. The spreadsheet had dropdown lists for species code, latin name and common name of each species and 32 columns for each nested quadrat. Because each plot had only one fixed survey unit (the nested 4m x 8m quadrat), only one spreadsheet had to be completed per plot.

This part of EMD v1.0 proved very quick to use, with data entry speeded up by the dropdown menus and accuracy facilitated by the named columns with nested quadrat number. There was, as with all spreadsheet entry, room for human error in entering the data in the columns. Errors spotted by Belinda Wheeler and Phil Wilson in their own data (when subsequently checked), and also spotted by Simon Poulton on receipt of the completed spreadsheets, were confined to very

occasional typographic errors in the cell numbers entered into the nest column. However, these errors were easily spotted and rectified prior to data analysis.

Most species encountered were in the dropdown lists provided, but additional species could be added.

Note/ Vegetation heights were recorded for each nest within the plot. There was no provision for entering this data into EMD v1.0, so a separate excel spreadsheet of vegetation heights was supplied to BioEcoSS.

7.2.2 Heather Grazing (Biomass Utilization)

The data from the heather transects, for the purposes of analysis, was divided into three separate datasets, each requiring the completion of a separate spreadsheet. The datasets were (1) Quadrat data, in which data relating to the vegetation community type and data relating to sheep, cattle or pony dung within each quadrat along the transect was entered; (2) Personnel Data, in which the name of the personnel who undertook the fieldwork and/or grazing index assessment elements of the work was entered; and (3) Dwarf Shrub Data, in which data relating to *Vaccinium myrtillus* (presence/absence), dwarf shrub (cover and height), and *Calluna vulgaris* (cover, age, growth stage, collection and grazing index) were entered. Because there were from 4–8 transects at each plot location, and along each transect there were 6 quadrats, there was a total of 24 (min)–48(max) fixed sampling units (FSUs) for this part of the data. Each FSU required a separate spreadsheet for each of the three datasets, consequently for each plot a total of between 72 and 144 spreadsheets had to be completed (albeit very short datasets).

This part of EMD v1.0 proved much slower to complete than the botanical data, taking up much more of the data entry time and required diligence verging on doggedness. From a data entry point of view it would have been much simpler and quicker to enter the data on fewer spreadsheets to avoid repletion of effort, but from a data analysts point of view this may not have been possible, or may have complicated the data analysis (BioEcoSS would be able to confirm this).

There was little error noted in the completion of this part of EMD v1.0, errors largely being confined to accidentally selecting the wrong FSU from the dropdown menu.

Note/ There was a discrepancy between data collected and data entry into EMD v1.0 with regard to cover of dwarf shrub and *Calluna.* The spreadsheet would only accept integers with the smallest cover value allowed of 1%, i.e. a 10x10cm area. However, the surveyors frequently recorded cover as less than 1% (<1), i.e. less than a 10 x 10 cm area. Those quadrats which contained <1% dwarf shrub or *Calluna* has 1% entered into the spreadsheet but a separate excel

spreadsheet of quadrats which contained <1% cover of dwarf shrubs or *Calluna* was supplied to BioEcoSS.

Acknowledgements

This contract was funded by Natural England. Belinda Wheeler and Phil Wilson would like to acknowledge the assistance of David Glaves, Andy Nisbet and Andy Jones of Natural England in the completion of this contract, and their help with staff training on a very cold day on Dartmoor in early March. Simon Poulton of BioEcoSS provided invaluable telephone support and tutorials on the EMD v1.0 software, for which we were most grateful. Access permission, including vehicular off–road access on existing tracks and the use of metal detectors, was kindly granted by Tom Stratton for the Duchy of Cornwall, Lt Col (Retd) Tony Clark OBE, Commandant Dartmoor Training Area for the MoD, The Maristow Estate and Dartmoor National Park. Advice on access routes and safety was also provided by Landmark and the Training Area Marshalls. Thanks are also due to the Ben Phillips, Forestry Commission Area Forester for allowing the survey team to drive through Fernworthy Forest on the forestry tracks to gain access to more inaccessible parts of the moor, which saved the team considerable time and effort. Serina Rowse of DNP gave advice and maps on the burnt area on South Dartmoor.

Appendix 1 The revised heather transect/heather sampling form

YEAR: 2010 **PSU Code:** **DATE:** **RECORDERS** Fieldwork: GI Assessment:

Quadrat						*V m*	Dwarf Shrub					*Calluna vulgaris*							
FSU	Code	Com-munity	Droppings			Present	%Cov	Heights				%Cov	Age	GS	Stems		Shoots		
			She	C/P				1	2	3	4				Pul	Col	Ung	Ind	Gra
145	1																		
146	2																		
147	3																		
148	4																		
149	5																		
150	6																		
151	7																		
152	8																		
153	9																		
154	10																		
155	11																		
156	12																		
157	13																		
158	14																		
159	15																		
160	16																		
161	17																		
162	18																		
163	19																		
164	20																		
165	21																		
166	22																		
167	23																		
168	24																		
169	25																		
170	26																		
171	27																		
172	28																		
173	29																		
174	30																		
175	31																		
176	32																		
177	33																		
178	34																		
179	35																		
180	36																		
181	37																		
182	38																		
183	39																		
184	40																		
185	41																		
186	42																		
187	43																		
188	44																		
189	45																		
190	46																		
191	47																		
192	48																		

Appendix 2 Key to plot photos provided in digital format.

Image name	Plot No.	Date	Details
plot 4 001	4	04.5.2010	Close up of burnt vegetation
plot 4 002	4	04.05.2010	View of burnt plot area with origin mound in background
plot 4 008	4	04.05.2010	Origin
plot 7 001	7	19.04.2010	Origin – no pipe found
plot 7 003	7	19.04.2010	View of plot
plot 7 005	7	19.04.2010	Nest 1
plot 7 006	7	19.04.2010	View from plot to origin.
plot 7 008	7	19.04.2010	New origin stone suggested showing position pipe should sit.
plot 7 009	7	19.04.2010	New origin stone suggested, showing view from stone to plot.
plot 8 001	8	20.5.2010	View of plot from south
plot 8 002	8	20.5.2010	Plot looking from Nest 1 to Nest 4 with nearby bog pool landmark
plot 8 003	8	20.5.2010	Nest 1
plot 33 002	33	31.05.2010	View of area of plot
plot 33 003	33	31.05.2010	Close up of vegetation in area of plot
Empetrum nigrum 001	33	31.05.2010	Close-up of *Empetrum nigrum* in vegetation near to plot 33
Empetrum nigrum 005	33	31.05.2010	*Empetrum nigrum* in vegetation near to plot 33
Plot 34 001	34	21.4.2010	Origin
Plot 34 003	34	21.4.2010	Origin to plot
Plot 34 004	34	21.4.2010	Plot to Origin
Plot 34 006	34	21.4.2010	Nest 1
Plot 39 001	39	15.4.2010	Origin
Plot 39 002	39	15.4.2010	Origin to plot
Plot 39 005	39	15.4.2010	Nest 1
Plot 39 007	39	15.4.2010	Plot from N end (Nests 29-32)
Plot 40 002	40	27.4.2010	Origin bog pool
Plot 40 006	40	27.4.2010	Origin to plot
Plot 40 010	40	27.4.2010	Plot marker pipe sunk 20cm beneath peat
Plot 40 011	40	27.4.2010	Plot looking towards Gt Kneeset
Plot 40 012	40	27.4.2010	Nest 1
Plot 40 013	40	27.4.2010	Plot to Origin bog pool (and Fur Tor)
Plot 41 001	41	19.5.2010	View from SE corner across the plot to the NW corner and to the boulder on the horizon
Plot 41 002	41	19.5.2010	Nest 1
Plot 41 003	41	19.5.2010	Triangle of rocks enclosing the pipe in the SE corner.
plot 44 001	44	22.4.2010	Nest 1
plot 44 002	44	22.4.2010	View across plot towards the origin
plot 44 003	44	22.4.2010	Location of the origin
plot 44 004	44	22.4.2010	View to the plot from the origin, tor on the horizon
plot 45 001	45	29.4.2010	Position of the origin from the trackside to the north looking towards the range pole
plot 45 002	45	29.4.2010	Nest 1
plot 44 003	45	29.4.2010	View of the whole plot from the north-west

Image name	Plot No.	Date	Details
plot 45 004	45	29.4.2010	Southern corner of the plot looking towards the nearby boulder
Plot 49 001	49	29.4.2010	Origin in corner on top of wall above ruin
Plot 49 002	49	29.4.2010	From origin along location-transect to plot beyond bank in background
Plot 49 003	49	29.4.2010	Plot in short acid grassland with dense *Molinia* beyond
Plot 49 005	49	29.4.2010	Nest 1
plot 94 001	94	21.5.2010	Nest 1
Plot 94 002	94	21.5.2010	View of the whole plot looking towards Fernworthy
plot 94 003	94	21.5.2010	View of the origin boulder
plot 95 001	95	25.5.2010	Nest 1
plot 95 002	95	25.5.2010	View from the large boulder back towards the plot and the origin boulder
plot 95 003	95	25.5.2010	View from the origin boulder towards the plot and the large boulder
plot 95 001	96	26.5.2010	View from the origin towards the plot
plot 95 002	96	26.5.2010	View from the origin towards the nearby large boulder
plot 95 003	96	26.5.2010	Nest 1
plot 95 004	96	26.5.2010	View from the plot towards the origin
Plot 97 002	97	18.5.2010	Origin
Plot 97 003	97	18.5.2010	Origin towards plot
Plot 97 004	97	18.5.2010	Plot towards origin
Plot 97 005	97	18.5.2010	Plot
Plot 97 006	97	18.5.2010	Nest 1
Plot 98 001	98	13.4.2010	Origin along location-transect towards plot
Plot 98 003	98	13.4.2010	Plot in tall *Ulex*
Plot 98 005	98	13.4.2010	Nest 1
Plot 98 006	98	13.4.2010	Height of plot
Plot 99 001	99	17.3.2010	Plot looking NW
Plot 99 002	99	17.3.2010	Bog pool 2m SE of stand Nest 4
Plot 99 003	99	17.3.2010	Nest 1
Plot 99 004	99	17.3.2010	Location of pin 25m along location-transect. Looking towards origin (located after plot found)
Plot 100 001	100	08.4.2010	Blocked up track (origin) foreground (right), 2nd track & rock (background left)
Plot 100 002	100	08.4.2010	Approx. location of origin behind bank, towards 15m location-transect pin. Bog pool at 4m.
Plot 100 004	100	08.4.2010	Nest 1
Plot 100 005	100	08.4.2010	Plot from N1-4.
Plot 101 001	101	16.3.2010	Plot reference point (Nest 4)
Plot 101 002	101	16.3.2010	Origin from S
Plot 101 003	101	16.3.2010	Origin to plot looking S
Plot 101 004	101	16.3.2010	Plot
Plot 101 005	101	16.3.2010	Nest 1
plot 114 001	114	28.4.2010	View towards the origin from the gully bank to the west
plot 114 002	114	28.4.2010	View from the origin towards the plot
plot 114 003	114	28.4.2010	Nest 1

Image name	Plot No.	Date	Details
Plot 116 001	116	27.4.2010	Plot view
Plot 116 002	116	27.4.2010	Plot view from bog pool at SW corner 2-3m from Nest 4
Plot 116 003	116	27.4.2010	Bog pool from Nest 4
Plot 116 004	116	27.4.2010	Nest 1
Plot 117 001	117	22.4.2010	Approximate location of plot
Plot 117 002	117	22.4.2010	Burnt vegetation
Plot 117 003	117	22.4.2010	Concrete post where origin pin is located
Plot 117 004	117	22.4.2010	Concrete post where origin pin is located
Plot 118 001	118	22.4.2010	From origin towards plot along location-transect
Plot 118 002	118	22.4.2010	Origin mound from location-transect
Plot 118 003	118	22.4.2010	Origin
Plot 118 004	118	22.4.2010	Plot including nest 1
Plot 119 001	119	08.4.2010	Origin towards plot
Plot 119 002	119	08.4.2010	Origin stone
Plot 119 003	119	08.4.2010	Nest 1 and dead sheep remains
Plot 119 004	119	08.4.2010	From plot along location-transect to origin and Gt Mis Tor
Plot 119 005	119	08.4.2010	Plot