

ECOLOGICAL SURVEY OF CUMBRIA

HANDBOOK OF FIELD METHODS

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Preface

The purpose of this handbook is to inform you of the background to this summer's survey, to explain its purpose, and to give a detailed account of the methods involved in the survey.

Introduction

Cumbria is over 7,000 sq. km. in extent having been reborn on 1 April 1974 by the amalgamation of the old counties of Cumberland and Westmorland, the Furness area of Lancashire and the north western extremity of the Yorkshire Dales National Park. Its centre consists of the Lake District National Park, covering approximately a third of the County. Existing Areas of Outstanding Natural Beauty (AONB) are the Arnside/Silverdale area on the southern boundary, and the Solway Coast. The North Pennines area, consisting of the Cross Fell Escarpment overlooking the Eden Valley, is a proposed AONB.

The topography, geology, climate and land use throughout the County is diverse enabling it to be subdivided into reasonably uniform areas on physical grounds. These areas are not coincident with the administrative boundaries which subdivide the County into six district council areas. The centre is dominated by the high, rocky fells of the Lake District with their steep slopes on Borrowdale Volcanic Rocks. The other highland area is the North Pennines on Carboniferous limestone, with a much flatter moorland top. The Eden Valley runs NNE between these two areas from Appleby to Carlisle and is predominantly a dairy farming region. The sub-coastal fringes of the County cover a large area to the north, whilst the coast proper can be sub-divided into coastal and estuarine areas, such as Morecambe Bay, the Solway Firth and the Duddon Estuary.

Background to the survey

One of the functions of the County Council is to produce a Structure Plan for the County setting out policies for future land use.

Nature conservation and the impact of land use upon wild life habitats is a major issue in Cumbria. Before policies can be set up to deal with this issue information is required on the extent and nature of wildlife habitats. Information about specific sites is readily available, there being 200 designated sites of biological/geological importance (SSSIs and nature reserves) in Cumbria. However, comparable information about the overall ecological situation is not available; and it is this information gap that the ecological survey of Cumbria is designed to fill.

The survey is being carried out jointly by the Cumbria County Planning Department and the Institute of Terrestrial Ecology, with the intention of producing a report for the Structure Plan by March/April 1976. The Planning Department is supplying most of the staff for the survey and for evaluating the data collected; ITE will provide the computer and laboratory facilities needed.

The ecological survey

The ecological survey is based on methods developed at ITE's Merlewood Research Station for surveys of the semi-natural woodlands of Great Britain and used in a survey of the native pinewoods of Scotland. The methods have been further adopted to regional ecological surveys and applied to the Lake District National Park and Shetland.

A number of randomly distributed points are marked on a map, and these are taken as the sampling plots for the survey. Each plot, is visited, and a 200m² quadrat is set up. Within this quadrat, all the plants are recorded, a soil pit is dug and described, and information is recorded on the habitats present. After the summer, this data will be analysed, using multivariate techniques, such as ordination, to help establish the range of variation in Cumbria's ecosystems.

Methods

Locating the plot

You will be working in pairs on the survey, and the work can be split between you; you will soon develop your own method of working as a team.

The first step will always be to locate the sampling plot you are going to visit. These plots are marked as points on the 6" O.S. maps which you will have been given. The 16 black plots must be visited; if this is impossible owing to danger to life and limb, or permission to enter the land is refused, then you can substitute the nearest red plot.

Since the plots are distributed in a random manner, it is important that there should be no subjective bias in locating them on the ground, and the plots in the field should be located as accurately as possible from the map. This is done in stages.

- (i) Firstly, find an easily-recognisable landscape feature on the map, near the plot to be sampled, which can be readily located in the field; such a feature could be a sharp bend in a road or track, a fork in a river, the corner of a lake, or any other unambiguous feature.
- (ii) Go to this control point on the ground.
- (iii) Using the map and Silva compass provided, take a bearing from the control point to the plot to be visited. Don't forget to add 10° for magnetic declination.
- (iv) Measure the distance from the control point to the plot, using the scale on the Silva compass. This is in 1/16ths of an inch; 1/16 of an inch on the six inch scale map will equal 18.33 yds on the ground.
- (v) Now pace the exact number of yards measured from the control point, following the correct bearing on the compass. The last pace you take will land your foot exactly in the middle of the plot to be sampled.

You should make allowance if your pace is less than one yard on average (i.e. if your average pace is 2' 6", add on 6" for each pace, or in other words, one extra pace every five).

If you need to pace uphill, you will have to add on extra paces to compensate for this. Thus for slopes of the approximate angle given below, add the given percentages onto the original number of paces.

20°	25°	30°	35°	40°
6%	10%	15%	22%	31%

For example, if the distance from your control point to the plot

is 1/16" on the map, (i.e. 18.33 yds on the ground), and it is all up a slope of about 25° , you should add on 1.8 yards, making 20 paces in all.

If this procedure is rigidly adhered to, it will ensure absolute absence of bias in locating the sampling plot. There may be some loss of accuracy (for example due to a slight deviation from the bearing walked, or the paces being slightly longer or shorter than 1 yard), so that the point on the map and the point in the field do not correspond exactly. This however, is not important, as long as there has been no subjective bias in locating the plot in the field.

Recording data in the plot

The basic sampling unit, as mentioned above, is a 200m^2 quadrat. This is set up using the five posts and strings provided. The centre post has a bolt on top, on which is a right-angled cross held on by a wing-nut. The other four posts are the corner-poles of the plot, and each has a 10-metre cord tied to it. Each of these cords can be attached to the centre pole by clips, and they form the diagonals of the plot.

When a quadrat is set up, the centre post should be struck into the ground at the central point of the plot (which has been paced out as described above). The cross is used to orientate the four diagonals, and spinning it ensures that this orientation is random.

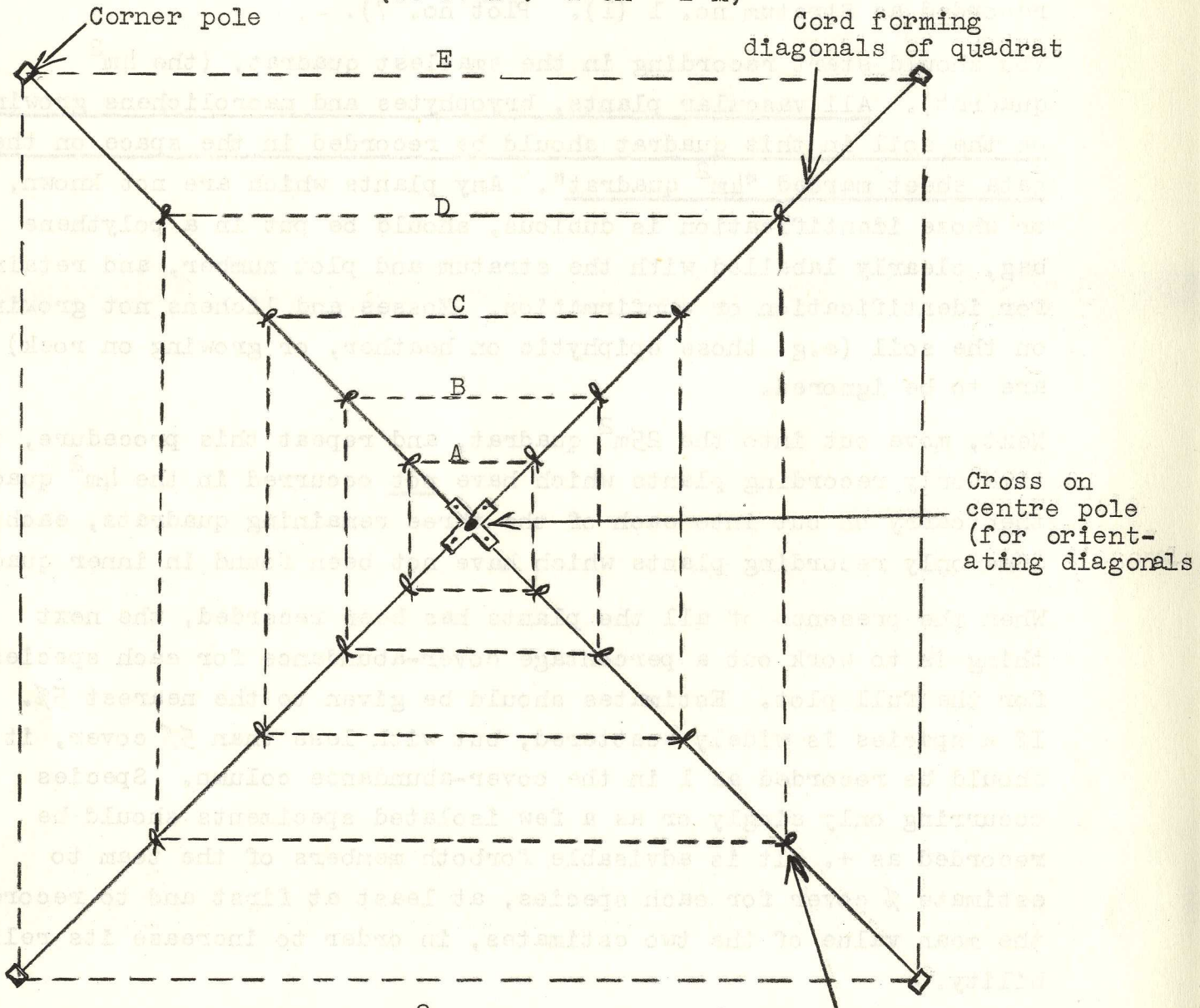
The next stage is to unroll the orange cord from each of the corner posts, and to clip it onto the centre post. The corner post should be carried out by one member of the team until the cord is taut; the other member can use the nails in the right-angled cross to sight onto the corner post, to make sure that it is orientated correctly.

When the cords are stretched out, it will be seen that they have four pieces of coloured rope tied on them at specified distances from the centre. These mark the corners of successively smaller quadrats within, and concentric with, the large 200m^2 quadrat. Thus there are five quadrats in all, of respectively 4m^2 , 25m^2 , 100m^2 and 200m^2 . This is illustrated in Figure 1. These five quadrats are the sampling units for the vegetation.

AERIAL VIEW OF QUADRAT

Fig. 1

(To scale: 1 cm = 1 m)



Key: A = outside of $4m^2$ quadrat
 B = " " $25m^2$ "
 C = " " $50m^2$ "
 D = " " $100m^2$ "
 E = " " $200m^2$ "

Coloured rope knots,
 marking the corners of
 smaller quadrats.

Ground flora (Species data sheet)

The sheet used for recording the plant species is shown in Figure 2. When filling it in, first enter the stratum and plot numbers as given on the map. (Thus point no. 1 (1) 7 on the map is recorded as Stratum no. 1 (1). Plot no. 7).

You should start recording in the smallest quadrat, (the 4m^2 quadrat). All vascular plants, bryophytes and macrolichens growing on the soil in this quadrat should be recorded in the space on the data sheet marked " 4m^2 quadrat". Any plants which are not known, or whose identification is dubious, should be put in a polythene bag, clearly labelled with the stratum and plot number, and retained for identification or confirmation. Mosses and lichens not growing on the soil (e.g. those epiphytic on heather, or growing on rock) are to be ignored.

Next, move out into the 25m^2 quadrat, and repeat this procedure, this time only recording plants which have not occurred in the 4m^2 quadrat; then carry on out into each of the three remaining quadrats, each time only recording plants which have not been found in inner quadrats.

When the presence of all the plants has been recorded, the next thing is to work out a percentage cover-abundance for each species for the full plot. Estimates should be given to the nearest 5%. If a species is widely scattered, but with less than 5% cover, it should be recorded as 1 in the cover-abundance column. Species occurring only singly or as a few isolated specimens should be recorded as +. It is advisable for both members of the team to estimate % cover for each species, at least at first and to record the mean value of the two estimates, in order to increase its reliability.

The cover-abundance % of the other categories (rock, water, litter, bare ground and bryophytes) should be recorded at the bottom of the sheet.

Ignore the column marked "code". This is for use later on when sorting out the data. An example of a completed field sheet is given in Figure 2.

Soil data sheet

To obtain a general picture of the type of soil present in the plot, without letting soil sampling become a time-consuming exercise, the soil is to be described from a single profile, in the exact centre of the plot (i.e. where the centre pole was placed). The soil data sheet has been worked out in advance (see Figure 3), and all that you have to do is to cross off those attributes which apply to the profile in question. To expose a profile, dig down as deep as you can with the trowel and collect cores of the soil below this level using the auger. In digging try to disturb the smallest area possible.

First, it is necessary to distinguish between the different horizons of the soil. The litter layer consists of undecomposed or readily recognisable plant remains. If this is present, record the depths between which it is found (attribute 5) and its composition; this is done by seeing what plant remains you can recognise in the litter (attributes 6 - 15). If there is standing water in the soil saturating the litter layer, record attribute 16. If there is no litter layer, delete this section completely with a diagonal line.

The organic matter layer consists of decomposed plant remains, with no (or virtually no) admixed mineral matter. This may be very shallow, as on some grassland, or very deep, where there is deep peat cover. If this is present, record the depths between which it occurs. If the peat is deeper than the length of the auger, record the maximum depth as 75+ cm (75 cm is the length of the auger.)

Colour (attributes 18 - 20): self explanatory.

Decomposition: this is a measure of the amount of decay of the organic matter. To determine this, take a handful of the organic matter and squeeze it in your hand. If only clear water oozes out, record low decomposition (23). If the whole handful oozes out as a black mush, then the material is completely decomposed (attrib. 21). If blackish or brownish water emerges, record medium decomposition (22).

Texture: Amorphous (24) humus rubbed in the fingers will break up into a black smear: if granular (25), it will retain some crumb-like structure when rubbed. Mixed fibrous-amorphous (27) is an intimate mixture of the two types of organic matter; layered fibrous/amorphous (28) indicates the two types are separate, and distinctly layered.

Moisture: it will be obvious if the soil is submerged (29). If a handful of organic matter oozes water without being squeezed it is very wet (30); if it has to be squeezed to expel water, it is wet (31). If no water oozes out on being squeezed, it is damp (32), and if it feels dry, record 33.

If there is no organic matter layer, delete this section.

The mixed mineral/organic matter layer is an intimate mixture of mineral particles and humus. This layer will often be only poorly developed. It can be distinguished from overlying organic matter by rubbing in the fingers, when mineral particles will be felt, and from underlying mineral matter by the dark colour of the admixed humus. If present, record the depths between which it is found: if it extends below the depth of the auger, again record maximum depth as 75+ cm.

Transition with mineral soil: the transition to the underlying mineral soil (if present) can be abrupt (35) or the two layers will gradually blend, with no distinct join between them (36). If there is no underlying mineral soil reached, cross out this section.

Texture: to distinguish clay (37), silt (38), and sand (39), try to roll a lump of soil between your hands into a sausage. If you cannot succeed, and the roll crumbles, it is sand. If you can, and can then bend this sausage into the form of a ring, it is clay. If the sausage breaks when you try to bend it, it is silt. If the layer consists of pure gravel (particles over 1/8"), record 40. If more than about 10% of this layer is made-up of stones, record attributes 41 - 43, depending on the texture of the matrix (determined by the sausage test).

SOIL DATA

1. Stratum No: 2. Plot No: 3. Recorder: 4. Date:

LITTER LAYER

COMPOSITION

5. Depth	cm	6. Conifer	11. Ericoid	14. Grass/sedge
		7. Hardwood	12. Other dicots	15. Other monocots
		8. Sphagnum	13. Eriopharum/ Trichophorum	16. Standing water
		9. Other bryophytes		
		10. Ferns		

ORGANIC MATTER LAYER

17. Depth	cms		<u>Texture</u>	<u>Moisture:</u>
<u>Colour:</u>		<u>Decomposition:</u>	24. Amorphous	29. Submerged
18. Black		21. High	25. Granular	30. Very wet
19. Dark brown		22. Medium	26. Fibrous	31. Wet
20. Light brown		23. Low	27. Mixed fibrous/ amorphous	32. Damp
			28. Layered fibrous/ amorphous	33. Dry

MIXED MINERAL/ORGANIC MATTER LAYER

34. Depth	cm	<u>Texture</u>	<u>Colour</u>	<u>Moisture</u>
		37. Clay	44. Black	49. Very wet
<u>Transition with</u>		38. Silt	45. Brown	50. Wet
<u>mineral soil</u>		39. Sand	46. Yellow/Brown	51. Damp
35. Sharp		40. Gravel	47. Red	52. Dry
36. Gradual		41. Stony/clay	48. Mottled	<u>Structure</u>
		42. Stony/clay		53. Powder
		43. Stony/sand		54. Crumb
				55. Clod

LEACHED LAYER

		<u>Colour</u>	<u>Texture</u>	
		57. Whitish	59. Clay	63. Stony/clay
56. Depth	cm	58. Greyish	60. Silt	64. Stony/silt
			61. Sand	65. Stony/sand
			62. Gravel	

WEATHERED MINERAL LAYER

		<u>Texture</u>	<u>Colour</u>	<u>Nature of deposition</u>
66. Depth	cm	71. Clay	78. Brown	<u>layer if present</u>
		72. Silt	79. Yellow/brown	<u>Colour</u>
<u>Moisture</u>		73. Sand	80. Yellow	86. Black
67. Very wet		74. Gravel	81. Red	87. Red/Brown
68. Wet		75. Stony/clay	82. Mottled	<u>Compaction</u>
69. Damp		76. Stony/silt	<u>Structure</u>	88. Hard
70. Dry		77. Stony/sand	83. Powder	89. Friable
			84. Crumb	
			85. Clod	

UNDERLYING MATERIAL

		<u>Texture</u>		
90. Depth	cm	91. Clay	93. Gravel	96. Rock fragments
from	cm	92. Sand	94. Stony/clay	97. Solid rock
			95. Stony/sand	

Colour: fairly obvious. A mottled layer (48) is one where changes in the water level cause alternating aerobic and anaerobic conditions, which will lead to deposition of iron oxides in the mineral matter. The mottled appearance is revealed by breaking the soil up in your fingers, when you will see alternating pale and reddish patches. This occurs most commonly in clays.

Moisture: as for the organic layer.

Structure: this is the type of aggregation shown by the soil particles and is determined by breaking the soil in your fingers. If there is no aggregation at all between particles, it is a powder (53). If the particles aggregate into small lumps (like breadcrumbs) it is a crumb (54) and if it stays as a solid lump, it is a clod (55). (This latter is most typical of clay soils).

Again, if this layer is not present, delete this section.

The leached layer is a pale layer immediately underlying the organic matter layer, and occurs typically in high rainfall areas, where humus and mineral ions are washed down through the soil, to form a podzol. It will usually be underlain by the weathered mineral layer. If absent, delete this section.

The weathered mineral layer is distinguished from the mixed mineral/organic layer by the absence of the dark humus particles adhering to the mineral particles. If this layer is present, record its depth, and its moisture, texture, colour and structure as for the mixed mineral/organic layer.

The deposition layer (attributes 86 - 89) only occurs where there is a podzol, and it is the layer of deposition of the humus and mineral ions leached from above. If present, record its colour (86 - 87): there may be two layers of different colours, and also whether it is hard (86) or easily broken up (89). If there is no deposition layer, delete this section.

The underlying material is that which occurs under all the previous layers. It may not always be easily distinguished from the weathered mineral layer; for example, in the case of a sand underlying a mixed mineral/organic layer, there is no way of telling. In such a case, record it as a weathered mineral layer. Usually there will be no problem; record the depth from which it occurs, and the texture (attributes 91 - 97).

If the soil shows any unusual features which are not taken account of in the soil sheet, make a note in the space at the bottom, or sketch a profile. An example of a completed soil sheet is given in Figure 3.

The final stage is to collect a soil sample. This should be taken from the top 10 cm of the soil under the litter layer. Collect enough to fill one of the polythene bags provided. This will be taken back to Merlewood for its pH to be determined along with other measurements (e.g. loss on combustion, mechanical analysis, and possibly some chemical analyses). Label the soil bag with the stratum and plot numbers.

When you have finished, fill the soil pit in again.

Habitat data sheet

These two sheets are intended to record various features of the area, some being physical variables and attributes, while others can also be considered in terms of their value as microhabitats for, say, invertebrate life. Yet others record the present management regime of the area.

The first sheet (habitat data) is to record those features found within the plot. The second sheet (main physiographic features within 50m of plot edge) is to record features lying outside the plot, up to a distance of 50m, which may have an effect on the plot itself. When you first start work, it is advisable to pace out 50m, but soon you should get a rough idea of the distance simply by locking. (50m is in fact $2\frac{1}{2}$ times the length of the diagonal of the 200m² quadrat.

Plot habitats

Record stratum and plot number, as for the other sheets. The slope is measured, using the clinometer provided, across the plot from the highest to the lowest point, passing through the centre. If one member of the team stands at the highest point, the other can go to the lowest point, and sight along the wooden body of the clinometer. When the plumb line has steadied, hold it in place against the protractor scale and read off the slope. Aspect is the bearing down this same slope, measured with the silva compass. (Do not read the aspect up the slope).

Roads and boundaries

Note the presence of drystone walling with limestone or other material, and whether or not it has mosses, lichens or both on it (attributes 1 - 6). Attributes 7 - 12 record these same categories but on fallen walls. The condition of hedgerows, when present, is noted; whether they are stock proof or not (15 - 17), their management (18 - 22), height (23 - 26), gaps present (27 - 28), whether the branches spread to make the hedge more than 9 ft. wide (29), whether outgrowths from the main body of the hedge extend more than 6 ft. into the verge or field (30), whether hedgerow trees (defined as being more than 6 ft. higher than the top of the hedge) are present (31).

The condition of road verges (32 - 34) and the presence of a wire or wooden fence (35) is to be noted. Tracks or roads can be either hardcore (36) or tarmacked (37), footpaths and bridleways (38 - 39) may be present.

Management

Distinguish buildings which are lived in (40) from those which serve other purposes (41), such as a shop or store, and from ruined ones (42). Dutch barns (43) have only a roof and are distinguished from closed ones (44). Sheep enclosures may be ruined (46) or used (45), "wood" is an error it should read "used". A clamp is an earth and straw covered store for root vegetables (47). Silage (50) can be stored in a pit or tower or in large polythene bags. A midden (51) is a manure heap, old ones have dense nettles growing out of a pile or rocks. Ploughing (56) must be recent with no crops growing; drain lines (57) indicate artificial drainage. Domestic rubbish (58) covers anything of household origin, beer cans etc. Other rubbish (59) is anything else (fertiliser bags, scrapped machinery, etc.)

Grassland from which livestock are excluded are hayfields (60), pasture (61) supports grazing animals. If there are droppings of any sort present, at average density of about $5/m^2$ or less record few (65), if more than $5/m^2$ record many (66).

Vegetation habitats

Nardus grassland (67) is dominated by mat-grass (Nardus stricta), Agrostis-fescue (68) is grassland dominated by fescues and bents. Molinia can form tussocks (69) or a sward (70) as can Sphagnum (75 - 76), and tussocks must be at least 1m across to be recorded. Dense heather (71) and bilberry (72) must cover at least $25m^2$ to be recorded. Bogs dominated by cotton grass (Eriophorum spp.) (73) or rushes (74) must similarly cover $25m^2$ to be recorded, similarly with bracken (77). Attributes 78 - 80 cover any bryophyte growing on soil, rock and peat. Aquatic bryophytes (81) grow in still or running water. Spring bryophytes (82) cover any bryophytes growing around the area of a spring. All lichens on soil, rock and peat should be recorded (83 - 85). Epiphytic lichens grow on other plants, i.e. trees, shrubs, Calluna, bryophytes, etc. Clumps of

HABITAT DATA

1. Stratum No. 2. Plot No. 3. Recorder 4. Date
5. Slope 6. Aspect

ROADS AND BOUNDARIES

Walls

1. Dry, lime, moss	5. Dry, not lime, lichen	9. Fallen, dry, lime, moss and lichen	12. Fallen, dry, not lime, moss and lichen
2. Dry, lime, lichen	6. Dry, not lime, moss and lichen	10. Fallen, dry, not lime, moss	13. Brickwall
3. Dry, lime, moss and lichen	7. Fallen, dry, lime, moss	11. Fallen, dry, not lime, lichen	14. Creeper on wall
4. Dry, not lime, moss	8. Fallen, dry, lime, lichen		

Hedges

15. Stockproof, no gaps	19. Machine trimmed	24. Height 2½-6ft.	29. Branches spread > 9 ft.
16. Stockproof, gaps blocked	20. Severe cut, recent	25. Height 6-10ft.	30. Outgrowths > 6 ft.
17. Not stockproof	21. Layed	26. Height > 10ft.	31. Trees (> 6ft. above)
18. Hand trimmed	22. Not recently managed	27. Gaps 10% to ground	
	23. Height < 2½ ft.	28. No light through bottom	

Verges

32. Cut	34. Partly cut
33. Uncut	35. Fence

Tracks

36. Hardcore	38. Footpath/bridle way < 2ft.
37. Tarmac	39. Footpath/bridle way > 2ft.

MANAGEMENT

Buildings

40. Habited	45. Sheep enc. (wood)	50. Silage pit	56. Ploughing
41. Used (not house or farm)	46. Sheep enc. (ruined)	51. Midden	57. Drain lines
42. Ruined	47. Clamp	52. Feeding trough	58. Domestic rubbish heap
43. Dutch barn	48. Haystack	53. Water trough	59. Other rubbish
44. Closed barn	49. Strawstack	54. Garden	
		55. Orchard	

Cultivation

60. Hay meadow	61. Pasture	63. Cereals	65. Few droppings
	62. Roots	64. Other arable	66. Many droppings

VEGETATION HABITS

67. Nardus grass-land	76. Sphagnum lawn	86. Epiphytic Clumps	<u>Ground vegetation</u>
68. Agrostis-fescue	77. Bracken	87. Rose	95. Height < 3"
69. Molinia tussocks	<u>Bryophytes</u>	88. Nettles	96. Height 3-10"
70. Molinia lawn	78. On soil	89. Bramble	97. Height > 10"
71. Dense heather	79. On rock	90. Willow-herb	<u>Overall Vegetation height</u>
72. Dense bilberry	80. On peat	91. Unbellifers	98. 0-10"
73. Cottongrass bog	81. Aquatic	92. Fern	99. 10-60"
74. Juncus bog	82. In springs	<u>Burning</u>	100. > 5 ft.
75. Sphagnum t tussocks	<u>Lichens</u>	93. Recent	
	83. On soil	94. Old	
	84. On rock		
	85. On peat		

WOODLAND HABITATS

- | | | | |
|---------------------------------|----------------------------|------------------------------|--------------------------------|
| 101. Scrub | 110. Shrubs | 117. Epiphytes,
trunks | 122. Hollow trees |
| 102. Conifer woods | 111. Young plant-
ation | 118. Macrofungi,
trunks | 123. Rot holes |
| 103. Hardwood | 112. Underplanted
areas | 119. Macrofungi,
ground | 124. Tree stumps |
| 104. Mixed woodland | 113. Felled areas | 120. Standing,
dead trees | 125. Brush heaps |
| 105. Willow grove | 114. Coppiced areas | 121. Fallen dead
trees | 126. Piles Timber/
cordwood |
| 106. Hazel grove | 115. Ivy on trees | | |
| 107. Alder grove | 116. Epiphytes
branches | | |
| 108. Glade, grass | | | |
| 109. Glade, mixed
vegetation | | | |

GROUND HABITATS

- | | | | |
|------------------------------|---------------------|----------------------------|------------------------|
| 127. Cliff, > 5m | 135. Piles of rocks | 144. Leaf filled
hollow | 150. Excavated
bank |
| 128. Rock out-
crop, < 5m | 136. Rock patterns | 145. Eroding bank | 151. Embankment |
| 129. " " "
> 5m | 137. Stone field | 146. Eroding peat | 152. Quarry |
| 130. Rock ledge | 138. Rock field | 147. Eroding soil | 153. Mine |
| 131. Scree | 139. Boulder field | 148. Grass bank | 154. Disused
mine |
| 132. Stones, < 4" | 140. Gully | 149. Moss and
fern bank | 155. Sheep
scrapes |
| 133. Rocks, 4-20" | 141. Gorge | | |
| 134. Boulders, > 20" | 142. Dell/hollow | | |
| | 143. Mossy rocks | | |

AQUATIC HABITATS

Flowing water

- | | | | |
|-------------------------------|--------------------------------|-------------------------------------|-------------------|
| 156. Stream < 2ft. | 161. Stony bottom | 167. Pool in stream
< 1 ft. deep | 170. Weir |
| 157. " , slow
2-10 ft. | 162. Peaty bottom | 168. Pool in stream
> 1 ft. deep | 171. Seepage |
| 158. Stream fast,
> 2 ft. | 163. Sandy bottom | 169. Waterfall,
> 2 ft. | 172. Rocky spring |
| 159. Stream, slow
> 10 ft. | 164. Gravelly" | | 173. Peaty spring |
| 160. Muddy bottom | 165. Rocky " | | |
| | 166. Shingle bank
in stream | | |

Standing water

- | | | | |
|--|--|-------------------------------|----------------|
| 174. Very small
pool (< 1m ²) | 175. Small ₂ ponds,
1-20m ² | 176. Lake, > 20m ² | 177. Reservoir |
|--|--|-------------------------------|----------------|

Aquatic margins

- | | | | |
|-----------------|-----------------------------|--------------------|-----------------|
| 178. Lake shore | 179. Emergent
vegetation | 180. Riverbank | 182. Streambank |
| | | 181. River cutting | |

Marine

- | | | | |
|------------------|------------------------|------------------------|----------------|
| 183. Sea cliff | 185. Sandy/muddy shore | 187. Intertidal
mud | 188. Saltmarsh |
| 184. Rocky shore | 186. Pebble shore | | |

Others

- | | | | |
|-------------------|--------------------|----------------|-------------------------------|
| 189. Drowned peat | 190. Dry peat cuts | 192. Wet ditch | 194. Canalised
river/canal |
| | 191. Island | 193. Dry ditch | |

vegetation must cover at least $2m^2$ to be recorded (87 - 92). If obvious traces of burning are present among the vegetation (e.g. ashes, charred heather) record this as recent burning (93). If there are no signs of burning evident among the vegetation, but traces are found in the top soil or among the surface litter (e.g. fragments of charcoal), record past burning (94).

Record the height of the ground vegetation (95 - 97) and the overall height (98 - 100).

Woodland habitats

Scrub woodland (101) consists of bushes and saplings with trees not greater than 10 ft. in height. If the woodland consists solely of conifers record 102, if of broad leaves record 103, for mixtures of the two record 104. A grove is dominated by one species and should only be recorded if it covers about $25m^2$ (105 - 107). Glades are clearings in woodland of grass (108) or of mixed grass/herbs (109). Shrubs such as hazel and dogwood are recorded as 110. A young plantation (111) can comprise either conifers or broadleaves, and is recorded if the trees in it have not closed canopy. Underplanted areas (112) usually consist of a broadleaved canopy species underplanted with conifers, usually western hemlock. Felled (113) and coppiced (114) areas are obvious, as are ivy (115), epiphytes (116 - 117) and macro fungi; (118 - 119). The presence of dead trees and piles of wood (120 - 126) should be recorded.

Ground habitats

127 - 129 must be solid outcrops, and not loose boulders (as far as can be defined). A rock ledge (130) is a horizontal surface of any size on a rock outcrop or cliff. A scree (131) is fairly obvious: it must be at least $20m^2$ and be unstable. This also includes man made screes caused by earth moving operations. Stones, rocks and boulders (132 - 134) are loose rocks lying on the ground, distinguished by size. Rock piles (135) must be at least 1m high and can be artificial or natural. Rock patterns (136) are regular patterns made by rocks, due to such features as creep, wind and/or frost. They usually take the form of alternate strips of rock and turf. Stone, rock and boulder fields (137 - 139) are areas where at least 50% of the ground area is covered by loose rocks: (as in 132 - 134). A gully (140) is the space between two rock outcrops facing one another.

A gorge (141) is the same but deeper than 50m. A dell/hollow covering more than $5m^2$ is recorded as 142, if leaf filled record 144. The presence of mossy rocks is recorded as 143. Eroding bank, peat and mineral soil (145 - 147) is obvious; the extent of the erosion must be at least $1m^2$ to be recorded. A bank (148 - 150) has only one slope whereas an embankment (151) has two, forming a ridge above the level of its surroundings. Quarries and mines (152 - 154) are obvious. Sheep scrapes (155) are crescent shaped gouges cut into the soil of hill sides by the burrowing action of sheep in search of shelter.

Aquatic habitats

Streams and rivers are divided into 4 categories based on size and speed of flow. 157 - 159 are incorrect and should read as follows:-

157 Stream > 2 ft.

158 Stream, fast

159 Stream, slow

Slow and fast streams are distinguished as those flowing slower or faster than 1 mph, i.e. a slow walking pace.

If a stream is present in the plot, then the nature of its bed should be recorded (160 - 165); as should the presence of shingle banks (166), pools (167 - 168), waterfalls (169) and weirs (170). If there is a definite spring emerging from the ground it should be recorded as 172 or 173. If, however, there is only a slight ooze of water, without it forming a definite spring, record it as a seepage (171).

Freshwater bodies are recorded as 3 size classes (174 - 176); reservoirs are recorded as 177.

A lake shore (178) is the area of land submerged by changes in water level of the lake. The presence of emergent vegetation is recorded as 179. A riverbank (180) edges a stream > 2 ft. in width, whereas a streambank (182) edges a stream < 2 ft. in width, and is distinct from a river cutting (181) in being cut by natural erosion rather than by man. A canalised river or canal (194) has reinforced sides. The marine habitats are obvious enough (183 - 188), a saltmarsh (188) differing from intertidal mud (187) in only being covered by the highest tides and having a vegetation cover.

Other habitats

If a peat-cutting has become flooded to a depth of at least 6", record it as drowned (189). An island (191) is vegetated and can occur in any river or pond, although it must cover at least 5m² to be recorded. An artificial ditch or drain should be recorded as wet (192) or dry (193).

MAIN PHYSIOGRAPHIC FEATURES WITHIN 50m OF PLOT EDGE

This sheet is designed to cover features which are larger than 200m². The quadrat, for instance, might be located in the bottom of a scree so that this fact would not be recorded in the other habitat sheet.

Definitions of the features are the same as for the other habitat sheet. A young conifer plantation (22) differs from an old one (23) in not having been thinned and not having closed its canopy.

MAIN PHYSIOGRAPHIC FEATURES WITHIN 50M OF PLOT EDGE

1. Stratum no. 2. Plot no. 3. Recorder 4. Date

MANAGEMENT

- | | | |
|------------------------|--------------------|------------------------------|
| 5. Drystone wall | 11. Garden | 17. Scrub |
| 6. Brickwall | 12. Orchard | 18. Underplanted wood |
| 7. Hedge | 13. Ploughed field | 19. Deciduous wood |
| 8. Verge | 14. Hay meadow | 20. Coppiced wood |
| 9. Road | 15. Pasture | 21. Felled wood |
| 10. Footpath/Bridleway | 16. Arable field | 22. Young conifer plantation |
| | | 23. Old conifer plantation. |

GROUND HABITATS

- | | | |
|-------------------|----------------|------------------|
| 24. Cliff | 29. Gorge | 34. Disused mine |
| 25. Scree | 30. Bank | 35. Spoil heap |
| 26. Stone field | 31. Embankment | |
| 27. Rock field | 32. Quarry | |
| 28. Boulder field | 33. Mine | |

AQUATIC HABITATS

- | | | |
|------------|---|---------------------|
| 36. Stream | 39. Small ₂ pond
1-20m ² | 42. Sea Cliff |
| 37. River | 40. Lake 720m ² | 43. Intertidal zone |
| 38. Canal | 41. Reservoir | 44. Sea |

Finishing the plot

When you have done all this, the recording of the plot is now complete. Make sure you have entered the stratum and plot numbers on all 4 sheets, and that the sheets have been fully filled in. Check that you have taken a soil sample, and that this, and any unidentified plants you have collected, are in polythene bags labelled clearly with stratum and plot number. Make certain that you have collected together all your equipment and samples into the rucksack. You can now move onto the next plot, and start the whole procedure all over again.

When you have finished for the day code the species you have found using the codes listed overleaf. Any species which are not on the list should be given a new code, which should be communicated to other groups as soon as possible.

Appendix 1

List of survey equipment provided

1 set plot-marking equipment

1 trowel

2 recording boards and pencils

Data sheets

1 ruler

1 soil auger and handle

1 Silva compass

1 clinometer

Polythene bags

Aluminium labels
(for polythene bags)

Maps

Appendix 2

Code	Species	Code	Species
1	Achillea millefolium	29	Cryptogramma crispa.
2	Acer pseudoplatanus	30	Dactylis glomerata.
3	Agrostis tenuis	31	Digitalis purpurea
4	Anthoxanthum odoratum	32	Deschampsia caespitosa.
5	Alchemilla glabra	33	Deschampsia flexuosa.
6	Bellis perennis	34	Dryopteris felix- mas.
7	Blechnum spicant	35	Drosera rotundifolia
8	Betula pendula	36	Epilobium palustre
9	Betula pubescens	37	Eriophorum angustifolium
10	Crataegus monogyna	38	Eriophorum vaginatum
11	Cerastium vulgatum	39	Filipendula ulmaria
12	Cirsium vulgare	40	Fraxinus excelsior
13	Cirsium arvense	41	Festuca ovina
14	Centaurea nigra	42	Festuca rubra
15	Corylus avellana	43	Galium aparine
16	Cynosurus cristatus	44	Galium saxatile
17	Cardamine pratensis	45	Geum urbanum
18	Chamaenerion angustifolium	46	Geranium robertianum
19	Chrysanthemum leucanthemum	47	Holcus lanatus
20	Campanula rotundifolia	48	Heracleum sphondyllum
21	Conopodium major	49	Hedera helix
22	Cirsium palustre	50	Ilex aquifolium
23	Carex panicea	51	Juncus effusus
24	Carex binervis	52	Juncus conglomeratus
25	Carex nigra	53	Juncus squarrosus
26	Carex echinata	54	Lolium perenne
27	Carex flacca	55	Lonicera pericly- menum
28	Calluna vulgaris	56	Lotus corniculatus

Code	Species	Code	Species
57	<i>Larix leptolepis</i>	82	<i>Quercus petraea</i>
58	<i>Luzula multiflora</i>	83	<i>Quercus robur</i>
59	<i>Luzula campestre</i>	84	<i>Rumex obtusifolius</i>
60	<i>Matricaria matricoides</i>	85	<i>Rumex acetosa</i>
61	<i>Molinia caerulea</i>	86	<i>Rumex acetosella</i>
62	<i>Nardus stricta</i>	87	<i>Rubus fruticosus</i>
63	<i>Narthecium ossifragum</i>	88	<i>Ranunculus repens</i>
64	<i>Oxalis acetosella</i>	89	<i>Rosa canina</i>
65	<i>Plantago major</i>	90	<i>Stellaria media</i>
66	<i>Plantago lanatus</i>	91	<i>Sambucus nigra</i>
67	<i>Potentilla erecta</i>	92	<i>Stachys sylvatica</i>
68	<i>Pteridium aquilinum</i>	93	<i>Salix atrocinerea</i>
69	<i>Prunella vulgaris</i>	94	<i>Sorbus aucuparia</i>
70	<i>Prunus spinosa</i>	95	<i>Senecia jacobaea</i>
71	<i>Potentilla anserina</i>	96	<i>Sieglingia decumbens</i>
72	<i>Phleum pratense</i>	97	<i>Trifolium repens</i>
73	<i>Poa annua</i>	98	<i>Trifolium pratense</i>
74	<i>Poa pratensis</i>	99	<i>Taraxacum officinale</i>
75	<i>Pinus sylvestris</i>	100	<i>Trichophorum caespitosum</i>
76	<i>Pinus contorta</i>	101	<i>Urtica dioica</i>
77	<i>Picea sitchensis</i>	102	<i>Ulmus glabra</i>
78	<i>Polygala Serpyllifolia</i>	103	<i>Ulex europaeus</i>
79	<i>Veronica chamaedrys</i>	104	<i>Vaccinium myrtillus</i>
80	<i>Vicia sepia</i>	105	<i>Viola palustris</i>
81	<i>Viola riviniana</i>	106	<i>Vicia faber</i>