

National Woodland Survey & Native Pine Survey Field Handbook

Amended by S M Smart and C M Wood. Adapted from original text by M W Shaw and R G H Bunce for the 1971 baseline broadleaved woodland survey of GB, and 2002 amended version by K Kirby, S M Smart and H I J Black. The authors thank Steven Cavers, Karsten Schönrogge, Bethan Purse and Sarah Green for advice on recording tree disease. We thank Dr. György Csóka of the NARIC Forest Research Institute, Hungary for allowing us to reproduce his tree disease photographs.

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1. Instructions on methods of survey and recording

1.1. General

The aim of the survey is to take a soil sample, record understorey plant species composition, DBH of trees shrubs and saplings and presence of plot attributes including tree regeneration, as close as possible to earlier survey locations.

You will be supplied with the necessary site and plot location maps, recording sheets and soil sampling bags. A check list of all equipment is given in Appendix V.

Woods will be located using a map, a list of grid references derived from the original plot location map and names for each woodland site, an A4 extract from the relevant 1:50,000 OS map.

1.2. Access and Permission to Survey Sites

Access and permissions are being handled by our contractor XSG Ltd. They identify all owners and attempt to make contact. They then send through a site map and a letter from CEH requesting permission to survey. When permission has been secured CEH will let you know. This will usually mean emailing you the map of the site showing each land owner and then below the map a list of contact details and any instructions received from the owner. It is very important to take note of these. The most common stipulation is that the owner is contacted by phone or email a few days prior to the survey starting. They may want to know registration number of vehicles. Also, if they know when you are coming they can inform farm managers, gamekeepers, foresters etc. They may also help out by suggesting access routes and parking places. Some owners will want CEH to apply for a permit or/and require copies of Public Liability insurance and Risk Assessments. This should all have been handled prior to permission being granted so you should not have to worry about these issues.

When visiting each site please have a copy of the map and ownership details on phone or tablet so you can let people know that X, Y or Z knows of your presence and has given permission. Also please familiarise yourself with the permission letter from CEH and the Risk Assessment.

During the repeat survey in 2002, there were very few cases where land-owners refused permission to survey their land. Most are fascinated by the fact that records existed from 1971 and that these records could be accurately updated.

1.3. Location of the Sampling Points

A map will be provided that is marked with the 16 random sampling points (numbered 1-16).

In practice, a very high level of accuracy is not possible because of the relatively imprecise way in which the plot locations were recorded in the baseline survey; that is just X's marked on a 2 ½ inch map. Therefore plot locations cannot be re-found with any greater accuracy than is achievable by simply trying to be as close as possible to these points. This is what surveyors therefore need to do. The best approach is to derive the grid reference from the plot location map provided and go to that point using a GPS. Claire has provided these for each site.

The lack of precise information on the location of plots will inevitably result in a degree of error and this is absolutely fine. This error is expected and can be factored into analysis of the data so please do not agonise about the lack of ability to re-find the original plot location exactly; in short

it cannot be done. The important thing is to get as close as possible to the rough location of the centre of each X as recorded on the plot location map. The quickest approach is to take a bearing from your entry point to the site or from the plot you've just completed to the next plot. Then use the grid square on your plot map to roughly gauge the distance you need to walk. Then quickly move to the rough plot location using compass and pacing. Once 'near' try to get close to the GPS point extracted from the plot map. Next, use the tree DBH data from the previous surveys to give greater confidence you are in roughly the right place. These data should however, be used very carefully since disease, natural growth and management interventions could all have resulted in DBH and species compositional change. However, clearly if a series of large or small trees of particular species are present within the locality of the plot and bare no relation at all to the previous records you should be questioning whether you are in the wrong part of the wood or whether change has occurred. If you have used the GPS translation of the point on the map then really you shouldn't be too far away. This is justification enough for not agonising over the matter, making a decision and getting on with the plot. This approach was trialled in a repeat survey of two of the Welsh broadleaved woodland sites in 2016 by S.Smart and a visiting group of woodland ecologists from Ghent University. We concluded that using the previous DBH data was an effective and recommended aide to re-finding plot locations but careful judgement has to be exercised. If you end up in a location that seems quite different in tree and shrub DBH and species composition but you feel that this could reflect real change then that's fine.

Notwithstanding the above advice, the avoidance of other sources of bias is critical. Such considerations as, "this bit is not very typical", or, "we had a bit like this last time, we will walk on another 10 paces, it looks better there", must be avoided at all costs. Taking short or long paces in order to avoid a blackthorn thicket or Bramble patch is an equally heinous crime as is the location of plots in situations judged to be in any sense 'homogenous'.

1.4. Recording the Data

Bear in mind that the sites may have altered significantly since the last survey. Collect soil samples and record the vegetation even if the plot is no longer woodland. Only do not record if it is built-over or the location is on land for which you do not have permission to access. For example, between 1971 and 2002 we know that some of the plots were 'assimilated' into neighbouring gardens! In these instances do not record the understorey etc but please DO create an entry for the plot but put a note in the Notes box telling us what the current land-use is. We know that at least one site has been bisected by a motorway since 1971. Dramatic changes in land-use may have affected other sites as well. In particular, do not record plots on used railway embankments or motorway verges. Be sensible and stay alive!

It is envisaged that data will be collected electronically (where possible) for the first time in 2020 and beyond. There are many advantages of recording electronically, including saving data entry time, recording locations automatically, recording and storing photos automatically, increased data validation, reduced transcription errors, easy submission of results to a central database via WiFi or mobile data and above all reduced cost. Survey forms have been designed using ESRI's 'Survey123' software, described as below.

Compatible Devices

Survey123 is compatible with a wide range of electronic devices including:

- Smartphones (Apple, Android)
- iPads
- Windows 7/10 tablet



A device with an inbuilt GPS which works offline is preferable in order to seamlessly record plot locations

Installing Survey123

1. The software is free to download. Find and install 'Survey123' (for ArcGIS, ESRI) from your App Store (this will depend on your type of phone or device) (*note: free to download*). The Windows version can be downloaded here: <https://doc.arcgis.com/en/survey123/download/>
2. Scan the 2 QR codes provided (you will need a QR reader on your phone or device, also freely downloadable from your App Store). One of these will load the survey for the overall site information, the other for plot recording. **You do not need to log in.**

Backup plan (paper forms)

There may be occasions where you find yourself with no electronic device on which to record for a number of reasons (flat battery, too wet etc.). In these circumstances, it is possible to use the paper recording sheet templates provided. However, surveyors must subsequently enter their data either using the tablet app, or the web page interface. Get in touch with us if this proves difficult.

If having to record on paper, we recommend you use clutch pencils to fill in all recording forms (preferably printed on waterproof paper). They do not need sharpening and pencil will be preferable to pen if it is raining. An example of each paper recording form is given in Appendix IV.

Recording Forms for each dataset

One site description and habitat survey form must be completed for each site, one plot recording survey form and one soil sample must be collected from each plot.

The ground flora should be recorded before the trees, sapling and shrubs and before taking the soils sample so that it is surveyed in a relatively undisturbed state. The remaining recording can then be carried out in the most manageable order.

Plot level information

- **Page 1: Plot details** – site name, recorders, slope, aspect, photos.
- **Page 2: Plot description and habitat data** - mostly presence and absence of attributes, from the same 14.14 x 14.14 m plot.
- **Page 3: Vegetation plot.** Ground Flora - presence and absence in five successively increasing quadrat sizes up to the full 14.14 x 14.14 m, with % cover/abundance estimates

for the largest of these. Major common bryophytes should be recorded but a full list is not expected (see below).

- **Page 4: Trees, saplings and shrubs** - trees, DBH (cm) and species from all four quarters of a 14.14 x 14.14 m plot (200 m²), the same data for saplings and shrubs from a pair of diagonally opposite quarters 1 (NE) and 3 (SW) of the plot.

Site level information

- **Page 1: Site header information** – site name, recorders, notes
- **Page 2: Site description and habitats** - mostly presence and absence of attributes.

Samples

- (i) A 15cm deep x 5cm wide soil core dug from each plot to be obtained at the same time as the plot survey.

The methods of setting out the plots and the collecting and recording of the data are now dealt with in detail.

2. Recording of Plot Data

There are four recording pages for the following categories. The Appendix provides further details on individual categories and classifications.

The recording forms are launched by selecting the relevant survey from 'My Surveys' within Survey123, then selecting 'Collect' as illustrated.

This will launch the survey forms, starting with the general plot information on page 1 (this may take a few seconds – be patient!)

- Enter the site name (note: there is a drop-down menu, or use 'auto-type'). The site number will appear automatically.
- Enter the plot number and the initials of the surveyors recording the plot.
- The location will be captured automatically if your device has an (offline) GPS. If you are online (either mobile data or WiFi), a map will appear to make it easier to ascertain how accurate the location is. For greatest accuracy and while we fix the link between Survey123 and tablet GPS please use a handheld GPS and make a note of the reading in the 'notes' box lower down the page. See notes below.

- **Slope (degrees)** and **aspect (degrees)** are entered on this page, and a reminder box to tick when the soils sample is taken (*it is best to do this after recording the ground flora to avoid disturbance*). If the ground is level then enter a zero in Aspect and zero in Slope. The easiest way to estimate Slope is to use your Smart phone and install the free app by Gamma Play called Bubble Level. It is excellent. Then, by eye, orient the phone and bubble level down the dominant slope within the plot. We don't expect or need huge accuracy.
- **Tree disease:** record tree disease and take photos of evidence as necessary. Of course most of you will not be disease experts – neither are we! You will probably be very familiar with Ash Dieback and perhaps not at all familiar with the other diseases. If you see anything that doesn't look like Ash Dieback but does look like a disease then tick 'Other' in the tree disease box unless of course you know what the disease is. Then do also record a rough % defoliation or %leaf browning if relevant when you move to the tree and shrub DBH form. You also have the option of taking up to five photos of any disease signs present in the plot.
- **Photos of the plot** should also be taken using your device. Expand the 'Photos' section, and click the camera to take a picture (photos can also be uploaded subsequently, using the folder option). There are five photos that are needed. The first one should be upward pointing and capture the canopy immediately above the centre post. The easiest way to do this is to click the 'selfie' button when the camera is activated. Then hold the tablet or your Smart phone away from you at chest height (c.1.3m) and click. The remaining four photos should be taken facing each cardinal bearing when standing at the centre post. Take these photos before recording the vegetation.

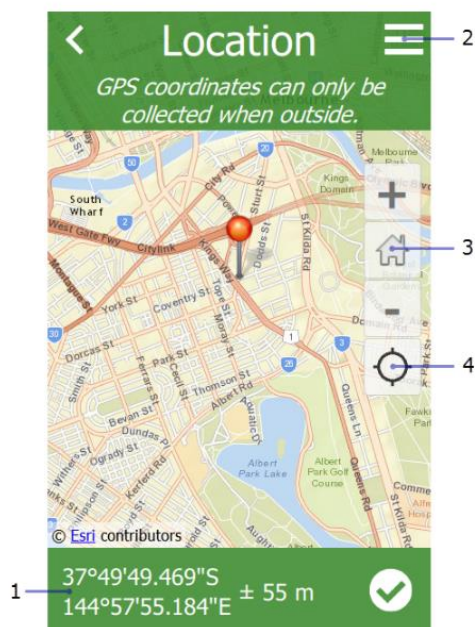
Note: You can navigate between pages using the arrows at the bottom of each page


Stamping the plot location

Geopoints have two forms of presentation. Initially, they are represented by a location panel on the form. When you press the location panel, it expands into a full-screen map with additional locating functions. You can capture a point on either the location panel or the full-screen map.





screen map.



The Location Averaging button  at the top right of the location panel captures an average of locations rather than a single result when it's pressed. This can also be used with an accuracy threshold to ensure only reliable results can be used. When you tap the location panel, it expands to a full-

The latitude and longitude of your current location are listed here. Selecting the area converts them into editable fields, allowing you to define a different location.

The Menu button  provides a number of alternative basemaps to the default, for a range of different purposes.

Home  returns the map marker to where the survey creator has defined a home location. If no home location has been defined, it instead returns the marker to the user's location.

The Location icon  starts displayed in black, indicating the location sensor is disabled. Select the

button to switch to Navigation  mode, enabling

Location and tracking the device's current location. Moving the map marker from here, either directly on the map or by changing the coordinates, still changes the location and coordinates of the answer, but the device's location remains visible as a pulsing blue dot while doing so. When

this happens, the button switches to an Active Location icon ; select it to return to Navigation



. Click the tick, bottom right on the recording form, when satisfied with position.

2.1. Plot description and habitats (page 2 of recording form)

The first operation when the plot centre has been located, is to lay out the plot, as described in section 2.2. Plot description and habitats are recorded on the basis of presence within the 14.14 x 14.14 m plot by ticking the appropriate attributes on the form. The object of this form is to obtain frequency data about important attributes that can reasonably be expected to occur a measurable number of times within a single site. A detailed account of methods and definitions of the attributes is given in Appendix IV (the second number in brackets referring to the plot form attributes and the first number to that given on the Site form; these numbers are relevant only if you are using backup paper forms). **In the case of attributes that have an appreciable defined**

area, e.g. ponds, glades¹, etc., only part of the full area needs to be in the plot for it to be recorded as present. For example if only part of a glade 50 m across occurred within the plot it would be recorded as present and attribute 76 struck off. The comments column can be used to record any information that is not included elsewhere and is considered relevant or useful in interpretation.

Page 2: Plots

▼ **Plot descriptions**

▼ **Trees - management**

Trees - management

<input type="checkbox"/> Cop. Stool	<input type="checkbox"/> Singled cop.	<input type="checkbox"/> Rec. cut. cop.
<input type="checkbox"/> Stump hard.new	<input type="checkbox"/> Stump hard.old	<input type="checkbox"/> Stump con.new
<input type="checkbox"/> Stump con.old	<input type="checkbox"/> Other	

▼ **Trees - regeneration**

Trees - regeneration

<input type="checkbox"/> Alder	<input type="checkbox"/> Ash	<input type="checkbox"/> Aspen
<input type="checkbox"/> Beech	<input type="checkbox"/> Birch	<input type="checkbox"/> Hawthorn
<input type="checkbox"/> Wych elm	<input type="checkbox"/> Hazel	<input type="checkbox"/> Holly
<input type="checkbox"/> Hornbeam	<input type="checkbox"/> Lime	<input type="checkbox"/> Oak
<input type="checkbox"/> Rowan	<input type="checkbox"/> Rhododendr on	<input type="checkbox"/> Sweet chestnut
<input type="checkbox"/> Sycamore	<input type="checkbox"/> Other hrwd.	<input type="checkbox"/> Scots pine
<input type="checkbox"/> Yew	<input type="checkbox"/> Other con.	<input type="checkbox"/> Other

2.2. Vegetation plot: Ground Flora



The first operation when the plot centre has been located, is to lay out the plot. The four corner posts circumscribe the whole 14.14 x 14.14 m (200 m²) plot. The plot should be located so that the diagonal strings, and hence corners of the plot, are orientated along cardinal compass bearings. Spaced along each of the distance strings are four coloured markers that give the half-diagonal

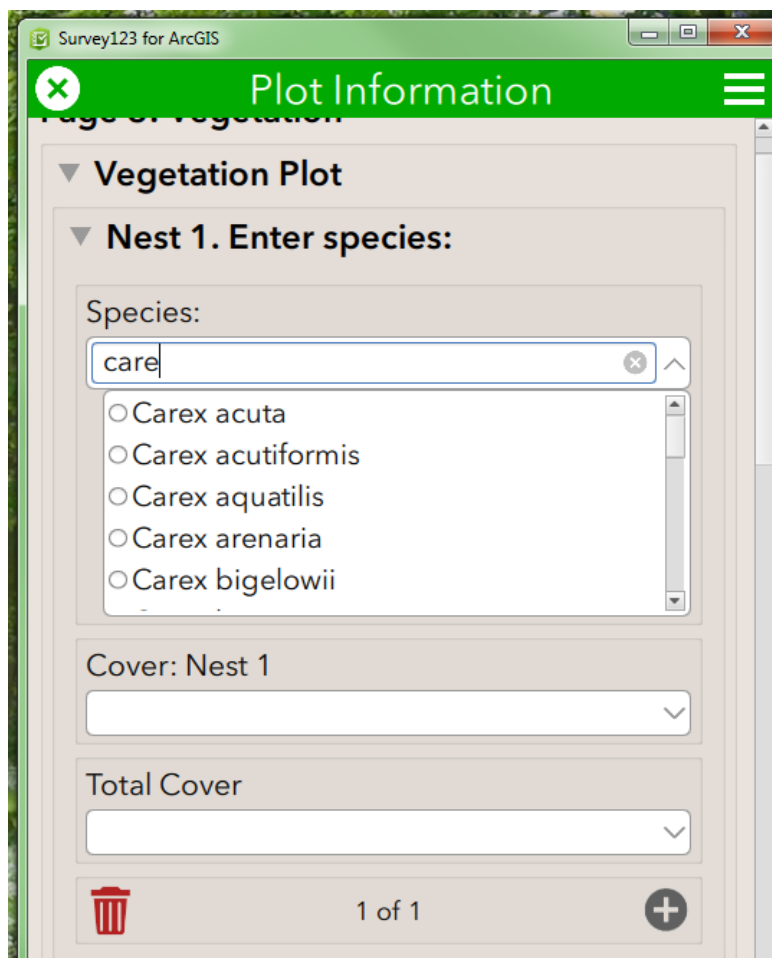
¹ Defining a 'glade': these are areas within the woodland site that are not shaded by a woodland or shrub canopy. They may be of recent origin e.g. after coppicing or windthrow, or more established. In the latter case this is likely to coincide with differences in the diversity of plants in the understorey, for example, more grass, less bare ground, more bracken or other shade-intolerant herbs. Where dead and dying Ash or other diseased trees are still standing then PLEASE indicate this by selecting Tree disease present but do not classify such areas as a glade. We are looking for significant canopy gaps rather than better lit understoreys beneath standing but leafless trees.

distances of the four smaller plots (see Figure 2). Starting with the smallest 2 x 2 m plot (nest 1), the area within is carefully searched recording the presence of all ground flora species - all vascular plants (monocots, dicots, and ferns) and common bryophytes - **including tree or shrub seedlings <25 cm in height**.

Nest 1

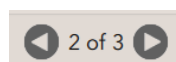
A record of the presence of species in this innermost quadrat are made by inserting the name of the species on page 3 of the recording form, under 'Nest 1'. A drop down menu is provided, but it is often easier to start typing the name of species, and suggestions will appear in the drop-down

menu. Additional species are entered by clicking the  (below 'Total Cover'), or can be deleted using the dustbin icon.  If the species is not listed, start typing 'Other', select 'Other' and a free-text box will appear in which you can type the species name. This may also be used to enter unknown species, for example 'Species A', 'Species B' and so on (once the species has been identified and added to the plot record, this generic entry should be deleted).



Having completed the record of presence of the vascular plants in the first nest, an estimate of percentage cover of each species for the nest should be made. This should include all vascular plants plus tree/shrub seedlings recorded as present, plus the six additional categories (**litter, wood, rock, bare ground, water and bryophytes**). **Estimates should be given to the nearest 5% only or 'present'**. Given a layered understorey, the total cover can sum to well over 100%. When

estimating cover include the horizontally projecting leaf canopy of each species i.e. do not just consider rooted basal area. DO NOT INCLUDE PRESENCE AND COVER OF TREES AND SHRUBS. THESE ARE RECORDED SEPARATELY ON PAGE 4 – SEE BELOW. Covers should be entered into the 'Cover: Nest 1' box for each species. Covers can be entered as species are entered, or can be entered subsequently using the scroll forward and back buttons.



Unfortunately, it is currently not possible to view the species entered in column list format. However, as a helpful guide, species are summarised at the bottom of the page, along with a sum of the covers entered.

Note: the software currently allows blank species or cover boxes, as well as duplicate species. PLEASE CHECK carefully that this does not occur in your plot. Note: For recording on the paper sheet, a record of the presence of species in this innermost quadrat are made by inserting a 1 in the column headed Q on the vegetation plot recording sheet and in the row corresponding to the species concerned (see Appendix II). If the species is not listed then pencil in the entry in the blank rows under 'Other species' at the bottom of the sheet. Cover for the first nest is entered in the first % column.

Subsequent Nests

Having recorded all species in a given quadrat nest, the next largest area enclosed by the next successive set of markers is searched for **additional species only**. This procedure is repeated until the full 14.14 x 14.14 m (200 m²) has been recorded. Record successive quadrats under the relevant Nest section on the recording form (*on paper, by inserting the quadrat number (2 to 5) in the Q column; as for quadrat 1*). If there are no additional species found in a nest then tick the box 'No additional species in nest'.

To maintain consistency with previous surveys only a limited range of common bryophytes should be recorded. These are provided for selection in the software and listed in Appendix I. Also only record bryophytes that characterise the understorey and **not directly on tree bases, logs, rocks or other specialised habitats. This is often a difficult distinction to make where the understorey is a thick carpet of moss growing over a large mass of woody debris.** If in doubt then record species by only those on the lists provided in Appendix I. A way to help discriminate between understorey and these elevated micro-habitats is to think whether the bryophytes on boulders and tree trunks are in a different microclimate to the majority of the understorey. If you suspect they are then don't record them.

Having completed the record of presence of the vascular plants in all five quadrat sizes, an estimate of cover abundance for the full plot (14.14 x 14.14 m) should be made and inserted in the 'Total Cover' box below each species. **Note: it is necessary to enter these under each species in each of the 5 nests.**

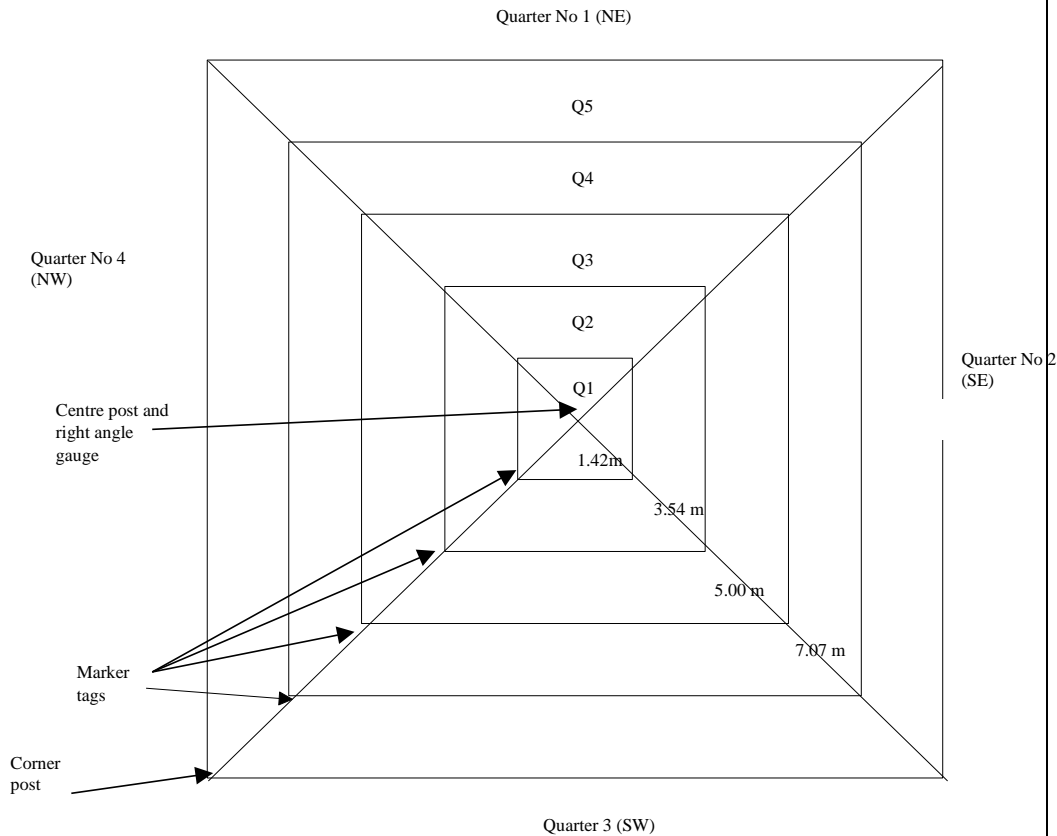
(On paper, the covers for the full plot are entered into the second % column)(see Appendix II).

As in the first nest, this should include all vascular plants plus tree/shrub seedlings recorded as present, plus the six additional categories (litter, wood, rock, bare ground, water and total bryophyte). **Estimates should be given to the nearest 5% only. Species present but with less than 5% cover, should be recorded as 'present'.** The total cover can add up to more than 100% where the vegetation is layered. Note that tree and shrub canopy cover is not included as the canopy composition and DBH is recorded instead.

Note: The cover of *Total bryophytes* and *Total lichen* will be added to the plot sum total. This means that any bryophyte species that you gave a cover value will be double counted – counted once in the individual species covers and again as part of Total Bryophyte. This is not a problem but means that the total summed cover may appear surprisingly high!

Figure 2

LAYOUT OF VEGETATION PLOT



Distance string position from centre - 1/2 diagonal

$$Q1 = 4 \text{ m}^2 \text{ quadrat (2 m x 2 m) = 1.42 m diagonal}$$

$$Q2 = 25 \text{ m}^2 (5.00 \times 5.00 \text{ m}) = 3.54 \text{ m}$$

$$Q3 = 50 \text{ m}^2 (7.07 \times 7.07 \text{ m}) = 5.00 \text{ m}$$

$$Q4 = 100 \text{ m}^2 (10.00 \times 10.00 \text{ m}) = 7.07 \text{ m}$$

$$Q5 = 200 \text{ m}^2 (14.14 \times 14.14 \text{ m}) = 10.00 \text{ m}$$

Not to scale

2.3. Trees, saplings and shrubs (page 4 of recording form)

Tree disease: If tree disease is present in the plot, estimate the % of defoliation and leaf browning present. We do not expect or require huge accuracy. Think of 100% being where leaves on all the trees and shrubs present would be intact and healthy. We realise this will be tricky. Don't agonise though. Even if quite uncertain, the information you record will be extremely useful. The most common disease you encounter will undoubtedly be Ash Dieback. See Appendix VI for pictures of disease signs. If you see anything that looks like disease do take a photo – use page 1 of the app.

Trees are defined as stems of ≥ 5 cm DBH of any species which is normally capable of attaining a tree like habit. Exceptions include **Hazel, Blackthorn, *Viburnum* spp., Juniper** and other shrubs, which rarely produce stems ≥ 5 cm diameter anyway. The species and DBH (cm) of all stems in the whole plot **greater or equal to 5 cm** diameter are measured (recording by quarters of the plot).

+

NOTE THAT ANY STEM LESS THAN 5cm DBH SHOULD BE RECORDED AS 1

Trees with multiple stems have each stem measured and recorded separately **but these need to be identified on the survey form as shown below**. The 'Tick if multi-stemmed' box should be ticked. Note that this will only appear once you have selected a species. Multiple stems on the same tree may then be recorded within the repeat group as follows:

The screenshot shows a digital survey form. At the top, 'Tree species:' is followed by radio buttons for 'None', 'Alder', 'Ash' (which is selected), 'Beech', 'Birch', 'Larch', 'Oak', 'Scots Pine', 'Sycamore', and 'Other (select below)'. Below this is a 'Tick if Multi-stemmed' section with a checked 'Yes' box. A purple box titled 'Multi-stems' is expanded, showing a 'Stem DBH' input field with the value '1' and a 'Tick if Dead' section with an unchecked 'Yes' box. At the bottom of the form, there are two rows, each with a trash icon, the text '1 of 1', and a plus icon.

To enter DBH for a stem on a multi-stemmed individual either click in the input box and type in a number, or if the stem is <5cm then click the + (*a default of 1 (= stem 0-5cm) is already present in the box*). Note that the last stem in a series does not need to be added by clicking +. If moving to another individual, then click the lower ribbon + to add another tree. Then if this next individual is multi-stemmed, again select the species and click multi-stemmed to bring up the multi-stems entry box.

(On the paper form, they are bracketed together on the recording sheet (see Appendix III)).

Dead trees (standing of course) or dead stems on multi-stemmed trees, are identified by ticking the 'Tick if Dead' check box (*on paper, are designated by a capital "D" in the top right-hand corner of the cell in which its diameter is recorded*).

Saplings

Saplings - tree species, with the same definition as (i), but with a height >130 cm (ie over breast height) but <5 cm DBH are recorded only in the diagonally opposite quarters 1 and 3. **Quarter 1 is always the NE quadrant. Quarter 3 is always the SW quadrant (see Figure 2)**. The same measurements as for trees, species and DBH (cm), are recorded for these with the same

conventions for multi-stemmed and dead trees or stems. Note that if a multi-stemmed tree has stems <5cm these are only recorded if the tree occurs in quarters 1 or 3. This means, for example, that a multi-stemmed tree in quarter 2 with stems of 3cm, 6cm and 5cm will only have the last two recorded.

Shrubs

Shrubs – are defined above according to species on the recording form. Like the saplings these are only recorded in the diagonally opposite quarters 1 and 3; same data, same conventions. The Shrub species names are selectable in the relevant quadrants of the plot. **Note that Hazel is considered a shrub and so should only ever be recorded in quadrants 1 and 3 even if a stem is ≥ 5 cm DBH.**

Shrubs are selectable from the relevant set of radio buttons as follows:

Hazel, Holly, Hawthorn, Blackthorn, Alder Buckthorn, Guelder Rose, Spindle Tree, Purging Buckthorn, Other, Sallow

2.4. Soil sampling

Soil samples are to be taken from the centre of each plot or as near as possible (not more than 1 m distant). Each sample bag must have a self-adhesive label stuck on indicating site and plot (labels provided – ideally done when the bag is dry and before starting fieldwork). Wherever possible, bags should also be marked using a permanent marker in the field after the soil sample has been collected – on the bag itself, showing site and plot. Unknown soil samples results in the loss of data – hence double labelling to reduce such error.

Soil samples are to be taken by banging a plastic tube (15cm x 5cm) into the soil surface thus sampling the top 15cm. Before taking the sample, check for fresh plant litter (green) on the surface of the soil. Carefully remove this to expose the layer of decomposing plant material below. If in doubt – include in the sample for later removal at CEH. If the area is rocky – remove the largest rocks to expose the soil surface. If there is more rock than soil – move to another area (within 1 m distance). Ensure that the top of the core is flush with the soil surface so that a full 15cm of soil is extracted.

If difficulties in obtaining sufficient sample are encountered, then move the core a few cm and try again. If you have difficulty filling the core then attempt to excavate some material from the bottom of whatever depth of hole you managed to create. The hole should be filled in and roughly disguised before leaving the plot - this is important.

Record any problems/changes in soil sampling on the plot form ([page 1](#), notes field). All soil sample bags should be kept in a cool box or fridge and dispatched as quickly as possible to the address provided.


2.5. Completion of the Plot

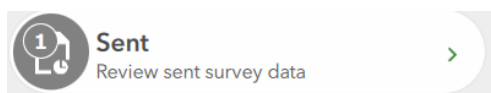
Having filled in all data recording forms and collected all necessary samples, the recording of the plots is now complete. At this point it is advisable to:

- (i) Check that all forms have been fully entered – make a quick check to see that major items have not been omitted, and that the **site, plot number and date of survey have been correctly entered. Save or submit your survey data (see below).**
- (ii) Check all the samples into your rucksack.
- (iii) Check all the equipment into your rucksack.
- (iv) Check the soil sampling hole has been filled in.
- (v) Take one last quick look round the plot to see that nothing important has been omitted and no equipment left behind.

The data you are collecting is being collected “forever”. Make sure that it is comprehensive and correct to the best of your ability even at the expense of taking a little extra time.

2.6 Submitting your data

Once a survey form has been completed, you have a number of options on clicking the green tick button on the last page of your survey. If you are online (either Wifi  or mobile data, and you are happy your survey is fully complete, you can submit your

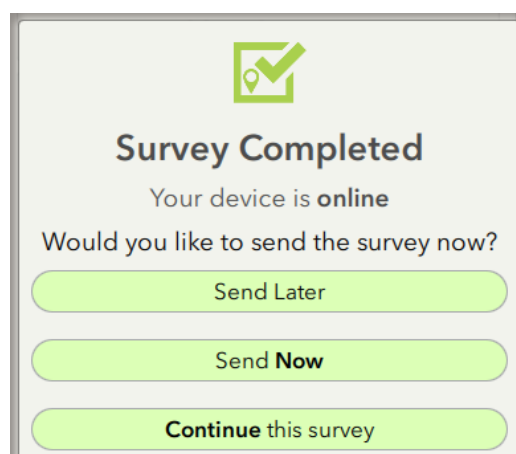


data directly to the central database using the ‘Send Now’ option (*note: it is possible to resend a survey if you find you have missed something – you will find your sent surveys in*

*the ‘Sent’ box. If you are resending, **please make a note in the notes section** to say which the correct version is).*

If you are offline, return halfway through a survey or choose ‘Send Later’, your survey will automatically be saved in the ‘Drafts’ or ‘Outbox’ from where you can reopen your survey and continue editing.

If your devices crashes at any point, Survey123 has auto save, so it is likely that if you are halfway through a survey, you should not have lost anything.



One additional set of data has to be collected for the site as a whole (i.e. comprising the plots and the ground in-between), namely site description and habitats for the whole site - separate but similar form to that for the plot...

3. Site Description and Habitats

3.1 Recording forms

A detailed description of how this data should be collected and recorded on the form and definitions for all attributes is given in Appendix IV. The attributes apply to the whole site and so should reflect the plots, the areas you walk through to reach each plot and aspects of the site boundary. You do not need to exhaustively search the whole site. It is more a record of the features you may happen to note while moving around the site from plot to plots. Please make full use of **comments section** to note any features that may help in the interpretation of change. Also make sure you record any information gleaned from conversation with the land-owner, although such anecdotal information will not be consistently recorded it can help when interpreting change.

The image displays two screenshots of the Survey123 for ArcGIS mobile application interface. The left screenshot shows the 'Site Information' form with fields for Plot Details: Site name (dropdown), Site number (text), Recorder (text), Date (calendar, showing 18 May 2018), Approx. time taken to survey in hours (text), Subjective overall impression of site (checkboxes for Smashing, Pleasant, OK, Nasty, Nightmare), and Notes (text area). The right screenshot shows the 'Site descriptions' form with sections for Trees - management, Trees - regen., and Trees - dead. The Trees - dead section includes checkboxes for Live/dead, Stnd.dead <10cm, Stnd.dead >10cm, Fallen brkn, Fallen uprtd., Log.v rotten, Fall bnb.>10cm, Hollow trees, Rot holes, Stump <10cm, Stump >10cm, None, and Other.

4. Soil dispatch to CEH Lancaster

When all 16 soil samples from each plot are collected, bagged and labelled they should be dispatched to CEH Lancaster or Lancaster University (TBA). Options for returning samples are: delivery by hand if you are in the area; courier; recorded delivery next day post; collection by CEH (when this is local or near a CEH station). Each survey team should, ideally ensure that samples are

sent so that they arrive at CEH within the week they are sampled. Please remember that CEH is closed over the weekend. It is much better to keep the samples until the following week in a cool place than send them on a Friday.

Appendix Ia - List of top 25 most common bryophytes recorded from Pilot woodland sites

BRC code	BRC names	CountOfBryoCode
8201214	<i>Polytrichum sp.</i>	254
820599	<i>Thuidium tamariscinum</i>	173
820507	<i>Pseudoscleropodium purum</i>	152
8101308	<i>Lophocolea sp.</i>	132
8201147	<i>Fissidens sp.</i>	123
820395	<i>Plagiomnium undulatum</i>	111
820382	<i>Mnium hornum</i>	109
820351	<i>Hypnum cupressiforme sens.lat.</i>	105
820463	<i>Pleurozium schreberi</i>	97
820206	<i>Dicranum scoparium</i>	80
820346	<i>Hylocomium splendens</i>	64
820532	<i>Rhytidiadelphus loreus</i>	64
820533	<i>Rhytidiadelphus squarrosus</i>	62
820534	<i>Rhytidiadelphus triquetrus</i>	52
8201243	<i>Sphagnum sp.</i>	38
820203	<i>Dicranum majus</i>	32
8201110	<i>Campylopus sp.</i>	32
820592	<i>Thamnobryum alopecurum</i>	26
820374	<i>Leucobryum glaucum</i>	25
8204	<i>Calliergon cuspidatum</i>	17
810867	<i>Pellia epiphylla</i>	16
820402	<i>Neckera crispa</i>	12
810827	<i>Marchantia polymorpha</i>	9
820335	<i>Hookeria lucens</i>	8
82042	<i>Aulacomnium palustre</i>	8

Appendix Ib - List of common bryophytes in Great Britain

BRC code	BRC names
82040	<i>Atrichum undulatum</i>
82042	<i>Aulacomnium palustre</i>
82081	<i>Brachythecium rutabulum</i>
8201106	<i>Bryum</i> spp.
8204	<i>Calliergon cuspidatum</i>
8201110	<i>Campylopus</i> spp.
810714	<i>Cephalozia bicuspidate</i>
820157	<i>Cirriphyllum piliferum</i>
820184	<i>Dicranella heteromalla</i>
820203	<i>Dicranum majus</i>
820206	<i>Dicranum scoparium</i>
820249	<i>Eurhynchium praelongum</i>
820255	<i>Eurhynchium striatum</i>
8201147	<i>Fissidens</i> spp.
820335	<i>Hookeria lucens</i>
820346	<i>Hylocomium splendens</i>
820351	<i>Hypnum cupressiforme sens.lat.</i>
820357	<i>Isopterygium elegans</i>
820363	<i>Isothecium myurum</i>
810807	<i>Lepidozia reptans</i>
820374	<i>Leucobryum glaucum</i>
810814	<i>Lophocolea heterophylla</i>
8101308	<i>Lophocolea</i> spp.
810827	<i>Marchantia polymorpha</i>
820382	<i>Mnium hornum</i>
820402	<i>Neckera crispa</i>
810867	<i>Pellia epiphylla</i>
200001105	<i>Plagiochila</i> spp.
820383	<i>Plagiomnium rostratum</i>
820395	<i>Plagiomnium undulatum</i>
820463	<i>Pleurozium schreberi</i>
820475	<i>Pohlia nutans</i>
8201214	<i>Polytrichum</i> spp.
820507	<i>Pseudoscleropodium purum</i>
820389	<i>Rhizomnium punctatum</i>
820245	<i>Rhynchostegium confertum</i>
820532	<i>Rhytidiadelphus loreus</i>
820533	<i>Rhytidiadelphus squarrosus</i>
820534	<i>Rhytidiadelphus triquetrus</i>
8201243	<i>Sphagnum</i> spp.
820589	<i>Tetraphis pellucida</i>
820592	<i>Thamnobryum alopecurum</i>
820599	<i>Thuidium tamariscinum</i>
8201052	<i>Ulota crispa sens.lat.</i>
820158	<i>Climacium dendroides</i>
8201121	<i>Cratoneuron</i> spp.
8201138	<i>Drepanocladus</i> spp.
820276	<i>Fontinalis antipyretica</i>
820512	<i>Ptilium crista-castrensis</i>

Appendix II Vegetation plot – backup paper sheet

Site No.

Plot No.

Recorder

Date _____

	Q	%	%		Q	%	%		Q	%	%		Q	%	%
Bare ground				FERNS etc				183 Gali sax				413 Sonc asp			
213 Barley				41 Athy fil				190 Gera mol				414 Sonc ole			
454 Wheat				53 Blec spi				193 Gera urb				415 Sorb auc			
GRASSES				137 Dryo dil				195 Geum urb				420 Stac syl			
10 Agro can				138 Dryo fil				197 Glec hed				421 Stel als			
12 Agro cap				147 Equi arv				204 Hede hel				423 Stel hol			
11 Agro sto				348 Pter aqu				206 Hera sph				424 Stel med			
20 Alop gen				FORBS/WOODY Sp				207 Hier pil				427 Succ pra			
21 Alop pra				2 Acer pse				208 Hier sp.				845 Thym pra			
28 Anth odo				4 Achi mil				220 Hype pul				441 Tori jap			
37 Arrh ela				5 Achi pta				223 Stet				443 Tric cae			
562 Aven fat				18 Alli pet				238 Lami alb				446 Trif dub			
55 Brac syl				26 Ange syl				239 Lami pur				448 Trif pra			
58 Brom mol				29 Anth syl				240 Laps com				841 Trip mar			
61 Brom ste				587 Arum mac				243 Lath pra				463 Vacc myr			
123 Cyno cri				47 Bell per				255 Loni per				467 Vero arv			
124 Dact glo				50 Betu sp.				256 Lotu cor				469 Vero cha			
404 Dan dec				64 Call vul				273 Matr mat				471 Vero off			
129 Desc ces				68 Camp rot				277 Merc per				472 Vero ser			
130 Desc fle				69 Caps bur				286 Myri gal				477 Vici sep			
8 Elymus rep				70 Card h/f				288 Nart oss				482 Viol pal			
165 Fest ovi				71 Card pra				296 Oxal ace				849 Viol r/r			
166 Fest rub				92 Cent nig				302 Pedi syl				490 Vero per			
209 Holc lan				96 Cera fon				307 Pice sit				MOSESSES/LICHENS			
210 Holc mol				97 Cham ang				311 Ping vul				850 Brac sp.			
253 Loli mul				98 Chen sp				315 Plan lan				512 Clad imp			
254 Loli per				101 Chry opp				316 Plan maj				106 Clad pyx			
283 Moli cae				103 Cirs arv				324 Poly avi				513 Clad unc			
287 Nard str				104 Cirs pal				328 Poly per				519 Dicr het			
304 Phle pra				105 Cirs vul				833 Poly vu/se				131 Dicr sco			
319 Poa ann				113 Cono maj				336 Pote ans				161 Eurh sp.			
321 Poa pra				114 Conv arv				339 Pote rep				216 Hylo spl			
847 Poa tr/ne				117 Cory ave				342 Prim vul				222 Hypn cup			
SEDGES/RUSHES				118 Crat mon				343 Prun vul				530 Loph sp.			
74 Care bin				121 Crep sp.				346 Prun spi				280 Mniu hor			
76 Care dem				590 Dact sp.				350 Quer sp.				282 Mniu und			
78 Care ech				132 Digi pur				351 Ranu acr				535 Pell sp.			
81 Care nig				136 Dros rot				354 Ranu fic				314 Plag und			
85 Care pan				140 Empe nig				355 Ranu fla				318 Pleu sch			
86 Care pil				141 Endy non				370 Rosa sp.				331 Poly com			
152 Erio ang				143 Epil hir				375 Rum a'sa				843 Poly jun			
153 Erio vag				747 Epil mon				376 Rum a'la				279 Pseu pur			
228 Junc a/a				144 Epil pal				837 Rume con				543 Rhan lan			
230 Junc bul				150 Eric cin				378 Rume cri				364 Rhyt lor			
231 Junc con				151 Eric tet				380 Rume obt				365 Rhyt squ			
232 Junc eff				160 Euph sp.				381 Sagi sp.				558 Spha g/f			
235 Junc squ				168 Fili ulm				386 Samb nig				559 Spha g/t			
260 Luzu c/m				170 Frax exc				401 Sene jac				561 Spha r/t			
443 Tric cae				177 Gali apa				402 Sene vul				439 Thui tam			
				182 Gali pal				405 Sile dio							

[illegible]

Appendix III DBH recording – backup paper sheet

Site No. 200
24/06/71

Plot No. 1

Recorder: MWS

Date

Q No	Species													Ht (m)
1														
T	Oak	37	34											16
R														
E	Birch	9	7	12										
E														
S														
S	Birch	2	5	2	2									
A														
P														
S														
S	Hazel	2	5	4	3	1	1	2	4	2	1			
H														
R														
B														
2														
T	Oak	16 ^D	24											
R														
E														
E														
S														
3														
T	Oak	15	16 ^D	15										
R														
E														
E														
S														
S	Birch	4	1											
A	Rowan	4	3	4										
P														
S														
S	Hazel	2	5	2	1	1	2	3	2 ^D	3 ^D	1	1	3 ^D	
H														
R														
B														
4														
T	Oak	34												
R														
E														
E														
S														

Appendix IV – Site and plot attributes

INSTRUCTIONS FOR COMPLETING THE PLOT AND SITE DESCRIPTION AND HABITAT FORMS

General

One copy of the Site Description and Habitat Form is completed for each site. The Plot Description and Habitat Form is a somewhat reduced version of the Site Form and one is completed for each plot (i.e. 16 per site). Checking that all the appropriate attributes for a given plot have been recorded is part of the routine procedure dealt with in the main text. A further check should, however, be made that there are no logical inconsistencies between the plot and site forms; attributes which are present on the plot form **must** be present on the site form (but not necessarily vice versa). Note that you are not expected to walk the entire site or its boundaries. Your time is best spent recording the 16 plots.

The attribute code numbers are dealt with in order below:

(SE = self-explanatory; and UA = unallocated).

- 1 (1) Site Number - SE
- 2 (2) Plot number - SE, on site form fill in as 1 -16
- 3 (3) Recorder - recorder's initials
- 4 (4) Date - day, month, year. Inclusive dates on site form.
- (5) Slope - (plot only) in degrees.
- (6) Aspect - ° magnetic, SE (See main text for methods).

- A. **Trees - Management**
- 5 Planted hardwoods - must be clear evidence that the trees have been planted, eg visible lines, uniform age and/or, in the case of mixtures, regular alternation of species. Gets more difficult to detect planted origin with age.
- 6 Planted conifers - these can usually be assumed to be planted except in the case of European larch and Scots pine, unless there is strong evidence to the contrary, eg irregular distribution and age. May be natural regeneration of some species.
- 7 Pollards - trees that have had their main branch systems cut off at some time at a height above breast height (4'3" or 130 cm) but have now resprouted. An ancient method of marking boundaries or obtaining firewood and/or browse for stock.
- 8 (7) Coppice stools - trees that have been cut off below breast height and have resprouted. Most multi-stemmed trees are the result of coppicing but not all. Usually the point of cutting can be seen and there are usually >2 stems. Hazel stools should not be recorded as coppice stools unless there are unmistakable cut stems to be seen; a multi-stemmed growth form is normal for this species. Many woods all over Britain, but particularly in the south, were formerly managed on a coppicing system. Most coppice origin woods have not been cut for 20, 50 or even more years and have grown on so that their former use is less evident (but see attribute 10 (9)).

- 9 (8) Singled coppice - where, in what was formerly coppice, with a preponderance of multi-stemmed trees, selected stools have had the number of shoots reduced to one by cutting the others off. This can be detected by the swollen base of the tree with scars where the other main shoots were removed or by the presence of residual twiggy growth. Becomes less detectable with time.
- 10 (9) Recently cut coppice - where there is evidence that coppicing is still, or has been until very recently, in progress. Recent coppice can be detected from cut shoot stubs on the stools and/or the presence of coppice produce (see also 20) in the wood. Recent - <c 5 years.
- 11 Mature conifers - trees >40 years old or >20 m height.
- 12 (10) Stumps hardwood new - hardwood stumps can usually be distinguished from conifers by the presence of ring-porous wood and/or medullary rays. Often the remnants of bark can be used to identify the hardwood species, eg oak, ash, birch. New stumps can be distinguished from old 13 (11) by the absence of advance rot, luxuriant growths or bryophytes and by the fact that the ring growth is still discernible without cutting or scraping the stump.
- 13 (11) Stumps hardwood old - the inverse of the characters used to identify new stumps in 12 (10) above. Stumps of species like birch rot away completely in a very short time, whilst those of more resistant species like oak persist for many (>50) years, so the old/new scale is necessarily arbitrary.
- 14 (12) Stumps conifer new - conifer stumps can be distinguished from hardwoods by the absence of ring-porous wood or medullary rays. Identifiable bark is often useful, as also is resin exudation, and the smell of resin if reasonably fresh. Apart from Sequoias (not very likely) **NO** conifers produce any coppice shoots from stumps cut near the ground. So if there are any signs of coppice shoots live or dead it is sure to be hardwood. the same rules for new/old hardwood stumps also apply to conifers. Yew coppices quite frequently but is easy to identify.
- 15 (13) Stumps conifer old - fully explained above, SE.
- 16 Stumps overgrown - in the more open woodlands, the older stumps in an advance state of decay will often be completely overgrown by such species as bramble, honeysuckle or bryophytes.
- 17 Brashing/pruning - where the lower branches of the trees have been artificially removed by cutting to improve access and/or timber quality.
- 18 Brash heaps - can result from brashing or pruning, or from the cutting of scrub species, or as the lop and top (the thinner branches) of felled trees. Essentially, therefore, a heap of thin branches which have been left to rot.
- 19 Cord wood - odds and ends of felled trees, almost invariably hardwood, which have been cut to log size (as for putting on the fire) and have been piled into regular stacks (usually about 4'-6' high and 2'-3' wide and any length).
- 20 Coppice sticks - the product from cutting coppice which has been tidily stacked for subsequent use. Can vary from large sizes such as hop poles down to pea sticks.
- 21 Stack timber - the larger parts of the stems of felled trees which have been cut into regular lengths (3' up to 30' or 40') and stacked. Anything from pulp bolts up to the largest sizes in saw timber.

- 22 Felled trees - trees that have been felled but have not been processed any further than having had the branches cut off.
- 23 Chips/sawdust - SE
- 24 Fire sites - SE, often used to get rid of brash 18.
- 25 Paint/blaze marks - used to mark trees for some special purpose; often for felling, retaining or thinning out the surrounding trees in favour of the best trees. Paint marks may consist of dots, rings or even numbers. Blaze marks consist of the bark being cut off in a strip at about breast height. The latter almost invariably means the tree is marked for felling. Also include scribe marks.
- 26 Extraction routes - places where logs have obviously been dragged or strips of trees removed for the same purpose.
- 27 Vehicle tracks - the use of vehicles on **unmade ground** off the main roads or tracks (see also attributes 114-118 (79-82)).
- 28 (14) UA

B. Trees - Regeneration

29-48 (15-34) (as per species listed) - **regeneration is any tree species >25cm height and <1.3m DBH and <5cm DBH and must be of seedling origin.** The only exception (ie non-tree) is hazel which must of course be >25 cm in height but must also be of obvious, recent, seedling origin (**do not** record coppice shoots - upper limit of 5 cm hardly applies here). Coppice shoots are not to be recorded as regeneration and care should be taken to check this point as far as possible. Younger seedlings, <25 cm height, will be recorded by plots as a part of the ground flora. Regeneration over breast height will similarly be recorded in more detail with the saplings.

C. Trees - Dead (= Habitats)

- 49 Live/Dead - trees which, although still alive, have substantial dead parts on them, >50%.
- 50 Standing dead <10 cm diameter - SE.
- 51 Standing dead >10 cm diameter - SE.
- 52 (35) Fallen broken - trees dead, or recently alive, which have fallen and are lying on or near the ground due to the main trunk breaking. Includes trees that have been felled and abandoned. Must be <10 cm diameter at widest point - does not include very small trees.
- 53 (36) Fallen uprooted - as for 52 but uprooted with a mass of soil and roots pulled out of the ground leaving a hole. Must be >10 cm diameter again.
- 54 (37) Log very rotten - a very old version of 52 (35) or 53 (36), the sort you can kick into with your boot (with no broken toes). Must be >10 cm diameter again.
- 55 (38) Fallen branch >10 cm diameter - SE.
- 56 (39) Hollow trees - as indicated by large holes in base or higher up, SE.
- 57 (40) Rot hole - smaller holes <25 cm diameter where branches have fallen off or the tree has been damaged in some way. In general not large or deep enough to indicate the tree is hollow.
- 58 (41) Stump <10 cm diameter - hardwood or conifer of any age and state of decay.
- 59 (42) Stump >10 cm diameter - as for 58 (41) apart from size.
- 60 UA.

E. Habitats - Rock

- 73 (51) Stones <5 cm - as with all attributes in this group, must be on the surface of the ground, otherwise SE.
- 74 (52) Rocks 5-50 cm - SE.
- 75 (53) Boulders >50 cm - SE.
- 76 (54) Scree - the essential characteristics of a scree is its actual or potential mobility, thus distinguishing it from a rock pile (attribute 82 (62)). In order to exhibit this mobility a scree consists of a mass of rock fragments resting at or near the maximum angle of repose. The instability of a scree is conferred either by additions from above or active erosion at the base (possibly at high altitudes by the severe climatic regime). The minimum size for recording scree is 25 m². Man-made scree produced by various earth-moving operations also count (see also 133 (87) and 134 (88)).
- 77 (55) Rock outcrop <5 m (height) - should be, as far as it is possible to tell, part of the solid geology. Height refers to vertical height (includes low angle outcrops such as limestone pavement).
- 78 (56) Cliff >5 m - a larger version of 77 (55).
- 79 (57) Rock ledges - horizontal surfaces of any size on rock outcrops or cliffs (77 (55) and 78 (56)). No width limits apply. Will usually be made very obvious by the presence of vegetation on the rock faces.
- 80 (58) Bryophyte covered rock - logically must record one or more of attributes 74 (52), 75 (53), 77 (55), and 78 (56) as well. Otherwise SE.
- 81 (59) Gully - where two rock faces or cliffs face one another. Must be at least 3 m in height and length and not more than 1.5 x their height apart. Logically must also record one or both of attributes 77 (55) and 78 (56) as well.
- 82 (60) Rock pile - as name suggests a pile of rocks, not less than 1 m in height and 2 m in diameter (see also 76 (54)). Logically must also record one or both attributes 74 (52) and 75 (53) as well.
- 83 (61) Exposed gravel or sand - must be at least 1 m² in extent in one piece.
- 84 (62) Exposed mineral soil - must be at least 1 m² in extent in one piece.

F. Habitats - Aquatic

- 85 (63) Small pool <1 m² - must not be running water, otherwise SE.
- 86 (64) Pond 1-20 m² - as for 85 (63) SE.
- 87 (65) Pond/lake >20 m² - as for 85 (63) SE.
- 88 Stream slow <1 m - speed less than 1 mph (very slow walking or 1 m/2 secs).
- 89 Stream fast <1 m - speed over 1 mph.
- 90 River slow 1-5 m speed as 88, SE.
- 91 River fast 1-5 m - speed as 89, SE.
- 92 River slow >5 m - speed as 88, SE.
- (66) Stream/river slow (plot only) - as above but no size limits.
- (67) Stream/river fast (plot only) - as below but no size limits.
- 93 River fast >5 m - speed as 89, SE.
- 94 Bottom rock - SE.

- 95 Bottom gravel - SE.
- 96 Bottom sand - SE.
- 97 Bottom mud - if water turbid, may have to poke with a stick (if turbid most likely mud anyway).
- 98 Bottom peat - SE.
- 99 (68) Aquatic vegetation - must be true water plants, not terrestrial plants submerged by an abnormally high water level.
- 100 (69) Spring - water emerging from ground, SE.
- 101 (70) Marsh/bog - water exuded under feet.
- 102 (71) Ditch/drain dry - may be wet at other times of year, SE.
- 103 (72) Ditch/drain wet - SE.
- 104 (73 & 74) - UA.

G. Habitats - Open

- 105 Glade 5-12 m grass - in order to qualify must be an area of 5-12 m in two dimensions at right angles not covered by tree canopy (ie. Trees >130 cm) and with grass as the main vegetation type. A gap 8 x 4 m would not count but one 11 x 5 m would.
- 106 Glade >12 m grass - same rules as 105 above, SE.
- 107 Glade 5-12 m mixed - as for 1-5 but vegetation mixed, eg. Grass, herbs, brambles or even woody species <130 cm.
- 108 Glade >12 m mixed - as 107 above, SE.
- 109 Glade 5-12 m boggy - as for 105 but ground exuding water under foot. Vegetation can be any of the boggy types, eg. Rushes, *Sphagnum*, even grasses such as *Molinia*. Is distinguished from attributes 105-108 by wetness.
- 110 Glade >12 m boggy - as for 109, SE.
- (75) Glade 5-12 m (plot only) - as above but any vegetation type.
- (76) Glade >12 m (plot only) - as above but any vegetation type.
- 111 (77) Rocky knoll <12 m (width) - consists of an area raised above the surrounding ground consisting largely of rocks with relatively little covering of soil.
- 112 (78) Rocky knoll >12 m - as 111 (77), SE.
- 113 Field - a field is a definite management division, an area of ground being currently or having been in the past managed as a field. Normally there will be well marked boundaries with the wood - wall or fence, but these may be in poor repair. In order to count as being in the wood it must be at least partly within the survey boundary and enclosed on at least three sides by the wood.
- 114 (79) Path 1-5 m - not normally used by wheeled vehicles. Vegetated apart from a narrow trodden area.
- 115 (80) Ride >5 m - same as for 114 (79) but largely vegetated.
- 116 (81) Track non-prepared - quite extensively used by wheeled vehicles and therefore deeply rutted, vegetation being significantly affected by this use (>25% destroyed). Has not been the subject of large scale earth-moving operations nor has any metal (stones) been added to the surface.
- 117 (82) Track metalled - as for 116 (81) but earth-moving and/or addition of stone to surface used in construction.
- 118 Road tarmac - must be within the site boundary SE.
- 119 & 120 UA.

H. Habitats - Human

- 121 House occupied - SE.
122 House unoccupied - SE.
123 Farm occupied - a farm is a complex of buildings for both human habitation and agricultural use (e.g. Farmhouse, barn, cowshed, pigsty, etc.). Do not fill in 121 as well unless there is a quite separate occupied house. Similarly 125.
124 Farm unoccupied - as for 123. Same rules apply to 122 and 125.
125 Agricultural building - must be separate from farm SE.
126 Other building - SE.
127 Ruined building - SE.
128 Sheep pen/enclosure - SE.
129 (83) Wall dry - dry stone walling, no use of mortar or earth packing.
130 (84) Wall mortared - wall held together with lime mortar, cement or earth. Also includes brick walls.
131 (85) Wall ruined - formerly 129 or 130, but fallen down. If the walls in a wood are part fallen and part standing must be at least 50 m fallen to count.
132 (86) Embankment - must be man-made either by the removal or addition of earth.
133 (87) Soil excavation - rather similar to 132, but more contemporary in nature, with exposed soil surfaces either because excavation is still in progress or subsequent erosion of the surfaces has not yet ceased (see also 84 (62) and possibly 83 (61)).
134 (88) Quarry/mine - historical or contemporary, SE.
135 (89) Rubbish domestic - SE.
136 (90) Rubbish other - SE.

J. Animals

Evidence from a number of different sources can be used to record the presence of these animals; sight, signs or sound. In the plots it will usually depend mainly on signs. A few suggestion are given below.

- 161 (107) Sheep - dropping, hoof marks, wool on brambles, tree bark and fences, bleating.
162 (108) Cattle - droppings, hoof marks.
163 (109) Horse/pony - care is required here because only horses living and/or feeding in the wood at some time should be recorded. Horses ridden through the wood should not be recorded. Droppings, hoof marks (may be unshod).
164 (110) Pig - droppings, hoof marks, digging, noises.
165 Goat - no suggestions (not very likely anyway).
166 (111) Red deer - droppings, fraying >1 m, hoof marks, scrapes.
167 (112) Other deer - droppings, fraying <1 m, hoof marks, scrapes.
168 (113) Rabbit - droppings (usually concentrated on small hummocks), holes and incipient holes, fur.

- 169 Hare - not easy, apart from sight, larger than rabbit, black tips to ears, runs differently.
- 170 (114) Badger - setts (large holes with remains of bedding materials outside, no smell), footprints, hairs on fence, latrines (groups of holes with dropping in them), feeding excavations and scrapings.
- 172 (116) Mole - mole hills.
- 173 Red squirrel - apart from dreys, not really distinguishable from those of grey squirrel, must rely on sight.
- 174 Grey squirrel - as for 173, SE.
- (117) Squirrel (plot only) - red or grey together, SE.
- 175 (118) Anthill - refers to larger species, with hill >25 cm.
- 176 (119) Corpse/bones - SE but can also be used to detect the presence of the deceased, e.g. Rabbit bones record rabbit, etc.
- (120) Spent cartridges - SE.

K. Birds

- 177 Rook - heavy beak, baggy trousers, usually in flocks.
- 178 Crow - like rook apart from above characteristics, usually seen singly or in pairs.
- 179 Jackdaw - smaller than rook or crow, greyish skull cap.
- 180 Magpie - easy.
- 181 Jay - easy, characteristic call as well.
- 182 Raven - larger than crow or rook, characteristic call.
- 183 Pigeon - easy, can also use grey feathers, egg shells, and nests to detect.
- 184 Owl - easy, call and pellets.
- 185 Buzzard - heavy birds, broad wings, soaring, characteristic mewing call.
- 186 Kestrel - more delicate, frequently hovering.
- 187 Other birds of prey - if in doubt about identity, record this.
- 188 Blackbird - easy, also alarm call.
- 189 Thrush - easy.
- 190 Heron - easy
- 191 Wildfowl - easy.
- 192 Robin - easy.
- 193 Wren - easy, also alarm call.
- 194 Finches - includes house sparrow, chaffinch, green finch, etc. Heavy finch-like beaks.
- 195 Tits - includes blue, great, coal, marsh, willow and long-tailed tits.
- 196 Woodpecker - green and others, nests, also drumming on trees.
- 197 Pheasant - easy, also call of cock pheasant.
- 198 Other game - SE.
- 199 Spent cartridges - SE.
- 200 UA.

N. Subjective Overall Impression of Site

- 236-241 Quite straightforward, simply one's subjective impression of the site.

Comments

Anything (but anything) that was noted about any aspect of the site and which was not formally recorded on the form may be included here. Obviously it will not be possible to use this information in a formal, analytical sense, but it may constitute an extremely valuable aid to interpretation or in designing the collection of information for future surveys.

Appendix IV (continued)**PLOT DESCRIPTION AND HABITATS**

1 Site No. 200	2 Plot No. 1	3 Recorder MWS	4 Date 24/06/71
5 Slope 12° or %	6 Aspect 120° Mag.		

A TREES - MANAGEMENT

7 Cop. Stool	8 Singled cop.	9 Rec. cut. cop.	10 Stump hard.new
11 Stump hard.old	12 Stump con.new	13 Stump con.old	14

B TREES - REGENERATION

15 Alder	16 Ash	17 Aspen	18 Beech
19 Birch	20 Hawthorn	21 Hazel	22 Holly
23 Hornbeam	24 Lime	25 Oak	26 Rowan
27 Rhododendron	28 Sweet chestnut	29 Sycamore	20 Wych elm
31 Other hrwd.	32 Scots pine	33 Yew	34 Other con.

C TREES - DEAD (- HABITATS)

35 Fallen brkn	36 Fallen uprtd.	37 Leg.v.rotten	38 Fall. bnh.>10cm
39 Hollow tree	40 Rot hole	41 Stump<10cm	42 Stump>10cm

E HABITATS - ROCK

51 Stone.<5cm	52 Rocks 5-50cm	53 Boulders >50cm	54 Scree
55 Rock outcrop.>5m	56 Cliff >5m	57 Rock ledges	58 Bryo.covd.rock
59 Gully	60 Rock piles	61 Exp.grav/sand	62 Exp.min.soil

F HABITATS - AQUATIC

63 Sml.pool <1m ²	64 Pond 1-20 m ²	65 Pon/lake>20 m ²	66 Strm/riv.slow
67 Strm/riv. fast	68 Aquatic veg.	69 Spring	70 Marsh/bog
71 Ditch/drain dry	72 Ditch/drain wet	73	74

G HABITATS - OPEN

75 Gld.5-12m	76 Gld.>12m	77 Rky.knoll<12m	78 Rky.knoll>12m
79 Path <5m	80 Ride >5m	81 Track non-prop	82 Track metalled

H HABITATS - HUMAN

83 Wall dry	84 Wall mortared	85 Wall ruined	86 Embankment
87 Soil excav.	88 Quarry/mine	89 Rubbish dom.	90 Rubbish other

J ANIMALS (mainly signs)

107 Sheep	108 Cattle	109 Horse/pony	110 Pig
111 Red deer	112 Other deer	113 Rabbit	114 Badger
115 Fox	116 Mole	117 Squirrel	118 Anthill
119 Copse/bones	120 Spent ctrdgs.	121	122

COMMENTS

APPENDIX IV (continued)

SITE DESCRIPTION AND HABITATS

1 Site No. 200	2 Plot No. 1-16	3 Recorder MWS	4 Date 24/06/71
A TREES - MANAGEMENT			
5 Plnted.hard	6 Plnted.con.	7 Pollards	8 Cop.stool
9 Singled.cop.	10 Rec.cut cop.	11 Mature.con.	12 Stump.hard.new
13 Stump.hard.old	14 Stump.con.new	15 Stump.con.old	16 Stump.ovgwn.
17 Brush/pruning	18 Brush.heaps	19 Cord wood	20 Cop.sticks
21 Stack timber	22 Felled trees	23 Chips/sawdust	24 Fire sites
25 Pnt/blaze mks.	26 Extrn. routes	27 Vehicle tracks	28
B TREES - REGENERATION			
29 Alder	30 Ash	31 Aspen	32 Beech
33 Birch	34 Hawthorn	35 Hazel	36 Holly
37 Hornbeam	38 Lime	39 Oak	40 Rowan
41 Rhododendron	42 Sweet Chestnut	43 Sycamore	44 Wych Elm
45 Other hard	46 Scots pine	47 Yew	48 Other con.
C TREES - DEAD (- HABITATS)			
49 Live/dead	50 Stnd.dead <10cm	51 Stnd.dead >10cm	52 Fallen brkn
53 Fallen uprtd.	54 Log.v rotten	55 Fall.bnb.>10cm	56 Hollow trees
57 Rot holes	58 Stump <10cm	59 Stump >10cm	60
E HABITATS - ROCK			
73 Stones	74 Rocks 5-50cm	75 Boulders >50cm	76 Scree
77 Rock outop.<5m	78 Cliff >5m	79 Rock ledge	80 Bryo.covd.rock
81 Gully	82 Rock piles	83 Exp.grav/sand	84 Exp.min.soil
F HABITATS - AQUATIC			
85 Sml.pool <1m ²	86 Pond 1-20m ²	87 Pond/lake >20m ²	88 Strm.slow <1m
89 Strm.fast <1m	90 Riv.slow 1-5m	91 Riv.fast 1-5m	92 Riv.slow >5m
93 Riv.fast >5m	94 Bottom rock	95 Bottom gravel	96 Bottom sand
97 Bottom mud	98 Bottom peat	99 Aquatic veg.	100 Spring
101 Marsh/bog	102 Dtch/drain dry	103 Dtch/drain wet	104
G HABITATS - OPEN			
105 Gld.5-12m grs	106 Gld.>12m grs	107 Gld.3-12m mxd.	108 Gld.>12, mxd.
109 Gld.5-12m bgy	110 Gld.>12m bgy	111 Rky.knoll <12m	112 Rky.knoll
113 Field	114 Path 1-5m	115 Ride >5m	116 Track non-prep.
117 Track metalled	118 Road tarmac	119	120
H HABITATS - HUMAN			
121 House occ.	122 House unocc.	123 Farm occ.	124 Farm unocc.
125 Agri.bldg.	126 Other bldg.	127 Ruined bldg.	128 Sheep pen/enc.
129 Wall dry	130 Wall mortared	131 Wall ruined	132 Embankment
133 Soil excav.	134 Quarry/mine	135 Rubbish dom.	136 Rubbish other
J ANIMALS (Sight, sign or sound)			
161 Sheep	162 Cattle	163 Horse/pony	164 Pig
165 Goat	166 Red deer	167 Other deer	168 Rabbit
169 Hare	170 Badger	171 Fox	172 Mole
173 Red squirrel	174 Grey squirrel	175 Anthill	176 Corpse/bones
K BIRDS (Sight, sign or sound)			
177 Rook	178 Crow	179 Jackdaw	180 Magpie
181 Jay	182 Raven	183 Pigeon	184 Owl
185 Buzzard	186 Kestrel	187 Other BOP	188 Blackbird

189 Thrush	190 Heron	191 Wildfowl	192 Robin
193 Wren	194 Finches	195 Tits	196 Woodpecker
197 Pheasant	198 Other game	199 Spent ctrdge.	200

N SUBJECTIVE OVERALL IMPRESSION OF SITE

237 Cracking	238 Pleasant	239 OK	240 Nasty
241 Nightmare	242 Approx.time taken to survey = hours		

COMMENTS

Appendix V – List of field equipment

This is a list of equipment needed to carry out the tasks outlined in the field handbook. Individual Personal Protective Equipment and Health & Safety requirements are the responsibility of individuals and their employers.

Site location and permissions

1:50,000 extract with individual sites marked (CEH)

Copies of original 2½” maps with individual sites, where available (CEH)

Copies (where relevant) of sketch map showing plot locations (1 to 16); 1:50,000 and/or 2 ½” – remember to check which you have to get correct scale for distances/contours (CEH)

Copy of letter to landowner explaining background to the project and seeking permission; word file to be sent to surveyors for editing for each site as necessary

Plot location and recording

1 x machete (experience during the pilot suggests this item will be very useful for accessing plot locations)

1 set of plot marking equipment (comprising centre pole, 4 x corner poles + distance strings) (CEH)

1 x sighting pole (CEH)

1 x magnetic compass

1 x clinometer or Relascope

1 x DBH girth tape (CEH)

1 x 30 m tape

PER SITE

Phone or tablet with recording software loaded, spare batteries or powerpacks

Paper recording forms in case of tablet/phone failure:

16 x Vegetation (ground flora) recording forms (CEH)

16 x Tree, sapling and shrub recording forms (CEH)

16 x Plot description sheets per site (CEH)

1 x Site description sheet per site (CEH)

Soil sampling equipment

1 x ‘Japanese Bog Digger’ (ask Bob!) – or a small draw hoe or V-shaped hoe

1 x trowel

1 x ruler

16 x self-sealing bags per site (CEH)

16 x pre-printed adhesive labels for each soil sample bag (CEH)

1 x permanent marker pen (use in addition to the adhesive label)

General Equipment

Clutch pencils - plus spares - plus leads

Rubber

Plastic boxes with lids (CEH)

Field keys

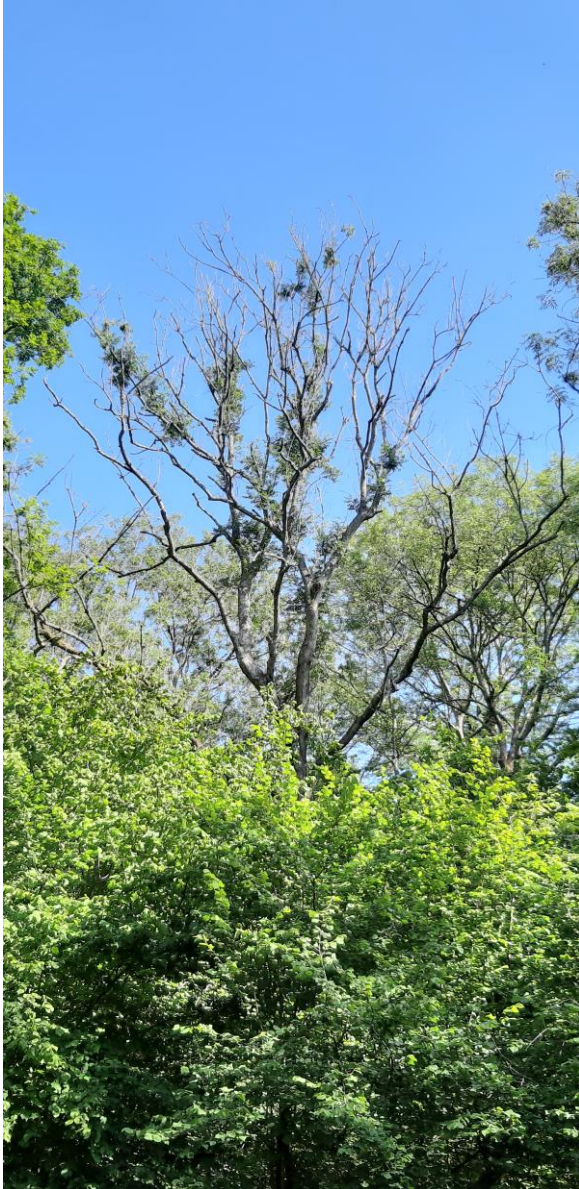
Hand lens

Weather writers

Cardboard boxes for return of soil samples (courier to be arranged).

Appendix VI: Pictures of tree diseases

Ash Dieback



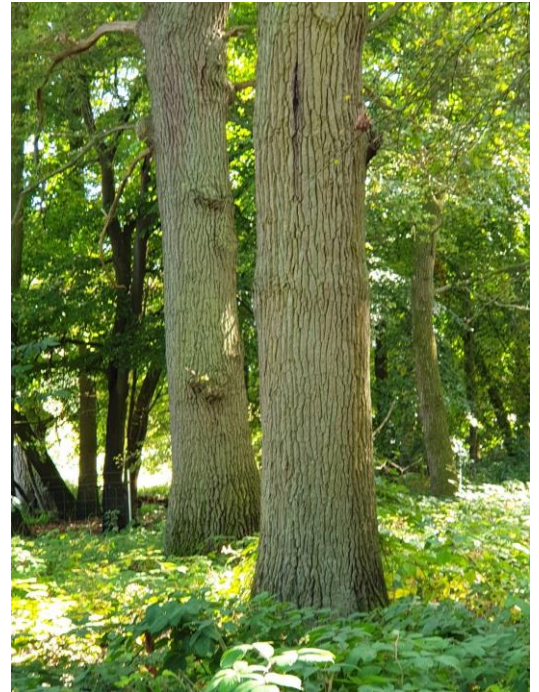
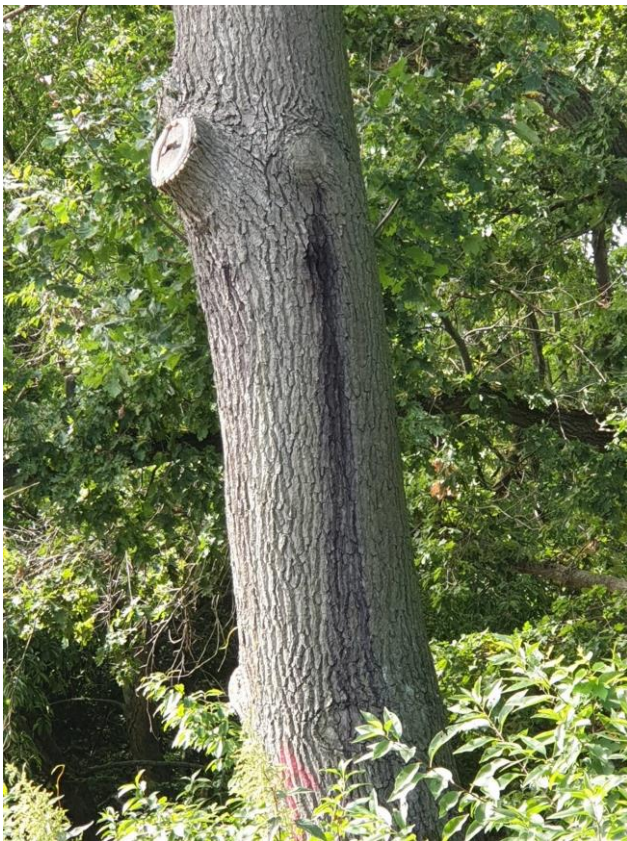
Phytophthora
..... on Alder



Phytophthora
..... on Beech



Acute Oak decline



Asian Chestnut Gall Wasp on *Castanea sativa* (they will turn red later in the year)



Red Needle Blight (*Dothistroma septosporum* on Scots Pine



Dieback on Castanea sativa

Chestnut blight (*Cryphonectria parasitica*)

Canker caused on the trunk



Appendix VII - Soil analysis: laboratory protocols

Soil was taken from the selected sites (up to 16 cores per site) then placed in labelled plastic bags and returned to UKCEH Lancaster/Lancaster University. The samples were placed in a cold room as soon as possible on arrival and left there until ready to be processed.

Then:

- Wearing gloves, push the soil out of the core into a labelled clean, weighed tin tray.
- Homogenise thoroughly using gloved hands, take approx. 50g total from various places within the sample, place in a labelled bag. Bags to be stored in the cold room until pH is carried out.
- Weigh the remaining soil and note wet weight on a 'post-it' note, place within the tray. Place sample in drying room (approx. 25°C). After a few days reweigh and note weight on the 'post-it' note, when the weight is constant for 2 days running, record weight. Samples are ready to be 2mm sieved.
- Sieve in the dust cupboard to remove stones/veg using 2mm stainless steel mesh sieve and wooden paddle, throw away stones/veg. Keep soil in clean labelled bag.

Fresh (wet) pHs were done and then soil samples were oven dried at 25°C for approx. 1 week. After one week the samples were re-sieved if necessary and then put into labelled pots. Air-dry pHs and loss on ignitions were then carried out.

pH Method

1. Calibrate the pH meter using buffer solutions of pH 4 and pH 7.
2. Add 10cm³ of the sample to a 50 ml beaker.
3. Add ~ 10ml of spectrum water (ultra pure) obtained from the Environmental Chemistry reservoir.
4. Mix thoroughly with a glass rod / spatula to a paste
5. Top up with spectrum water to the 50ml mark and stir.
6. Leave to stand for 20 minutes.
7. Stir.
8. Insert pH electrode, stir and press read button on pH meter.
9. Leave for a further minute.
10. Take pH reading and record result.
11. After each sample has been read, rinse electrode with pure water and touch-dry.

Determination of air-dry moistures - loss of ignitions (LOIs)

1. Dry small crucible in small oven at 105°C.
2. Cool in dessicator
3. Tare balance.
4. Weigh crucible (record crucible weight, Cw g)
5. Add approx. 1g air-dry sieved sample to weighed crucible (= W₁ g)
6. Dry 3 hours at 105°C
7. Cool in desiccator and weigh as before (crucible plus sample) (= W₂ g)
8. Place in muffle (ashing) at 550°C for 2 hours (allow ½ hour to reach 550°C)
9. Cool in desiccator and re-weigh as before (crucible plus sample) (= W₃ g)

Calculation

Let:

Oven dried OD = (W₂ - Cw g)

Muffle dried MD = (W₃ - Cw g)

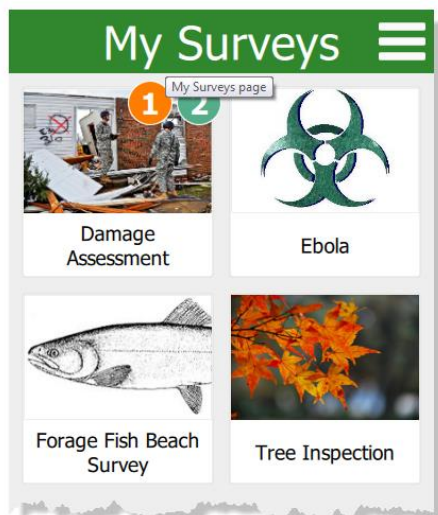
Then % loss on ignition =

$$\frac{(OD-MD)}{(OD)} \times 100$$


Appendix VIII - Survey123 - generic notes

My Surveys

When starting the Survey123 field app and signing in with your ArcGIS organizational account, the app opens to the My Surveys page. This is the table of contents for all of your currently installed surveys, although it will be empty on first launching the app. Note that, once there is a survey downloaded onto your device, you will no longer need to sign in at launch.





To access the menu for a particular form, select its icon. Numbers in the corner of a survey's icon indicate unfinished or unsent results. If one has unfinished draft entries, the number of them will be listed in an orange circle, while the surveys queued to be sent later are numbered in a green circle. If a survey has inbox editing enabled, the amount of downloaded surveys in the inbox are numbered in a blue circle.

Use the Menu  at the upper-right to access the Download Surveys page, sign in with your ArcGIS organizational account, or view settings.

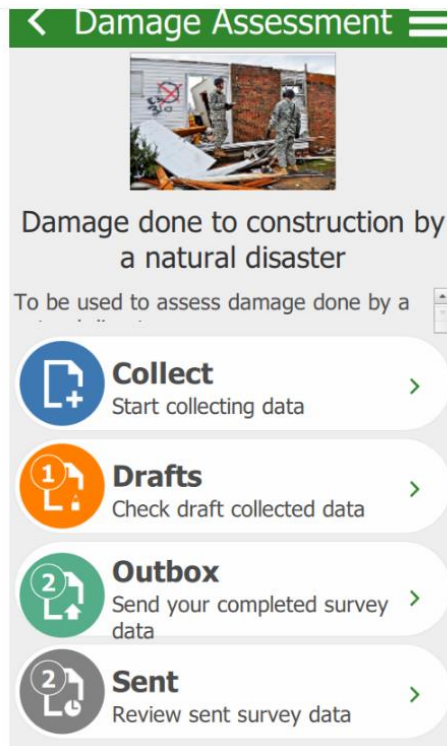
Download Surveys

On the Download Surveys page, all surveys currently available to your account are listed alphabetically. In the following screen shot, the bottom survey has been downloaded,

evidenced by Download  being replaced by Refresh .

Survey contents

The survey contents page can be accessed by selecting a survey from My Surveys. Here, you can start collecting new data or access previously collected surveys.




The options on this page are as follows:

Collect—Opens a new, blank survey page for inputting data.

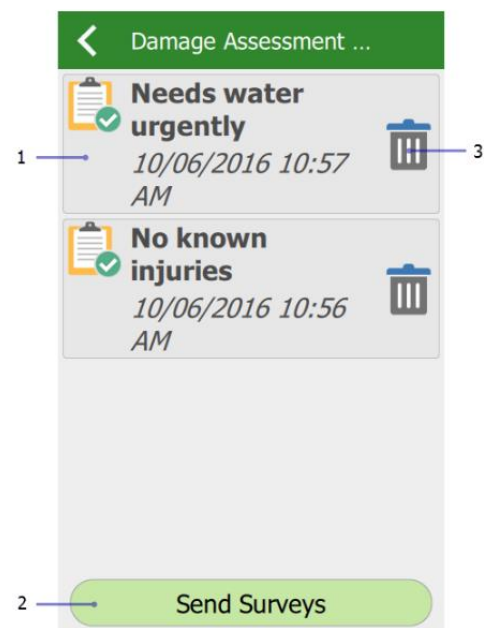
Drafts—Opens to a form currently left uncompleted by closing the survey before sending it.

Outbox—Opens to a listing of all forms finished but unsent, either by choice or due to the device being offline when submitting.

Sent—Contains the records of all forms submitted to the survey's creator.

The Menu  at the upper right contains the options to delete the survey from your device and to download an associated basemap (if this choice is not available, the survey has no basemap associated with it).


The Drafts, Outbox, and Sent pages have similar layouts, with standardized buttons and functions. The following screen shot is of the Outbox page, but be aware that all three pages look and behave similarly:



The options on these pages are as follows:

Press the field for the form to reopen it. On the Sent page, this instead opens a copy of the form and its answers. The text in this field defaults to the raw data of the survey. To replace it with something else, see instance names.


The Send Surveys button on the Outbox page submits all forms currently listed within it. This button does not exist on the Sent page; however, the Sent page instead has an Empty Sent Surveys button, which clears the listing of all sent forms. It does not delete the surveys from their destination. There is no equivalent button on the Drafts page.

Delete  deletes the form from the device. This button is not present on the Sent page.

Survey

On the individual survey page, you can fill in the data requested by the survey's creator. Surveys are modular and designed for specific purposes, so the actual layout and presentation will vary from survey to survey. However, the Menu button Menu and its contents remain the same throughout.


Favourites

To create a set of favourite answers that you can reuse, first complete a survey with your preferred answers, then open the Menu  and select Set as favourite answers (1a) before submitting it. This saved survey will now be marked with a star icon in the Sent list, and the Paste answers from favourite option (1b) will become visible. This menu option will apply your favourite answers to the current survey automatically.

Note:

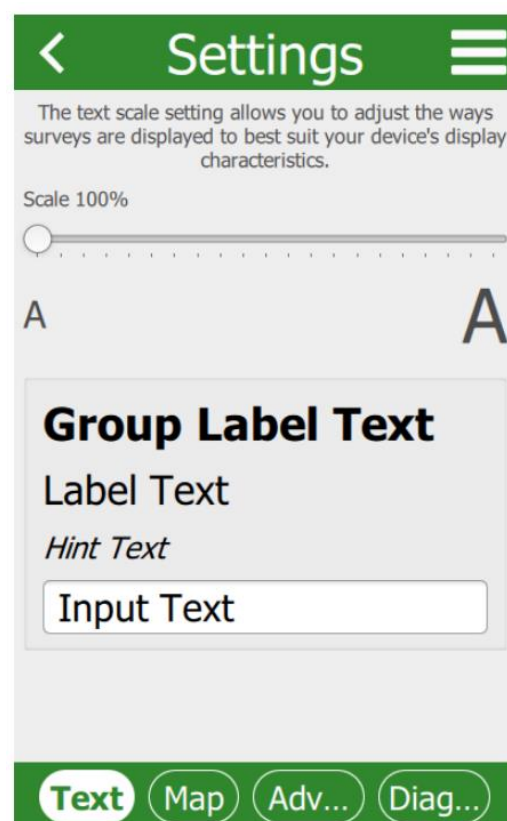
Favourite answers are saved as a marker on the sent survey, signified by a gold star on their entry on the Sent page. If this survey is deleted from your device, the favourite answers will also be deleted.

Settings


Accessed from the Menu  on the app's initial page, Settings contains a number of options and choices to customize the Survey123 field app to your preference.

Text settings

The slider on the Text tab allows you to alter the scale of text within the app, up to 200 percent of the default. The text preview updates in real time to display the currently selected scale.



Map settings

Designate the Map Library Folder, from which the app will pull offline basemaps. The Map Library can be accessed within the app through the Menu button  in the Settings pages.

Advanced Settings

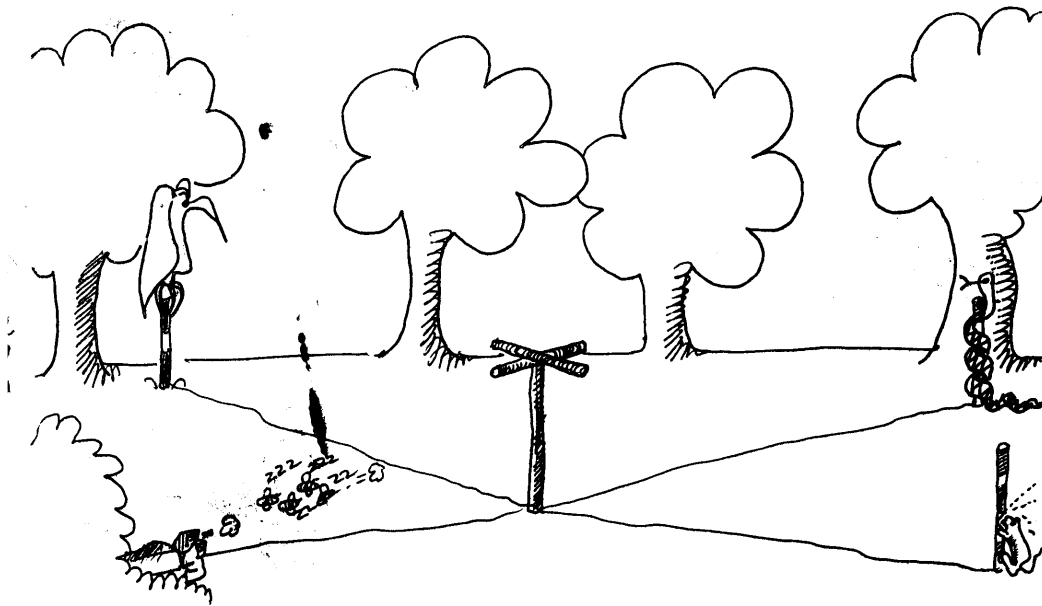
Reinitialize Database returns the device's survey database to the default; all surveys, complete or incomplete, are deleted, and the submitted surveys list is cleared.

Fix Database fixes the existing entries in the survey database on your device when the folder path for the database has changed. This is required when you update the version of the Survey123 field app on iOS from the App Store. When the app is updated, its location on the device changes. Fixing the database ensures the new folder path is used for existing records. This tool is also useful if you want to copy a database from one device to another to send records. After copying the .sqlite database from one device to another, click Fix Database on the destination device to fix the data paths. For additional details, see Recover data from a mobile device.

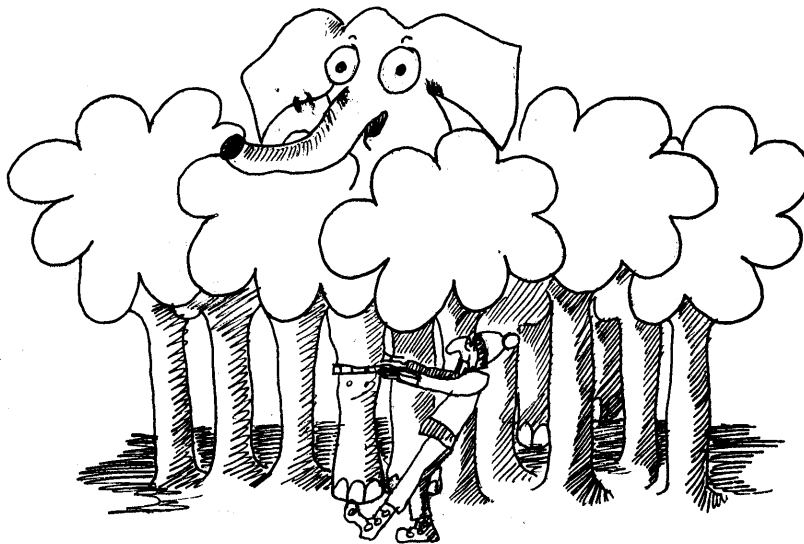
Delete Submitted Surveys clears the submitted surveys list for all surveys saved onto the device.

Clear Map Cache deletes the cache of map tiles that surveys have loaded. The button also lists the current size of the cache on the device

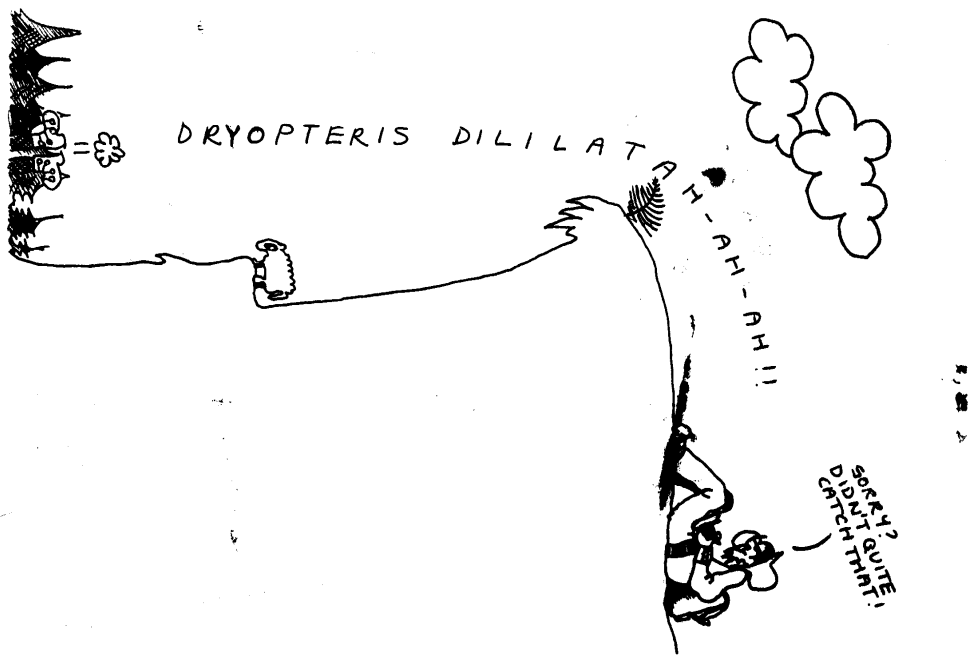
Setting out a plot



Measuring tree d.b.h.'s



Recording ground flora



Taking a soil sample

