UK-SCAPE Field Survey Field Handbook 2019

Vegetation plots

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1	Claire Wood	01/06/2018	Edited from GMEP Vegetation and Soils Handbook, v. 16.1.

Contents

1 Introduction to Vegetation Plots

The survey involves recording plant species presence and abundance in two different sizes of vegetation plot as described below. Being able to position and record plots (and then repeat them by re-finding their exact location) is a very important part of the survey. It will provide the data needed to quantify changes in the countryside with great precision allowing vegetation change to be expressed by habitat type and landscape location. In order to maintain this valuable dataset it is essential that the following information is collected for each plot.

General information about the plot including plot number and type, vegetation height etc. (header information) as well as species presence and (usually) cover.

Plot photos – for plot relocation (i.e. finding the position of the previously recorded plot) by surveyors in the next survey and to provide visual information about the plot and the ways it may have changed over time.

Paper sketch map – for plot relocation by surveyors in the next survey.

Most of this data will be collected in a digital format. To this end, 'apps' based on ESRI's 'Survey123' (named **'Vegplots')** and 'Collector' software will be used.

For ease of use, plot maps will continue to be provided on paper and newly drawn onto paper although digital copies will also be available on the tablet.

1 Location of veg plots

1.1 Repeated plots

In many cases, surveyed plots will have been visited before, in some cases on several occasions since 1978.

To access a map showing the locations of previously surveyed plots, the surveyor will need to open up *Collector*. The precise locations of individual plots are described using GPS, a sketch map per plot and a series of associated photographs to aid re-finding the plot. In most cases there will be one map per plot. Protocols for recording plots are described below. These protocols rely on BOTH the plot map and the map provided by the software.

1.1.1 Plot markers

In most cases, plots were additionally marked using either a 20 x 20cm aluminium metal plate or a wooden stake (particularly in upland areas) as indicated on the plot maps. Finding the metal plate or stake is the proof of relocation. Metal detectors are provided to enable surveyors to detect the plates. Note however, that many plates will now have been buried for several years and may have been covered by layers of soil or may have moved. This will be especially true in damp areas or alongside streams. In waterlogged soil we also know that metal detectors do not work very well. Also be aware that metal junk including buried fence wire can make you think you have found the plate when you haven't; for this reason the metal plate was always buried 1m out from the base of any adjacent vertical feature. To ensure you've found the marker, dig down with minimum disturbance and experience a frisson of well-earned delight as the aluminium plate winks back at you after years underground. If the plate cannot be detected within 5-10 minutes of searching (less if surveyors have other evidence of being in the correct location or more if time allows and other location aids are poor (e.g. plots on open moorland), then the plot should be located as well as possible using the sketch map and photograph. If surveyors are not confident that the plot will be a valid repeat then this can be indicated on a drop-down in the software by choosing 'not found' This indicates that the plot was positioned using the available information but should not be considered as being re-recorded as in the same exact location as in previous surveys.

1.2 Adding new veg. plots

If a square has never been surveyed before, X plots will always have been randomly allocated in the square beforehand. In some cases, these may need to be moved. Additionally, plots may need to be relocated if a plot is lost (photo/map not clear, built-on etc.). New plots can be located in any vegetation apart from within urban areas, land without access permission, inland water and sea or other dangerous and inaccessible land. Plots can be placed in amenity grass such as playing fields or on golf courses where permission has been given. It is important to record the location of the plot as accurately as possible with sketch maps, photos and GPS systems.

2 Data Entry

2.1 Repeated Plots

2.1.1 Collector

In order to navigate to a plot and begin plot data entry, you will open ESRI's Collector app. Open the map (name tbc in training), on which the plots will appear. You can then:

Navigate to plot using this map

When you get to your plot, click the plot symbol. A window will open on the right.

Click on the link in the window - this will open a new form (in Survey123) to enter the plot data (it's a bit slow, so be patient)

Note: If you are returning to edit plot data you have already created, do not do this. Follow the instructions for opening a plot in Survey123 below.

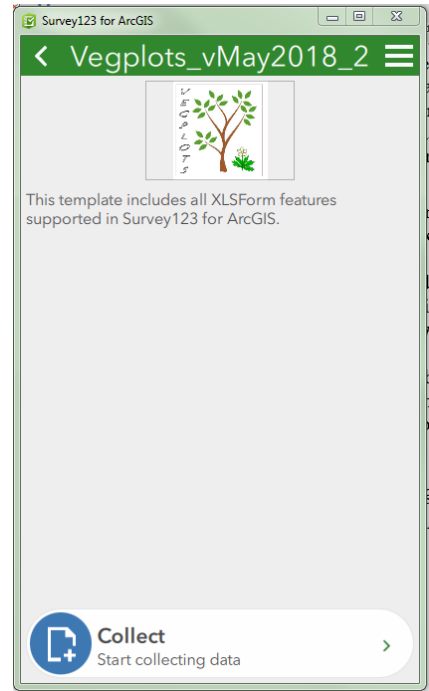For further technical notes regarding Collector, see Appendix I.
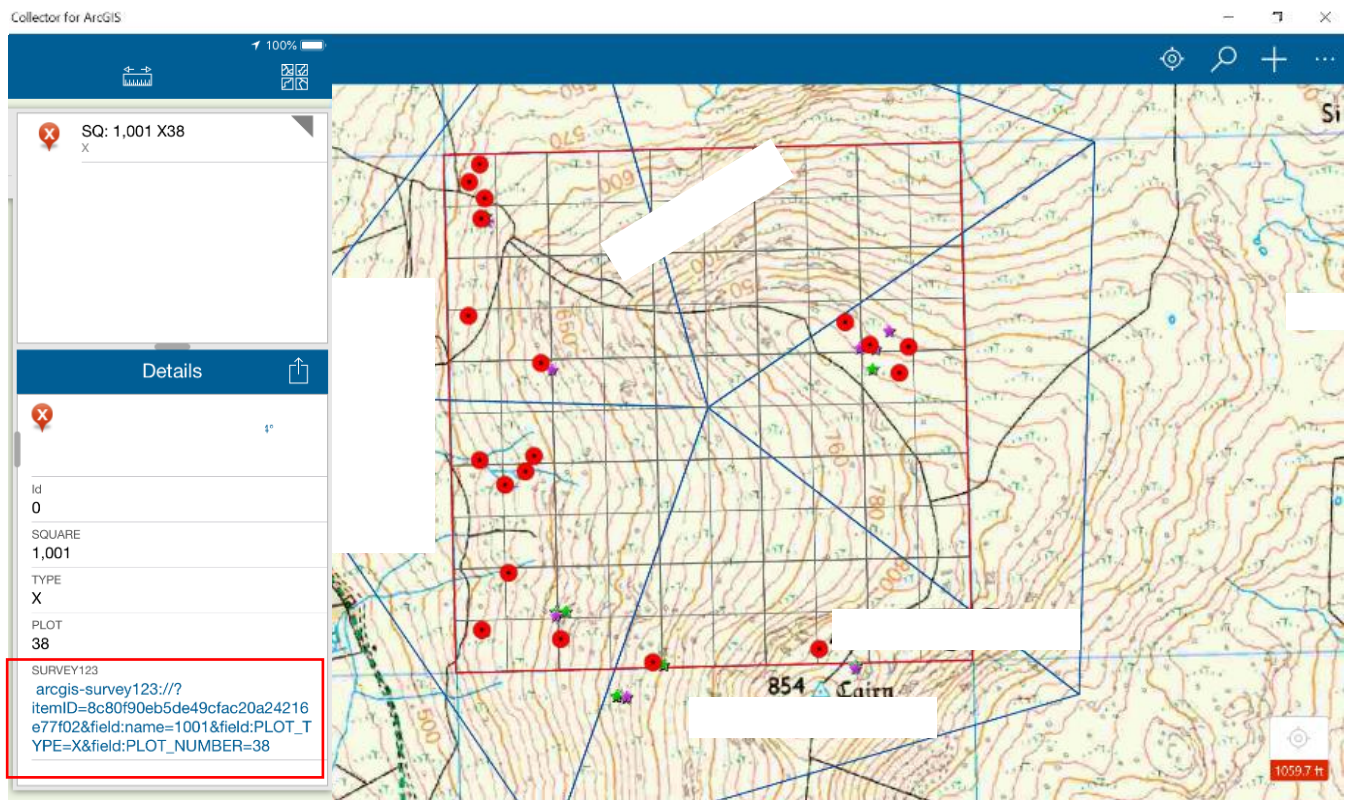
2.2 New plots (or editing a previously created plot)

In order to begin plot data entry for a plot not featured on a previous map (or editing a previously created plot), the recording forms are launched by selecting the relevant survey from 'My Surveys' within Survey123, then selecting 'Collect' as illustrated below.

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

Note: For further technical notes regarding *Survey123*, see Appendix I.

2.3 Plot Recording in Veg Plots

> **Take care to disturb the vegetation as little as possible - this applies particularly to fragile assemblages in flushes and other wetlands - but bear in mind that a full census of the vegetation species composition must be carried out.**

Plot level information

There are three recording pages for the following categories.

- **Page 1: Plot header information** – site name, recorders, slope, aspect, location, photos
- **Page 2: Plot specific headers**
- **Page 3: Vegetation plot**.
  - ○ VEGETATION SQUARES: 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 (plus an additional nest, nest 0 - see below).
  - ○ *OR* SOILS SQUARES: Ground Flora - presence and absence in a 2x2m plot.

- Major common bryophytes should be recorded but a full list is not expected (see below).

Please ensure you record information for all plots in the square – <u>this includes those that are refused, inaccessible etc</u>. It is important to know why a repeat plot has not been re-recorded.

2.3.1 Plot header information (page 1)

If the plot was launched from within the *Collector* map (or is being edited from a previously created plot), Square, Plot Type, Plot Number and Plot ID will be already entered at the top of the form consisting of the following:

- **Square** – Survey square number

- **Plot Type** – 'X' (200m^2) or 'XX' (2x2m)

- **Plot Number** - 1, 2, 3,…

- **Plot ID** (filled automatically) = Square + Plot Type + Plot Number

*If the plot is new, these can be filled in manually – **take care to enter the correct details.***

- **Surveyors** – choose name / free text initials

Plot relocation

If the plot you are recording is a new plot for some reason, some of the options will not apply - only being relevant for squares revisited from a previous survey.

- **Plot Recorded** [Found, Not Found, New Plot (Replacement for unfound plot), New Plot (New feature/Land cover), Not appropriate, Access Denied, Too Dangerous]. NB: Choosing 'Found' means you are telling us that you are happy that the location of the plot is close enough to the

location in previous surveys that the data recorded can be considered as a snapshot of the vegetation in that same location but at the present time. Please do not be overly strict about this decision. Some small amount of relocation error is acceptable; more so if the vegetation is reasonably homogenous. Choose 'Not appropriate' for example if you do not record the vegetation or attempt to record the vegetation but then abandon recording because the plot cannot be effectively censussed. This would occur if the the plot had just been mown, burnt or was under water. Please indicate the kind of disturbance responsible in the Notes box for the plot.

- **Location** (geopoint) 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. **Make sure you are standing in the correct place in relation to the plot when you record this**. *See notes on next page.*

Geopoint questions

Geopoint questions 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.

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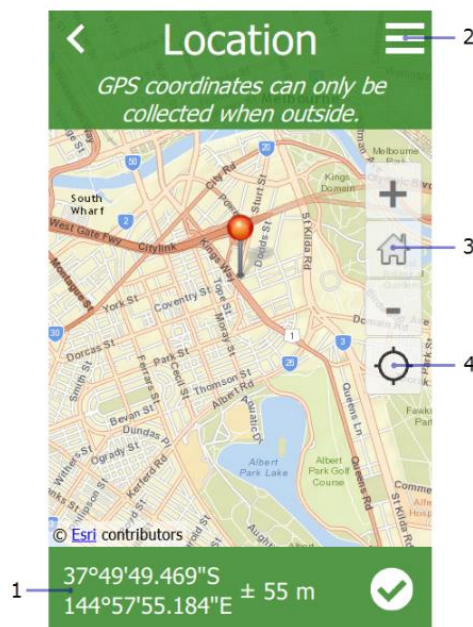
The latitude and longitude of your current location are listed here. Selecting the area converts them into editable fields, allowing you to define a different location.

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

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 .

Notes on plot relocation

If a previous plot position cannot be relocated satisfactorily using previous maps and photos the plot should be recorded as 'Not found' and a new plot created. A degree of judgement is needed. If for example, the vegetation being sampled is reasonably homogenous fertile grassland or upland heath then a greater amount of relocation error might be allowed i.e. you believe you are in roughly the right location but 10-20 metres either way might not bring the plot into a different habitat type or result in a significant change in species composition. On the other hand, the same uncertainty over the location of a plot could result in the plot being in a very different habitat type than that originally targeted. This might lead you to recommend that the data cannot be reliably analysed as if it were a repeat recording of the vegetation in the same position as last time. The decision is left to the surveyor as they are in the best position to decide. Basically if you feel the plot can be considered to be in the same location as previous then select 'Found' from Plot Recorded.

Note that a plot may also not need to be recorded if it is no longer appropriate due to changes in land use. For example, a new housing estate built on a grass field would no longer have an X plot. In both these cases you would select 'Not appropriate' from the list.
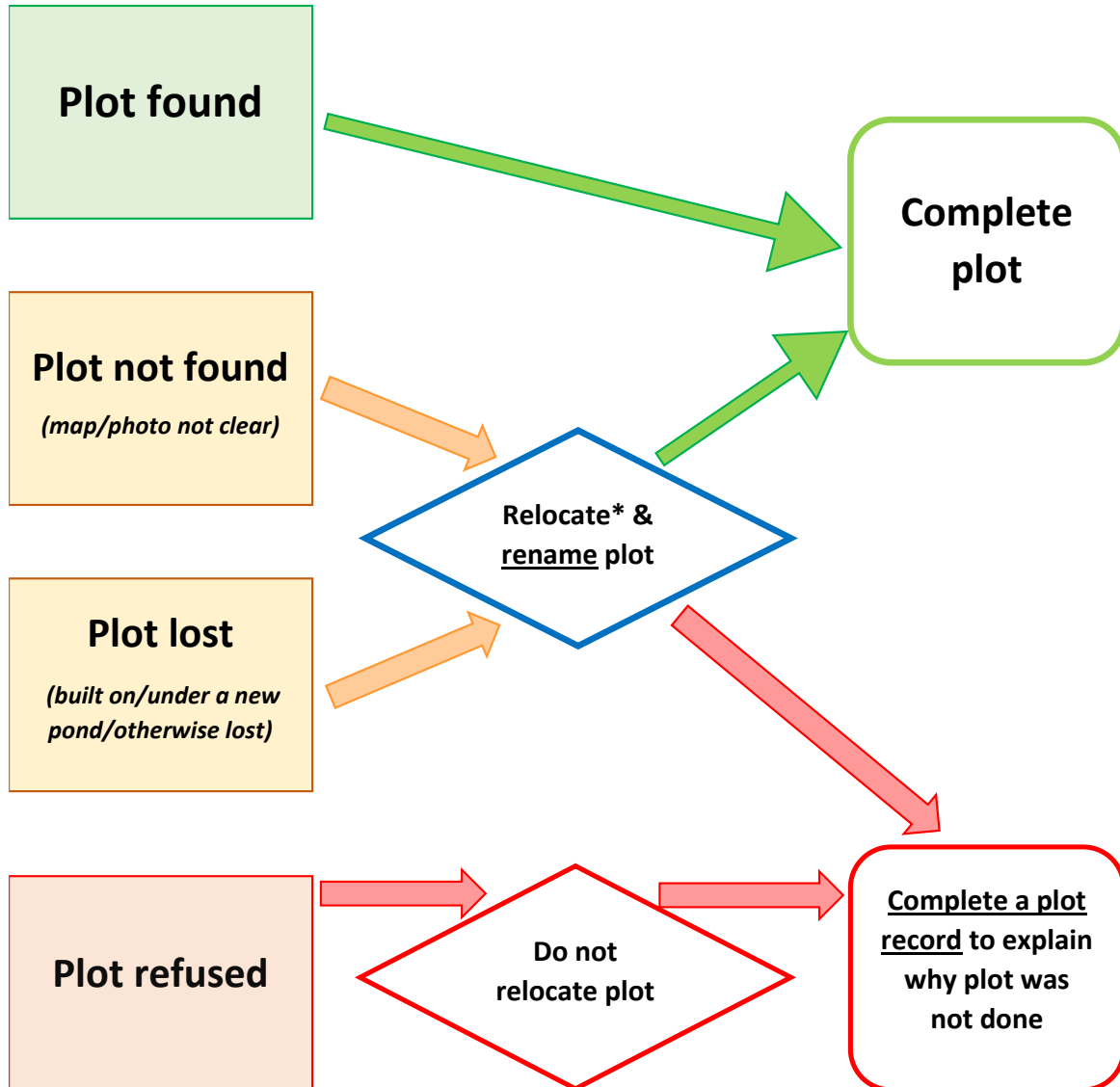
Surveyors may encounter the following scenario: In the previous survey an area of land was refused access and so a number of plots were moved from this area to parts of the square that could be visited. On revisiting the square, the area of land previously refused access now can be visited. This may mean that you have a greatly increased number of possible plots to do because as well as repeating the previous plots you can put in new plots in the newly accessible area. In this situation prioritise repeating the previous plots and only put in new plots if you have time.

Another scenario is where the plot was recorded in 1990 in one place say and in 1998 in a different place, because the surveyors failed to correctly find the repeat plot location in 1998. However if on return, you can find the oldest plot position then repeat the plot in that position. This maximises the length of the interval between plot recording and so maximises the chances of picking up vegetation change.

Plot ID of unfound plot – Rep ID of plot that has been replaced when plot not found.

Plate found? In repeat plots, a metal plate or stake may be be present to mark the location. Have these been re-found? *(Tick yes if you have definitely found the plate. If you are confident you have refound the plot using plot maps and photos, click 'Found' in the Plot Relocation question <u>even if you do not find the metal plate or stake</u>.).*

2.3.1.1.Rules for plot relocation

Plot found → Complete plot

Plot not found *(map/photo not clear)* → Relocate* & <u>rename</u> plot → Complete plot

Plot lost *(built on/under a new pond/otherwise lost)* → Relocate* & <u>rename</u> plot

Relocate* & <u>rename</u> plot → Complete a plot <u>record</u> to explain why plot was not done

Plot refused → Do not relocate plot → Complete a plot <u>record</u> to explain why plot was not done

***Check which land has access permission**

▼ Plot description

Broad Habitat (plot) *
Broadleaved Mixed and Yew Woodland

Priority Habitat (plot) *
Lowland Beech and Yew Woodland

Broad Habitat (wider polygon) *
Broadleaved Mixed and Yew Woodland

Priority Habitat (wider polygon) *

○ Lowland Beech and Yew Woodland
○ Upland Mixed Ashwood
○ Wet Woodland
○ Upland Oakwood
○ Lowland Mixed Deciduous

Trees present
○ Yes

- **Broad habitat (at plot)** - The BH selected in the dropdown for X plots should reflect the habitat that makes up the majority of the X plot. If in a soil-only square, then for consistency, you should still assign the full 14.14 x 14.14m area containing the 2x2m plot. Just estimate the size of this area rather than setting up the full X plot.
- **Broad habitat (wider polygon)** - The BH selected in this dropdown plots should reflect the assignment of the wider mapped polygon (or 'minimum mappable unit'). (UNLESS the polygon is a Mosaic. This will invariably be in Unenclosed habitats, for example Bog and heath or Bog and Fen, Marsh & Swamp).
- **Priority Habitat (at plot)**: List of PH options, or none. Surveyors are asked to record the specific Priority Habitat which the plot represents (or 'none' if the habitat is not a PH). Priority Habitat names or 'Not priority habitat' should be selected from the drop-down list.

- **Priority Habitat** (wider polygon): as above, but for wider polygon (or 'minimum mappable unit').
- **Tree disease.** If the box 'Trees present' is checked then choose either **'Dead trees'** or 'Signs of tree disease'.

Plot description

- **Slope** - Flat, Slight, Moderate, Steep
- **Aspect** - None, N, NE, E, SE, S, SW, W, NW
- **Shade** (as at 12 noon) - None, Partial (some direct sunlight is reaching the plot) , Full
- **Plot Map drawn?** – Yes, No, Edited, Redrawn. Plot maps are essential data, we need both a record of what has been done with the maps and copies of the maps themselves. See Plot Sketch Map protocol.
- **Notes** Free text, mainly to describe why plot has been lost or other reasons why it was not appropriate to do plot. Notes on soil samples or unidentified species should also be entered. For example if you have recorded Species A and then subsequaently identified it, go back and enter a note to say Species A= *Carex diandra* (for a gorgeous example).

▼ Plot description

Slope *

Aspect *

Shade *

Plot map (re) drawn? *
○ Yes   ○ No   ○ Edited
○ Redrawn

Notes

Vegetation Height

Surveyors are asked to provide an estimate or measure of **modal** (the most frequently encountered) vegetation height at three levels in the plot.

- **Canopy** subdivided into None, 3-5m, 5-10m and >10m

- **Shrub** subdivided into None, 0-5cm, 5-15cm, 15- 40cm, 40cm -1m, 1-3m, 3-5m, and >5m

- **Ground** subdivided into None, 0-7cm, 7-15cm, 15- 40cm, 40cm -1m, and >1m

- *Photos* See Plot photo protocol. The camera icon will launch the device camera, from where you can take a photo. The folder icon can be used to attach a previously taken photos stored in a folder on the tablet.

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

2.3.1.2 Plot Photo Protocol

Surveyors are asked to take photos of each plot location - two or three will usually suffice. These photos will primarily be used to help surveyors find the same plot locations in the next survey. However the photos have also proved useful for illustrating trends in vegetation change. Since the principal aim of the photos is to aid re-finding the plot, the most useful photos depict the plot in relation to a nearby feature that is unlikely to have moved since the last survey and is unique and obvious, for example, a prominent rock, tree or fence post. It is essential that all plot photos feature information on plot number and type. Surveyors are supplied with a set of letters and numbers on waterproof paper which can be attached to the back of a '*weatherwriter'* to indicate the number and type of plot featured in the photo as well as the square number. From the evidence of previous surveys, the most useful plot photos show the surveyor holding the weather writer vertically behind or to the side of a plot (at plot location marker) NOT facing the sun (which can cause glare and make it impossible to decipher the plot type and number) or including too much sky. As surveyors will be using digital cameras it will be possible to check the quality of the photo and take another if the one taken is inadequate. Also indicate the direction of

the photo taken on the plot sketch map; do not label these as P1, P2 as this can be confused with other codings. Use 'Po' instead.

2.3.1.3 Plot Sketch Map Protocol

Accurate and clear plot sketch maps will enable plots to be re-found in subsequent surveys. The plot sketch maps are therefore vital. When drawing new maps please make them as clear and precise as possible using the measuring tape, rangefinder and compass. **Ensure that the point at which the GPS reading was taken is also clearly marked.** The maps need not be works of art but they do need to be useable. You will know from your own experience of using plot maps drawn by others what is and is not useful. Try to be as helpful as possible in upland situations where reference points may be scarce. In such situations, surveyors have often taken back bearings from reasonably distant features on the skyline. This is completely acceptable although admittedly has high error. The possibility of misty conditions next survey is no reason not to record them but also do not use distant features as a substitute for measuring to nearby reference points.

Note that if you have no rangefinder and you have to pace then translate your paces into metres. Measure your pace to determine whether one long stride really is 1m or whether two ordinary paces combine to more accurately give a metre. Writing distances in metres is always to be preferred.

A sketch of the plot location should be drawn on one of the waterproof A4 sheets provided. The map should clearly define plot location using measured distances and compass bearings to nearby reference features. Always draw a north arrow on the map. These sketches should be clearly labelled with square and plot number. If

surveyors run out of map recording sheets they should record maps on blank sheets and ensure that maps include Square number, Plot type and number, date and surveyors initials.

If a map is drawn/redrawn, take a photo of the map using the tools provided in Survey123. It is also possible to draw/annotate the map on the tablet.

Surveyors have been provided with plot sketch maps for all squares which have previously been surveyed. Where surveyors are repeating a plot and the map provided is adequate, this should be recorded in the Vegplots software by answering NO to the Plot Map drawn entry and no further action taken.

> **Where the surveyor considers a map to be inadequate (e.g. missing an essential feature) or where something has changed in the landscape since the previous map was drawn, they may want to edit or redraw the map they have been provided with. If this is the case, it should be indicated in the Vegplots software by answering Edited or Redrawn. An edited map should feature edits made in pencil (make sure the map is clear enough to appear on a photocopy), the word 'edited' with surveyors initials and date. Similarly for maps redrawn, plot location should be drawn on a map recording sheet provided, clearly showing plot position with relevant measurements and angles to nearby reference features. Surveyors should indicate that the plot map has been 'redrawn' on the recording sheet.**

Having successfully re-found a plot using sketch map and photos, you may often find that is in a different position to that indicated by the point on the plot map layer. This is because GPS may not have been used to stamp the plot in the previous survey and so the plot point is an approximation.

Plot Location Diagram
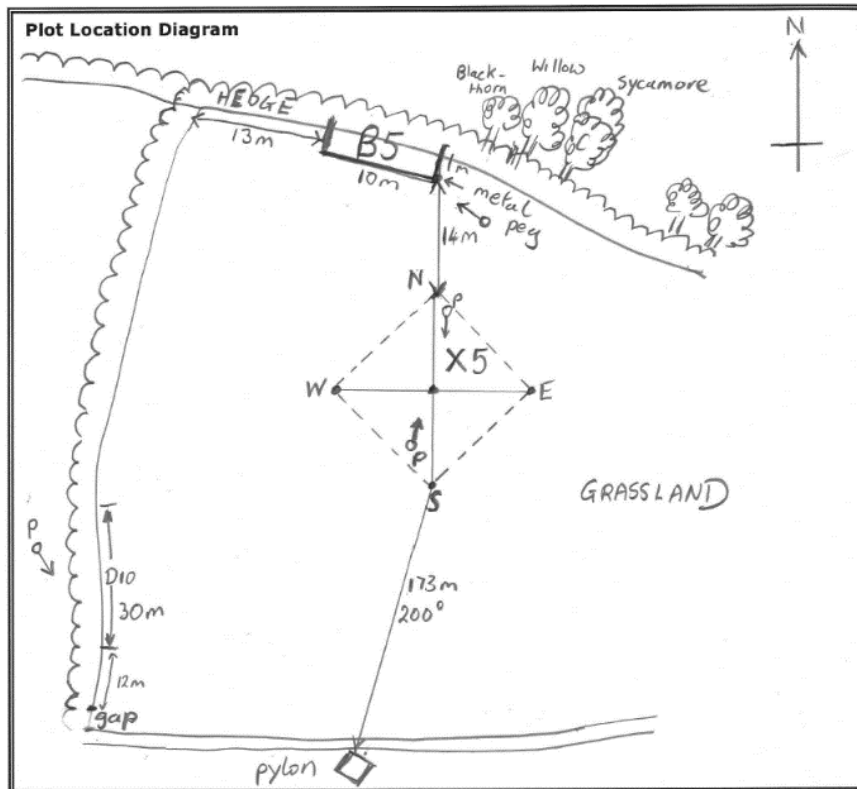
Example of a plot location diagram (the 'B' plot on the map is not relevant for 2019 although it may be necessary to use its location to find the X plot)

2.3.2 Plot Specific Header Information (Page 2)

This page contains a range of information which is required for the different plot types. The surveyors will only be able to enter data relevant to the plot type being surveyed. *The header information relevant to the 'X' plots pertains to soil sampling and is detailed in the soils manual.*

HEADER

The only header information required specifically for X plots is:

Soil sample taken: Yes, No, Some (may occur if soil is particularly difficult to sample)

Date: a calendar is provided which defaults to today's date

Scan barcode: The barcode on each bag provided should be scanned. *Check the correct code type is set (Code 39).*

See soil sampling handbook for further guidance on core depth recording and peat depth recording.

2.3.3 Entering Species (Page 3)

- For the soil + vegetation squares plant species recording will be carried out in a series of nested plots.
- Comprehensive species lists are provided in each drop-down box – 'auto-type' is enabled in these boxes to allow for ease of data entry.
- Enter species as described in the section 'Recording X plots'

2.4 Completing Plots

The software will check that certain fields are filled in. If something is missing, you will get a reminder before submitting, for example:
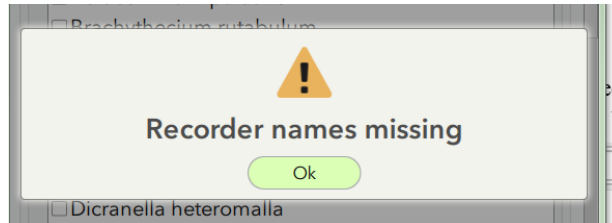

2.4.1 Submitting your data

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
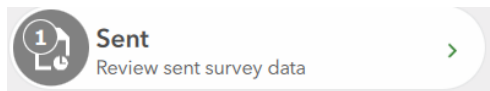
Note: it is possible to resend a survey if you find you have missed something – you will find your sent surveys in the 'Sent' box. You must choose the 'Copy to new survey' option otherwise you will find you can't edit certain fields. If you are resending, please make a note in the notes section to say which the correct version i).

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.
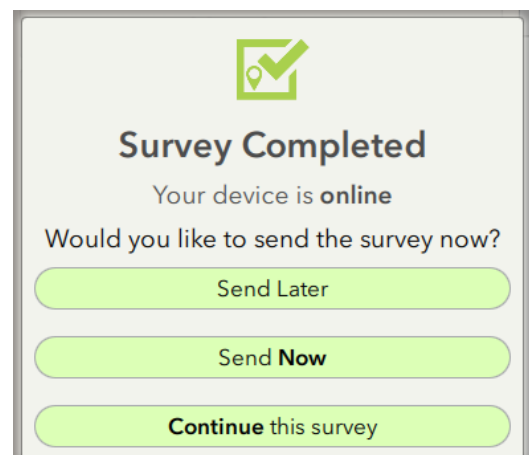
3 Plot types

Plot types to be recorded in each square. Note that if any plot protrudes outside the square move it so that it is wholly inside the 1km square that is unless this means you are not recording the plot in the same location as in previous surveys.

Code	Name	Other names	Where	Size	No. per square
Areal plots					
X	**VEGETATION SQ** Large (occasionally small in some circumstances)	'Wally plot' Main	Random points not on linear features	200m^2	Up to 5
XX	**SOIL SQ** Small X		Random points not on linear features	4m^2	Up to 5

3.1 X Plots (X1-X5)

X plots are placed at five predetermined random positions.

- VEGETATION SQUARES contain standard X plots, which is nested and covers an area of 200m^2.
- SOIL SQUARES contain small X plots, which cover an area of 2x2m i.e. the 2x2m nest of the larger X plot that would have been fully recorded in previous surveys.

3.1.1 Locating X plots

Surveyors will be provided with a map of random points indicating previous X plot locations. However if the plot is a new one, surveyors should locate these as close as possible to those points marked on the plot map. Where the random point indicates that the X plot would cross a linear feature, the plot should be located in vegetated land so that the linear feature is at least 12m from the edge of the X plot. A position on the boundary closest to the X plot and on a cardinal axis from it (i.e. N, S E or W) will be the location of a previously recorded boundary (B) plot. **Although this will not be surveyed in 2019, sometimes you may have to locate your X plot based on the location of this 10x1m plot, based on the information given in the sketch map**.

Metal plates for repeated X plots (200m^2) were placed at the south-most corner of the plot (or in the field boundary). Check the plot map and photographs provided.

Note: For 2x2m SOIL plots, the plate will be buried as if for a 200m² plot, as recorded in the last survey.

The plot location (GPS) reading should be taken at the south corner of the plot. In the small 4m² plots, there will be no X plot centre post and so the most reliable position from which to project all measurements and associated plots is the south corner of the plot *Ensure this is clearly indicated on plot sketch maps.*

If the plot falls in the sea, inland water, built land, unsafe or inaccessible land, then choose a new location at random from land within the same sector. If there is no plot-able land then the plot cannot be recorded and no Vegplots entry is necessary. This rule is applied because simply positioning these plots on the nearest land will oversample coastal or waterside habitats.

Note that if, as a result of land-use change, plot-able vegetated land is very scarce in a square, it may not be possible to find and record locations for all new plots. To determine whether a new X plot position can be feasibly recorded, the surveyors should use the five sector overlay on the plot location map.
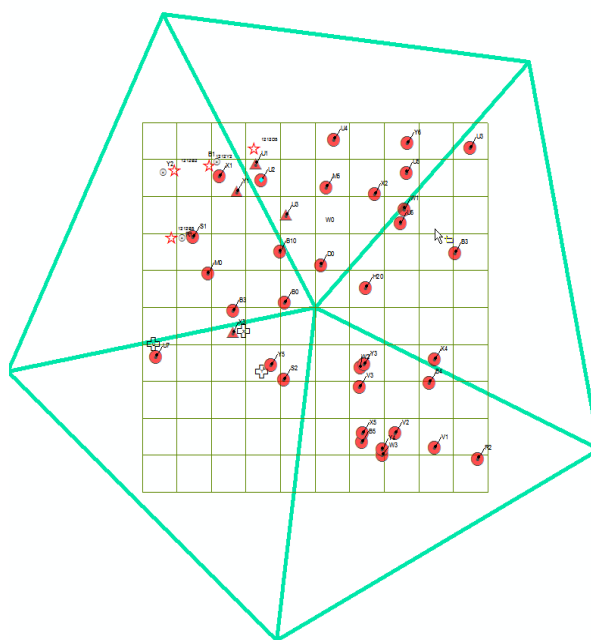
The five sector stratification for X plots

The five sector stratification is a layer (XPlotSectors) available in *Collector*. If there is eligible land available in that sector then apply the rule above for finding a new X plot location.

If the X plot lands in an arable field then the plot will need to be moved to **12m** away from the edge of the crop to avoid excessive trampling damage. Then access the vegetation via tram lines in the crop and do not attempt to layout the X plot string and poles if this will cause crop damage. In hay meadows, if there is high risk of

irreparably flattening the hay close to harvest time then move the X plot to the field edge.

3.1.2 Laying out X plots

4m² X plot layout

The small vegetation X plot is 4m². It should be orientated along north/south, east/west axes. The best way to set out the plot is to run out 2.82m of tape (the diagonal length of the 2x2m plot) and orient this north to south and peg both ends. Then simply run out 8m of tape pegging out the north and south ends at 0 and 4m and pulling out the tape taught so that the 2m and 6m corners are pegged.

In arable fields the plot should be taken as being a 2x2m square (estimated, not measured), starting 12 metres into the crop (to avoid any edge effect). Access should be made using drill lines where possible and causing minimum disturbance to the crop (or where the crop may be on a future visit). The species list should be compiled from what can be seen in the crop - accuracy is difficult to achieve but samples must be taken from arable crops however possible.

200 m² X plot layout (standard)

The vegetation plot is 200 m² (14.14 x 14.14m) and is set up by using the survey poles provided with the strings forming the diagonals of the square. The diagonals should be orientated carefully at right angles and the plot should be orientated with the strings on the North/South, East/West axes.

The different nested plots shown are marked by different coloured strings on the appropriate position of the diagonal. The 1m² nest is not marked and comprises the northernmost corner of the inner 4 m² nest.

An easy way to mark out nest 0 is as follows:

1. Locate the marker tag for nest 1 along the north-pointing 1/2 diagonal string. This tag should be positioned at 1.41m

2. Run out 4m of tape and place the 2m position at the nest 1 marker tag then run the 0-2m and 2-4m lengths back to the centre post.

3. Now simply pull out the slack in the tape, placing pegs at 1m and 3m to derive the 1x1m quadrat.
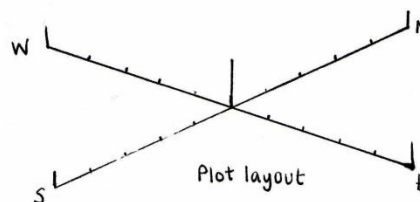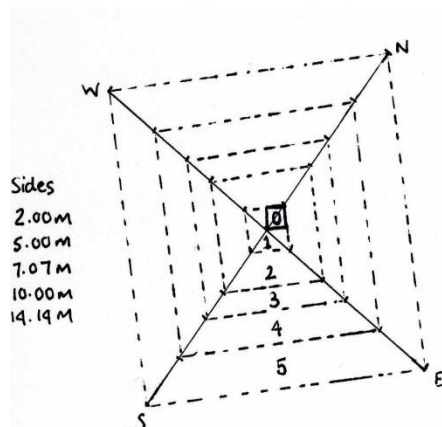
Design of X (Wally) Plot

Nest	Area (m^2)	Sides(m)	Diagonal(m)	1/2 diagonal(m)
0	1	1	1.41	not needed
1	4	2.00	2.83	1.41
2	25	5.00	7.07	3.54
3	50	7.07	10.00	5.00
4	100	10.00	14.14	7.07
5	200	14.14	20.00	10.00

X plot dimensions

3.1.3 Recording X plots

Listed Species

**4m2 X plot: All species are recorded from the 4m2 nest**

200m2 X plot: Species are recorded cumulatively starting in nest 0 and then censussing successively larger nests up to nest 5, which is the outermost nest. Any additional species are recorded in each successive nest.

3.1.3.1 200m^2 X plot ('VEGETATION')

Note that the GPS reading for the X plot should be taken at the south corner of the X plot.

Nest 0

A record of the presence of species in this   nost quadrat are made by inserting the name of the species on the recording fᴏ...., ᴜnder 'Nest 1 (include X plot 0)'. 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. 🗑

Tip! *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. This may also be used to enter unknown species, for example 'Species A', 'Species B' and so on (once the species has been identified, this should be replaced with the correct species). Plants which cannot be immediately identified, or for which a subsequent check, in a flora or herbarium, is required, can be placed in a labelled paper bag, or alternatively, an option is also provided to take a photo of unknown species at the bottom of the page for later identification (this is preferable in the first instance).*

Rep ID
100X2

▼ **Vegetation Plot**

▼ **Nest 1 (include X plot 0). Enter species:**

Species:

care ⊗ ∧

○ Carex acuta
○ Carex acutiformis
○ Carex aquatilis
○ Carex arenaria
○ Carex bigelowii

Cover: Nest 0

Cover: Nest 1

Total Cover

🗑   1 of 1   ➕

Species:

Other ⊗ ∨

Specify other.
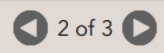
Species A - curly moss ⊗

Total Cover

Having completed the record of presence of the vascular plants in the nest (0), an estimate of cover abundance 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'.** The total cover should add up to ca. 100% (making due allowance for the 'presents' (=1)), **or more if the ground flora is markedly layered**.

Covers should be entered into the 'Cover: Nest 0' box for each species. Covers can be entered as species are entered, or can be entered subsequently using the scroll
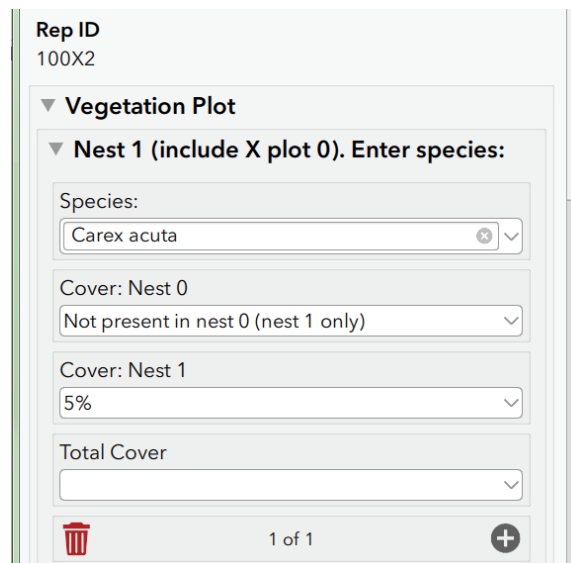
forward and back buttons. ◀ 2 of 3 ▶ .

Unfortunately, it is currently not possible to view the species entered as a list. 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.

Nest 1

For Nest 1, the innermost 2 x 2 m nest is searched. Species additional to those recorded in nest 0 are added to the same nest section as Nest 0 '(Nest 1 (include X plot 0)'. However, for those species appearing in Nest 1 only (not nest 0), the option 'Not present in nest 0 (nest 1 only)' must be selected in the 'Cover: Nest 0' box.

Subsequent Nests

Having recorded all species in a given quadrat size, the new 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 m^2) has been recorded. The most convenient method of search for the successive sizes of quadrat is for the two operators to spiral outwards moving in opposite directions so that both cover the

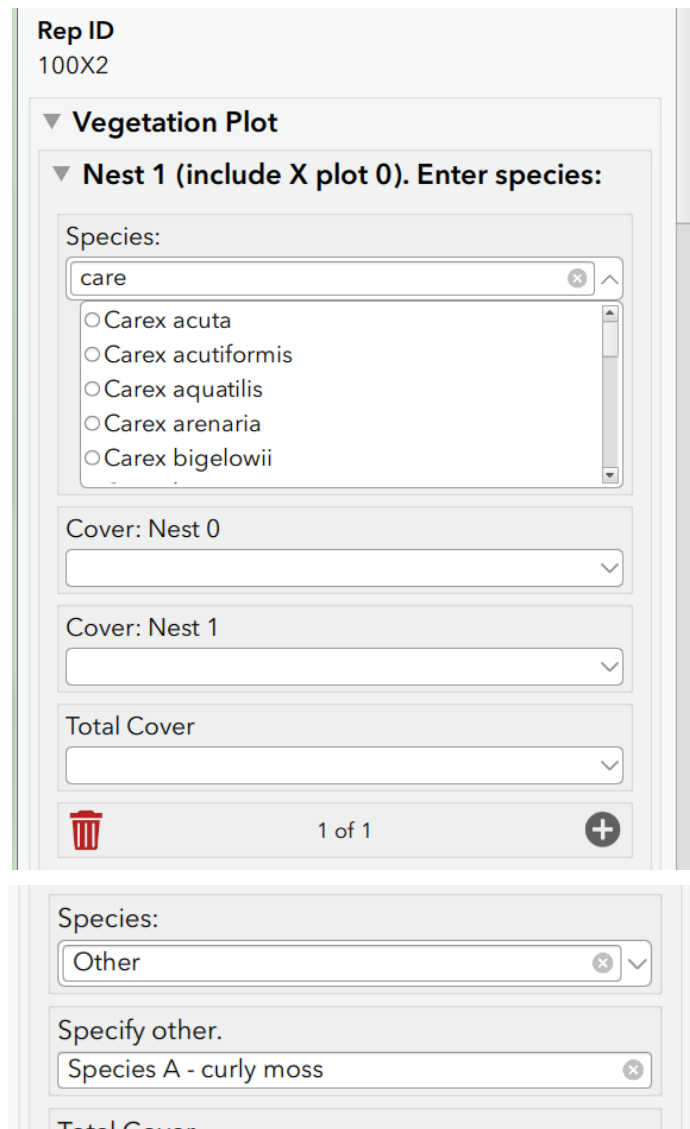whole area. Record successive quadrats under the relevant Nest section on the recording form.

If there are no additional species on the particular nest, the 'No additional species in nest' box may be ticked.

3.1.3.2 4m² X plot ('SOIL')

A record of the presence of species in the quadrat are made by inserting the name of the species on the recording form, under 'Nest 1 (include X plot 0)'. 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. 🗑

Tip! 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. This may also be used to enter unknown species, for example 'Species A', 'Species B' and so on (once the species has been identified, this should be replaced with the correct species). Plants which cannot be immediately identified, or for which a subsequent check, in a flora or herbarium, is required, can be placed in a labelled paper bag, or alternatively, an option is also provided to take a photo of unknown species at the bottom of the page for later identification (this is preferable in the first instance).

Having completed the record of presence of the vascular plants in the quadrat, an estimate of cover abundance for the plot 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'.** The total cover should add up to at least 100% (making due allowance for the 'presents' (=1)), **or more if the ground flora is markedly layered**. For example in woodland or % cover could be as much as 300%. Covers should be entered into the 'Total cover' box for each species. Covers can be entered as species are entered, or can be entered subsequently using the scroll forward and back buttons. ◀ 2 of 3 ▶ .

Unfortunately, it is currently not possible to view the species entered as a list. 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.

4 Guidelines on Species Identification

4.1 Aggregations/Combinations

Surveyors are expected to record to the species level. However, there are certain species which are notoriously difficult to separate. In order to remain consistent with previous surveys, certain amalgamated taxa should be recorded.

The combinations were determined on the basis of experience, where it is considered that unless good specimens are available it is not possible to identify the species accurately. A number of the species combinations have similar ecological amplitudes e.g. *Cardamine hirsuta/flexuosa*. Where the separate species name is known unequivocally, then it should be used; otherwise, the combination name should be used, as provided in the BRC list on the tablet.

> **Please DO NOT ATTEMPT TO UPROOT invasive species. If they are removed, we cannot detect an increase in abundance and gather evidence that there may be a problem. Moreover trying to uproot these species may encourage them to spread further.**
>
> **Also be aware that if you uproot a plant in a plot in order to identify it and it is the only individual present you are potentially changing the species richness and may also be causing a discrepancy to occur with the subsequent QA visit! It is preferable to take a photo with the unidentified species photo button on the tablet in the first instance.**

4.2 Bryophytes and Lichens

Only the bryophytes and lichens listed in section 7.2.1 (mosses only) and on the Vegplots list (lichens, liverworts and mosses), should be recorded (with their individual cover values). **No other bryophytes or lichens should be recorded.**

Sphagna

Sphagnum (green/fat)*

Sphagnum (green/thin)*

Sphagnum (red/fat)*

Sphagnum (red/thin)*

The simple classification above includes the following species (following AJE Smith, *The moss flora of Britain and Ireland* (1978)

Green/Fat

S. compactum

S. molle

S. palustre

S. papillosum

S. squarrosum

S. strictum

S. subsecundum (Sect.)

S. teres

Red/Fat

S. magellanicum

Green/Thin

sect. Cuspidata*

S. fimbriatum

S. fuscum

S. girgensohnii

S. recurvum (note this species is now part of *S.fallax*)

S. russowii (green form)

S. quinquefarium

(* includes *S. recurvum* and *S. cuspidatum*)

Red/Thin

S. subnitens

S. capillifolium

S. russowii (red form)

S. warnstorfii

Note: The specific species may be recorded if desired, however do not waste time on this as it is likely the species will be aggregated for analysis

4.2.1 List of mosses to be recorded in vegetation plots where possible.

Note that surveyors should put effort into recording vascular plants, especially sedges and grasses, accurately and completely rather than spend effort on identifying bryophytes.

Even if you record those listed below, this will often only represent part of the total. Hence attach the highest priority to recording 'Total bryophyte' and cover of the coarse *Sphagnum* categories.

No	Species	Compare with
1	*Atrichum undulatum*	*Plagiomnium undulatum*
2	*Aulacomnium palustre*	-
3	*Brachythecium albicans*	4, 5, 21
4	*Brachythecium rivulare*	3, 5, 21, *Brachythecium plumosum*
5	*Bracyhthecium rutabulum*	3, 4, 21
6	*Breutelia chryoscoma*	-
7	*Bryum pseudotriquetrum*	32
8	*Calliergon (Calliergonella) cuspidatum*	9
9	*Calliergon giganteum*	8, *Calliergon cordifolium*
10	*Campylium stellatum*	-
11	*Campylopus introflexus*	*Campylopus atrovirens*, *Grimmia* sp.
12	*Campylopus sp.*	16, 18
13	*Climacium dendroides*	52
14	*Cratoneuron (Palustriella) commutatum*	*Cratoneuron filicinum*
15	*Ctenidium molluscum*	-
16	*Dicranella heteromalla*	12, 19
17	*Dicranum majus*	19
18	*Dicranum scoparium*	12, 16, 17
19	*Drepanocladus aduncus* Only in swamps, not flushes	47, *Drepanocladus revolvens*, *D. cossonii*, *Warnstorfia fluitans*, *W. exannulata*
20	*Eurhynchium spp.*	3, 4, 5
21	*Fissidens sp.*	37
22	*Fontinalis antipyretica*	*Fontinalis squamosal*
23	*Hedwigia stellate*	42
24	*Homalothecium lutescens*	26
25	*Homalothecium sericeum*	25
26	*Hookeria lucens*	-
27	*Hylocomium splendens*	53
28	*Hypnum cupressiforme*	29, 47
29	*Hypnum jutlandicum*	28
30	*Leucobryum glaucum*	*Sphagnum* spp.

No	Species	Compare with
31	*Mnium hornum*	7
32	*Neckera crispa*	-
33	*Pellia spp.*	*Riccardia* spp.
34	*Philonotis fontana*	-
35	*Plagiothecium sp.*	22
36	*Plagiothecium undulatum*	-
37	*Pleurozium schreberi*	40
38	*Polytrichum commune*	*Polytrichum formosum*
39	*Polytrichum juniperinum*	*Polytrichum piliferum*
40	*Pseudoscleropodium (Scleropodium) purum*	37
41	*Ptilidium ciliare*	-
42	*Racomitrium lanuginosum*	23
43	*Rhizomnium punctatum/pseudopunctatum*	31, *Plagiomnium* spp.
44	*Rhytidiadelphus loreus*	45, 46
45	*Rhytidiadelphus squarrosus*	44, 46
46	*Rhytidiadelphus triquetrus*	44, 45
47	*Scorpidium scorpioides*	19
48	*Sphagnum green/fat*	-
49	*Sphagnum green/thin*	-
50	*Sphagnum red/fat*	-
51	*Sphagnum red/thin*	-
52	*Thamnobryum alopecurum*	13
53	*Thuidium tamariscinum*	27

5 Appendices

5.1 Appendix 1 - COLLECTOR & SURVEY123

Generic reference guides

Installing Collector

1.   Find and install 'Collector' (for ArcGIS, ESRI) from your App Store (this will depend on your type of phone or device) (note: free to download).

Installing Survey123

1.   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/

Collector – Generic Notes

The main parts of the app are as follows:

- *Map*
- *Collect screen*
- *Map Gallery*
- *Menu*

Map

The majority of your time in the app is spent interacting with the map, where a basemap and features display. This is the active open map used in your data collection. When viewing the map, you can collect data, begin measuring, and initiate all the other capabilities of the app. Use the Map Gallery to open a map.
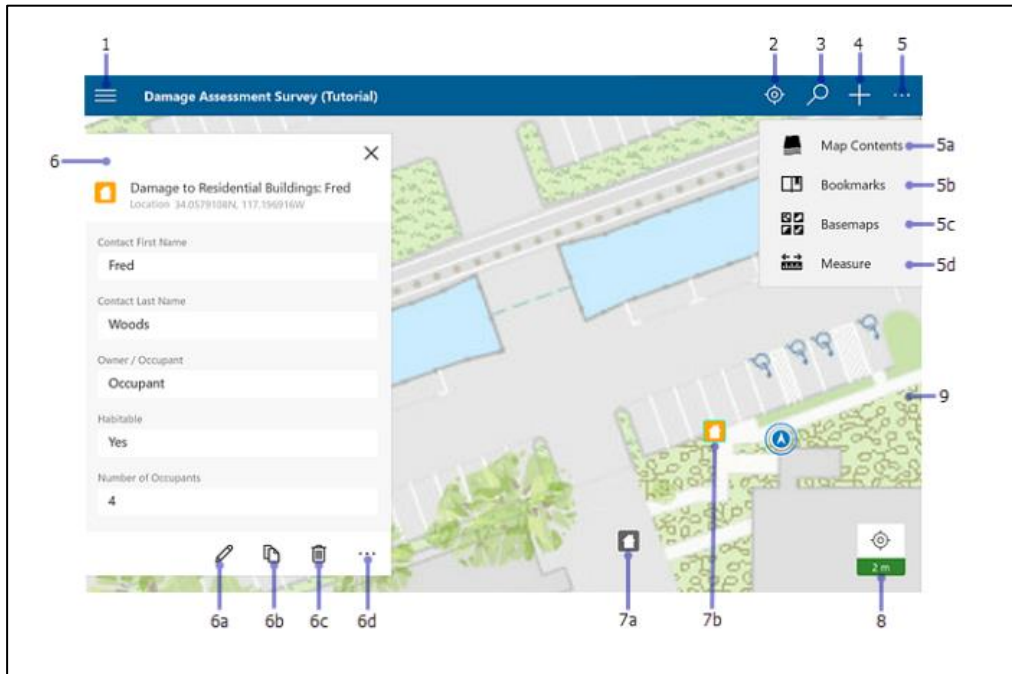

The following are highlighted in the image of the map:

1. **Menu**—Expands the menu to display collections of maps and provides access to accounts and app settings.
2. **My Location** tool—Uses GPS to show your location on the map. To enable **My Location**, turn on location services in your device's settings. The icon changes to show the state of the GPS. The icon ⬡ indicates your location does not display on the map. Once your location is turned on, the icon ⊙ indicates your location displays on the map and is kept centred. As you move, the map moves on the screen to keep your location centred on the screen. Once you pan the map while your location displays, the icon ⊕ indicates your location displays on the map but isn't kept centred. As you move, your location displayed on the map moves on the screen and can even move outside of the visible part of the map.

    Tip! *When you don't need to see your location on the map, turn off My Location ⬡. This saves the battery by turning off not only the display of your location but also the GPS. If the map tracks your location, it continues to do so when location is not displayed on the map, turning on the GPS when needed. If you're collecting data, the GPS turns back on as needed to get collection locations.*
3. **Search** tool—Searches for a place-name, address, coordinate location, or feature. The map author configures the search and the hint text, which provides information about what you can search.

4. **Collect New** tool—Adds a feature.
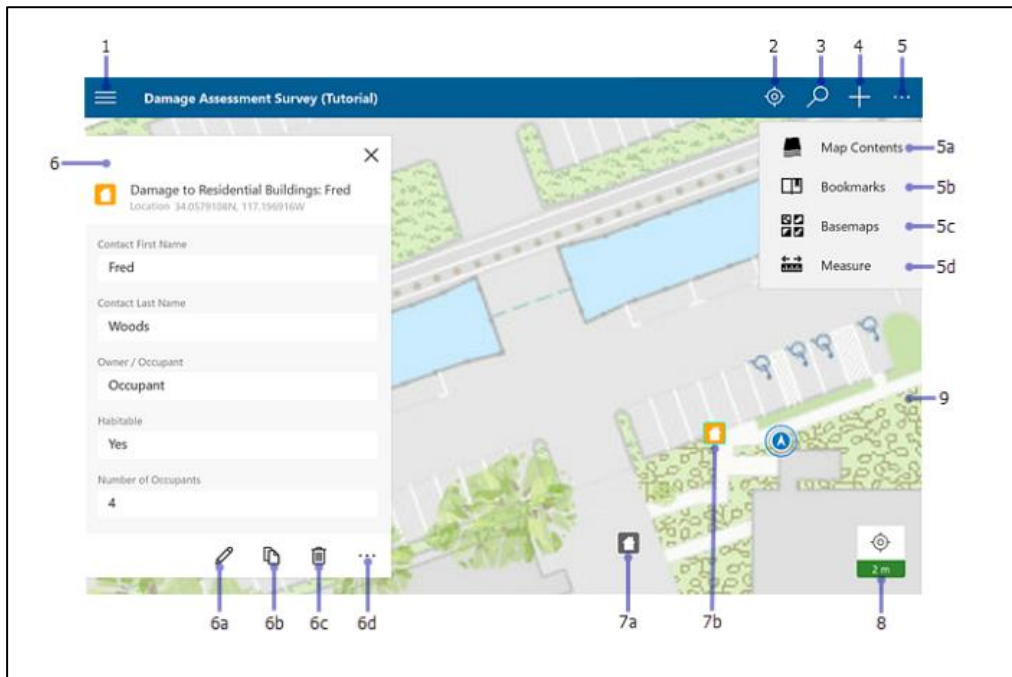
5. **More**—Shows a menu of the additional tools available. The screen capture shows the menu.
   a. **Map Contents** tool—Shows the legend and layers. If you turn layers on and off on the **Layers** tab, these changes are reflected in the legend. While this changes which features display on the map, it doesn't change the saved map or how the map appears to others.
   b. **Bookmarks** tool—Goes to previously defined areas of interest. These include **Bookmarks** defined on the map and **My Places** that you may have stored in your device.
   c. **Basemaps** tool—Changes the basemap to another one that is either online or on your device. The basemap, also known as a reference or background map, provides the information displayed under the interactive features.
   d. **Measure** tool—Draws lines and shapes on the map, and calculates their lengths and areas in a variety of measurement units.

6. **Panel**—Displays contextual information based on the tools being used and the interactions with the map. The possible contents include types for data collection, searches and search results, feature lists and feature details, and editable feature details. When displaying a list of search results or features, the selected item is highlighted on the map. Select a result or use **More** • • • to interact with the result.

   The screen capture shows the panel with the details of a feature. While feature details are displayed, the following tools are available (these are not relevant for this survey):
   a. Edit—Starts editing the feature.
   b. Copy—Copies the feature to create a new feature.
   c. Delete—Deletes the feature.

d. More—Provides access to the Zoom to and Add to my places actions if applicable to the selected feature.

7. **Map**—The map appears here, including a basemap and features. You can pan, zoom in, and zoom out to see other areas.

8. **Location Accuracy**—Indicates current horizontal GPS accuracy as well as whether it is below the location accuracy threshold. To display more information about your current GPS location, such as vertical accuracy and fix type, select the badge.

FAQ – GPS in Collector

My GPS locations are not being updated on the map, and after I select the location accuracy badge, it shows that it's taking increasingly longer to calculate a fix time. Why is this happening and how do I fix it?

The time on your Windows 10 device might be ahead. Collector calculates fix time by determining the difference between the time on your GPS receiver and the time on your Windows device. If the time on your Windows 10 device is ahead, Collector assumes that your GPS positions are invalid and discards them. To fix this, synchronize the time on your device with the time on the Internet.

How do I know the accuracy of the GPS positions I'm getting?

*When you have a map open and **My Location** ⊕ is on, displaying your location on the map, the **Location Accuracy** badge displays in the lower right corner of the map.*

This indicates current horizontal accuracy as well as whether the current accuracy is below the location accuracy threshold required to use the GPS to collect data. If the horizontal accuracy is valid for data collection, the badge is green; if the accuracy is not good enough to use the GPS for data collection, the badge is red. If no positions have been received, dashes appear in the badge where the accuracy is supposed to display. If you are not receiving any position information and are using an external GPS receiver, first verify that your receiver is turned on and connected to Collector.

*How can I get more information about my current GPS location?*

*If you have a GPS location and want to see the details of that position, select the **Location Accuracy** badge in the lower right corner of the map to display information such as the time that the position was received, vertical accuracy, and fix type.*

Note: GPS – *make sure it is turned on*

In order to conserve battery power, it is best to keep
 your tablet in flight mode.
However, you need to make sure your GPS is on, when
in flight mode (Click on the Network and Internet
settings link)
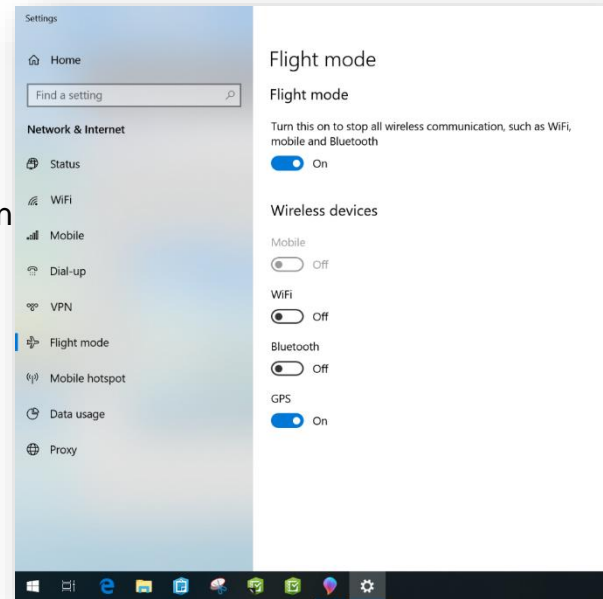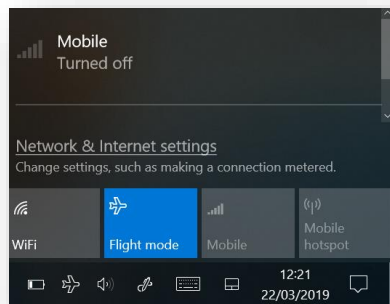
Map Gallery

To go to the Map Gallery when viewing a map, select Menu and select a collection of maps. To change the collection of maps displayed, use the menu or select a group. To return to the open map, select the map's thumbnail at the top of the menu.
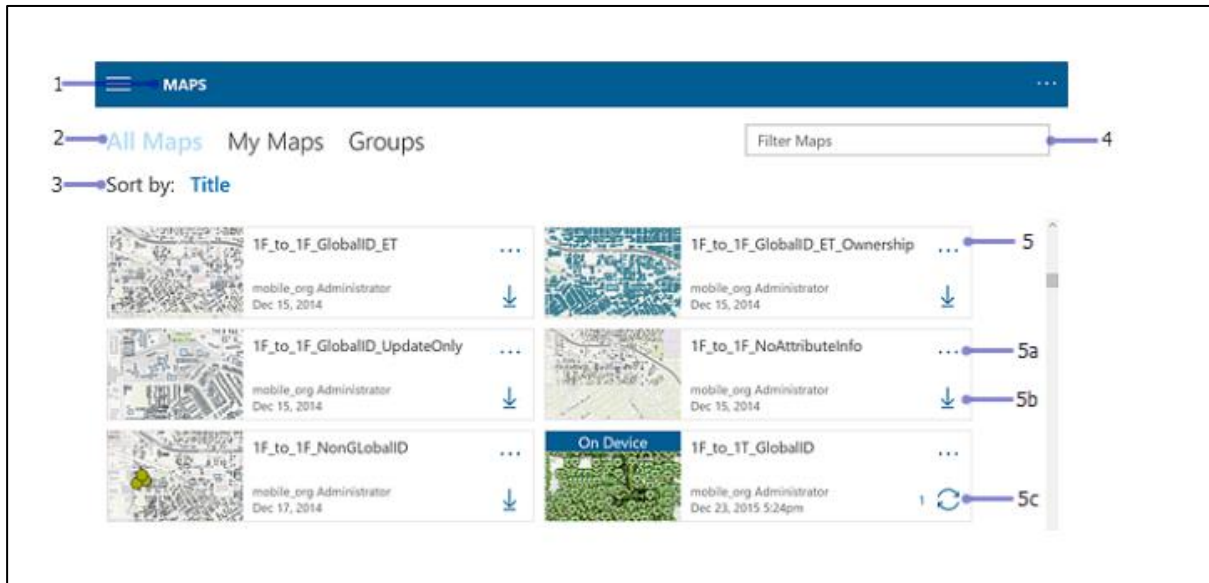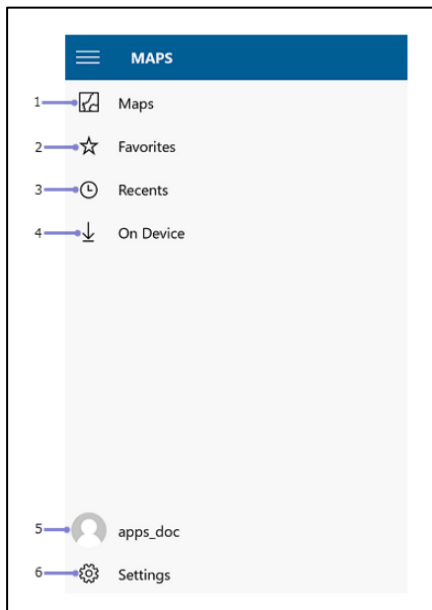

The following items are highlighted on the image of the Map Gallery:

1. **Gallery title**—Describes the list of maps.
2. **Tabs**—Displays the selected category of maps. When viewing **Maps**, it has the following options:
   a) **All Maps** (as shown in the image)—Shows all available maps, including those you authored and those available to groups of which you are a member.
   b) **My Maps**—Shows all the maps you authored. They are shown as a flat list, ignoring any folders that you have set up.
   c) **Groups**—Shows the groups of which you are a member. Choose a group to show the maps shared with that group.

   When viewing the On Device collection, **Maps** shows maps downloaded to your device, and **Basemaps** allows you to manage your basemaps.
3. **Sort by**—Allows you to sort maps by title, date, or owner.
4. **Filter Maps**—Filters the available maps to only display those maps with matching title, summary, or tags.
5. **Map Card**—An available map. Select the map card to open a map.
6. **... More**—Provides access to additional actions you can take with the map. These depend on the chosen map and can include **Details (5a)**, **Download (5b)**, **Sync (5c)**, and **Remove**. In the map's details, you can open the map , add the map to your favourites by choosing the star , and download the map if that option is available.

The following items are highlighted on the image of the menu:

1. **Maps**—Displays **All Maps**, **My Maps**, and **Groups**.
2. **Favourites**—Displays your favourite maps. To make a map a favourite, select **More** ••• on the map's card, select **Details**, and select **Favorite** ☆ .
3. **Recents**—Displays the maps recently used by the current account and on this device.
4. **On Device**—Displays the maps and basemaps you've downloaded to your device.
5. **Account**—Provides access to add, remove, or switch user accounts.
6. **Settings**—Provides access to view and update the app settings, such as location accuracy, streaming interval, collection mode, and measurement units. It also provides access to information about the licensing of the app.

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.
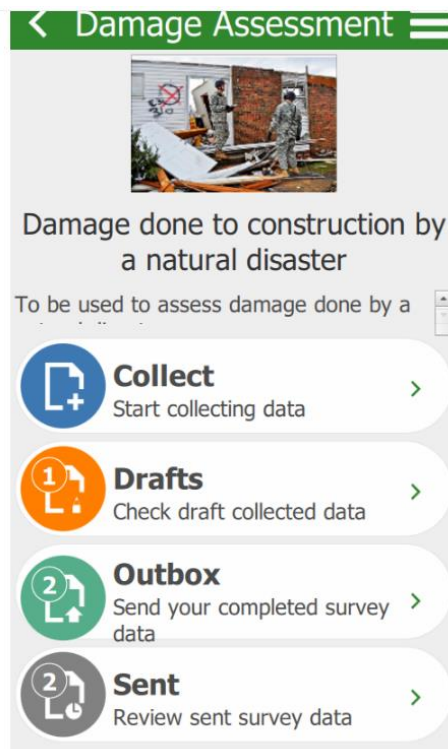
The options on this page are as follows:

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
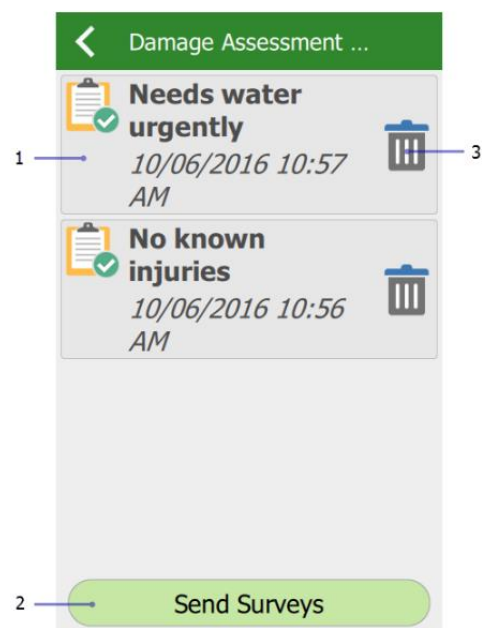
and its answers. The text in this field defaults to the raw data of the survey. To replace it with something else, see instance names.

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
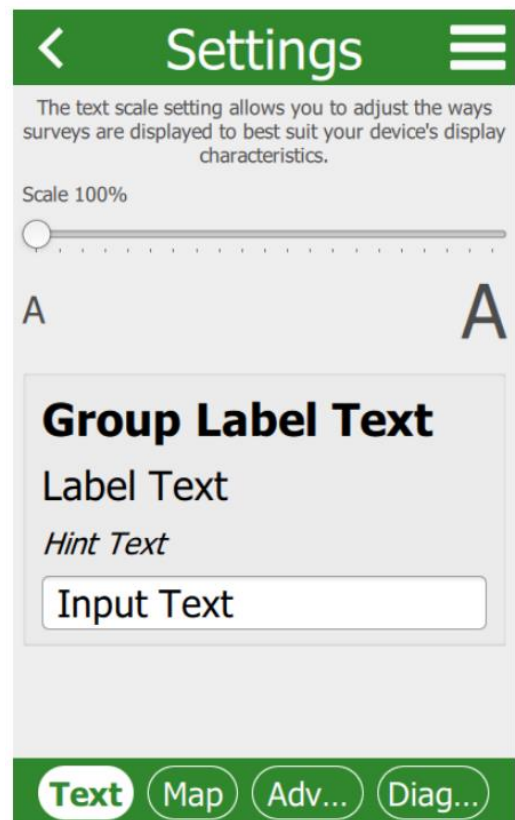
5.2 Appendix 2 Random numbers between 0 and 1

0.155	0.209	0.487	0.595	0.561	0.558	0.194	0.687	0.307	0.409
0.779	0.215	0.509	0.000	0.869	0.309	0.891	0.194	0.005	0.633
0.171	0.198	0.250	0.442	0.059	0.991	0.158	0.276	0.425	0.275
0.250	0.703	0.995	0.534	0.883	0.677	0.988	0.454	0.134	0.087
0.138	0.225	0.544	0.869	0.586	0.315	0.795	0.094	0.727	0.604
0.488	0.177	0.995	0.098	0.888	0.840	0.769	0.758	0.854	0.894
0.733	0.131	0.203	0.195	0.976	0.244	0.340	0.143	0.662	0.556
0.864	0.059	0.507	0.460	0.002	0.811	0.731	0.104	0.935	0.130
0.016	0.999	0.734	0.142	0.978	0.014	0.376	0.025	0.141	0.212
0.512	0.844	0.965	0.270	0.550	0.772	0.127	0.470	0.810	0.855
0.523	0.534	0.173	0.640	0.117	0.653	0.156	0.765	0.838	0.815
0.046	0.296	0.654	0.627	0.674	0.990	0.822	0.663	0.585	0.574
0.464	0.666	0.094	0.851	0.115	0.439	0.234	0.799	0.583	0.347
0.046	0.590	0.935	0.373	0.205	0.991	0.658	0.811	0.443	0.204
0.734	0.862	0.755	0.298	0.262	0.702	0.534	0.408	0.573	0.794
0.461	0.925	0.486	0.588	0.725	0.513	0.371	0.566	0.295	0.644
0.112	0.091	0.123	0.452	0.016	0.948	0.060	0.294	0.591	0.868
0.560	0.953	0.872	0.851	0.695	0.414	0.478	0.016	0.405	0.114
0.961	0.249	0.888	0.487	0.787	0.618	0.179	0.551	0.357	0.483
0.907	0.704	0.374	0.368	0.488	0.986	0.153	0.920	0.696	0.291
0.148	0.064	0.627	0.417	0.144	0.496	0.620	0.018	0.317	0.982
0.059	0.101	0.227	0.311	0.628	0.674	0.271	0.517	0.693	0.735
0.720	0.083	0.070	0.576	0.904	0.508	0.118	0.036	0.933	0.321
0.637	0.288	0.257	0.037	0.757	0.006	0.303	0.145	0.960	0.236
0.418	0.776	0.970	0.710	0.856	0.392	0.416	0.409	0.841	0.537
0.348	0.950	0.318	0.431	0.709	0.766	0.097	0.004	0.511	0.650
0.966	0.540	0.731	0.384	0.376	0.079	0.900	0.778	0.312	0.978

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