Living England Specification for Ground Data Collection

Amended for the Natural Capital and Ecosystem Assessment (NCEA)

December 2022
(Revised for an external audience)

Evidence Earth Observation Service (EEOS)
&
Natural England Field Unit (NEFU)

NATURAL ENGLAND

Contents

1 Introduction

The Living England (LE) project, led by Natural England, is a multi-year programme delivering a satellite-derived national habitat layer in support of the Defra Environmental Land Management (ELM) System and the Defra Natural Capital and Ecosystem Assessment (NCEA). The project uses a machine learning approach to image classification, developed under the Defra Living Maps project (Kilcoyne *et al.*, 2017). The method first clusters homogeneous areas of habitat into segments, then assigns each segment to a defined list of habitat classes using a Random Forest classification model (a machine learning algorithm). Through Phases I-IV (2018-2022) the LE project has undergone a number of iterations to develop the methodology and in Phase IV has released a habitat classification under the Open Government Licence (OGL). Phase V (2022-23) aims to standardise the methodology used in the classification process and Phase VI (2023-24) will implement the agreed standardised methods. The Living England team intend to publish updated maps every two years in order to provide up-to-date evidence as part of the NCEA on the distribution and extent of England's natural capital assets.

NCEA is a transformative programme to understand the extent and condition of England's terrestrial and marine environmental assets over time, supporting the government's ambition to improve the environment within a generation.

To accommodate the phenological and habitat variation across England and to facilitate the acquisition of cloud-free image mosaics, LE divides England into 14 Biogeographic Zones (BGZs, Figure 1).

While the LE output is primarily derived from satellite data, the LE methodology does not in any way replace the need for field survey. It is a tool which requires input of recently captured field data to inform a classification model, allowing It is a tool which compliments field data and allows for the revision of habitat data at a national scale. The production and improvement of the map would not be possible without the regular provision of high-quality robust field survey data to train the model and carry out the model validation.

This document describes and supports the field data collection method that should be used for recording LE ground data points, using a mobile device and the ArcGIS Field Maps app (Esri, 2022).

For any enquires about this guidance or the LE project, please contact the LE enquires mailbox:

livingenglandenquiries@naturalengland.org.uk

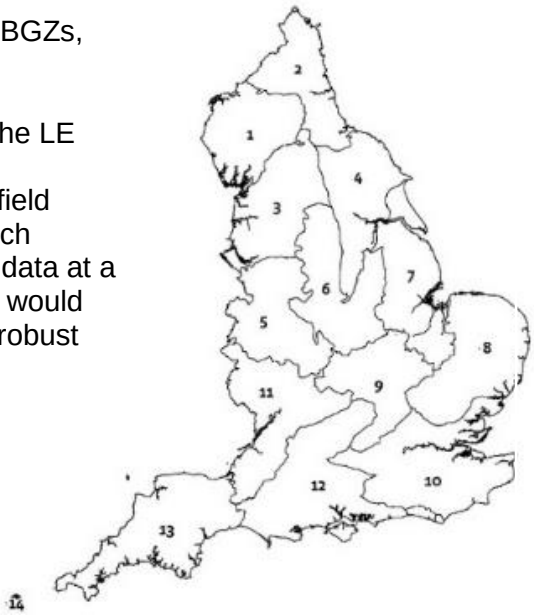


Figure 1: Biogeographic Zones

2 Habitat Types

2.1 LE follows the UK Biodiversity Action Plan (UKBAP) classification framework with some adjustments, as shown in Table 1 (JNCC, 2011). The UKBAP habitat classification was undertaken in Phase IV to ensure the habitat classification framework used by LE remains available under an OGL.

2.2 The **LE UKBAP NCEA Classification Framework (2022) Vs2** sets out the relationship between ecosystems, broad and priority UKBAP habitats, and the "Broad" and "Detailed" LE Classification.

2.3 In most cases, Detailed LE habitats equate to the broad UKBAP level. Exceptions are introduced where classes can or cannot be confidently mapped in relation to the resolution of Sentinel-1 and Sentinel-2 satellite imagery. These include:

2.3.1 Acid, Calcareous, Neutral Grassland is a combined class equivalent to Semi-natural Grasslands at the ecosystem level.

2.3.2 Coastal Sand Dunes and Coastal Saltmarsh are mapped at the higher resolution priority habitat level.

2.3.3 Segments labelled as 'Unclassified' typically indicate locations where cloud-free satellite imagery was not available or where urban areas are misclassified as cloud.

2.3.4 For Phase IV Inland Rock and Bare Soil/Peat were combined into Bare Ground.

Table 1: Phase IV LE UKBAP habitat classification framework

Broad Habitat	UKBAP Level	Ecosystem Habitat
Acid, Calcareous, Neutral Grassland	Semi-natural Grasslands	Grassland
Arable and Horticultural	Broad	Cropland
Bare Ground	EO Resolution	Bare Ground
Bare Sand	EO Resolution	Bare Ground
Bog	Broad	Wetland
Bracken	EO Resolution	Grassland
Broadleaved, Mixed and Yew Woodland	Broad	Woodland
Built-up Areas and Gardens	Broad	Urban
Coastal Saltmarsh	Priority	Coastal
Coastal Sand Dunes	Priority	Coastal
Coniferous Woodland	Broad	Woodland
Dwarf Shrub Heath	Broad	Heath
Fen, Marsh and Swamp	Broad	Wetland
Improved Grassland	Broad	Grassland
Scrub	EO Resolution	Woodland
Water	EO Resolution	Freshwater
Unclassified	-	Unclassified

2.4 To improve the transferability of ground data collected for LE for use by other mapping products and to aid validation of the probability map, a higher level of habitat resolution than UKBAP priority habitat level is also collected using the European Union (EU) Habitats Directive Annex 1 habitat classification framework (EU, 2013).

2.4.1 Descriptions of UKBAP Broad habitats, UKBAP Priority habitats (UK BAP Priority Habitats | JNCC - Adviser to Government on Nature Conservation) and EU Habitats Directive Annex 1 habitats are within the provided information pack. The Baseline Evaluation of Higher Tier Agreements (BEHTA) manual (Natural England, 2016) is also provided for defining the percentage cover of positive indicators for a range of habitat classes to help with decision making in recording the primary and secondary LE habitat percentage cover across a segment (note that not all habitat classes are included here). An abridged BEHTA Grassland Key is also provided for gauging differentiation between improved and semi-natural grassland habitats (Improved Grassland and Acid, Calcareous and Neutral Grassland LE habitat classes). Documentation of these can be provided upon request.

2.4.2 Specific queries about where certain habitats fall under the adjusted LE UKBAP classification framework, with information about how to record them at UKBAP priority habitat and EU Habitats Directive Annex 1 level, are provided in Table 7 in Annex 3.

2.5 Some LE habitats do not require ground data collection for LE Phase V, and these are excluded from fieldwork targets set out in Section 3.

2.5.1 Habitats that do not use ground data, as they are either taken from a reliable external source or modelled separately in the LE classification process, are identified by crosses under “Ground Data Accepted” in Table 2.

2.5.2 Alternatively, some habitats use ground data but are not a priority for surveys as they either have sufficient reliable ground data from an external source or are modelled separately in the LE classification process. These are identified by crosses under “Ground Data Required” in Table 2

Table 2: Phase V LE habitats required for ground data collection per year in each BGZ.

	LE Habitat	Number of Ground Data Points Required	Justification
1	Arable and Horticultural	**0**	External dataset used
2	Bare Sand	**50**	
3	Bare Soil/Peat	**25**	Separate LE algorithm
4	Bog	**50**	
5	Costal Sand Dunes	**50**	
6	Coastal Saltmarsh	**25**	External dataset used
7	Dwarf Shrub Heath	**50**	
8	Fen, Marsh and Swamp	**50**	
9	Acid, Calcareous and Neutral Grassland	**50**	
10	Improved Grassland	**50**	
11	Inland Rock	**25**	Separate LE algorithm
12	Bracken	**50**	
13	Scrub	**50**	
14	Built-up Areas and Gardens	**0**	Separate LE algorithm
15	Water	**0**	Separate LE algorithm
16	Broadleaved, Mixed and Yew Woodland	**0**	Sufficient ground data
17	Coniferous Woodland	**0**	Sufficient ground data

3 Planning Your Survey

3.1 To optimise the usefulness of the ground data for LE, surveys should be targeted at the currently under-represented habitat classes in each BGZ. Please note that BGZ 14 (Isles of Scilly) is merged with BGZ 13 for the LE classification and does not require points to be collected.

3.2 The annual **minimum** requirement for LE ground points for each habitat is shown in Table 2. Some habitats will not be present in all BGZs (such as Coastal Sand Dunes and Bare Sand in land locked BGZs), and these are exempt from this minimum requirement If habitats are not abundant enough in a BGZ to record the target number of points, then this should be reported to the LE team.

3.3 Detailed priority areas and habitats for survey may be supplied by the LE team throughout the year as the habitat classification maps are investigated for errors or areas of low confidence. These specific areas and habitats should be a priority for surveyors as they have the potential to significantly improve the LE classification in future iterations. The priority points collected will still contribute towards the overall fieldwork minimum requirement.

3.4 Where possible, surveys should take place within the main growing season or productivity period for each habitat. For ease of identifying deciduous habitats such as broadleaved woodlands or semi-natural grasslands, plan the survey when vegetation is (as far as possible) in full leaf or before grasses are starting to fall over, coinciding with the main survey season for site monitoring. However, where ecologists are confident (can identify the LE classes out of season and correctly measure the percentage cover of the segment), data may be collected at any time of year. This is particularly the case for upland habitats and will help manage surveys to coincide outside game management periods. The **Field Survey Calendar** has been developed with NEFU to help identify when certain habitats should or should not be surveyed.

3.5 The spatial framework for the LE classification is based on a segmentation process using Sentinel-2 satellite imagery. This process groups together pixels of similar spectral appearance into polygons, which are referred to as “segments” and should approximately relate to stands of vegetation on the ground. These segments are classified by the LE modelling process, and each is assigned the most likely LE habitat class. Examples of LE segments are shown in Annex 1.

3.6 Use the **LE Quick Start Guide to Ground Data Collection** as a guide for how to identify which habitats are under-recorded in each BGZ, plan LE surveys, and obtain access permissions for LE surveys.

3.7 The **LE Ground Data Dashboard** (Figure 4 and Figure 3) should be used to identify current under-recorded classes in each BGZ and keep track of new data points recorded using ArcGIS Field Maps, as the dashboard updates automatically. Further details on the dashboard and ground data targets are provided in Annex 2.

3.8 It is essential to ensure you have permission from landowners and tenants to visit the site and to record data for LE, that all necessary risk assessments have been completed, and that you are in compliance with all health and safety requirements, including for lone working if appropriate. If you are planning to survey a new area, you must use the **Living England Access Permission Letter** to ensure Living England can continue to be released as an OGL product and data used for other mapping products.

3.9 The LE survey method is designed to be a rapid, light touch approach and only requires a smartphone or tablet running ArcGIS Field Maps. It is therefore ideal to integrate with other survey methods, such as Common Standards Monitoring / Integrated Site Assessment surveys, or National Vegetation Classification surveys.

3.10 LE ground data is captured in the field onto a mobile device (smartphone or tablet) using the ArcGIS Field Maps app (Esri, 2022). You must download and install “ArcGIS Field Maps” and configure it for use before going out on site (see Section 4 for details). Using the Field Maps app will make navigation to your survey points simple, as it uses your mobile device’s GPS location and displays a map showing the LE segments and habitat classification, as well as high resolution satellite imagery. Data capture is then a simple form-based process (see Sections 4 and 5 for details).

4 ArcGIS Field Maps User Guide

4.1 What you'll need – equipment and user account:

4.1.1 **Mobile device (phone or tablet) with GPS and camera.** Ideally your mobile device will have a SIM card although this is not essential, as maps can be downloaded for offline use over Wi-Fi. Your mobile device will need enough storage space available for installing ArcGIS Field Maps, storing offline map data, and storing your captured LE ground data points and photos.

4.1.2 **ArcGIS Online (AGOL) user account and group membership.** You will need a Defra AGOL user account and to be a member of the "Living England – Contracted field survey" Group. If you do not have access to the AGOL group, please contact the Living England team by sending a request to the Living England enquires mailbox (livingenglandenquires@naturalengland.org.uk).

4.1.3 Note that all screenshots in this section were taken using an Android (version 11) mobile phone with ArcGIS Field Maps (version 20.0.1). If you are using an Apple device, a different version of ArcGIS Field Maps, then the menus may appear slightly different, but this will not change the functionality of the app. The screenshots are numbered and labelled by their relevant points as e.g., "[*Fig. 2-01, 2-02*]".

4.2 Getting and installing the ArcGIS Field Maps app:

4.2.1 On your mobile device, go to the appropriate app store (App Store on iPhone, Google Play store on Android) and search for "ArcGIS Field Maps". Click on the matching app name to go to its page. [*Fig. 2-01*]

4.2.2 Install ArcGIS Field Maps on your device, open the app, and click the "Sign in with ArcGIS Online" to log in with your Defra AGOL account. [*Fig. 2-02, 2-03*]

4.2.3 When opened, Field Maps will present you with lists of the Maps and Groups which you have access to. [*Fig. 2-05, 2-07*]

4.3 Configuring app settings:

4.3.1 Make sure to allow the app to use any of your device's services the app requests access to (e.g., GPS, Camera, Photos etc.). [*Fig. 2-04*]

4.3.2 Only if using ArcGIS Collector (not Field Maps): Open the app settings by clicking the profile icon. Make sure the Accuracy is set to "9m", GPS Averaging is "Off", **Photo Upload Size is "Small"**, Snapping is 'Off', and that Units are "Metric" for Measurement Units and "Automatic" for the others. [*Fig. 2-06*]

4.3.3 From the app settings (click on the profile icon), you can configure the map download and sync options using "Cellular data" (sync & download when off Wi-Fi) and "Auto-sync" (automatically sync offline edits) depending on your preferences (see Sections 4.4 and 4.8 for details about offline working and synchronisation). [*Fig. 2-06*]

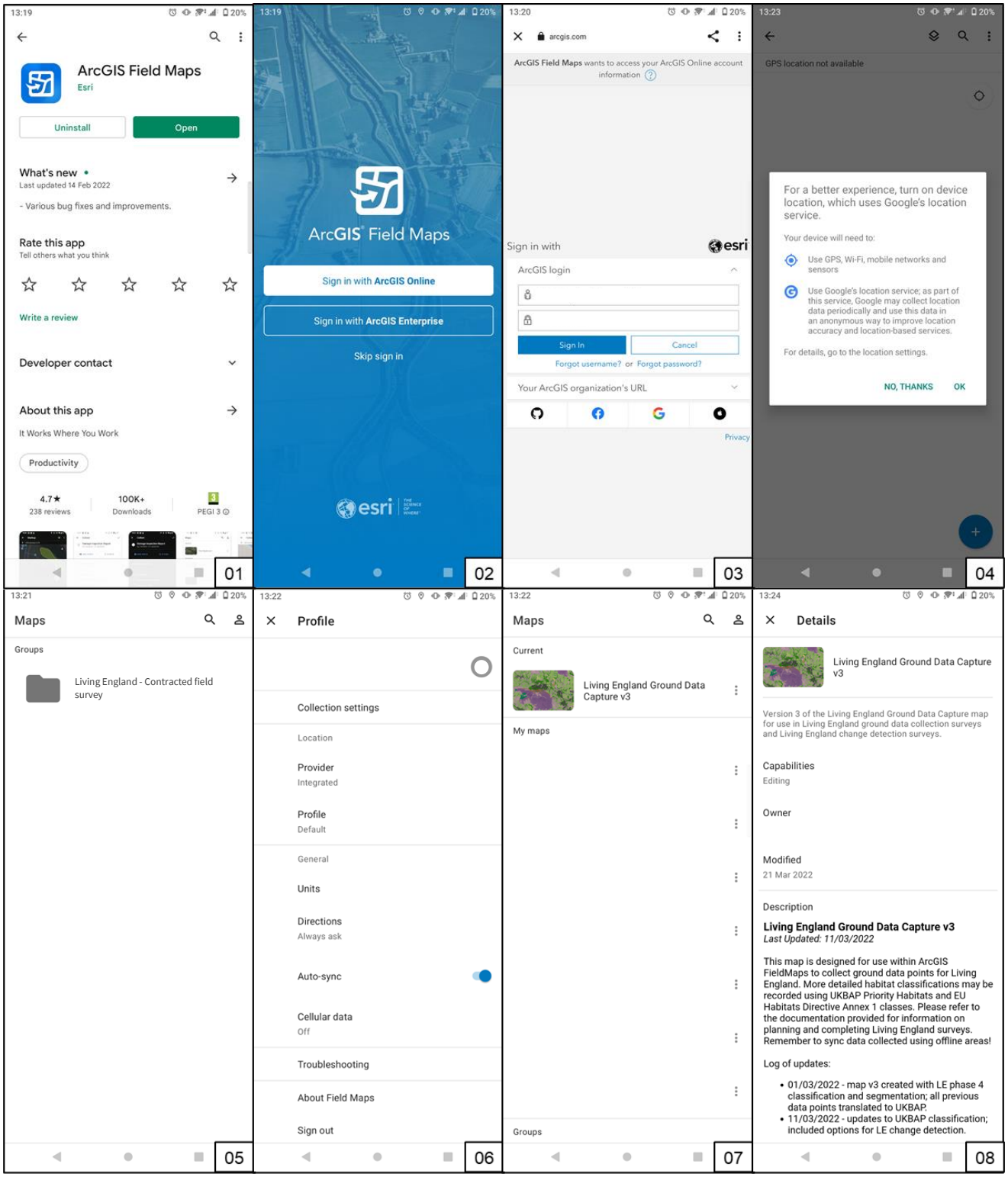


Figure 2: Screenshots 01-29 showing ArcGIS Field Maps (Esri, 2022) and the LE Ground Data Capture map. Background source: Esri et al. (2022) and OSM (2022).

4.4 Loading map and adding offline areas in Field Maps:

4.4.1 Within the “Groups” section of the app home screen, click on the Group called “Living England – Contracted field survey”. If the group is not listed, then you will need to request membership (see Section 4.1.2). [*Fig. 2-05*]

4.4.2 Within the group there is a list of the maps this group can access. Click on the map called **Living England Ground Data Capture v3**. [*Fig. 2-07*]

4.4.3 If you are connected to the internet (Wi-Fi or mobile signal), when you click on this map it will open in Field Maps in **online mode** (by default, it will automatically zoom to your location). This will use your internet connection to load the map and any data points collected are synced automatically as they are created/edited.

4.4.4 The menu icon next to the Living England Ground Data Capture map allows you to view the map details, download offline regions, and refresh the online map. [*Fig. 2-07, 2-08*]

4.4.5 You need to download **offline areas** to use the map in the field where your mobile signal will be unreliable or absent. You can adjust the area to download by moving and zooming the map in and out. The size of the download region is set to “Small building” by default, but you can change it (to e.g., “Street”) if you need to download a larger region. Note that downloads can take a long time (30-45 minutes on a good Wi-Fi connection), and any disruptions can cause the download to fail. We recommend you download offline areas over Wi-Fi to avoid excessive use of your mobile data allowance. [*Fig. 2-09 to 2-11*]

4.4.6 When the download is complete, the progress indicator is replaced by a menu icon. This allows you to rename the offline area, synchronise your offline area to update it with new data points collected by other surveyors, or remove the area from your device. [*Fig. 2-12*]

4.4.7 Now that there is an offline area downloaded to your device, it will open by default when you click on the Living England Ground Data Capture map instead of opening in online mode. When disconnected from the internet, the downloaded region of the map is still visible. You can also synchronise the data from within the map using the circular arrows icon. [*Fig. 2-13, 2-14*]

4.5 Using the Living England Ground Data Capture map:

4.5.1 When you open the Living England Ground Data Capture map in either online or offline mode, the map will show the LE ground data points, LE habitat classification and segmentation, BGZs, designated sites such as Sites of Scientific Interest (SSSI) (Natural England, 2022a) and National Nature Reserve (NNR) areas (Natural England, 2022b, OpenStreetMap mapping (OSM, 2022), and a basemap showing Esri high resolution imagery (Esri et al., 2022). You can centre the map on your location (blue dot) using the location button. [*Fig. 2-14*]

4.5.2 You can change which layers are visible by selecting the layers icon and switching them on and off. The segmentation and classification layers are grouped so you can toggle all the whole layer easily without having to find the relevant BGZ. [*Fig. 2-15 to 2-17*]

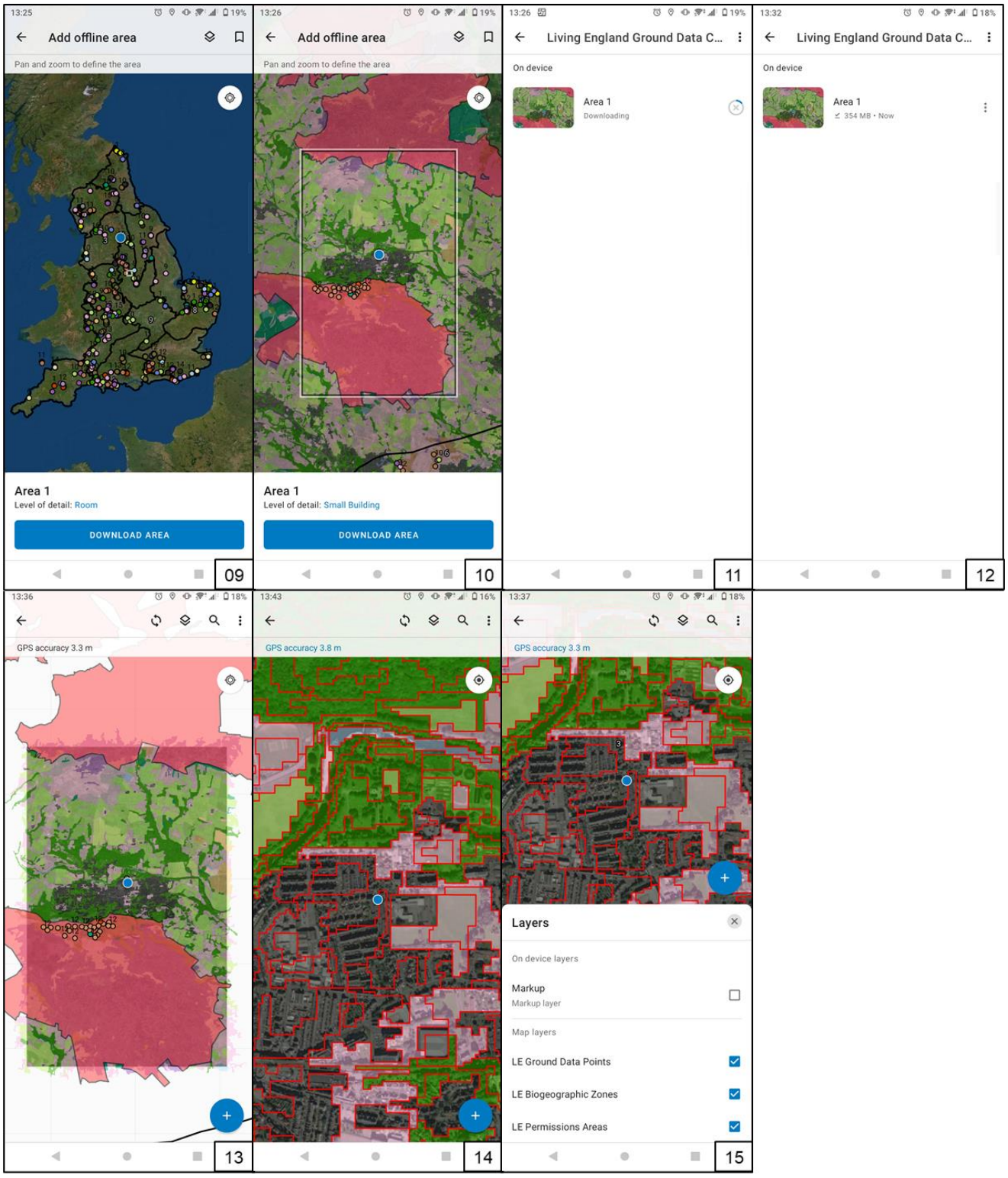


Figure 2 (cont.): Screenshots 01-29 showing ArcGIS Field Maps (Esri, 2022) and the LE Ground Data Capture map. Background source: Esri et al. (2022) and OSM (2022).

4.5.3 From the map menu icon, you can also view the legend for the map, change the basemap (if you are in online mode), view the bookmarks, and activate markup. Markup is a freehand drawing tool for you to annotate the map and highlight areas you may wish to survey. You can then toggle its visibility within the layers tab. Remember to clear your markups using the bin icon before syncing your offline map. [*Fig. 2-18*]

4.5.4 You can use the search tool to find locations more easily. By dropping a pin, you can choose to save the pin location by clicking “Favourite” (“Add to my places” if using ArcGIS Collector). The pin will now stay on your device so you can easily find it again in the map and when downloading an offline area. Your saved locations can also be found from within the search tool (or within bookmarks if using ArcGIS Collector). [*Fig. 2-19, 2-20*]

4.5.5 You can view additional information about the habitat classification in the map based on the latest iteration of LE (currently Phase IV). When selected, the segment outline is highlighted in blue and its details show the predicted habitat class for the segment (A_pred), and the probability (as a percentage) that the segment is dominated by that class (A_prob). The second most likely habitat class for the segment and its probability (B_pred, B_prob) are also shown here. [*Fig. 2-21*]

4.5.6 Previously collected ground data points are shown on the map as coloured dots, labelled with a number representing the main LE habitat class. The codes (1-18, 999) and colours for each class are shown in the legend. When selected, the details of a ground data point appear with the primary and secondary habitat classes and segment coverage. [*Fig. 2-22*]

4.5.7 When collecting or editing data points, it is essential to follow the survey method developed for Living England Ground Data Capture, as shown in Section 5.

4.6 Adding a new point:

4.6.1 When you have arrived at the location of the point you wish to record, click the blue plus button in the bottom-right corner to add a data point.

4.6.2 A pop-up menu then appears to select the dominant LE habitat within the segment you are surveying. Once you have selected this, a second menu appears to fill out the remaining details for the data point and attach photos of your surrounds (see Section 5 for details). Sections of this form are grouped to easily distinguish between the main LE ground data collection and the additional information. [*Fig. 2-23 to 2-26*]

4.6.3 When you have completed data entry, check that the “GPS accuracy” has stabilised on a value lower than 9 m. The ring around your location will show as blue if it is less than 9 m, and red if it is more than 9 m. [*Fig. 2-23, 2-24*]

4.6.4 To save the point, click “Submit” (iOS) or the tick icon (Android) in the top right of the screen. If you are working offline, this will store the point data locally on the device until you synchronise your map. If you are working online, the point data will be uploaded immediately. [*Fig. 2-24 to 2-26*]

4.6.5 You can cancel the ground data point collection at any time by clicking “Discard” (iOS) or the cross icon (Android) in the top left of the screen. [*Fig. 2-23 to 2-26*]

4.6.6 You can change the location of the point you are recording by dragging the cross on the map to the desired location and clicking “Update Point”. This can be very useful if the location you want to record is inaccessible, but you can clearly identify the habitats within the segment. [*Fig. 2-24*]

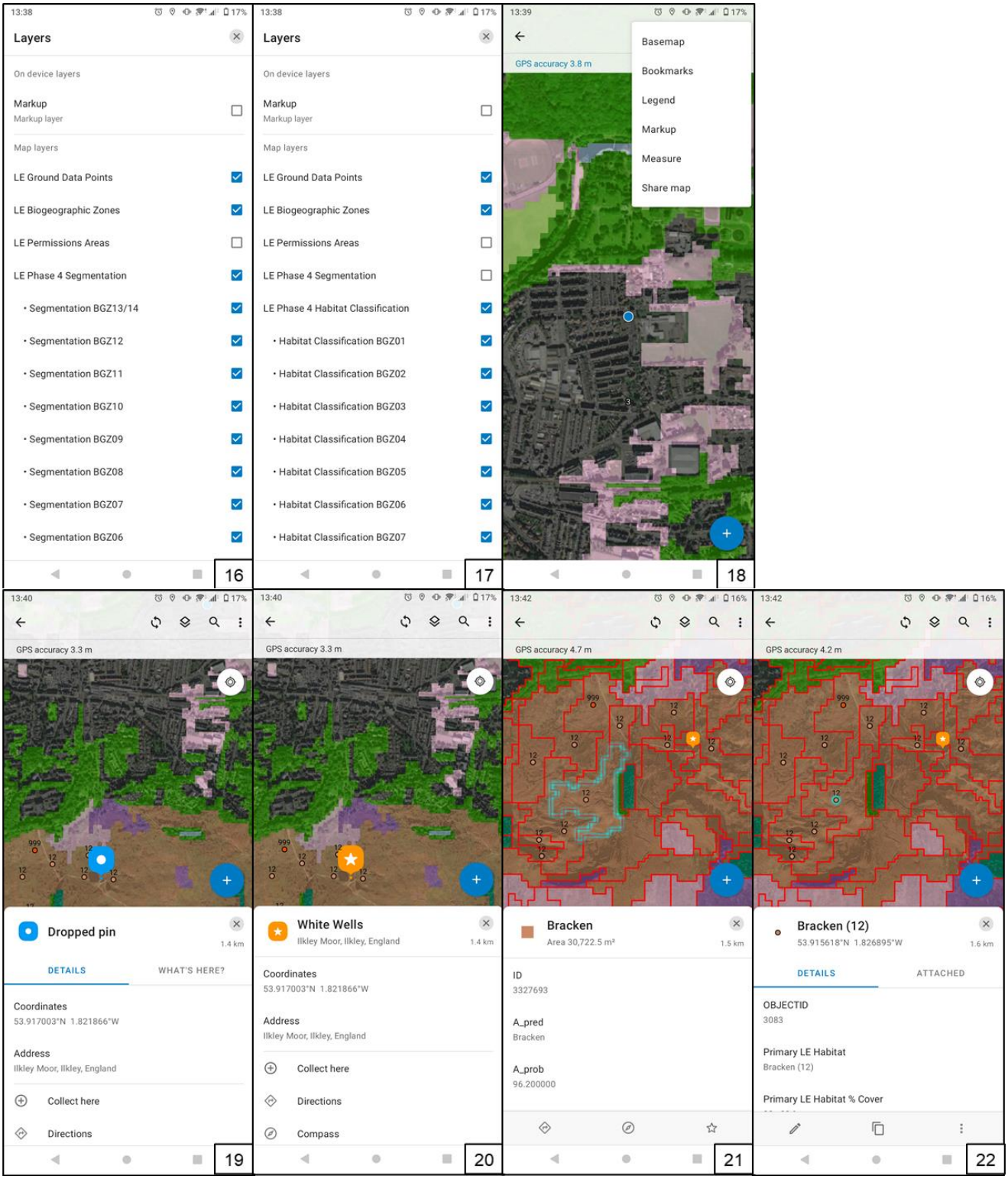


Figure 2 (cont.): Screenshots 01-29 showing ArcGIS Field Maps (Esri, 2022) and the LE Ground Data Capture map. Background source: Esri et al. (2022) and OSM (2022).

4.6.7 Note that by moving the point location away from your position, the GPS information will be lost (the GPS accuracy ring no longer shows as blue or red).

4.6.8 You can also record points away from your location by dropping a pin on the map (see [*Fig. 2-19, 2-20*]) and clicking “Collect here”. This will open a data collection form for a new training point at the location of the pin (see [*Fig. 2-23 to 2-26*]). This option should only be used when the vegetation is too difficult to pass through and can be done with accuracy e.g., a reed bed. Ensure that you take a clear photograph of the habitat showing where you have dropped the pin.

4.7 Editing and deleting points:

4.7.1 When a ground data point is selected, you can use the icons near the bottom of the pop-up to edit or copy the point. You can only edit or delete points you have created. From the edit (pen) icon you can change the form details, move the point, and attach photos as shown in Section 4.6. [*Fig. 2-22*]

4.7.2 You should only use the edit functionality to correct mistakes you may have made when collecting data. **If the segment habitat has changed you should not change the point’s form details; instead collect a new point in the same segment.** You may move points so that they are not directly on a segment boundary.

4.8 Syncing your offline data points:

4.8.1 You should sync the data when you have a stable network connection (preferably Wi-Fi), by clicking the circular arrows icon within the map. This indicates if you have data ready to be synced by showing a small dot under the icon. [*Fig. 2-27*]

4.8.2 Click the icon to access the synchronise screen, which shows you any offline edits that have been made so you can review your points before you sync by clicking the “Sync now” button. [*Fig. 2-28*]

4.8.3 Optionally you can choose to “Auto-sync” at defined time intervals defined under the app settings. If you use this option, Field Maps will synchronise when the device next connects to a network. [*Fig. 2-06, 2-28*]

4.8.4 You can also sync an offline area from the menu options in the offline areas screen. This also shows how many offline edits there are to sync. [*Fig. 2-12, 2-29*]

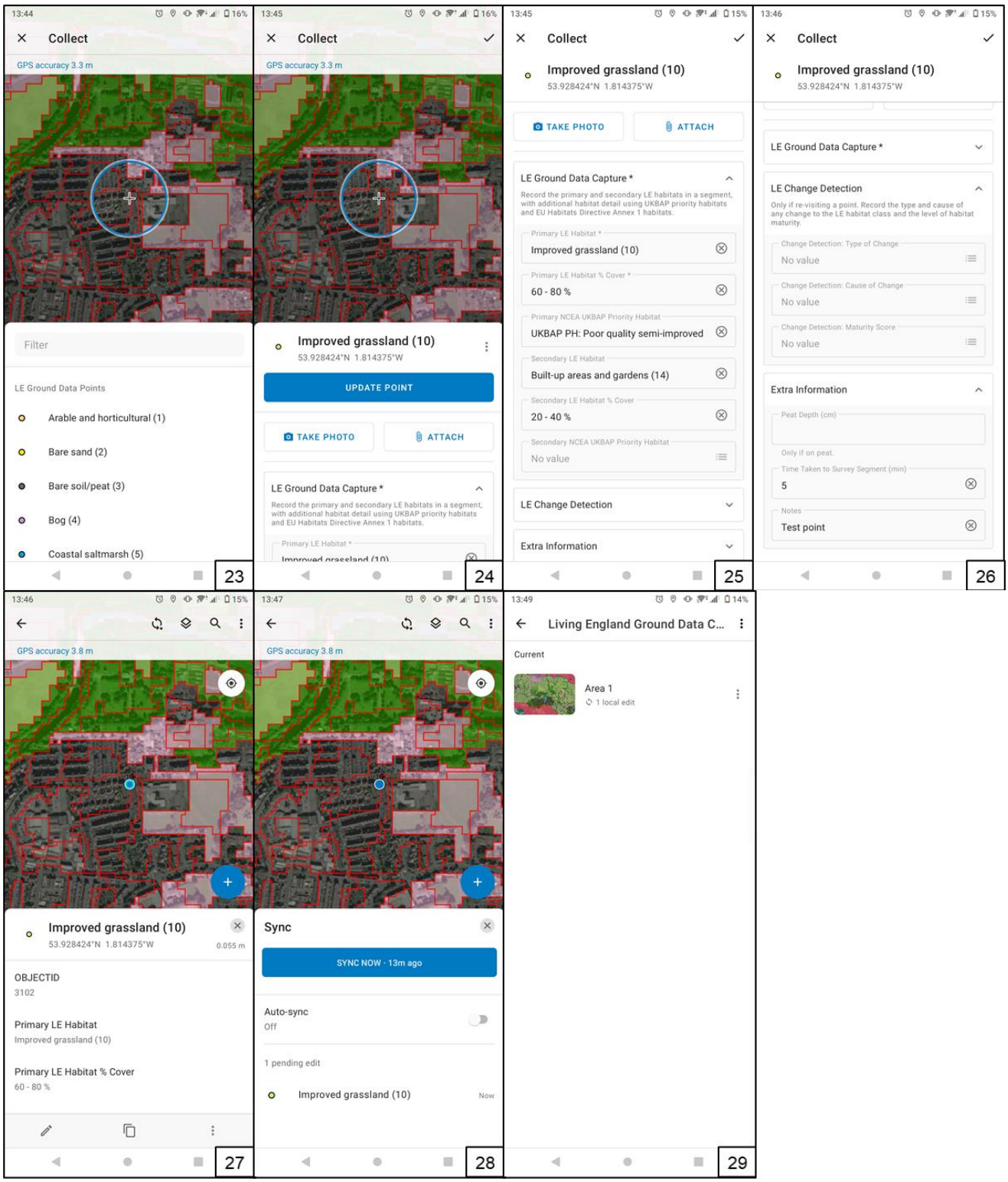


Figure 2 (cont.): Screenshots 01-29 showing ArcGIS Field Maps (Esri, 2022) and the LE Ground Data Capture map. Background source: Esri et al. (2022) and OSM (2022).

5 Field Method

5.1 General approach: On site, your aim is to record a single point in each LE segment you survey using ArcGIS Field Maps, recording your point in a large homogenous patch of the most abundant habitat class present within the segment, well away from segment edges. The LE habitat class you record in your survey may be different from the class currently shown in the LE classification.

5.2 Remember that LE segments were created automatically from satellite imagery, so they often have odd or unexpected shapes which will cross some of the vegetation types you will see on the ground. Give some thought to a rough route around the site, taking in all the segments you plan to survey. **You do not have to survey every segment, concentrate on segments with wholly or predominantly homogeneous habitat cover**.

5.3 Use the map interface in the Field Maps app to orient yourself on the site, and to navigate to each segment to survey (dropping a pin and using compass function can guide you to the centre of your next segment).

5.4 At the segment:

5.4.1 Observe the extent and shape of the segment using the Field Maps map. Identify the LE habitat classes within the segment from the vegetation around you. You should walk briefly across most of the segment to “get your eye in”, making a mental note of the different types present and their percentage cover across the whole segment. You must have been able to see the whole of the segment to record a point.

5.4.2 Although the segmented polygons should only contain one homogenous habitat class, this is frequently not the case. You should record the most abundant LE habitat class that has equal to or > 60 % cover, as the Primary Habitat i.e., wholly or predominantly covers the segment and if present record the second most abundant class if it covers > 10% of the segment (this takes into account any minimal transition towards another habitat).

5.4.3 If after assessing the cover of a segment you have identified there are three or more habitat classes present, each covering > 10 % of the segment, record a point in a central part of the segment as having “MULTIPLE” LE habitat classes and move on to the next segment. **Add in the notes** briefly which LE habitats have > 10 % cover in the segment and their approximate percentage cover.

5.4.4 Note that points collected as “MULTIPLE”, marked as not required in Table 2, or points where the primary habitat has a coverage of < 60 % within the segment, will not be suitable for use as ground truth data as they do not represent a homogenous segment. These points can be used for validating the LE classification and change detection analysis, but **it is better to collect fewer high-quality points than to survey every segment.**

5.4.5 Navigate to the area of the segment containing the largest homogenous patch of the most abundant habitat class. You will record the single point at this location. If you cannot locate the largest patch, navigate to a patch ideally at least 30 x 30 m in size, and in all cases at least 10 m inside the boundary of the segment.

5.5 At the point, record the following in Field Maps (see Section 4.6 for details):

5.5.1 **Primary (most abundant) LE habitat class (equal to or > 60 % cover of the segment).** There are 17 Habitat Classes, each name is followed by its code number in brackets, e.g., Bog (4). The additional class “MULTIPLE (999)” is available for recording a point in those segments where 3 or more habitat classes are significantly represented, and a dominant class is not apparent.

5.5.2 **Primary (most abundant) LE habitat class % cover across the segment.** Choose from: 40% - 60%, 60% - 80%, 80% - 99%, 100%.

5.5.3 **Primary (most abundant) UKBAP priority habitat class.** Priority habitat and Annex 1 classes have been combined into a single list, which will be constrained to those UKBAP priority habitat classes which are appropriate for the Primary LE habitat class you have chosen for this point. Spend no more than 5 minutes determining this. If you cannot decide within this timeframe, don’t record an entry.

5.5.4 **Secondary (second most abundant, > 10 % cover) LE habitat class.** Not always required. This should not be the same as the primary class recorded.

5.5.5 **Secondary (second most abundant, > 10 % cover) LE habitat class % cover across the segment.** Not always required. This should not be the same as the primary class recorded. Choose from: 10% - 20%, 20% - 40%, 40% - 60% (if it is > 60 % then it should be the Primary habitat).

5.5.6 **Secondary (second most abundant) UKBAP priority habitat class.** LE classes, Priority habitat and Annex 1 classes have all been combined into a single long list. You can filter the options using the search functionality within the list. Spend no more than 5 minutes determining this. If you cannot decide within this timeframe, don’t record an entry.

5.5.7 **Time taken to survey segment (min).** The time taken in minutes to locate and survey the segment and record the point.

5.5.8 **Notes.** Any short supporting text to help explain your responses above or provide useful context and additional information.

5.5.9 **Take 2 photos using the app button to access the camera.** One focussing in on the vegetation at your feet or immediately around you, and the other with a wider view of the habitat patch you are in, which should be the primary (most abundant) LE class present in the segment.

5.6 The Field Maps app will automatically capture your AGOL account ID, the date and time of capture of the record, and the location of the point.

5.7 Remember to synchronise your app when you are next connected to a network. If you do not do this, your data will not be used. Details of how to do this are shown in Section 4.8.

5.8 Hypothetical examples of segments, habitats, and how to record points are provided in Annex 1.

Annex 1

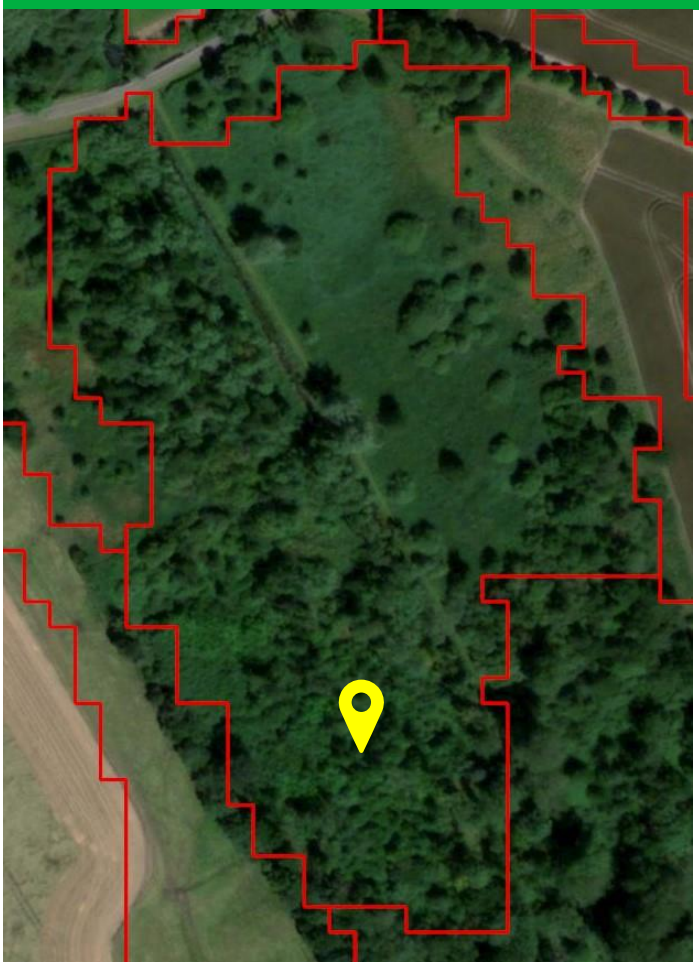
The following 3 examples (Table 3, Table 4, Table 5) illustrate scenarios you may encounter when in the field. They are illustrative only, and the habitats on the ground may differ from those shown below. Yellow location icons represent suitable locations for recording a point within the segment.

Table 3: Example 1 – LE segment containing only woodland.

Habitat imagery and segment outline	LE ground data fields	Data entry
	Primary LE Habitat	Broadleaved mixed and yew woodland (16)
	Primary LE Habitat % Cover	100%
	Primary UKBAP Priority Habitat	UKBAP PH: Lowland mixed deciduous woodland | Annex 1: Dry oak-dominated woodland
	Secondary LE Habitat	[Empty]
	Secondary LE Habitat % Cover	[Empty]
	Secondary UKBAP Priority Habitat	[Empty]
	Peat Depth (cm)	[Empty]
	Time Taken (min)	4
	Notes	[Empty]

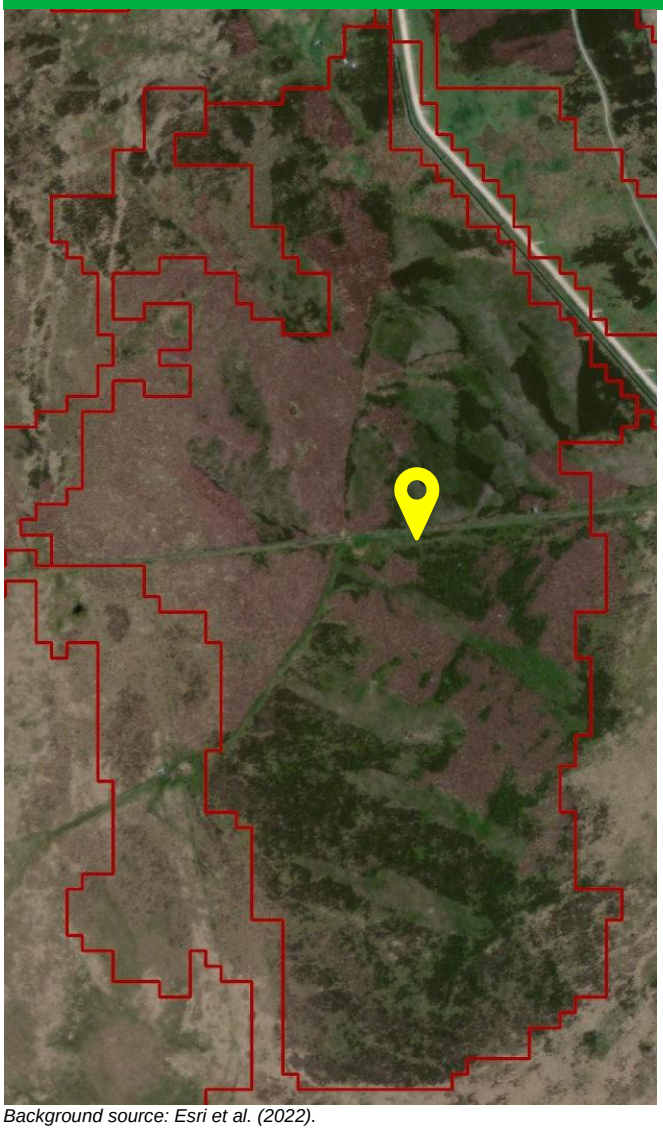
Background source: Esri et al. (2022).

Table 4: Example 2 – LE segment containing mixture of woodland and grassland.

Habitat imagery and segment outline	LE ground data fields	Data entry
	Primary LE Habitat	Broadleaved, mixed and yew woodland (16)
	Primary LE Habitat % Cover	40% - 60%
	Primary UKBAP Priority Habitat	UKBAP PH: Lowland mixed deciduous woodland | Annex 1: Dry oak-dominated woodland
	Secondary LE Habitat	Acid, calcareous and neutral grassland (9)
	Secondary LE Habitat % Cover	20% - 40%
	Secondary UKBAP Priority Habitat	LE: Acid, calcareous and neutral grassland | UKBAP PH: Lowland acid grassland
	Peat Depth (cm)	[Empty]
	Time Taken (min)	8
	Notes	[Empty]

Background source: Esri et al. (2022).

Table 5: Example 3 – LE segment containing multiple habitats. This is a large upland segment containing Dwarf Shrub Heath, Bracken, and Acid, Calcareous and Neutral grassland, each covering > 10 % of the segment.

Habitat imagery and segment outline	LE ground data fields	Data entry
	Primary LE Habitat	MULTIPLE (999)
	Primary LE Habitat % Cover	[Empty]
	Primary UKBAP Priority Habitat	[Empty]
	Secondary LE Habitat	[Empty]
	Secondary LE Habitat % Cover	[Empty]
	Secondary UKBAP Priority Habitat	[Empty]
	Peat Depth (cm)	[Empty]
	Time Taken (min)	10
	Notes	Contains: Dwarf Shrub Heath (40%), Bracken (40%), Acid Calcareous Neutral Grassland (20%).

Background source: Esri et al. (2022).

Annex 2

Table 6 shows the number of ground data points in each habitat class and in each BGZ that were used for LE Phase IV. All ground data points undertake a rigorous quality assurance process to ensure that only 1 point is used per segment and to remove points that produce spectral outliers.

- As described in Section 3.2, the **annual** requirement is 50 ground data points per habitat class in each BGZ (see Table 2 for details). To be counted towards this requirement, points collected must have > 60 % segment coverage for the primary LE habitat.
- Table 6 shows the total LE ground dataset used in Phase IV (8th Nov 2021). Cells coloured in orange had an insufficient number of points and these habitat classes should be a priority for data collection, provided that the habitat class is present within the BGZ. Cells coloured in light green have < 100 verified ground data points and require further data collection to reach the requirement of 100 points. Cells coloured in dark green have > 100 points and are not currently a priority for data collection.
- Note that not all the habitat classes in Table 6 require ground data collection (see Table 2 and Section 2.5 for details).

All this information plus the map from the ArcGIS Field Maps app is visible on the **Living England Ground Data Dashboard.**

- On the dashboard (Figure 3 and Figure 4) the data can be filtered by BGZ to keep track of which classes in each BGZ are under-represented and require attention. The rings for each targeted habitat class appear red when the number of collected ground data points is below 50, light green when it is above 50, and appear as green complete circles when the number of collected ground data points reaches 100.
- The dashboard updates automatically as new points are collected (or synced from offline areas).

Table 6: Total training points for LE habitat classes in each BGZ for Phase IV (8th Nov 2021).

		Biogeographic Zone													
		1	2	3	4	5	6	7	8	9	10	11	12	13/14	Total
Living England Detailed Habitat	Acid, Calcareous, Neutral Grassland	309	98	712	128	147	154	61	167	84	139	238	767	148	3152
	Bare Ground	48	10	15	12	2	19	4	22	0	6	3	47	20	208
	Bare Sand	8	51	31	0	1	0	30	55	17	48	4	61	14	320
	Bog	239	194	726	49	28	198	0	40	0	4	15	0	54	1547
	Bracken	66	134	58	13	58	66	1	12	0	41	108	56	54	667
	Broadleaved, Mixed and Yew Woodland	1024	719	1178	1775	1537	1522	1039	2333	2239	7155	2800	4621	2996	30938
	Coastal Sand Dunes	55	141	122	0	0	0	64	113	0	59	18	51	74	697
	Coniferous Woodland	1296	2802	575	2179	684	411	303	1815	417	1956	1105	1622	1956	17121
	Dwarf Shrub Heath	349	186	334	263	126	283	6	135	2	377	64	625	383	3133
	Fen, Marsh and Swamp	551	56	165	104	75	46	65	81	3	65	37	1153	116	2517
	Improved Grassland	103	115	121	55	59	51	64	51	85	93	76	140	62	1075
	Scrub	39	13	19	5	11	2	19	22	0	46	34	79	10	299
	Water	66	64	64	82	76	79	89	55	82	76	51	73	48	905
	Total	4153	4583	4120	4665	2804	2831	1745	4901	2929	10065	4553	9295	5935	62579

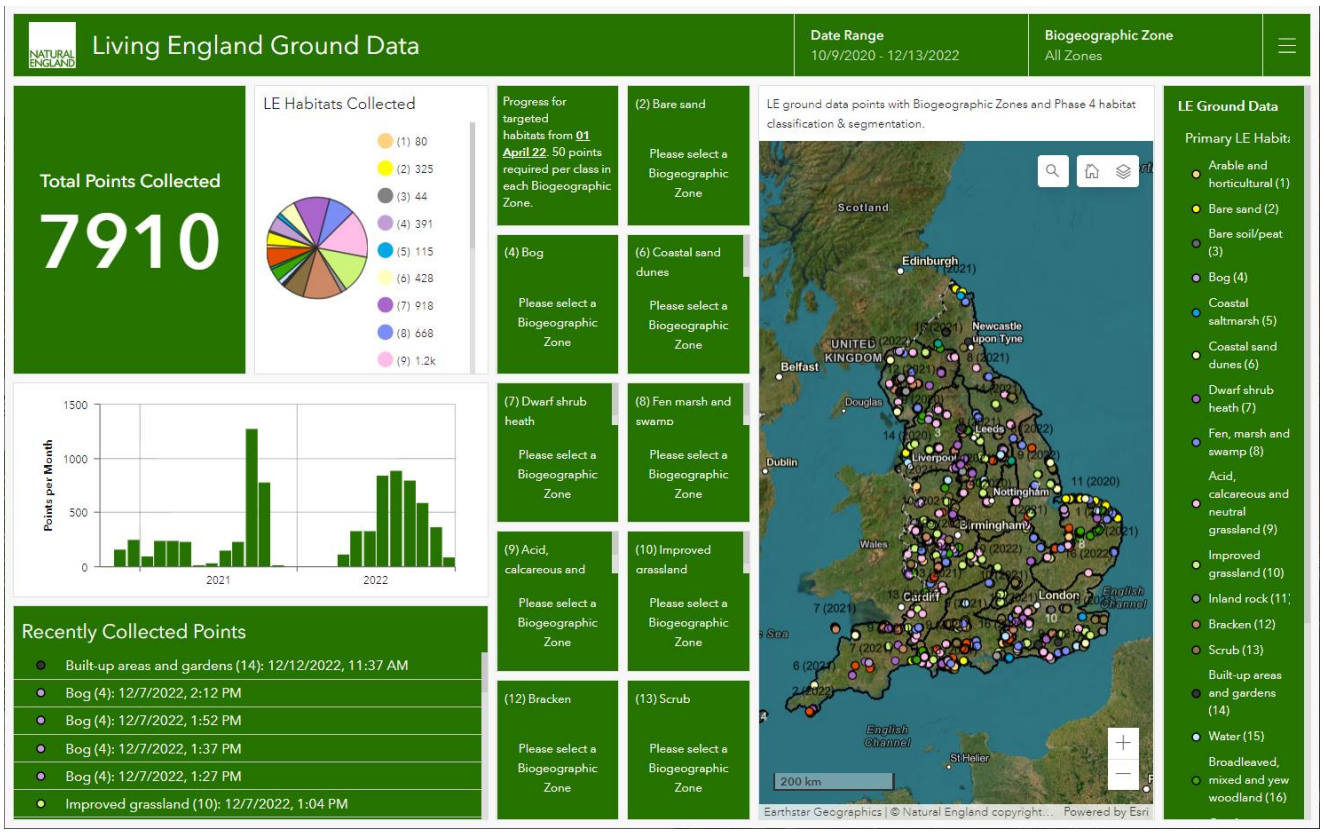


Figure 4: LE dashboard showing a national summary of the current progress of LE ground data collection. Data correct as of 12/12/2022. Background source: Esri et al. (2022) and OSM (2022).

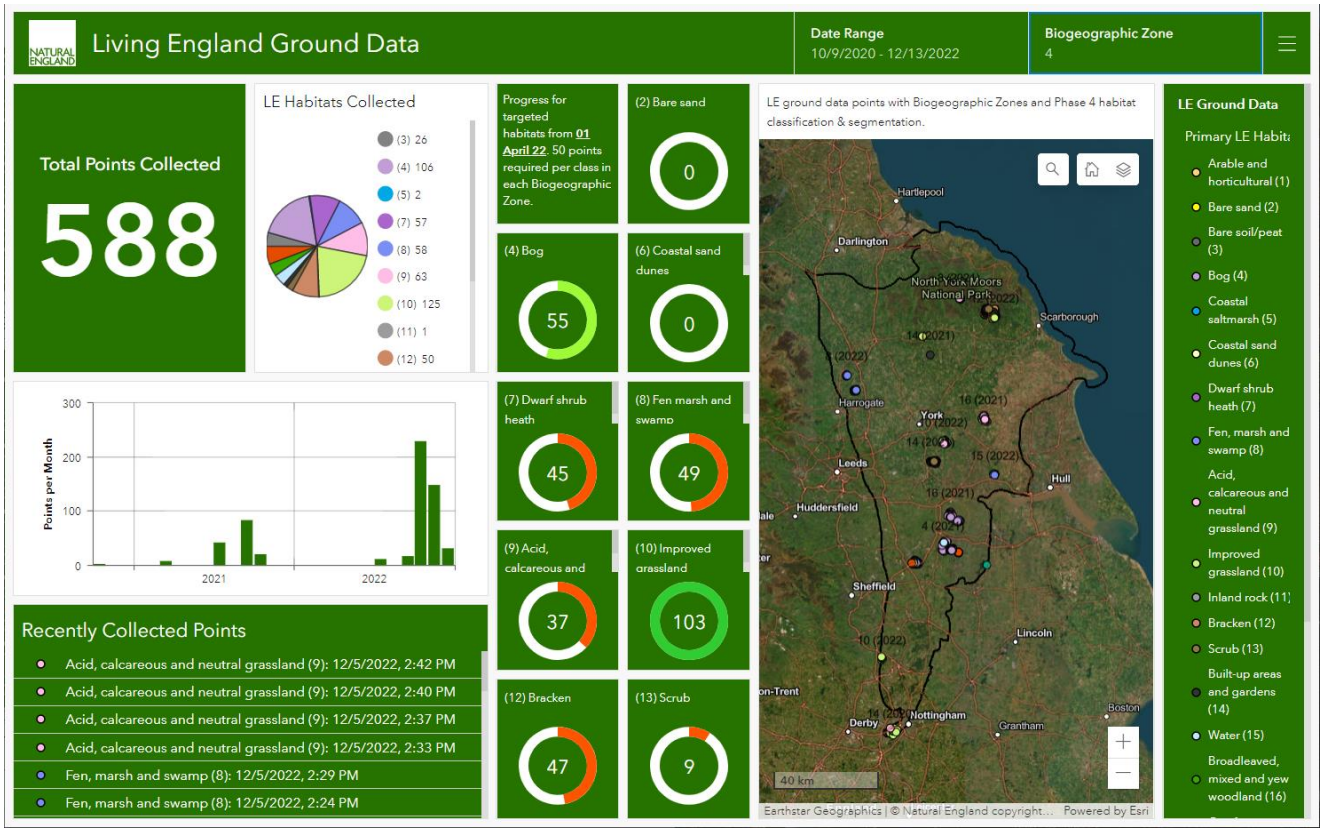


Figure 3: LE dashboard showing the total number of LE ground data points recorded in BGZ 4 and the progress towards ground data collection targets. Data correct as of 12/12/2022. Background source: Esri et al. (2022) and OSM (2022).

Annex 3

Details about specific habitat types and how they fit into the LE UKBAP classification framework (UKBAP priority habitat (PH) (JNCC, 2011) and EU Habitats Directive Annex 1 (EU, 2013) habitat level) are shown in Table 7. Where several habitats could be applied the options are indicted as: [*First habitat /Second habitat*].

Table 7 (continued next page): Details of how to record specific habitats within the LE UKBAP classification framework

Habitat type	What to record for LE	Description
Bogs which are dominated by dwarf shrub heath	LE: Dwarf shrub heath | UKBAP PH: [*Upland/Lowland*] heath (dominating on bog)	Although the habitat is bog, record the LE class as dwarf shrub heath (as that is what is visible with satellite imagery) and use the additional UKBAP PH level class to record that it is dwarf shrub heath dominating on bog.
Bogs which are dominated by purple moor grass	LE: Bog | UKBAP PH: [*Lowland raised/Blanket*] bog (dominated by purple moor grass)	Where bogs are dominated by purple moor grass, there is an additional UKBAP PH level class to record this.
Fens, Marshes & Swamps which meet the priority habitat criteria for purple moor grass and rush pasture	LE: Fen, marsh and swamp | UKBAP PH: Purple moor grass and rush pasture	Updated in Nov 2022, use UKBAP PH level class for purple moor grass and rush pasture.
Fens, Marshes & Swamps which are dominated by purple moor grass	LE: Fen, marsh and swamp | UKBAP PH: [*Upland flushes, fens and swamps/Lowland fens*] | Annex 1: Purple moor-grass meadows	Use the Annex 1 code for purple moor grass meadows (H6410) to record fen, marsh and swamp segments dominated by purple moor grass.
Acid Grasslands which are dominated by purple moor grass	LE: Acid, calcareous and neutral grassland | UKBAP PH: [*Upland/Lowland*] acid grassland | Annex 1: Purple moor-grass meadows	Use the Annex 1 code for purple moor grass meadows (H6410) to record upland or lowland acid grassland segments dominated by purple moor grass.
Coastal Vegetated Shingle when heavily vegetated	LE: Inland rock | UKBAP PH: Coastal vegetated shingle (heavily vegetated)	Record under inland rock, but with the option to select when it is heavily vegetated at UKBAP PH level as may appear very different to bare shingle.
Maritime Cliffs & Slopes when heavily vegetated	LE: Inland rock | UKBAP PH: Maritime cliffs and slopes (heavily vegetated)	Record under inland rock, but with the option to select when it is heavily vegetated at UKBAP PH level as may appear very different to bare cliffs/slopes.
Coastal Sand Dunes covered with sea-buckthorn scrub	LE: Scrub | UKBAP PH: Single species scrub | Annex 1: Dunes with sea-buckthorn	Record scrub covered sand dunes using scrub as the LE class as that is what is visible with satellite imagery.

Areas **of scrub with** more than 1 species	LE Scrub | UKBAP PH: Mixed Scrub	Add in the notes what species are present if it is more than 1 scrub species.
Orchards	LE: Broadleaved, mixed and yew woodland | UKBAP PH: Traditional orchards	Previously orchards were recorded under Arable & Horticultural, but under UKBAP record them using Broadleaved, Mixed and Yew woodland.
Semi-improved grassland	LE: Improved grassland | UKBAP PH: [*Good/Poor quality*] Semi-improved grassland	Record using the Improved Grassland LE class with good & poor quality semi-improved grasslands defined at UKBAP PH level.
Montane Heath	LE: Dwarf shrub heath | UKBAP PH: Montane heath	Record areas of Montane Heath at UKBAP PH level within the Dwarf Shrub Heath LE class.
Coastal and floodplain grazing marsh	LE: Improved grassland | UKBAP PH: Coastal and floodplain grazing marsh	Updated in Nov 2022, now record under the Improved Grassland LE class at UKBAP PH level rather than under Coastal Saltmarsh.
Various habitats dominated by rush pasture	LE: [*Bog/Fen, marsh and swamp/Acid, calcareous and neutral grassland/Improved grassland*] | UKBAP PH: [*Various*] (rush dominated)	Added in Nov 2022, areas dominated by rush pasture should be recorded using the dedicated UKBAP PH level category.
Calcareous grassland dominated by Brachypodium Pinnatum	LE: Acid, calcareous and neutral grassland | UKBAP PH: [*Upland/Lowland*] calcareous grassland (**b**rachypodium **p**innatum dominated)	Added in Nov 2022, areas of calcareous grassland dominated by heath false brome or tor-grass should be recorded using the dedicated UKBAP PH level category.

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