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What drives biodiversity patterns? Using long-term multi-disciplinary data to discern centennial-scale change

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Abstract:

1. Biodiversity plays an important role in ecosystem functioning, habitat recovery following disturbance and resilience to global environmental change. Long-term ecological records can be used to explore biodiversity patterns and trends over centennial to multi-millennial time scales across broad regions. Fossil pollen grains preserved in sediment over millennia reflect palynological richness and diversity, which relates to changes in landscape diversity. Other long-term environmental data, such as fossil insects, palaeoclimate and archaeologically-inferred palaeodemographic (population) data, hold potential to address questions about the drivers and consequences of diversity change when combined with fossil pollen records.
2. This study tests a model of Holocene palynological diversity change through a synthesis of pollen and insect records from across the British Isles along with palaeodemographic trends and palaeoclimate records. We demonstrate relationships between human population change, insect faunal group turnover, palynological diversity and climate trends through the Holocene.
3. Notable increases in population at the start of the British Neolithic (~6000 calendar years before present (BP)) and Bronze Age (~4200 BP) coincided with the loss of forests, increased agricultural activity, and changes in insect faunal groups to species associated with human land use. Pollen diversity and evenness increased, most notably since the Bronze Age, as landscapes became more open and heterogeneous. However, regionally-distinctive patterns are also evident within the context of these broad-scale trends. Palynological diversity is correlated with population, while diversity and population are correlated with some climate datasets during certain time periods (e.g. Greenland temperature in the mid-late Holocene).

4. *Synthesis:* This study has demonstrated that early human societies contributed to shaping palynological diversity patterns over millennia within the context of broader climatic influences upon vegetation. The connections between population and palynological diversity become increasingly significant in the later Holocene, implying intensifying impacts of human activity, which may override climatic effects. Patterns of palynological diversity trends are regionally variable and do not always follow expected trajectories. To fully understand the long-term drivers of biodiversity change on regionally-relevant ecological and management scales, future research needs to focus on amalgamating diverse data types, along with multi-community efforts to harmonise data across broad regions.

Key words: *Biodiversity, Biogeography and macroecology, Global change ecology, Insects, Land-cover change, Landscape ecology, Land-use change, Palaeoecology and land-use history*

Introduction:

Current biodiversity patterns and potential of long-term environmental data

Biogeographers aim to understand the importance of different factors governing patterns of biodiversity and increasingly recognise the significance of historic dynamics in shaping current diversity patterns (Gaston, 2000; Birks et al., 2016a). Understanding how climate and human land use shape diversity allows the processes of community assembly to be explored, which can feed into efforts to mitigate the effects of human-driven influences on global biodiversity (Rowan et al., 2019). Biodiversity patterns emerge as a combined result of speciation, extinction and migration, and play an important role in the stability of ecosystems and global climate (Symstad et al., 2003). Environments with higher levels of biodiversity are thought to recover faster following natural disasters and experiments have demonstrated that biodiverse ecosystems are more productive (Fargione et al., 2007). Recent debate has questioned whether biodiversity patterns are shaped by local or continental-scale factors (Borregaard et al., 2020); global drivers include climate trends, latitudinal gradients, evolutionary processes and speciation, while local disturbance factors include agricultural activity, erosion, grazing animals, changes in soil properties, and water/nutrient availability. Human impact over the last 3000 years has been an increasingly important disturbance factor at sub-continental scales, as illustrated in a recent survey of research community opinions (Stephens et al., 2019) and through studies based on empirical data (Roberts et al., 2018). Through analysis of spatially-extensive fossil pollen datasets, Giesecke et al. (2019) demonstrated that past human impacts on the latitudinal diversity gradient in Europe had greater impacts on species richness than climate. Long-term multi-millennial scale environmental datasets have been under-utilized in research aiming to understand recent biodiversity trends (Willis et al., 2005; 2006). Such datasets hold great potential to inform restoration ecology (Higgs et al., 2014; Hobbs et al., 2014; Fordham et al., 2020) through revealing ecological legacies and the influence of past human activities on current biodiversity patterns, which can be problematic to measure in relation to achieving conservation targets (Watts et al., 2020).

Spatial patterns in diversity derived from fossil pollen datasets (Colombaroli et al., 2013; Matthias et al., 2015; Felde et al., 2016; Reitalu et al., 2019) can reveal information about ecological memory, shifting baselines, and dynamic equilibrium, i.e. the patterns of change in species assemblages that have persisted or changed through millennia. Shifting baseline syndrome (Pauly, 1995; Soga & Gaston, 2018) represents the tendency of modern societies to believe that conditions in recent human memory provide an appropriate reference for a particular environment. Such historical baselines are largely a 'snap-shot' of species assemblages that have developed over centuries and millennia of natural and human-induced disturbance. They rarely represent stable or natural 'baselines'. Consideration of the evolutionary and ecological legacies of both the recent and ancient past is key to understanding the forces shaping global patterns of present-day biodiversity (Rowan et al., 2019). This challenges the concept of stable baselines, demonstrating that communities can re-assemble through millennia (Edwards et al., 2017). Divíšek et al. (2020) incorporated historical processes in modelling current species richness using Holocene species-distribution data from central Europe revealing that landscape changes since the Last Glacial Maximum are important predictors of current plant species richness. However, historical effects were found to be habitat specific and often show a non-linear relationship with species richness due to the impacts of recent environmental conditions and anthropogenic activity. This highlights the importance of using multiple data types to tease apart these relationships over time and space. Relationships and thresholds between diversity and ecosystem functioning operate on regional scales (Brooke et al., 2013), therefore the regional vegetation signature captured by fossil pollen datasets provides an ideal data type to explore relationships between land use and diversity change.

Identifying the drivers of biodiversity trends

Patterns of change in Holocene plant diversity trends have been summarised by Birks et al. (2016a) in a conceptual schematic for north-west Europe, building on McGill et al.'s (2015) biodiversity classification (summarised in Fig. 1). Initial forest development is expected to have involved a period of change from high to lower diversity, which was followed by declining diversity when landscapes became increasingly dominated by closed mixed forests. An increase in diversity is then predicted on fertile soils linked to early agriculture, land-use change and natural/human-induced disturbance, which is then followed by recent loss of diversity in the last 200 years associated with major land-use intensification. Plant assemblages in areas with infertile soils are expected to show declining or static diversity during these latter periods. This model has yet to have been tested for the British Isles, particularly alongside analyses of how population change and climate interact to affect diversity patterns.

Here we present current understanding of long-term changes in land cover, palynological (pollen) diversity and insect faunal groups through the last 10,000 years (Holocene) via a synthesis of pollen sequences, insect faunal group assemblages, human population inferred from radiocarbon-dated archaeological sites from the British Isles, and palaeoclimate records driven by North Atlantic conditions. We aim to test the aforementioned model of Holocene biodiversity trends using pollen datasets. Pollen-derived patterns of vegetation/land-cover change have been established (Fyfe et al., 2013) and these have been compared with archaeologically-derived human population estimates (Woodbridge et al., 2014) across the British Isles, but diversity impacts and influence on faunal communities have yet to be investigated.

Periods of human population increase are often associated with major land-cover transformations, such as the loss of woodlands and increasingly open landscapes associated with agriculture (Woodbridge et al., 2014; Roberts et al., 2019). However, deforestation in the British Isles, from the start of the Neolithic around 6000 years ago, is recognised as occurring slightly earlier than major population increases through evidence of axe-production and declining forest vegetation (Schauer et al., 2019). There is no simple correlation between population rise and deforestation; therefore, the way in which people use the land requires investigation as well as understanding of population change. Insect assemblages show a large degree of turnover in lowland Britain as a consequence of prehistoric field system development, with the open ground and dung-associated ‘field fauna’ replacing woodland insects (Smith et al., 2019; 2020). Similar evidence is now emerging in other regions (e.g. Schafstall et al., 2020). Insect datasets reflect land-use/cover change on a finer scale than pollen records, which reflect both local (on-site) and catchment vegetation. Goring et al. (2013) tested relationships between pollen and plant richness and suggested that palynological richness cannot be considered a universally reliable proxy for inferring plant richness. However, Matthias et al. (2015) demonstrated that palynological diversity can capture landscape structure and diversity. They found that Shannon index and the number of taxa are highly correlated providing a useful measure of pollen type diversity that reflects landscape diversity. Insect and pollen data therefore allow complementary scales of analysis on community turnover.

Pollen diversity measures represent both taxa richness and assemblage evenness through estimating particular numerical characteristics of fossil pollen assemblages (Birks et al., 2016b). Quantifying biodiversity trends remains challenging because “there is no single index that adequately summarises the concept” (Morris et al., 2014). These challenges, along with taxonomic precision, the effects of sample size, and pollen representation of different plant types, can result in biases in biodiversity measures (Odgaard, 1994; 2001). Kuneš et al. (2019) demonstrated that ecosystems were most affected by disturbances during the Early

Holocene with lower level disturbance in the mid-Holocene. These shifts in disturbance were associated with pronounced changes in pollen richness. However, the relationship between pollen type richness and plant species richness is not straightforward and reflects pollen population evenness. This is related to vegetation evenness and disturbance (Odgaard, 2001), which reflects the degree of landscape homogeneity or heterogeneity. These factors require consideration when interpreting diversity trends derived from pollen data.

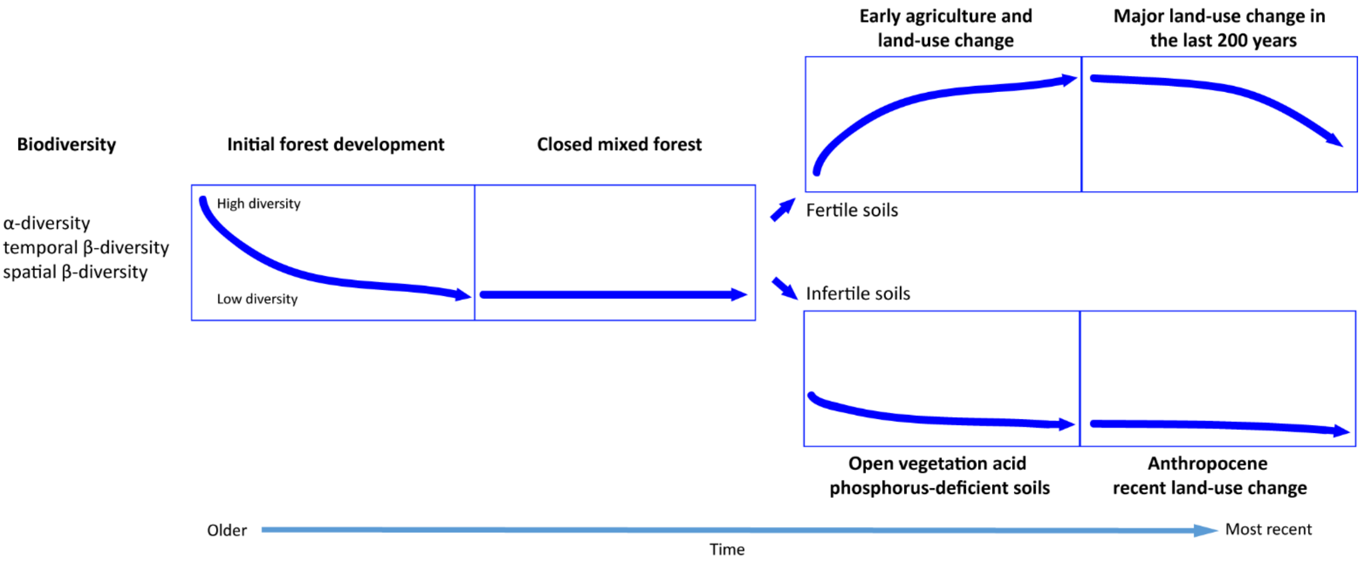

Figure 1. Theoretical model of local to meta-community scale diversity and possible drivers of change: summary of trends in biodiversity through the Holocene for fertile and infertile soils (based on Birks et al., 2016a).

Methods:

Fossil pollen data:

The datasets included in this study (Fig. 2) consist of 269 fossil pollen datasets (SI: Table 2) extracted from the European Pollen Database (Leydet et al., 2007-2020) or provided by data contributors. Pollen datasets were selected based on their radiocarbon dating quality and sample size (Fyfe et al., 2013). Sediment core chronologies were taken from Giesecke et al. (2014) or where necessary established through fitting a new age-depth model using CLAM (Blaauw, 2010). Data have been taxonomically harmonised at two levels of aggregation (233 and 558 taxa groups) and placed on a common chronological time scale summed into 200 year-long time windows, which has been demonstrated in previous studies to be a suitable time resolution over which to investigate vegetation turnover (Woodbridge et al., 2014). The relationships between palynological diversity and plant or vegetation diversity are complex; however, most studies comparing modern pollen richness with contemporary plant richness show good relationships between the two (Birks et al., 2016b). Within this study, we explore pollen (palynological) diversity as opposed to plant or vegetation diversity. Pollen data are also presented as quantified land-cover types transformed using the REVEALS (Regional Estimates of Vegetation Abundance from Large Sites) approach (Sugita, 2007), which converts pollen count data into quantified vegetation using knowledge of the differential pollen productivity, fall speed and pollen dispersal distances characteristic of different plant types (Broström et al., 2008; Fyfe et al., 2013). The pollen productivity estimates (PPEs) and fall speed of pollen for the 25 taxa in Trondman et al. (2015) were used in this study. These PPEs are derived by investigating relationships between vegetation and pollen abundance in modern landscapes (Broström et al., 2008). A detailed description of the REVEALS method is provided in Fyfe et al. (2013) and Trondman et al. (2015).

There are numerous approaches for estimating diversity from ecological data (Hill 1973), and most are strongly related (Matthias et al., 2015). Several approaches were provisionally tested within this work, with Shannon diversity and evenness index identified as the most suitable for capturing broad scale trends alongside rarefaction, which provides a record of species richness accounting for varied sample sizes. Shannon diversity index reflects both taxa richness and evenness, which relates to assemblage heterogeneity and can be analysed as a separate component of the index. These indices were calculated using pollen percentages from taxa count data binned into 200-year time windows. As the REVEALS approach can only be applied to a limited number of taxa for which there are reliable PPEs, we chose to estimate diversity using all 233 or 558 land pollen taxa groups rather than REVEALS transformed data. Felde et al. (2016) found that results based on transformed and untransformed pollen data show the same patterns and pollen richness and diversity estimates generally increase after transformations. This occurs because greater weight is placed on rare taxa as the influence of abundant pollen taxa is reduced. Therefore, we chose not to transform the pollen data in order to retain more information about the assemblage. The R vegan package (Oksanen, 2019) was used to summarise both species richness and relative abundance (Magurran, 2003) within the entire pollen assemblage. Shannon (H) index provides a useful measure of pollen type diversity corresponding to landscape diversity (Matthias et al., 2015). The index reflects the proportion of each taxon in the population relative to the total number of taxa present. Index values are derived by dividing the number of individuals of each taxon in each sample by the total number of individuals of all taxa. This value is then multiplied by the fraction by its natural logarithm and the results for all taxa are summed together and multiplied by minus 1. A high value of H represents a diverse and equally distributed community while lower values represent less diverse assemblages that are less equally distributed (Gaunle, 2020). The evenness of a community reflects the ratio of observable diversity to maximum diversity. This ranges between 0 and 1, with 1 representing complete evenness (Magurran, 2003). Rarefaction (pollen taxa richness) has been calculated from pollen count data using the R vegan package function ‘rarefy’ (Oksanen et al., 2019) to generate randomly rarefied community data for a given sample size (based on the mean of all samples) producing species richness estimates for each time window. Typically, the minimum of all samples is used, however, the minimum was not suitable for this dataset due to the presence of time windows with zero values; consequently the mean was selected as an alternative measure. The rarefaction trend is identical to pollen richness derived from Hill numbers; therefore this approach is deemed suitable for capturing diversity change that accounts for varied sample sizes.

Palaeodemographic data:

22,719 archaeological radiocarbon dates for mainland Britain have been extracted from Bevan et al. (2017) to infer regional-level palaeodemographic changes (Palmisano et al., 2017; Bevan & Crema, 2018). Palaeodemographic trends are inferred using a summed probability distribution (SPD) approach where the number of radiocarbon dates act as a proxy for human population size for a given time period (Shennan et al., 2013). Potential biases resulting from multiple dates being sampled from the same archaeological phase are accounted for by aggregating uncalibrated radiocarbon dates from the same site within 100 years of one another and dividing by the number of dates in the ‘time bin’ (Timpson et al., 2014). The resulting SPDs, which represent summed probabilities from each calibrated date, are binned into 200-year time windows to allow multi-proxy comparisons.

Fossil insect data:

We used the 30 fossil insect beetle (Coleoptera) datasets from archaeological sites summarised in Smith et al. (2019; 2020) to reconstruct insect turnover. Metadata and references for the fossil insect sites are provided in Smith et al. (2020). Insect taxa have been allocated to ecological groups where possible and the relative proportions of these groupings calculated. The ecological groups used are a revision of Robinson (1981; 1983). Insect species are also classified as semi- or fully- synanthropic (human-dependent) (Smith et al., 2020) and this is represented in Fig. 3 by the proportions of Kenward's 'house fauna' recovered for the periods concerned. As the insect data are derived from archaeological sites, it is necessary to aggregate by archaeological period, rather than into time windows that are comparable to the pollen data. Thus, it is not possible to perform detailed statistical comparisons between the insect data and the other proxies presented here.

Climate data:

Palaeoclimate datasets (Fig. 2) were selected to cover the majority of the Holocene and characterise North Atlantic atmospheric and oceanic climatic patterns. These include:

- A record of sea surface temperature (SST) from northwest Iceland (Moossen et al., 2015). This dataset reflects sea surface temperatures reconstructed using the hydrogen isotopic composition of the C29 n-alkane (see Moossen et al., 2015 for further details).
- An ^{18}O isotope speleothem record from Crag Cave (southwest Ireland) (McDermott et al., 2001) that provides a regional signal predominantly driven by temperature and North Atlantic Oscillation, but is also influenced by factors such as ice rafting, meltwater input and moisture availability (see McDermott et al., 2001 for further details).
- A Holocene record of deviation from modern temperature derived from Greenland ice cores reconstructed from ^{18}O isotopic data (see Vinther et al., 2009 for further information).
- A cosmogenic isotope and total solar irradiance (TSI) record as a proxy for solar activity (Steinhilber et al., 2012). The reconstruction is based on a combination of different ^{10}Be

ice core records from Greenland and Antarctica with the global ^{14}C tree ring record (see Steinhilber et al. (2012) for further information) (site locations not displayed in Fig. 2).

General Additive Models (GAMs) were fitted to the climate data using the 'gam' function in the mgcv R package (Wood, 2017) to smooth and interpolate values in the climate data series for time periods that match the pollen and archaeological datasets. GAMs allow flexible modelling of non-linear relationships, such as those displayed in climate data series; therefore we used a smoothing function to capture these non-linear patterns through time. Spearman's rank correlation coefficient was used to identify relationships between the datasets, as ranked correlation coefficients are most suitable when a proxy indicator is not linearly related to a variable (e.g. SPDs are not linearly related to population, but indicate magnitude of population change). The 'p.adjust' function in R using the 'bonferroni' method was applied to correct p-values for multiple tests and avoid spurious significant correlations (Benjamini & Yekutieli, 2001). The dataset was divided into periods representing the early (10000-6000 BP), mid (6000-3000 BP), late (3000-0 BP) and entire Holocene for correlation analysis to explore differences in relationships between the datasets over time.

Site distribution:

The fossil pollen sites are generally located within upland regions with data gaps in central England and Wales, while the insect sites are mostly situated in southeast and central England with very few datasets in Scotland. The palaeodemographic archaeological sites are mainly located in England and the coastal regions of Scotland (Fig. 1), which impacts upon the trends identified in the different datasets. We have not included the island of Ireland as it was separate from the British Isles by the start of the Holocene, and therefore might be expected to have different patterns of biodiversity to Britain, which remained connected to continental Europe until several millennia after the start of the Holocene. The pollen and palaeodemographic datasets have been analysed at sub-regional scales to address these spatial biases. Climate records based on sites within the British Isles were explored, but these datasets largely only cover short periods of the Holocene, therefore we selected records from different locations within the North Atlantic that principally reflect temperature variation across the majority of the Holocene epoch.

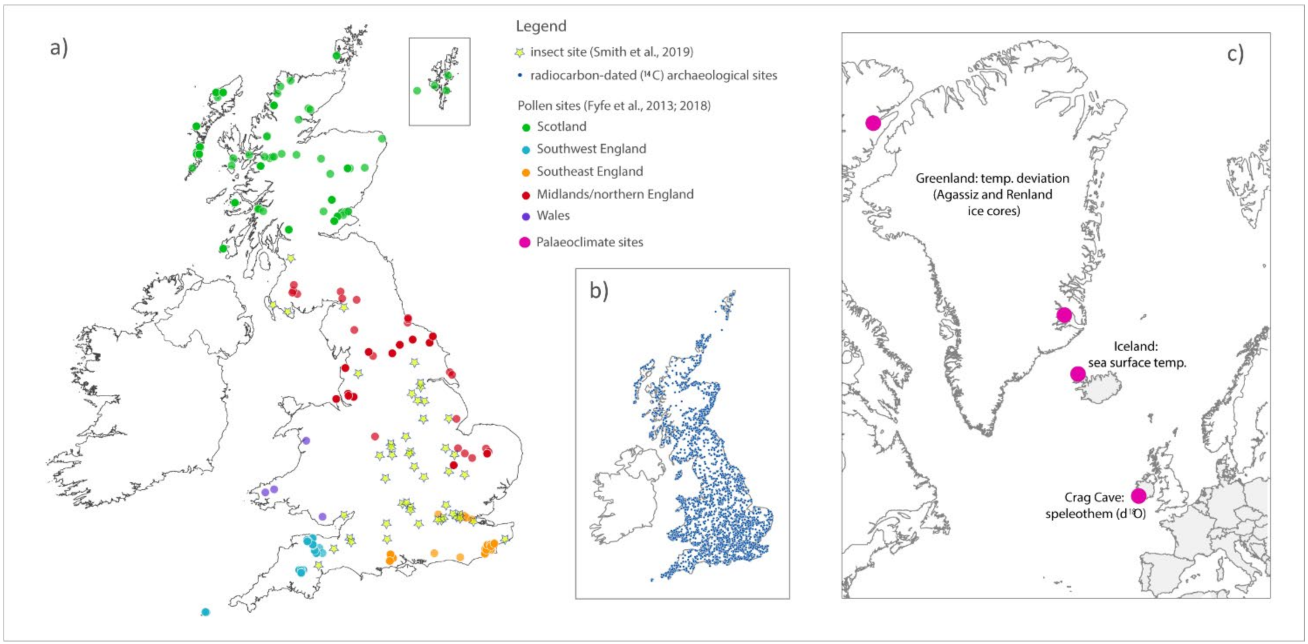

Figure 2. a) Fossil pollen and insect sites, b) radiocarbon-dated archaeological (palaeodemographic) site distribution, and c) palaeoclimate sites.

Results:

Holocene trends in environmental datasets

Synthesis of the pollen-inferred land cover, fossil insect faunal groups, palaeodemographic trends, and pollen-derived diversity measures (Fig. 3 and 4), reveals that population increases at the start of the Neolithic, ~6000 BP (Before Present), and Bronze Age, ~4200 BP, coincided with declining deciduous forest and increasing open land. The first appearance of plant types indicative of agriculture, such as cereals and plant species associated with disturbance as a result of human land use, is evident from the start of the Neolithic. Marked increases in these indicators are not apparent until the Bronze Age (Stevens & Fuller, 2012), which marks the first widespread evidence for cereal cultivation with more pronounced increases in the most recent 3000 years. The transition from the Neolithic to the Bronze Age also saw a significant shift in insect fauna from woodland types to open ground and dung insect types associated with agricultural activity and the presence of grazing animals. See Smith et al. (2019) for further discussion around the site types investigated. We see an increase in palynological diversity from ~9400 BP, which was followed by a period of stable diversity scores. Shannon diversity index values then increase at the start of the Bronze Age, continue to steadily increase until the Iron Age (~2700 BP), and remain stable until the most recent part of the record with a slight decline since the Medieval period (~1000 BP). The palynological evenness component of the Shannon index shows a similar trend to the index scores that incorporate taxa richness, but evenness values decline more from the end of the Iron Age into the Medieval period, showing that these trends are increasingly decoupled during the most recent 2000 years. Calculating diversity measures at different levels of pollen taxonomic resolution (232 and 558 taxa groupings) (e.g. separating or combining pollen taxonomic units) reveals the same trends throughout the Holocene. Rarefaction analysis provides a measure of taxa richness that is independent of evenness, and indicates that palynological richness was lowest during periods of high woodland cover, and increased as landscapes became more open, similarly to the Shannon diversity curve. Changes in broad landscape openness are much more subtle after the middle Iron Age.

Significant relationships between palaeodemographic, climate and pollen data are mostly evident with palynological richness rather than evenness (Table 1). Palaeodemographic (population) trends are also more strongly correlated with pollen diversity in the later Holocene with higher r-values, although the p-values were not deemed significant after correcting for multiple tests. Some climate datasets show correlations with the pollen datasets in the early Holocene (e.g. Iceland temperature) and others in the later Holocene (e.g. Greenland temperature). The strongest relationships are shown with the Greenland ice core temperature deviation and Iceland sea surface temperature records (SST). Population and climate trends show the strongest significant relationships for the entire Holocene, but this is likely associated with the higher number of samples compared, which leads to lower p-values. The climate record from Iceland indicates that the early Holocene was characterised by high air temperatures relative to the later Holocene, but SSTs were dampened by melt water events (Moossen et al., 2015) (Fig. 5). The middle Holocene saw a peak in SSTs, followed by cooling into the late Holocene (Moossen et al., 2015). The Crag Cave speleothem $\delta^{18}O$ sequence reflects temperature change with cooling events evident at ~7730, 7010, 5210 and 4200 BP (McDermott et al., 2001) while the Greenland ice core record reveals a number of abrupt shifts in climate with the most significant ~7600, 6500, 6300 and 4300 BP. The total solar irradiance (TSI) record fluctuates through the Holocene with lowest values in the early and late Holocene.

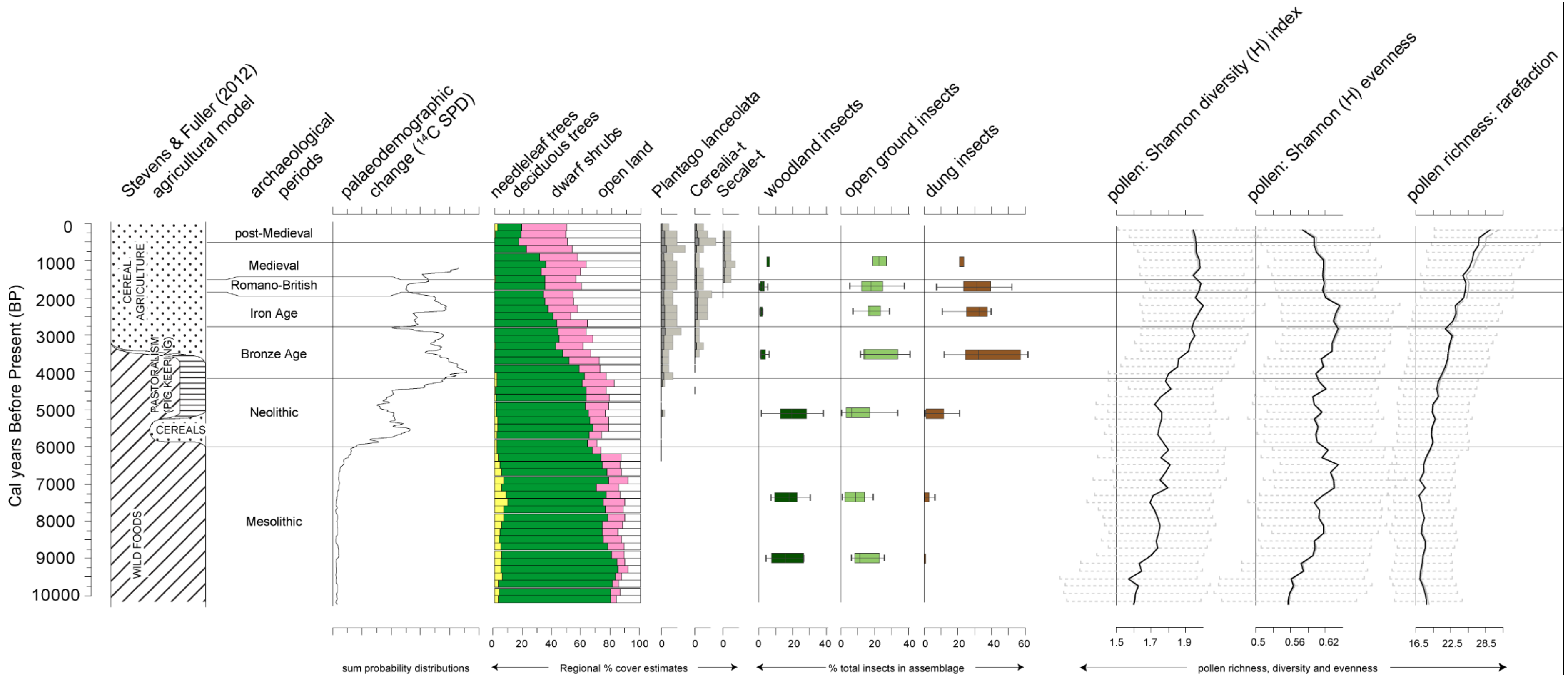

Figure 3. Synthesis of pollen and insect records from the British Isles: Stevens and Fuller's (2012) model of agricultural changes in the UK presented with archaeological periods, radiocarbon-inferred palaeodemographic changes (from Bevan et al., 2017), pollen-based vegetation cover and key land-use indicators (Fyfe et al., 2013), changes in key insect faunal groups (Smith et al., 2019) represented as average, minimum, maximum and interquartile range, and pollen taxa richness and evenness (Shannon diversity and rarefaction) indices averaged for all pollen sites. Dashed grey lines show values based on 233 pollen taxa groups and solid black lines show values for 558 pollen taxa groups. Dotted horizontal lines show the standard deviation.

Testing the conceptual diagram presented by Birks et al. (2016a) (Fig. 1) at the scale of the British Isles indicates that loss of diversity associated with initial forest development is not reflected in the current dataset in the early Holocene. However, this may be because the transitional phase from late-glacial vegetation to early Holocene forest initiation is not captured by these datasets. Subsequent periods show similar trends to those predicted by the model. Closed mixed forest is characterised by a period of limited change in palynological diversity (~10,000 - 6,000 BP), which is followed by early agriculture and land-use change associated with a clear increase in diversity, particularly since the beginning of the Bronze Age when agricultural activity increased (Fig. 3). The final phase in the model for fertile soils, declining diversity associated with recent land-use change in the last 200 years, is not clearly captured by the Shannon diversity index. The model predicts no change in diversity in the most recent phase on infertile soils, which may be expected in upland regions and in parts of Scotland and Wales with acid infertile soils, a pattern that is supported by the sub-regional analyses for Scotland and the midlands/northern England where little recent change is evident (Fig. 4). This final phase may be indistinguishable at the broad spatial and temporal scale used here (200 year-long time windows) and shows the importance of exploring patterns at smaller sub-regional and site-specific scales. It may also reflect the lack of pollen data spanning recent decades in the synthesis, which could capture this more recent decline in diversity (e.g. Hanley et al., 2008).

At the sub-regional scale (Fig. 4), some of the patterns predicted by Birks et al's (2016a) model are shown more clearly. For example, the decline in palynological diversity in the last five hundred years appears to be reflected in the diversity indices for southwest England and the midlands/northern England pollen sites where a minor recent decline in diversity is evident, but not clearly for sites in southeast England and Scotland. Regional variation is evident when average palynological diversity index scores for the four regions are compared (Fig. 4). The large standard deviation in palynological diversity within the pollen datasets from Scotland reflects the greater number of sites capturing the diverse landscapes within this region. Whereas the smaller standard deviation for sites in the southwest, southeast, midlands/northern England, show that palynological diversity trends through the Holocene were more similar for sites within these regions, which may represent more similar landscapes or land-use types. Pollen taxa richness (rarefaction) reflects the diversity index and indicates gradually increasing values in all four regions as landscapes became more open. The palaeodemographic curves (SPDs of radiocarbon-dated archaeological sites) for these areas indicate increasing population at the start of the Neolithic with all regions showing a peak ~5200 BP. This is followed by another population peak ~3500 BP during the Bronze Age, and further increases in the late Iron Age / early Roman period (~2000 BP) and in the Medieval period (~1000 BP) (Fig 4).

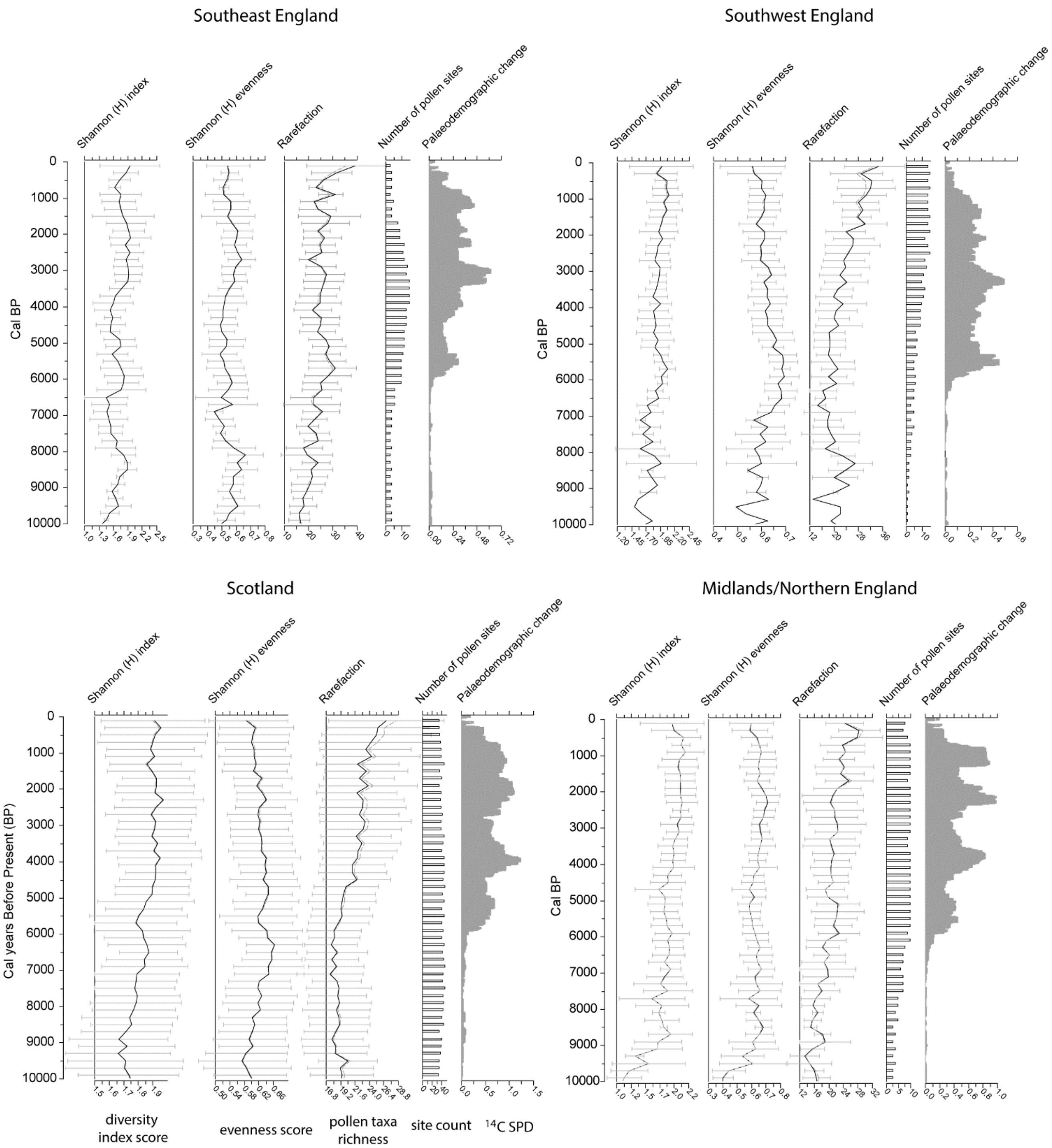

Figure 4. Pollen taxa richness and assemblage evenness summarised by Shannon diversity and evenness indices and rarefaction (pollen richness) (with standard deviation and number of pollen sites) averaged for four regions of the British Isles: southeast England, southwest England, Scotland and the midlands/northern England. Dashed grey lines show values based on 233 pollen taxa groups and solid black lines show values for 558 pollen taxa groups.

Palaeodemographic (population) trends are shown for each region (based on the summed probability distributions (SPDs) of radiocarbon-dated archaeological sites.

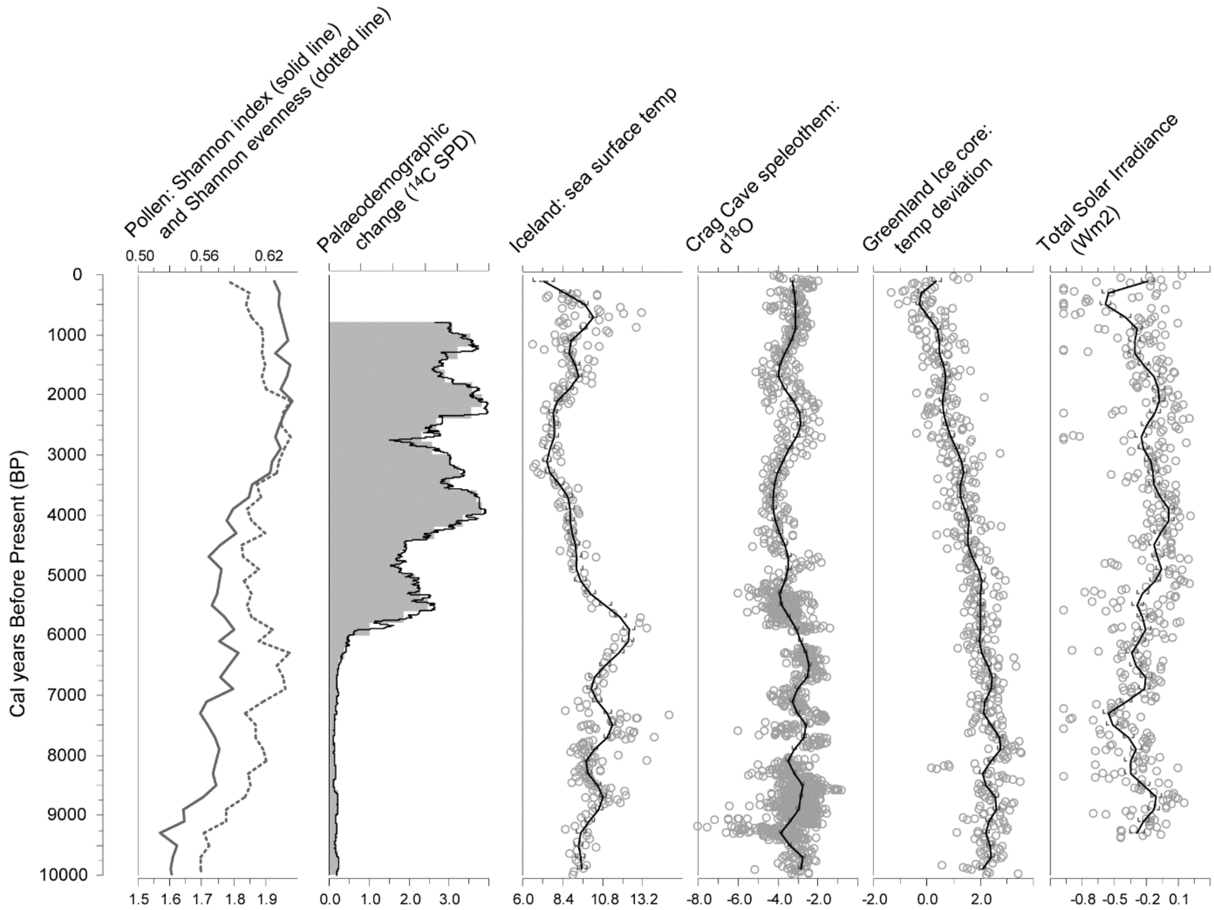

Figure 5. Pollen taxa richness and assemblage evenness summarised by Shannon diversity and evenness indices for the British Isles presented with palaeodemographic data for all regions and palaeoclimate datasets: sea surface temperature (SST) from Iceland (Moossen et al., 2015), an ^{18}O isotope speleothem record from Crag Cave (Ireland) (McDermott et al., 2001), temperature deviation from the Greenland ice core (Vinther et al., 2009) and total solar irradiance (TSI) (Steinhilber et al., 2012). Grey circles represent all data points and black lines represent smoothed data values derived using a general additive model (GAM).

Table 1 Spearman's rank correlations (r and p-values) between the palaeoclimate records reflecting North Atlantic patterns, pollen taxa richness and evenness (Shannon diversity index and evenness) and taxa richness (rarefaction), and palaeodemographic change (population) inferred from summed probability density (SPD) functions of radiocarbon-dated archaeological sites. Correlation analyses were carried out for the early, mid, late and entire Holocene and significant relationships are shaded. Dates represent the mid-point of each 200-year time window. Grey shading indicates significant correlations ($p < 0.05$). P-values corrected for multiple comparisons of significantly correlated variables are shown in brackets.

	Time period	*Pollen: Shannon diversity index*	*Pollen: Shannon evenness*	*Pollen taxa richness (rarefaction)*	*Palaeo-demographic change*
Palaeo demographic change	**9900-1700 BP**	*0.768 0.00*	*0.048 0.762*	*0.88 0.00*	
	2900-1700 BP	*0.821 0.023 (0.138)*	*0.036 0.939*	*0.679 0.094*	
	5900-3100 BP	*0.532 0.041 (0.246)*	*0.229 0.413*	*0.746 0.001 (0.006)*	
	9900-6100 BP	*0.102 0.668*	*0.056 0.816*	*0.299 0.2*	
Palaeoclimate records					
Iceland: sea surface temperature	**9900-100 BP**	*-0.547 0.00*	*-0.249 0.081 (0.486)*	*-0.669 0.00*	*(9900-1700 BP) -0.676 0.00*
	2900-100 BP	*0.446 0.095*	*-0.411 0.128*	*0.45 0.092*	*(2900-1700 BP) 0.5 0.253*
	5900-3100 BP	*-0.689 0.004 (0.024)*	*-0.396 0.143*	*-0.957 0.00*	*-0.746 0.001 (0.006)*
	9900-6100 BP	*0.508 0.022 (0.132)*	*0.484 0.031 (0.186)*	*0.008 0.975*	*0.126 0.596*
Crag Cave speleothem: ^{18}O	**9900-100 BP**	*-0.227 0.112*	*0.041 0.779*	*-0.348 0.013 (0.078)*	*(9900-1700 BP) -0.584 0.00*
	2900-100 BP	*-0.257 0.355*	*0.186 0.508*	*-0.111 0.694*	*(2900-1700 BP) -0.214 0.645*
	5900-3100 BP	*-0.421 0.118*	*-0.143 0.612*	*-0.646 0.009 (0.054)*	*-0.925 0.00*
	9900-6100 BP	*0.411 0.072*	*0.295 0.207*	*0.352 0.128*	*0.302 0.195*
Greenland ice core: temperature deviation	**9900-100 BP**	-0.848 0.00	*-0.291 0.04 (0.240)*	*-0.94 0.00*	9900-100 BP *-0.879 0.00*
	2900-100 BP	*-0.057 0.84*	*0.743 0.002 (0.012)*	*-0.882 0.00*	*(2900-1700 BP) -0.929 0.003 (0.018)*
	5900-3100 BP	*-0.7 0.004 (0.024)*	*-0.411 0.128*	*-0.832 0.00*	*-0.65 0.009 (0.054)*
	9900-6100 BP	*0.002 0.995*	*0.002 0.995*	*-0.236 0.316*	*-0.368 0.11*
Total Solar Irradiance (TSI)	**9300-100 BP**	*0.124 0.405*	*0.079 0.596*	*0.166 0.265*	*(9300-1700 BP) 0.719 0.00*
	2900-100 BP	*0.261 0.348*	*0.571 0.026 (0.156)*	*-0.471 0.076*	*(2900-1700 BP) 1 0.00*
	5900-3100 BP	*0.143 0.612*	*-0.054 0.85*	*0.364 0.182*	*0.375 0.168*
	9300-6100 BP	*0.044 0.866*	*-0.123 0.639*	*0.145 0.58*	*0.414 0.098*

Discussion:

Biodiversity trends in the Holocene

The synthesis presented in this study (Fig. 3) has demonstrated that people and climate have played important roles in shaping past land-cover change with likely impacts on the changing diversity and abundance of vegetation types, which reflects previous literature demonstrating the impact of people on past vegetation and pollen richness (e.g. Iversen, 1949; Birks & Line, 1992). However, the relationships between human population, climate, land cover and palynological and insect diversity are not straightforward and consideration of the processes involved in landscape transformation and different species traits, which influence species responses, is key to understanding how modern biodiversity patterns emerged within a long-term context.

Trends identified in the pollen-inferred land-cover types reflect Stevens & Fuller's (2012) agricultural model (Fig. 3), which is based on radiocarbon-dated wild and cultivated food plants. The model recognises an initial phase of arable agriculture in the early Neolithic followed by predominantly pastoral practices and evidence of later more pronounced Bronze Age intensification of agriculture. This reflects the patterns shows in Fig. 3 and the findings of Colombaroli et al. (2013) who identified that land clearance promoted diverse open ecosystems, but in the long-term, this led to reduced woodland and forest diversity. In our study, this is reflected by decreased deciduous forest cover from the start of the Neolithic, which became more pronounced from the start of the Bronze Age. This was followed by a clear increase in cereals and a shift from woodland to open ground insect types.

The palynological diversity indices presented here imply that opening of the landscape, associated with early land-use and forest removal, initially led to an increase in the diversity of vegetation types across many sites, which varied regionally (Fig. 4). Similar patterns identified by Kuneš et al. (2019) in central Europe show that diversity increased continuously throughout the Holocene with comparable trends between pollen richness and evenness. This pattern is reflected in the rarefaction curves presented here. Whilst the Shannon index also provides a measure of taxa richness, it does not account for varied sample sizes and slight differences in the Shannon and rarefaction figures are apparent (Figure 3). Recent loss of diversity is not clearly reflected by the majority of sites in this study, which is likely the result of pollen records not extending into the most recent period, the amalgamation of pollen data from 200 BP until present, the absence of modern (i.e. datasets spanning recent decades) pollen data in the analyses, and as a result of many sites being located on infertile soils, which Birk's (2016a) model predicts should not show a recent decline in diversity. Once landscapes have become predominantly open (i.e. by the start of the historic period in Britain), measures such as woodland cover become insensitive proxies for understanding biodiversity trends and more ecologically detailed interpretations of pollen assemblages are required. This study also demonstrates that vegetation communities are rarely stable over time as assemblages reassemble on centennial to millennial timescales (Edwards et al, 2017).

Smith et al. (2020) identified distinct phases in the introduction of synanthropic insects in the British Isles. This included an initial group of taxa originating from natural ecosystems during the Mesolithic and Neolithic, followed by a second phase of new insect taxa associated with pasture, fodder production and animal stocking in the Bronze Age and Iron Age. This was proceeded by the appearance of strongly-synanthropic insect species, such as grain pests, during following time periods, which were introduced into Britain during Romans times (Smith et al., 2020). The agricultural landscape may have become more even and less diverse in the Roman period as areas became specialised in producing for larger populations. Insect remains can provide a range of information at an intermediate scale on land-use nature and practice, particularly the clearance of forest and the development of pasture, along with indicating the spread and intensity of settlement (Kenward, 1977; Smith, 2012; Smith et al., 2010; 2019; 2020).

The absence of patterns between the palaeodemographic curves and the palynological diversity indices for each region (Fig. 4) implies that there are no direct detectable regional-scale relationships between population change and palynological diversity in this study beyond the initial change at the start of the Neolithic at the onset of agriculture. Therefore, the size of the population may be less important than the way in which people used the land. Within some regions, such as the midlands/northern England, palynological diversity appears to have remained stable during multiple population ‘boom and bust’ cycles; however, changing palynological diversity patterns may not be easily detectable at this spatial scale. In other regions, such as southwest England, highest levels of palynological diversity occur when population peaks in Neolithic times. This implies that low levels of human-induced disturbance and associated land-use practices may have initially led to an increase in pollen diversity; however, this pattern is not evident for all regions. In a review of biodiversity trends through the Anthropocene, McGill et al. (2015) highlighted human-induced land-cover change as a major factor influencing biodiversity patterns. They identified that land-cover change typically results in decreased species richness in the changed area. They also recognise that by creating more heterogeneous habitat structures, meta-community to biogeographical-scale species richness can increase through integration of edge or open habitat species. This is clearly demonstrated in the pollen-inferred diversity trends presented here (Fig. 3), which increase when deciduous forest declines and vegetation becomes more open. During recovery from natural or human-mediated disturbance, species richness often peaks during periods of intermediate disturbance, as demonstrated by McGill et al. (2015). This too is reflected in the pollen-inferred diversity trends, such as from the start of the Bronze Age as landscapes became more open as a result of forest removal and use of land for agriculture. This 'intermediate' land use would have been less intensive than later agriculture and forest removal, which is demonstrated in Fig. 3 as woodland/open land cover, increasing cereal crops and insect groups indicative of human activity. McGill et al. (2015) identified 15 categories of biodiversity trends based on a range of data types and highlighted the importance of scale in interpreting diversity indices. Pollen data represent different spatial scales dependent on taxa group and landscape type, such as closed forest or open grassland. The results presented in this study mostly represent meta-community scales (i.e. spatial heterogeneity with dispersal as the dominant process) as opposed to biogeographical and global scales, which are governed by speciation and global extinction (McGill et al., 2015). This study has highlighted that spatial scale plays an important role in understanding human drivers of biodiversity.

The results from this data synthesis indicate that patterns of diversity change are more heterogeneous than the theoretical schema presented by Birks et al. (2016a) and highlight that there is a great deal of regional and temporal variability in palynological diversity trends, although the conceptual model may reflect large (continental) scale trends. The relationships between population change, land cover and diversity are not straightforward, which implies that the ways in which people managed the land has greater impact on diversity than changing population levels through the Holocene. Detailed information about the type, scale and intensity of land use is needed to allow diversity patterns to be fully understood in relation to changing human populations over time. The specific combinations of taxa driving diversity change and traits that condition ‘success’ or ‘failure’ to persist also require exploration alongside diversity, as interpreting diversity indices alone may mask the decline or loss of key taxa or functional types (e.g. Reitalu et al., 2015; Davies, 2016; Carvalho et al., 2019). More detailed analysis of species characteristics or traits is needed, which will be addressed in future work on the combined analyses of pollen and archaeobotanical data, which provide information about the scale and intensity of land use (Treasure et al., 2019), cultivation practices, cereal and horticultural crops, and the evolution of weed floras. Further work at smaller spatial scales is also needed to explore patterns between demographics, land use, and trends in particular taxa or phytosociological groups, which is demonstrated by the high standard deviation in certain sub-regional patterns indicating dissimilar trends between individual sites. Broad spatial scale macroecological syntheses are valuable for understanding to what extent there are generalisable relationships between human land use and biodiversity trends. However, meta-analyses need to consider sub-regional patterns and site-specific characteristics along with exploration of the nature of past land use to assess species sensitivity to change. This has potential to provide answers to questions about the way in which these factors shaped plant assemblages, which can facilitate more efficient communication across palaeo- and neo-ecology and conservation.

The majority of the significant correlations appear between climate, palaeodemography and the pollen taxa richness component of diversity rather than evenness. This implies that the significant associations with Shannon diversity mostly depend on the richness component and not evenness. Analyses of palaeoclimate trends can also help to address debates about the relationships between climate, land use and land cover over time (Dark, 2006). The climate datasets analysed within this study provided mixed results with some climate trends showing significant correlations with palynological diversity and population change for specific time periods, but not others. Weak correlations are to be expected during periods of stable Holocene climate when climatic influence on vegetation change would have been minor. However, the significant correlations identified with climate records from Iceland and Greenland demonstrate a strong relationship between pollen diversity trends and climate, suggesting that the climatic optima and ranges of different taxa played an important role in shaping vegetation patterns. The Greenland temperature deviation record shows strongest correlations with population and the diversity indices. Despite the numerous significant correlations between the datasets, we cannot assume that causation directly relates to the variables of interest. Despite statistically significant correlations between population and both Shannon index and rarefaction for the entire time period covered by both records (9900-1700 BP), r-values indicate that population change is correlated with palynological diversity more clearly in the later Holocene in comparison with the earlier Holocene. This suggests that people had an increasingly impactful influence on landscapes and palynological diversity, which is reflected by the increase in insect fauna associated with human land use and the increasing abundance of cereals and arable pollen indicators.

Conclusions:

Synthesis of fossil pollen, archaeological and insect datasets from the British Isles has demonstrated that humans played an important role in shaping landscape transformation throughout the Holocene within the context of climatic influences on vegetation change. However, relationships between population change, land cover and palynological diversity in the past are not straightforward. Testing a model of biodiversity change has demonstrated that patterns of palynological diversity trends are regionally variable and may not always follow expected trajectories. Current understanding of environmental change is often focused on recent decades, which only represents a 'snap-shot' in time. Exploring trends at smaller spatial scales, and understanding how different types of human-induced disturbance, such as land-use change, lead to loss or increases in diversity, also holds great potential for addressing questions about human impacts on biodiversity change. In order for long-term environmental data to inform modern challenges surrounding land use and biodiversity loss, detailed high-resolution spatial and temporal datasets need to be synthesised through multi-community efforts and large-scale data harmonisation exercises.

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Figures:

Figure 1. Theoretical model of local to meta-community scale diversity and possible drivers of change: summary of trends in biodiversity through the Holocene for fertile and infertile soils (based on Birks et al., 2016a).

Figure 2. a) Fossil pollen, insect and potential archaeobotanical sites, b) radiocarbon-dated archaeological (palaeodemographic) site distribution.

Figure 3. Synthesis of pollen and insect records from the British Isles: Stevens and Fuller's (2012) model of agricultural changes in the UK presented with archaeological periods, radiocarbon-inferred palaeodemographic changes (from Bevan et al., 2017), pollen-based vegetation cover and key land-use indicators (Fyfe et al., 2013), changes in key insect faunal groups (Smith et al., 2019) represented as average, minimum, maximum and interquartile range, and pollen taxa richness and evenness (Shannon diversity and rarefaction) indices averaged for all pollen sites. Dashed grey lines show values based on 233 pollen taxa groups and solid black lines show values for 558 pollen taxa groups. Dotted horizontal lines show the standard deviation.

Figure 4. Pollen taxa richness and assemblage evenness summarised by Shannon diversity and evenness indices and rarefaction (pollen richness) (with standard deviation and number of pollen sites) averaged for four regions of the British Isles: southeast England, southwest England, Scotland and the midlands/northern England. Dashed grey lines show values based on 233 pollen taxa groups and solid black lines show values for 558 pollen taxa groups. Palaeodemographic (population) trends are shown for each region (based on the summed probability distributions (SPDs) of radiocarbon-dated archaeological sites.

Figure 5. Pollen-derived Shannon diversity and evenness for the British Isles presented with palaeodemographic data for all regions and palaeoclimate datasets: sea surface temperature (SST) from Iceland (Moossen et al., 2015), an ^{18}O isotope speleothem record from Crag Cave (Ireland) (McDermott et al., 2001), temperature deviation from the Greenland ice core (Vinther et al., 2009) and total solar irradiance (TSI) (Steinhilber et al., 2012). Grey circles represent all data points and black lines represent smoothed data values derived using a general additive model (GAM).

Table 1 Spearman's rank correlations (r and p-values) between the palaeoclimate records reflecting North Atlantic patterns, pollen taxa richness and evenness (Shannon diversity index and evenness) and taxa richness (rarefaction), and palaeodemographic change (population) inferred from summed probability density (SPD) functions of radiocarbon-dated archaeological sites. Correlation analyses were carried out for the early, mid, late and entire Holocene and significant relationships are shaded. Dates represent the mid-point of each 200-year time window. Grey shading indicates significant correlations ($p < 0.05$). P-values corrected for multiple comparisons of significantly correlated variables are shown in brackets.

Supplementary Information, Table 2. Pollen site metadata from data contributors and the European Pollen Database (EPD) Leydet et al. (2007-2020) and Fyfe et al. (2013).

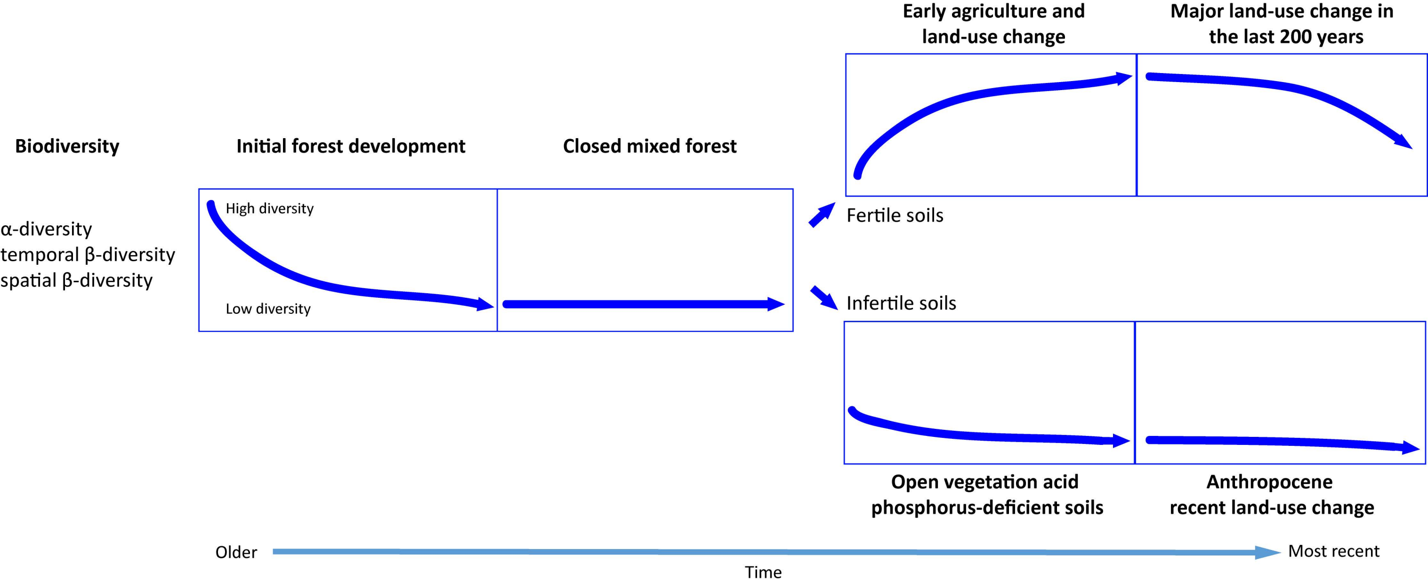
Authors' contributions:

JW wrote the manuscript, carried out analyses and produced the figures. RF acquired and amalgamated the fossil pollen datasets, wrote R script to carry out pollen data harmonisation and REVEALS reconstructions and conceptualised Figure 3. RF, RP, DS and JW designed the research while JW and RF led the conception and design on the manuscript. DS acquired and amalgamated the fossil insect datasets, RB contributed numerous pollen datasets from the London area and AD contributed several pollen datasets from Scotland. AB acquired and amalgamated radiocarbon-dated archaeological data and wrote R script for producing summed probably distributions (SPDs) as a proxy for population change. JW, RF, RP, DS,

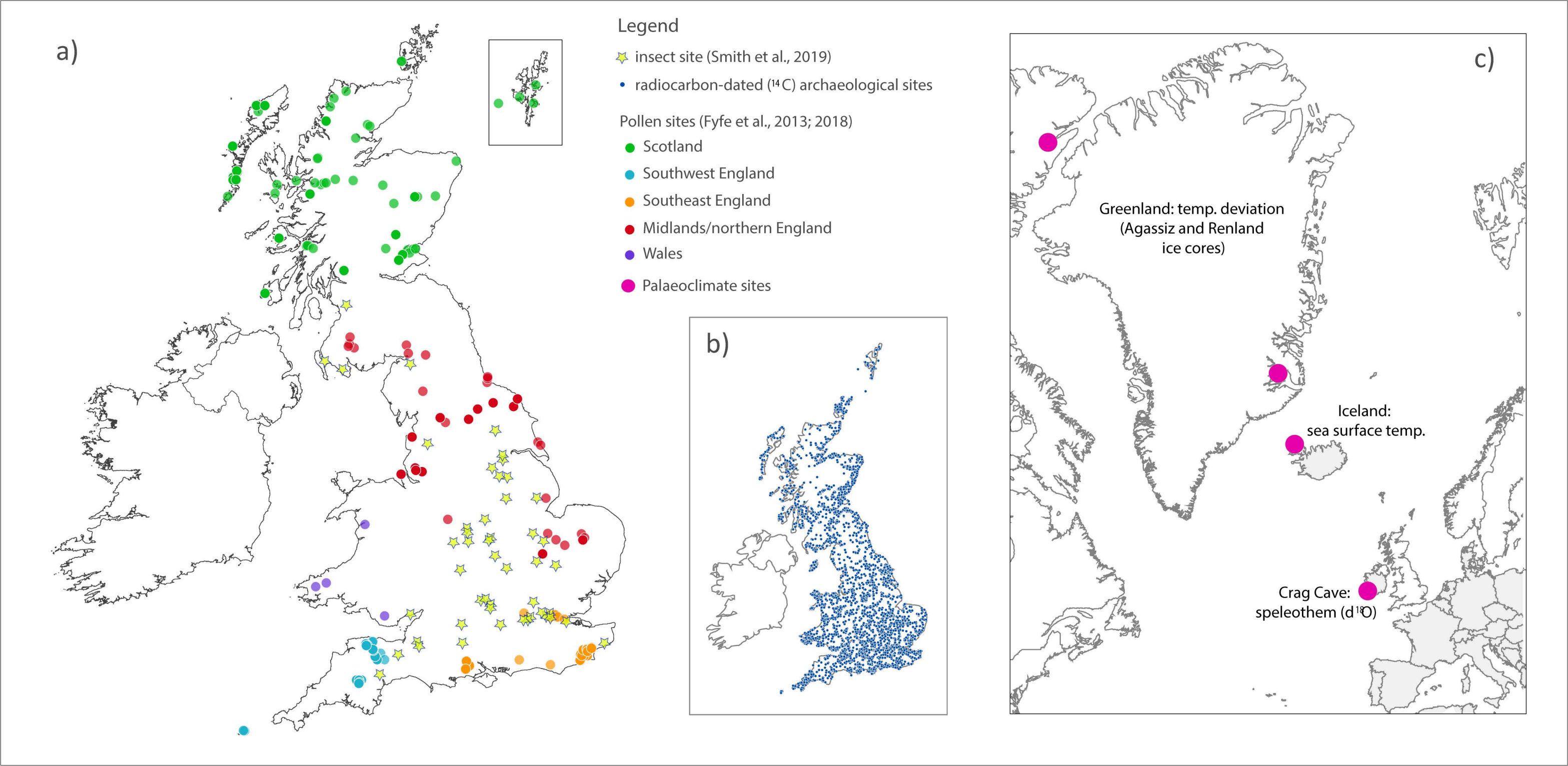
AdV, RB, AB and AD contributed to the interpretation of data, revised the manuscript critically, made intellectual contributions and approved the final version for publication.

Data accessibility statement:

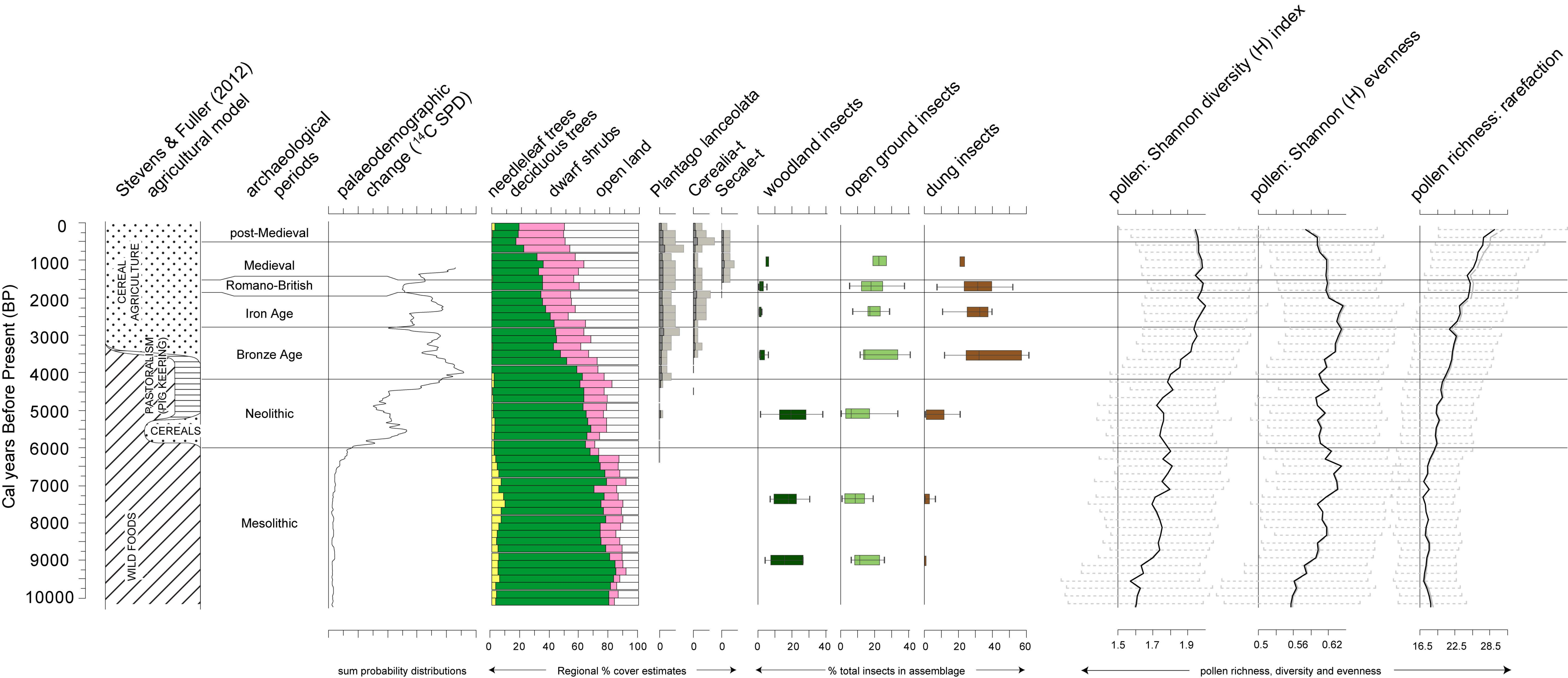
The majority of the original pollen and insect datasets used in this study are available from the European Pollen Database (www.europeanpollendatabase.net/), Neotoma (www.neotomadb.org/) and BugsCEP (http://bugscep.com/). For any datasets that are not available within these databases, readers would need to contact the original author. Radiocarbon dates used for palaeodemographic reconstructions are available in the University College London's Discovery database (discovery.ucl.ac.uk/10025178/: doi: 10.14324/000.ds.10025178). For a full set of sources and acknowledgements for the radiocarbon data see Bevan et al. (2017). The climate datasets are available from NOAA (https://www.noaa.gov/).



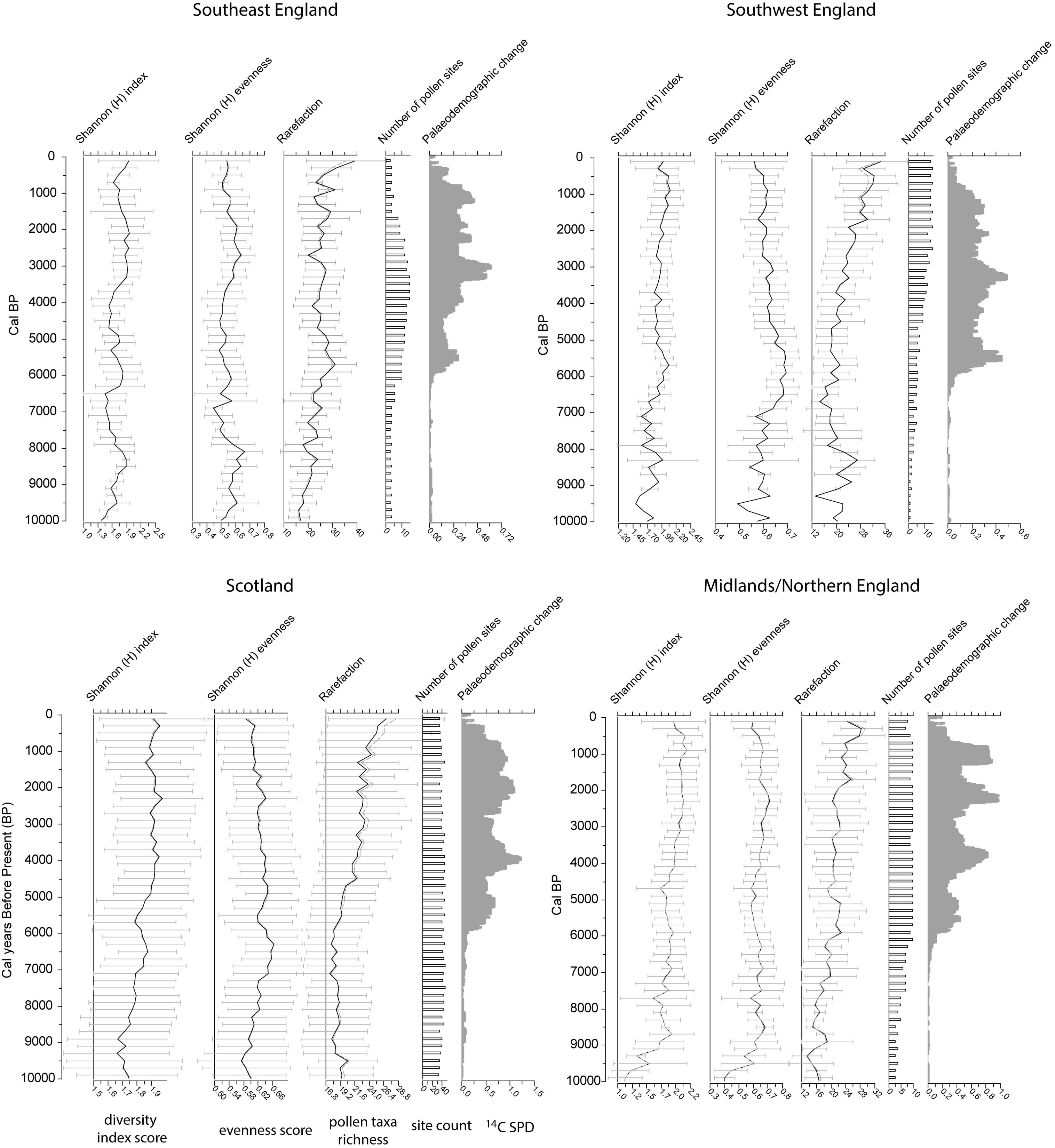
Early agriculture and land-use change
Major land-use change in the last 200 years
Biodiversity
Initial forest development
Closed mixed forest
High diversity
Low diversity
α-diversity
temporal β-diversity
spatial β-diversity
Fertile soils
Infertile soils
Open vegetation acid phosphorus-deficient soils
Anthropocene recent land-use change
Older
Most recent
Time

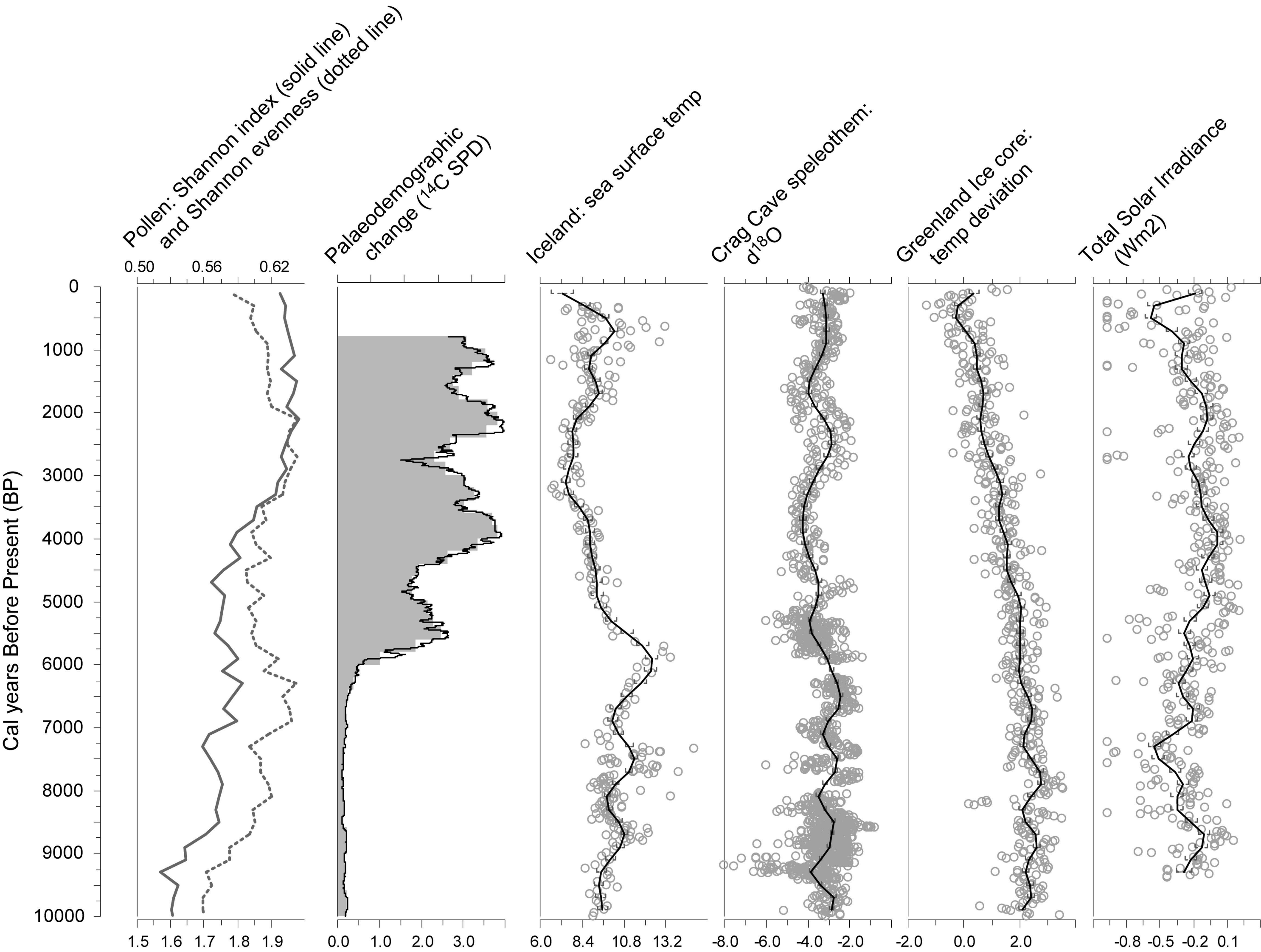


a)
Legend
insect site (Smith et al., 2019)
radiocarbon-dated (14C) archaeological sites
Pollen sites (Fyfe et al., 2013; 2018)
Scotland
Southwest England
Southeast England
Midlands/northern England
Wales
Palaeoclimate sites
b)
c)
Greenland: temp. deviation (Agassiz and Renland ice cores)
Iceland: sea surface temp.
Crag Cave: speleothem (d18O)



Stevens & Fuller (2012) agricultural model
archaeological periods
palaeodemographic change (^{14}C SPD)
needleleaf trees
deciduous trees
dwarf shrubs
open land
Plantago lanceolata
Cerealia-t
Secale-t
woodland insects
open ground insects
dung insects
pollen: Shannon diversity (H) index
pollen: Shannon (H) evenness
pollen richness: rarefaction
Cal years Before Present (BP)
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
CEREAL AGRICULTURE
PASTORALISM (PIG KEEPING)
CEREALS
WILD FOODS
post-Medieval
Medieval
Romano-British
Iron Age
Bronze Age
Neolithic
Mesolithic
sum probability distributions
0 20 40 60 80 100
Regional % cover estimates
0
0
0
0 20 40
0 20 40
0 20 40 60
% total insects in assemblage
1.5 1.7 1.9
0.5 0.56 0.62
16.5 22.5 28.5
pollen richness, diversity and evenness


Southeast England
Southwest England
Scotland
Midlands/Northern England
Shannon (H) index
Shannon (H) evenness
Rarefaction
Number of pollen sites
Palaeodemographic change
Cal BP
Cal years Before Present (BP)
1.0 1.3 1.6 1.9 2.2 2.5
0.3 0.4 0.5 0.6 0.7 0.8
10 20 30 40
0 10
0.00 0.24 0.48 0.72
1.20 1.45 1.70 1.95 2.20 2.45
0.4 0.5 0.6 0.7
12 20 28 36
0.0 0.2 0.4 0.6
1.5 1.6 1.7 1.8 1.9
0.50 0.54 0.58 0.62 0.66
16.8 19.2 21.6 24.0 26.4 28.8
0 20 40
0.0 0.5 1.0 1.5
1.0 1.2 1.5 1.7 2.0 2.2
0.3 0.4 0.5 0.6 0.7 0.8
12 16 20 24 28 32
0 5 10
0.0 0.2 0.4 0.6 0.8 1.0
diversity index score
evenness score
pollen taxa richness
site count
^{14}C SPD



Pollen: Shannon index (solid line) and Shannon evenness (dotted line)
0.50
0.56
0.62
Palaeodemographic change (14C SPD)
Iceland: sea surface temp
Crag Cave speleothem: d18O
Greenland Ice core: temp deviation
Total Solar Irradiance (Wm2)
Cal years Before Present (BP)
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
1.5 1.6 1.7 1.8 1.9
0.0 1.0 2.0 3.0
6.0 8.4 10.8 13.2
-8.0 -6.0 -4.0 -2.0
-2.0 0.0 2.0
-0.8 -0.5 -0.2 0.1

Supplementary Information, Table 2. Pollen site metadata from data contributors and the European Pollen Database (EPD) Leydet et al. (2007-2020) and Fyfe et al. (2013).

Site name	Source	Code	Longitude	Latitude	Site type	Reference
Abernethy Forest	EPD	AF1974	-3.710556	57.235278	Bog	Birks, H.H., and R.W. Mathewes. 1978. Studies in the vegetation history of scotland. V. Late Devensian and early Flandrian pollen and macrofossil stratigraphy at Abernethy forest, Inverness-shire. New Phytologist, 80, 455-484.
Aveley marshes	EPD	AMRN	0.2225	51.492222	Bog	Batchelor, C.R. 2009. Middle Holocene Environmental Changes and the History of Yew Taxus baccata L. Woodland in the Lower Thames Valley. PhD Thesis, Royal Holloway, University of London, UK.
Aveley marshes	EPD	AMRS	0.2225	51.492222	Bog	Batchelor, C.R. 2009. Middle Holocene Environmental Changes and the History of Yew Taxus baccata L. Woodland in the Lower Thames Valley. PhD Thesis, Royal Holloway, University of London, UK.
Ballynahatty Bog	EPD	BALLYNAH	-5.953056	54.544167	Bog	Plunkett, G., F. Carroll, B. Hartwell, N.J. Whitehouse, and P.J. Reimer. 2008. Vegetation history at the multi-period prehistoric complex at Ballynahatty, Co. Down, Northern Ireland. Journal of Archaeological Science, 35, 181-190.
Beckton	EPD	GWR	0.058889	51.519444	Bog	Batchelor, C.R. 2009. Middle Holocene Environmental Changes and the History of Yew Taxus baccata L. Woodland in the Lower Thames Valley. PhD Thesis, Royal Holloway, University of London, UK.
Bigholm Burn	EPD	BBURN3	-3.0725	55.120278	Bog	Moar, N.T. 1969. Late Weichselian and Flandrian pollen diagrams from south-west Scotland. New Phytologist, 68, 433-467.
Broad Down	EPD	BROADOWN	-3.962222	50.6125	Bog	Fyfe, R.M., and J. Woodbridge. 2012. Differences in time and space in upland vegetation patterning, analysis of pollen data from Dartmoor, UK. Lanscape Ecology, 27, 745-760.
Butter Mountain	EPD	BUTTER	-6.033333	54.166667	Bog	Holland, S.M. 1975. A pollen-analytical study concerning settlement and early agriculture in County Down, Northern Ireland. Ph.D. Dissertation. Queen's University, Belfast, Northern Ireland.
Caburn	EPD	CABURN	0.050556	50.857222	Bog	Waller, M.P., and S. Hamilton. 2000. Vegetation history of the English chalklands, a mid-Holocene pollen sequence from the Caburn, East Sussex. Journal of Quaternary Science 153. , 253-272.
Carrivmoragh	EPD	CARRIV	-5.983333	54.316667	Bog	Holland, S.M. 1975. A pollen-analytical study concerning settlement and early agriculture in County Down, Northern Ireland. Ph.D. Dissertation. Queen's University, Belfast, Northern Ireland.

Clatteringshaws Loch	EPD	CLATTERI	-4.283333	55.066667	Bog	Birks, H.H. 1975. Studies in the vegetational history of Scotland. IV. Pine stumps in Scottish blanket peats. Philosophical Transactions of the Royal Society of London, B 270, 181-226.
Comerslade	EPD	COMERSL A	-3.804722	51.120278	Bog	Fyfe, R.M. 2012. Bronze Age landscape dynamics, spatially detailed pollen analysis from a ceremonial complex. Journal of Archaeological Science, 398., 2764-2773.
Cooran Lane	EPD	COORAN	-4.4	55.116667	Bog	Birks, H.H. 1975. Studies in the vegetational history of Scotland. IV. Pine stumps in Scottish blanket peats. Philosophical Transactions of the Royal Society of London, B 270, 181-226.
Creich Castle	EPD	CREICHCA	-3.083333	56.383333	Lake	Cundill, P.R., and G. Whittington. 1983. Anomalous arboreal pollen assemblages in Late Devensian and Early Flandrian deposits at Creich Castle. Fife, Scotland. Boreas 12, 297-311.
Cut Hill	EPD	CUTHILL2	-3.981944	50.6275	Bog	Fyfe, R.M., and J. Woodbridge. 2012. Differences in time and space in upland vegetation patterning, analysis of pollen data from Dartmoor, UK. Lanscape Ecology, 275., 745-760.
Exebridge	EPD	EXEBRID	-3.517222	51.017222	Bog	Fyfe, R.M., A.G. Brown, and B.J. Coles. 2003. Mesolithic to Bronze Age vegetation change and human activity in the Exe Valley, Devon, UK. Proceedings of the Prehistoric Society, 69, 161-181.
Ferry Lane	EPD	FERRYLAN	0.194444	51.511944	Bog	Waller, M.P., and M.J. Grant. 2012. Holocene pollen assemblages from coastal wetlands, differentiating natural and anthropogenic causes of change in the Thames estuary, UK. Journal of Quaternary Science, 275., 461-474.
Foula	EPD	FOULA6B	-2.1	60.15	Bog	Shotyk, W. 1997. Atmospheric deposition and geochemical mass balance of major elements and trace elements in tow oceanic blanket Bogs, northern Scotland and the Shetland Islands. Chemical Geology 138, 55-72.
Glen West	EPD	GLENWES T	-8.033333	54.416667	Bog	Plunkett, G. 2009. Land-use patterns and cultural change in the Middle to Late Bronze Age Ireland, inferences from pollen records. Vegetation History Archaeobotany, 18, 273-295.
Gors Fawr Bog	EPD	GORSFAW R	-4.718333	51.931667	Bog	Fyfe, R.M. 2007. The importance of local-scale openness within regions dominated by closed woodland. Journal of Quaternary Science, 226., 571-578.
Hangingstone Hill	EPD	HANGINGS	-3.956944	50.654722	Bog	Fyfe, R.M., and J. Woodbridge. 2012. Differences in time and space in upland vegetation patterning, analysis of pollen data from Dartmoor, UK. Lanscape Ecology, 275., 745-760.
Hobbs Lot March	EPD	MARCH	0.071389	52.601667	Bog	Waller, M.P. 1994. The Fenland Project, Number 9, Flandrian environmental change in Fenland. East Anglian Archaeology Monograph No.70.
Hope farm Walland marsh	EPD	HOPEFAR M	0.835556	51.017778	Bog	Waller, M.P., A.J. Long, D. Long, and James Innes. 1999. Patterns and processes in the development of coastal mire vegetation, Multi-site investigations from Walland Marsh, Southeast England. Quaternary Science Reviews 18, 1419-1444.

Hornchurch marshes	EPD	DAGFINAL	0.176944	51.520278	Bog	Batchelor, C.R. 2009. Middle Holocene Environmental Changes and the History of Yew Taxus baccata L. Woodland in the Lower Thames Valley. PhD Thesis, Royal Holloway, University of London, UK.
King's Pool	EPD	KINGS	-2.108333	52.808333	Lake	Bartley, D.D., and A.V. Morgan. 1990. The palynological record of the King's Pool, Stafford, England. New Phytologist, 116, 177-194.
Lackan Bog	EPD	LACKAN1	-6.083333	54.266667	Bog	Holland, S.M. 1975. A pollen-analytical study concerning settlement and early agriculture in County Down, Northern Ireland. Ph.D. Dissertation. Queen's University, Belfast, Northern Ireland.
Lackan Bog	EPD	LACKAN2	-6.083333	54.266667	Bog	Holland, S.M. 1975. A pollen-analytical study concerning settlement and early agriculture in County Down, Northern Ireland. Ph.D. Dissertation. Queen's University, Belfast, Northern Ireland.
Lade Bank	EPD	LBA	0.057778	53.0725	Bog	Waller, M.P. 1994. Paludification and pollen representation, the influence of wetland size on Tilia representation in pollen diagrams. The Holocene, 4, 430-434.
Llanilid	EPD	LLANILID	-3.45	51.516667	Lake	Walker, M.J.C., and D.D. Harkness. 1990. Radiocarbon dating the Devensian Lateglacial in Britain, New evidence from Llanilid, south Wales. Journal of Quaternary Science 5, 135-144.
Llyn Gwernan	EPD	LLYN-JL	-3.921389	52.725556	Bog	Lowe, J.J., S. Lowe, A.J. Fowler, R.E.M. Hedges, and T.J.F. Austin. 1988. Comparison of accelerator and radiometric radiocarbon measurements obtained from Late Devesian late-glacial lake sediments from Gwernan, north Wales. Boreas, 17, 355-369.
Loch a'Chroisg	EPD	CHROISGP	-5.327778	57.568333	Lake	Pennington, W. 1977. The Late Devensian flora and vegetation of Britain. Philosophical Transactions of the Royal Society of London, Series B 280, 247-271.
Loch Clair	EPD	CLAIR	-5.343611	57.558889	Lake	Pennington, W., E.Y. Haworth, A.P. Bonny, and J.P. Lishman. 1972. Lake sediments in northern Scotland. Philosophical Transactions of the Royal Society of London, Series B 264, 191-294.
Loch Laxford	EPD	LAXFORD	-5	58.366667	Peat	Shotyk, W. 1996. Peat Bog archives of atmospheric metal deposition, geochemical evolution of peat profiles, natural variations in metal concentrations, and metal enrichment factors. Environ. Rev. 4, 149-183. Shotyk, W. 1997. Atmospheric deposition and geochemical mass balance of major elements and trace elements in tow oceanic blanket Bogs, northern Scotland and the Shetland Islands. Chemical Geology 138, 55-72. Weiss, D., W. Shotyk, E.A. Boyle, J.D. Kramers, P.G. Appleby, and A.K. Cheburkin. 2002. Comparative study of the temporal evolution of atmospheric lead deposition in Scotland and eastern Canada using blanket peat Bogs. The Science of the Total Environment 292, 7-18.

Lochan an Druim	EPD	DRUIM	-4.7	58.466667	Lake	Birks, H.H. 1984. Late-Quaternary pollen and plant macrofossil stratigraphy at Lochan an Druim, north-west Scotland. Pages 377-405 in E. Haworth and J.W.G. Lund. Lake sediments and environmental history. Leicester University Press, Leicester, United Kingd
Lochan coir a' Ghobhainn	EPD	GHOBHAI N	-6.3	57.183333	Lake	Birks, H.J.B., and W. Williams. 1983. Late-Quaternary vegetational history of the Inner Hebrides. Proceedings of the Royal society of Edinburgh, 83B, 269-292.
Malham Tarn	EPD	MALHAMT M	-2.163611	54.096389	Lake	Brown, A.D. 2006. Late-Holocene palaeoclimates, cross-validation of multiple proxies from lake and Bog archives in Northern England. PhD Thesis, University of Southampton.
Middle North Coombe	EPD	MIDNORC O	-3.433333	50.933889	Bog	Fyfe, R.M., A.G. Brown, and S.J. Rippon. 2004. Characterising the late prehistoric, "Romano-British" and medieval landscape, and dating the emergence of a regionally distinct agricultural system in South West Britain. Journal of Archaeological Science, 31
Moles Chamber	EPD	MOLECHA M	-3.832778	51.139444	Bog	Fyfe, R.M. 2012. Bronze Age landscape dynamics, spatially detailed pollen analysis from a ceremonial complex. Journal of Archaeological Science, 398., 2764-2773.
Morrone Birkwoods	EPD	MORRONE	-3.4325	56.9975	Bog	Huntley, B. 1994. Late Devensian and Holocene palaeoecology and palaeoenvironments of the Morrone birkwoods, Aberdeenshire, Scotland. Journal of Quaternary Science, 94., 311-336.
Redmere	EPD	REDMERE	0.438056	52.439722	Bog	Waller, M.P. 1994. The Fenland Project, Number 9, Flandrian environmental change in Fenland. East Anglian Archaeology Monograph No.70.
Round Loch of Glenhead	EPD	RLGH3DAT	-4.418889	55.084722	Lake	Jones, V. J., Stevenson, A. C., & Battarbee, R. W. 1989. Acidification of lakes in Galloway, south west Scotland, a diatom and pollen study of the post-glacial history of the Round Loch of Glenhead. The Journal of Ecology, 1-23.
Saham Mere	EPD	SAHAMME R	0.806389	52.581389	Lake	Bennett, K.D. 1988. Holocene pollen stratigraphy of central Est Anglia, England, and comparison of pollen zones across the Isles. New Phytologist, Vol.109, N°2, 237-253.
Slieve Croob	EPD	CROOB	-5.983333	54.333333	Bog	Holland, S.M. 1975. A pollen-analytical study concerning settlement and early agriculture in County Down, Northern Ireland. Ph.D. Dissertation. Queen's University, Belfast, Northern Ireland.
Slieve Naslat	EPD	NASLAT	-5.983333	54.35	Bog	Holland, S.M. 1975. A pollen-analytical study concerning settlement and early agriculture in County Down, Northern Ireland. Ph.D. Dissertation. Queen's University, Belfast, Northern Ireland.
Sluggan	EPD	SLUGGAN M	-6.258333	54.776944	Bog	Plunkett, G. 2009. Land-use patterns and cultural change in the Middle to Late Bronze Age Ireland, inferences from pollen records. Vegetation History Archaeobotany, 18, 273-295.

Tank Hill Road	EPD	TANKHILL	0.234167	51.491944	Bog	Waller, M.P., and M.J. Grant. 2012. Holocene pollen assemblages from coastal wetlands, differentiating natural and anthropogenic causes of change in the Thames estuary, UK. Journal of Quaternary Science, 275., 461-474.
Teanga	EPD	TEANGDAT	-7.284722	57.319167	Lake	Stevenson, A. C., & Rhodes, A. N. 2000. Palaeoenvironmental evaluation of the importance of fire as a cause for Calluna loss in the British Isles. Palaeogeography, Palaeoclimatology, Palaeoecology, 1641-4., 195-206.
The Dowels Walland marsh	EPD	DOWELS	0.828056	51.043611	Bog	Waller, M.P., A.J. Long, D. Long, and James Innes. 1999. Patterns and processes in the development of coastal mire vegetation, Multi-site investigations from Walland Marsh, Southeast England. Quaternary Science Reviews 18, 1419-1444.
The Mere Stow Bedon	EPD	STOWBEDO	0.873889	52.529444	Lake	Bennett, K.D. 1986. Comparative interactions among forest tree populations in Norfolk, England, during the last 10000 years. New Phytologist, Vol.103, N°3, 603-620.
Tilbury Fort	EPD	TFT	0.376111	51.455833	Bog	Batchelor, C.R. 2009. Middle Holocene Environmental Changes and the History of Yew Taxus baccata L. Woodland in the Lower Thames Valley. PhD Thesis, Royal Holloway, University of London, UK.
Welney Washes	EPD	WELNEY	0.25	52.516667	Bog	Waller, M.P. 1994. The Fenland Project, Number 9, Flandrian environmental change in Fenland. East Anglian Archaeology Monograph No.70.
William King Flour Mill	EPD	WILLIA17	-0.483889	51.552222	Bog	Grant, M.J., C.J. Stevens, N.J. Whitehouse, D. Norcott, R.I. Macphail, C. Langdon, N.G. Cameron, C. Barnett, P.G. Langdon, J. Crowder, N. Mulhall, K. Attree, M. Leivers, R. Greatorex, and C. Ellis. 2014. A palaeoenvironmental context for Terminal Upper Palaeolithic and Mesolithic activity in the Colne Valley, Offsite records contemporary with occupation at Three Ways Wharf, Uxbridge. Environmental Archaeology, 19, 131-152.
Winneys Down	EPD	WINNEYS	-3.94271	50.622778	Bog	Fyfe, R.M., and J. Woodbridge. 2012. Differences in time and space in upland vegetation patterning, analysis of pollen data from Dartmoor, UK. Lanscape Ecology, 27, 745-760.
Woolwich Trade Park	EPD	WTP	0.085556	51.491667	Bog	Batchelor, C.R. 2009. Middle Holocene Environmental Changes and the History of Yew Taxus baccata L. Woodland in the Lower Thames Valley. PhD Thesis, Royal Holloway, University of London, UK.
Swap Hill	Ralph Fyfe	SWAPHILL	-3.698869	51.164589	Bog	Davies H., Fyfe, R.M. and Charman D. 2015 Does peatland drainage damage the palaeoecological record? Review of Palaeobotany and Palynology 221, 92-105
Beckham	Ralph Fyfe	BECKHAM	-3.706244	51.165993	Bog	Davies H., Fyfe, R.M. and Charman D. 2015 Does peatland drainage damage the palaeoecological record? Review of Palaeobotany and Palynology 221, 92-105

Larkbarrow	Ralph Fyfe	LARKROW	-3.688389	51.170577	Bog	Davies H., Fyfe, R.M. and Charman D. 2015 Does peatland drainage damage the palaeoecological record? Review of Palaeobotany and Palynology 221, 92-105
Lower Moors LM1019	Ralph Fyfe	LM1019	-6.307	49.92	Bog	Perez, M., Fyfe, R.M., Charman, D.J. and Gehrles, W.R. 2015 Disentangling coastal influence from human land use in pollen diagrams from island contexts Journal of Quaternary Science 30, 764-778
Lower Moores LM1028	Ralph Fyfe	LM1028	-6.306	49.916	Bog	Perez, M., Fyfe, R.M., Charman, D.J. and Gehrles, W.R. 2015 Disentangling coastal influence from human land use in pollen diagrams from island contexts Journal of Quaternary Science 30, 764-778
Higher Moors	Ralph Fyfe	HM1016	-6.286	49.917	Bog	Perez, M., Fyfe, R.M., Charman, D.J. and Gehrles, W.R. 2015 Disentangling coastal influence from human land use in pollen diagrams from island contexts Journal of Quaternary Science 30, 764-778
Porthloo	Ralph Fyfe	PLOO	-6.308	49.921	Bog	Perez, M., Fyfe, R.M., Charman, D.J. and Gehrles, W.R. 2015 Disentangling coastal influence from human land use in pollen diagrams from island contexts Journal of Quaternary Science 30, 764-778
Lochan a'Bhuilg Bhith	Faye Davies	BBTHESIS	-5.446879	56.39402	Lake	Davies, F. M. 1997. Holocene palaeoenvironmental studies in the Oban region, western Scotland Doctoral dissertation, University of Newcastle upon Tyne.; Macklin M, Bonsall C, Robinson M, Davies F. 2000. Human–environment interactions during the Holocene, new data and interpretations from the Oban area, Argyll, Scotland. The Holocene 10, 109-121.
Gallanach Beg	Faye Davies	GBDAVIES	-5.503556	56.39162	Lake	Davies, F. M. 1997. Holocene palaeoenvironmental studies in the Oban region, western Scotland Doctoral dissertation, University of Newcastle upon Tyne.; Macklin M, Bonsall C, Robinson M, Davies F. 2000. Human–environment interactions during the Holocene, new data and interpretations from the Oban area, Argyll, Scotland. The Holocene 10, 109-121.
Lon Mor	Faye Davies	LMDAVIES	-5.480637	56.398021	Bog	Davies, F. M. 1997. Holocene palaeoenvironmental studies in the Oban region, western Scotland Doctoral dissertation, University of Newcastle upon Tyne.; Macklin M, Bonsall C, Robinson M, Davies F. 2000 Human–environment interactions during the Holocene, new data and interpretations from the Oban area, Argyll, Scotland. The Holocene 10, 109-121.
Lochan Cnoc Philip	Faye Davies	PH1ALL	-5.339902	56.364496	Lake	Davies, F. M. 1997. Holocene palaeoenvironmental studies in the Oban region, western Scotland Doctoral dissertation, University of Newcastle upon Tyne.; Macklin M, Bonsall C, Robinson M, Davies F. 2000. Human–environment interactions during the Holocene, new data and interpretations from the Oban area, Argyll, Scotland. The Holocene 10, 109-121.
Cruvic	Paula Milburn	CRUVIE	-2.944371	56.393863	Lake	Milburn P 1997. Palaeoenvironmental investigation into aspects of the vegetation history of north Fife and south Perthshire, Scotland. Unpublished PhD Thesis, University of Edinburgh

Pitbladdo	Paula Milburn	PITBLADDO	-3.035396	56.345518	Bog	Milburn P 1997. Palaeoenvironmental investigation into aspects of the vegetation history of north Fife and south Perthshire, Scotland. Unpublished PhD Thesis, University of Edinburgh
Methvern	Paula Milburn	METHVERN	-3.603772	56.395174	Bog	Milburn P 1997. Palaeoenvironmental investigation into aspects of the vegetation history of north Fife and south Perthshire, Scotland. Unpublished PhD Thesis, University of Edinburgh
Hares Down	Ralph Fyfe	HARESDOWN	-3.644	50.978	Bog	Fyfe, R.M., Brown, A.G., Rippon, S.J., 2004. Characterising the late prehistoric, "Romano-British" and medieval landscape, and dating the emergence of a regionally distinct agricultural system in South West Britain. Journal of Archaeological Science 31, 1699-1714.
A'Chrannag	Kevin Edwards	CHRANNAG	-6.171	56.473	Lake	Sugden, H., 1999. High Resolution Palynological, Multiple Profile and Radiocarbon Dating Studies of Early Human Impacts and Environmental Change in the Inner Hebrides, Scotland. University of Sheffield, UK. Ph.D. thesis.
Barrow Moor	Michael Grant	BARROW	-1.711	50.921	Bog	Grant, M.J. 2005. The Palaeoecology of Human Impact in the New Forest. Unpublished PhD Thesis, University of Southampton
Black Loch	Kevin Edwards	BL2	-3.196	56.32	Lake	Whittington, G., Edwards, K.J., Cundill, P.R., 1991. Late- and post-glacial vegetational change at Black Loch, Fife, eastern Scotland e a multiple core approach. New Phytologist 118, 147-166
Bonfield Gill Head	James Innes	BGHLEVER	-1.081	54.354	Bog	Innes, J.B., Blackford, J.J. and Rowley-Conwy, P.A. 2013. Late Mesolithic and early Neolithic forest disturbance, a high resolution palaeoecological test of human impact hypotheses. Quaternary Science Reviews 77, 80-100
Braeroddach Loch	Kevin Edwards	BRAER	-2.856	57.09	Lake	Edwards, K.J., 1978. Palaeoenvironmental and Archaeological Investigations in the Howe of Cromar, Grampian Region, Scotland. University of Aberdeen, UK. Ph.D. thesis.
Brede Bridge	EPD	BREDCOUN	-0.6	50.933	Bog	Waller, M.P., Alderton, A., Shennan, I.,1994. The Fenland Project, Number 9. Flandrian environmental change in Fenland. East Anglian Archaeology Monograph 70.
Brookland	Martyn Waller	BROOKLAN	0.835	50.996	Bog	Waller, M.P., Long, A.J., Long, D., Innes, J.B., 1999. Patterns and processes in the development of coastal mire vegetation, multi-site investigations from Walland Marsh, southeast England. Quaternary Science Reviews 18, 1419-1444.
Cess Dell	Kevin Edwards	CESS	-0.088	53.821	Bog	Tweddle, J.C. 2000. A high resolution palynological study of the Holocene vegetational development of central Holderness, eastern Yorkshire, with particular emphasis on the detection of prehistoric human activity. Unpublished PhD Thesis, University of Sheffield
Chapel Bank	Martyn Waller	CHAPEL	0.752	51.041	Bog	Long, A., Waller, M., Hughes, P., Spencer, C., 1998a. The Holocene depositional history of Romney Marsh proper. In, Eddison, J., Gardiner, M.,

						Long, A. Eds., Romney Marsh, Environmental Change and Human Occupation in a Coastal Lowland. OUCA Monograph, vol. 46, pp. 45-63.
Church Moor	Michael Grant	CHURCH	-1.649	50.861	Bog	Grant, M.J. 2005. The Palaeoecology of Human Impact in the New Forest. Unpublished PhD Thesis, University of Southampton
Clickimin	Kevin Edwards	CLICK	-1.166	60.149	Bog	Edwards, K.J., Whittington, G., Robinson, M. and Richter, D. 2005. Palaeoenvironments, the archaeological record and cereal pollen detection at Clickimin, Shetland, Scotland. Journal of Archaeological Science 32, 1741-1756
Coire Bog	EPD	COIREBOG	-4.417	57.85	Bog	Birks, H.H., 1975. Studies in the vegetational history of Scotland. IV. Pine stumps in Scottish blanket peats. Philosophical Transactions of the Royal Society Series B 270, 181-226.
Cranes Moor	Michael Grant	CRANES	-1.731	50.817	Bog	Grant, M.J. 2005. The Palaeoecology of Human Impact in the New Forest. Unpublished PhD Thesis, University of Southampton
Dallican Water	EPD	DALLICAN	-1.1	60.392	Lake	Bennett, K.D., Boreham, S., Sharp, M.J. and Switsur, V.R. 1992. Holocene history of environment, vegetation and human settlement on Catta Ness, Lunnasting, Shetland. Journal of Ecology 80 2., 241-273.
Dubh-Lochan	Cynthia Froyd	DUBH	-4.439	57.288	Lake	Froyd, C.A. 2006. Holocene fire in the Scottish Highlands, evidence from macroscopic charcoal records. The Holocene 16, 235-249
East Guldeford	Martyn Waller	EGULD	0.766	50.964	Bog	Waller, M.P., Schofield, J.E., 2007. Mid to late Holocene vegetation and landuse history in the Weald of southeast England, multiple pollen profiles from the Rye area. Vegetation History and Archaeobotany 16, 367-384.
Esgryn Bottom	Ralph Fyfe	ESGRYN	-4.942	51.876	Bog	Fyfe, R.M., 2007. The importance of local-scale openness within regions dominated by closed woodland. Journal of Quaternary Science 22, 571-578.
Fenton Cottage Lancashire.	Elizabeth Huckerby	FCP	-2.916	53.9	Bog	Wells, C.E., Huckerby, E., Hall, V., 1997. Mid- and late-Holocene vegetation history and tephra studies at Fenton Cottage, Lancashire, UK. Vegetation History and Archaeobotany 6, 153-166.
Frobost	Kevin Edwards	FROBOST1	-7.379	57.203	Lake	Mulder, Y., 1999. Aspects of Vegetation and Settlement History in the Outer Hebrides, Scotland. University of Sheffield, UK. Ph.D. thesis.
Gilderson Marr	Kevin Edwards	GM	-0.03	53.778	Bog	Tweddle, J.C. 2000. A high resolution palynological study of the Holocene vegetational development of central Holderness, eastern Yorkshire, with particular emphasis on the detection of prehistoric human activity. Unpublished PhD Thesis, University of Sheffield
Gourte Mires	Ralph Fyfe	GOURTEMI RES	-3.678	51.054	Bog	Fyfe, R.M., Brown, A.G., Rippon, S.J., 2003. Mid- to late-Holocene vegetation history of Greater Exmoor, UK, estimating the spatial extent of human-induced vegetation change. Vegetation History and Archaeobotany 12, 215-232.
Greatham Tioxide Pipeline 2003	James Innes	GTP03	-1.214	54.627	Bog	

Hartlepool Bay 4	James Innes	HB4	-1.198	54.678	Bog	Innes, J.B., Donaldson, M. and Tooley, M. 2005. Chapter 4, The palaeoenvironmental evidence. In Waughman, M. ed. Archaeology and Environment of Submerged Landscapes in Hartlepool Bay, England. Tees Archaeology Monograph Series No. 2, 78-142.
Hartlepool Bay 6	James Innes	HB6	-1.198	54.678	Bog	Innes, J.B., Donaldson, M. and Tooley, M. 2005. Chapter 4, The palaeoenvironmental evidence. In Waughman, M. ed. Archaeology and Environment of Submerged Landscapes in Hartlepool Bay, England. Tees Archaeology Monograph Series No. 2, 78-142.
Hockham Mere	EPD	HOCKHAM	0.833	52.5	Lake	Bennett, K.D., 1983. Devensian late-glacial and Flandrian vegetational history at Hockham Mere, Norfolk, England. New Phytologist 95, 489-504.
Horsemarsh Sewer	Martyn Waller	HMS	0.828	51.051	Bog	Waller, M.P., Long, A.J., Long, D., Innes, J.B., 1999. Patterns and processes in the development of coastal mire vegetation, multi-site investigations from Walland Marsh, southeast England. Quaternary Science Reviews 18, 1419-1444.
Keiths Peat	Kevin Edwards	KEITHSPE ATB	-3.326	58.883	Bog	Blackford, J.J., Edwards, K.J., Buckland, P.C., Dobney, K., 1996. Keith's peat Bank, Hoy, Mesolithic human impact. In, Hall, A.M. Ed., The Quaternary of Orkney, Field Guide. Quaternary Research Association, Cambridge, pp. 62-68.
Knowsley Park	James Innes	KNOWSEL Y	-2.822	53.458	Bog	Cowell, R.W., Innes, J.B., 1994. The Wetlands of Merseyside. Lancaster University Press, Lancaster.
Lea Farm	Martyn Waller	LEAFARM	0.717	50.967	Bog	Long, A.J., Waller, M.P., Plater, A.J., 2007. Dungeness and Romney Marsh, Barrier Dynamics and Marshland Evolution. Oxbow Books, Oxford.
Little Cheyne Court	Martyn Waller	LCC	0.832	50.962	Bog	Waller, M.P., Long, A.J., Long, D., Innes, J.B., 1999. Patterns and processes in the development of coastal mire vegetation, multi-site investigations from Walland Marsh, southeast England. Quaternary Science Reviews 18, 1419-1444.
Little Loch Roag	EPD	ROAG	-6.883	58.133	Lake	Birks, H.J.B. and Madsen, B.J. 1979. Flandrian vegetational history of Little Loch Roag, Isle of Lewis, Scotland. Journal of Ecology 673., 825-842.
Lobbs Bog	Ralph Fyfe	LOBBSBO G	-3.624	50.97	Bog	Fyfe, R.M., Brown, A.G., Rippon, S.J., 2004. Characterising the late prehistoric, "Romano-British" and medieval landscape, and dating the emergence of a regionally distinct agricultural system in South West Britain. Journal of Archaeological Science 31, 1699-1714.
Loch a'Bhogaidh	Kevin Edwards	LAB1	-6.421	55.732	Lake	Edwards, K.J., Berridge, J.M.A., 1994. The Late-Quaternary vegetational history of Loch a'Bhogaidh, Rinns of Islay S.S.S.I., Scotland. New Phytologist 128, 749-769.
Loch a'Chabhain	Kevin Edwards	CHABHAIN	-7.384	57.238	Lake	Mulder, Y., 1999. Aspects of Vegetation and Settlement History in the Outer Hebrides, Scotland. University of Sheffield, UK. Ph.D. thesis.

Loch Airigh na h-Achlais	Kevin Edwards	LAA4	-7.305	57.327	Lake	Mulder, Y., 1999. Aspects of Vegetation and Settlement History in the Outer Hebrides, Scotland. University of Sheffield, UK. Ph.D. thesis.
Loch airigh na h-Aon Oidhche	Kevin Edwards	LAS	-7.308	57.209	Lake	Edwards, K.J., Whittington, G., Hirons, K.R., 1995. The relationship between fire and long-term wet heath development in South Uist, Outer Hebrides, Scotland. In, Thompson, D.B.A., Hestor, A.J., Usher, M.B. Eds., Heaths and Moorlands, Cultural Landscapes. HMSO, Edinburgh, pp. 240-248.
Loch an Amair	Cynthia Froyd	AMAIR	-4.882	57.292	Lake	Froyd, C.A. 2006. Holocene fire in the Scottish Highlands, evidence from macroscopic charcoal records. The Holocene 16, 235-249
Loch Ashik	EPD	ASHIK	-5.833	57.25	Lake	Birks, H.J.B., and W. Williams. 1983. Late-Quaternary vegetational history of the Inner Hebrides. Proceedings of the Royal society of Edinburgh, 83B, 269-292.
Loch Bharabhat	Kevin Edwards	BHARABHAT	-6.942	58.21	Lake	Lomax, T.M., 1997. Holocene Vegetation History and Human Impact in Western Lewis, Scotland. University of Birmingham, UK. Ph.D. thesis.
Loch Cleat	EPD	CLEAT	-6.333	57.067	Lake	Birks, H.J.B., and W. Williams. 1983. Late-Quaternary vegetational history of the Inner Hebrides. Proceedings of the Royal society of Edinburgh, 83B, 269-292.
Loch Davan	Kevin Edwards	DAVAN	-2.925	57.092	Lake	Edwards, K.J., 1978. Palaeoenvironmental and Archaeological Investigations in the Howe of Cromar, Grampian Region, Scotland. University of Aberdeen, UK. Ph.D. thesis.
Loch Doon IV	Kevin Edwards	Doon4	-4.386	55.207	Lake	Newell, P.J. 1990. Aspects of the Flandrian vegetational history of south-west Scotland, with special reference to possible Mesolithic impact. Unpublished PhD Thesis, University of Birmingham.
Loch Lomond Ross Dubh	EPD	LLDR1	-4.583	56.086	Lake	Dickson, J.H., Stewart, D.A., Thompson, R., Turner, G., Baxter, M.S., Drndarsky, N.D., Rose, J., 1978. Palynology, palaeomagnetism and radiometric dating of Flandrian marine and freshwater sediments of Loch Lomond. Nature 274, 538-553.
Loch Maree	EPD	MAREE	-5.483	57.083	Lake	Birks, H.H., 1972. Studies in the vegetational history of Scotland III. A radiocarbon dated pollen diagram from Loch Maree, Ross and Cromarty. New Phytologist 71, 731-754.
Loch na Beinne Bige	Kevin Edwards	BB	-6.73	58.218	Lake	Lomax, T.M., 1997. Holocene Vegetation History and Human Impact in Western Lewis, Scotland. University of Birmingham, UK. Ph.D. thesis.
Loch Olabhat	Kevin Edwards	OLABHAT	-7.455	57.65	Lake	Mulder, Y., 1999. Aspects of Vegetation and Settlement History in the Outer Hebrides, Scotland. University of Sheffield, UK. Ph.D. thesis.
Loch Sionascaig	EPD	SIONASCA	-5.175	58.061	Lake	Pennington, W., E.Y. Haworth, A.P. Bonny, and J.P. Lishman. 1972. Lake sediments in northern Scotland. Philosophical Transactions of the Royal Society of London, Series B 264, 191-294.
Lochan na h-Inghinn	Cynthia Froyd	INGINN	-5.088	58.252	Lake	Froyd, C.A. 2006. Holocene fire in the Scottish Highlands, evidence from macroscopic charcoal records. The Holocene 16, 235-249

Long Breach	Ralph Fyfe	LONGBRE ACH	-3.687	51.066	Bog	Fyfe, R.M., Brown, A.G., Rippon, S.J., 2003. Mid- to late-Holocene vegetation history of Greater Exmoor, UK, estimating the spatial extent of human-induced vegetation change. Vegetation History and Archaeobotany 12, 215-232.
Midgeholme Moss	James Innes	MIDGE	-2.625	54.991	Bog	Wiltshire, P.E.J. 1997. The pre-Roman environment. In Wilmott, T, ed. Birdoswald excavations of a Roman fort on Hadrian's Wall and its successor settlements 1987–92. English Heritage Archaeological Report 14, 25-40
Newby Wiske	James Innes	NEWBY	-1.434	54.272	Bog	Bridgland, D., Innes, J., Long, A. and Mitchell, W. 2009. Late Quaternary Landscape Evolution of the Swale-Ure Washlands, North Yorkshire. Oxford, Oxbow.
North Locheynort	Kevin Edwards	LOCHEYN ORT	-7.341	57.243	Lake	Edwards, K.J., 1996. A Mesolithic of the Western and Northern Isles of Scotland? Evidence from pollen and charcoal. In, Pollard, T., Morrison, A. Eds., The Early Prehistory of Scotland. Edinburgh University Press, Edinburgh, pp. 23-38.
North Twitchen Springs	Ralph Fyfe	NTWITCHE N	-3.822	51.12	Bog	
Pannel Bridge	EPD	PANBRI	0.683	50.9	Bog	Waller, M.P., 1993. Flandrian vegetational history of south-eastern England. Pollen data from Panel Bridge, East Sussex. New Phytologist 124, 345-369.
Pannel Farm	Martyn Waller	PANNELF	0.677	50.905	Bog	Waller, M.P., Schofield, J.E., 2007. Mid to late Holocene vegetation and landuse history in the Weald of southeast England, multiple pollen profiles from the Rye area. Vegetation History and Archaeobotany 16, 367-384.
Park Road Meols	James Innes	PARKMEO L	-3.147	53.403	Bog	Cowell, R.W., Innes, J.B., 1994. The Wetlands of Merseyside. Lancaster University Press, Lancaster.
Parr Moss	James Innes	PARRMOS S	-2.681	53.439	Bog	Cowell, R.W., Innes, J.B., 1994. The Wetlands of Merseyside. Lancaster University Press, Lancaster.
Peasmarsh	Martyn Waller	PEASE	0.692	50.981	Bog	Waller, M.P., Schofield, J.E., 2007. Mid to late Holocene vegetation and landuse history in the Weald of southeast England, multiple pollen profiles from the Rye area. Vegetation History and Archaeobotany 16, 367-384.
Pickletillem	Kevin Edwards	PICKLE	-2.887	56.4	Bog	Whittington, G., Edwards, K.J., Cundill, P.R., 1991. Late- and post-glacial vegetational change at Black Loch, Fife, eastern Scotland e a multiple core approach. New Phytologist 118, 147-166
Rae Loch	Kevin Edwards	RAE2	-3.37	56.584	Lake	Edwards, K.J., Whittington, G., 1997. A 12,000-year record of environmental change in the Lomond Hills, Fife, Scotland, vegetational and climatic variability. Vegetation History and Archaeobotany 6, 133-152.
Red moss of Candyglirach	Kevin Edwards	REDMOSS	-2.422	57.103	Bog	Clark, S.H.E. and Edwards, K.J. 2004. Elm bark beetle in Holocene peat deposits and the northwest European elm decline. Journal of Quaternary Science 19, 525-528.

Reidh-lochan	Cynthia Froyd	REIDH	-4.132	58.035	Lake	Froyd, C.A. 2006. Holocene fire in the Scottish Highlands, evidence from macroscopic charcoal records. The Holocene 16, 235-249
Reineval	Kevin Edwards	REINEVAL	-7.366	57.233	Lake	Edwards, K.J., 1996. A Mesolithic of the Western and Northern Isles of Scotland? Evidence from pollen and charcoal. In, Pollard, T., Morrison, A. Eds., The Early Prehistory of Scotland. Edinburgh University Press, Edinburgh, pp. 23-38.
Romney Marsh 18	Martyn Waller	ROMNEY1 8	0.924	51.058	Bog	Long, A., Waller, M., Hughes, P., Spencer, C., 1998a. The Holocene depositional history of Romney Marsh proper. In, Eddison, J., Gardiner, M., Long, A. Eds., Romney Marsh, Environmental Change and Human Occupation in a Coastal Lowland. OUCA Monograph, vol. 46, pp. 45-63.
Romney Marsh 7	Martyn Waller	ROMNEY7	0.925	51.068	Bog	Long, A., Waller, M., Hughes, P., Spencer, C., 1998a. The Holocene depositional history of Romney Marsh proper. In, Eddison, J., Gardiner, M., Long, A. Eds., Romney Marsh, Environmental Change and Human Occupation in a Coastal Lowland. OUCA Monograph, vol. 46, pp. 45-63.
Seavy Slack	James Innes	SEAVY	-0.617	54.3	Bog	
Sharow mires	James Innes	SHAROW	-1.643	54.138	Bog	Bridgland, D., Innes, J., Long, A. and Mitchell, W. 2009. Late Quaternary Landscape Evolution of the Swale-Ure Washlands, North Yorkshire. Oxford, Oxbow.
Simonswood Moss B	James Innes	SIMONS	-2.837	53.49	Bog	Cowell, R.W., Innes, J.B., 1994. The Wetlands of Merseyside. Lancaster University Press, Lancaster.
Solway Moss Cumbria.	Elizabeth Huckerby	SOLWAY	-3.025	55.009	Bog	Huckerby, E. and Wells, C. 1993. Recent work at Solway Moss, Cumbria. In Middleton, R. ed. North West Wetlands Survey annual report 1990. Lancaster, 36-42
St Fergus Moss	Kevin Edwards	STFERGUS	-1.913	57.569	Bog	Clark, S.H.E. and Edwards, K.J. 2004. Elm bark beetle in Holocene peat deposits and the northwest European elm decline. Journal of Quaternary Science 19, 525-528.
Stonetor Brook	Ralph Fyfe	SBE3	-3.91	50.656	Bog	Fyfe, R.M., Brück, J., Johnston, R., Lewis, H., Roland, T., Wickstead, H., 2008. Historical context and chronology of Bronze Age enclosure on Dartmoor, UK. Journal of Archaeological Science 35, 2250-2261.
Stoup Beck	James Innes	STOUPE	-0.527	54.4	Bog	
The Dowels	Martyn Waller	DOWELLS	0.828	51.044	Bog	Waller, M.P., Long, A.J., Long, D., Innes, J.B., 1999. Patterns and processes in the development of coastal mire vegetation, multi-site investigations from Walland Marsh, southeast England. Quaternary Science Reviews 18, 1419-1444.
The Slake, Hartlepool	James Innes	SLAKE	-1.198	54.7	Bog	Innes, J.B., Donaldson, M. and Tooley, M. 2005. Chapter 4, The palaeoenvironmental evidence. In Waughman, M. ed. Archaeology and

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Troni Shun	Kevin Edwards	TRONI	-1.533	60.233	Bog	
West Lomond	Kevin Edwards	WESTLOM	-3.287	56.246	Lake	Edwards, K.J., Whittington, G., 1997. A 12,000-year record of environmental change in the Lomond Hills, Fife, Scotland, vegetational and climatic variability. Vegetation History and Archaeobotany 6, 133-152.
Wet Sleddale	James Innes	WSLEDNE W	-2.684	54.51	Bog	Chin, S.J. and Innes, J.B. 1995. Appendix 3, Pollen analysis from Wet Sleddale, 19-22. In Cherry, J. and Cherry, P.J. Prehistoric habitation sites of the Cumbrian limestone uplands, occupation sites found between 1986 and 1993. Transactions of the Cumberland and Westmorland Antiquity and Archaeological Society 55, 1-22
Willingham Mere	EPD	WILLINGH AM	-0.051	52.333	Lake	Waller, M.P. 1994. Paludification and pollen representation, the influence of wetland size on Tilia representation in pollen diagrams. The Holocene, 4, 430-434.
Windmill Rough	Ralph Fyfe	WINDMILL	-3.633	50.975	Bog	Fyfe, R.M., A.G. Brown, and S.J. Rippon. 2004. Characterising the late prehistoric, "Romano-British" and medieval landscape, and dating the emergence of a regionally distinct agricultural system in South West Britain. Journal of Archaeological Science, 31
Winmarleigh Moss Lancashire.	Elizabeth Huckerby	WINP	-2.286	54.159	Bog	Wells, C.E., Huckerby, E., Hall, V., 1997. Mid- and late-Holocene vegetation history and tephra studies at Fenton Cottage, Lancashire, UK. Vegetation History and Archaeobotany 6, 153-166.
Borve Bog	Kevin Edwards	BORVE	-7.472	56.979366	Bog	Ashmore, P., Brayshay, B.A., Edwards, K.J., Gilbertson, D.D., Grattan, J.P., Kent, M., Pratt, K.E. and Weaver, R.E. 2000. Allochthonous and autochthonous mire deposits, slope instability and palaeoenvironmental investigations in the Borve Valley, Barra, Outer Hebrides, Scotland. The Holocene 10, 97-108.
Camban	Althea Davies	CAMBAN	-5.224088	57.213092	Bog	Davies, A.L. 2000 Fine Spatial Resolution Holocene Vegetation and Land-Use History in West Glen Affric and Kintail, Northern Scotland. Unpublished PhD thesis, University of Stirling; Davies, A.L., Tipping, R., 2004. Sensing small-scale human activity in the palaeoecological record, fine spatial resolution pollen analyses from Glen Affric, northern Scotland. The Holocene 14, 233-245.
Carnach Mor	Althea Davies	CARNACH	-5.154846	57.236424	Bog	Davies, A.L. and Tipping, R. 2004. Sensing small-scale human activity in the palaeoecological record, fine spatial resolution pollen analyses from Glen Affric, northern Scotland. The Holocene 14, 233-245.
Farlary	Althea Davies	FARLARY	-4.075198	58.016328	Bog	Tipping, R., 2008. Blanket peat in the Scottish highlands, timing, cause, spread and the myth of environmental determinism. Biodiversity and

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Morvich	Althea Davies	MORVICH	-5.373394	57.233437	Bog	Davies, A.L. 2000 Fine Spatial Resolution Holocene Vegetation and Land-Use History in West Glen Affric and Kintail, Northern Scotland. Unpublished PhD thesis, University of Stirling; Davies, A. (2003) Morvich and Strath Croe: lowland vegetation change and land-use history. In Tipping, R.M. (ed.) The Quaternary of Glen Affric and Kintail. London: Quaternary Research Association, 141-147.
Torran Beithe	Althea Davies	TORRANB	-5.100559	57.241372	Bog	Tipping R, Davies A and Tisdall E. (2006) Long-term woodland dynamics in West Glen Affric, northern Scotland. Forestry 79: 351-359; Davies, A.L., Tipping, R., 2004. Sensing small-scale human activity in the palaeoecological record, fine spatial resolution pollen analyses from Glen Affric, northern Scotland. The Holocene 14, 233-245.
157 Tower Bridge	Rob Batchelor		-0.079208419	51.49943731	Coastal lowland/ floodplain	Batchelor, C.R., Allott, L., Alison, E., Black, S. & Young, D.S. 2010. 157 TOWER BRIDGE ROAD, LONDON BOROUGH OF SOUTHWARK, ENVIRONMENTAL ARCHAEOLOGICAL ANALYSIS. Quaternary Scientific QUEST. Unpublished Report May 2010; Project Number 019x09
161IldertonRoad	Rob Batchelor		-0.054159363	51.48677639	Coastal lowland/ floodplain	Young, D.S. & Batchelor, C.R. 2018. 161 ILDERTON ROAD, LONDON BOROUGH OF SOUTHWARK Environmental Archaeological Assessment Report. Quaternary Scientific QUEST. Unpublished Report November 2017; Project Number 031x17.
20HornLane	Rob Batchelor		0.019159294	51.48977233	Coastal lowland/ floodplain	Young, D.S. & Batchelor, C.R. 2017. 20 HORN LANE, ROYAL BOROUGH OF GREENWICH Environmental Archaeological Assessment Report. Quaternary Scientific QUEST. Unpublished Report September 2017; Project Number 213x16.
2-12HighStreet	Rob Batchelor		-0.01353765	51.53024023	Coastal lowland/ floodplain	Batchelor, C.R & Young, D.S. 2014. 2-12 HIGH STREET, STRATFORD, LONDON BOROUGH OF NEWHAM NGR, TQ 37889 83129., ENVIRONMENTAL ARCHAEOLOGICAL ASSESSMENT REPORT
50LombardRoad	Rob Batchelor		0.036611736	51.49350824	Coastal lowland/ floodplain	Young, D.S., Batchelor, C. R. & Austin, P. J. 2012. 50 Lombard Wall, Charlton, London Borough of Greenwhich SE7 7SQ Site Code, LBW11., Environmental Archaeological Assessment Report. Quaternary Scientific QUEST. Unpublished Report; Project Number 157x11.
65SouthwarkStreet	Rob Batchelor	SOUTHWA RK	-0.098715264	51.48561885	Coastal lowland/ floodplain	Batchelor, C.R., Young, D.S., Cameron, N., Green, C.P. & Allott, L. 2011. 65 SOUTHWARK STREET, LONDON BOROUGH OF SOUTHWARK SITE CODE, SOU11., GEOARCHAEOLOGICAL ANALYSIS REPORT.

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75BerwickRoadQBH2	Rob Batchelor	BERWICK	0.031890524	51.51173747	Coastal lowland/ floodplain	Batchelor, C. R., Young, D.S. & Allott, L. 2015. 75 BERWICK ROAD, CANNING TOWN, LONDON BOROUGH OF NEWHAM Environmental Archaeological Analysis Report. Quaternary Scientific QUEST. Unpublished Interim Report October 2015; Project Number 134x15
79-85MonierRoad	Rob Batchelor		-0.023639145	51.53968225	Coastal lowland/ floodplain	Batchelor, C.R., Green, C.P., Young, D.S. & Hill, T. 2016. 79-85 MONIER ROAD, LONDON BOROUGH OF TOWER HAMLETS Geoarchaeological Assessment Report. Quaternary Scientific QUEST. Unpublished Report June 2016; Project Number 032x16
9-13NewRoadSamples5152	Rob Batchelor	NEWROAD	0.164600176	51.52671029	Coastal lowland/ floodplain	Young, D.S. & Marini, N. A 2014. 9-13 NEW ROAD, RAINHAM, LONDON BOROUGH OF HAVERING SITE CODE, NRO13., ENVIRONMENTAL ARCHAEOLOGICAL ASSESSMENT REPORT. Quaternary Scientific QUEST. Unpublished Report June 2014; Project Number 001x14
AbbeyWoodSchoolBH5	Rob Batchelor	ABBEYWOOD	0.105982955	51.49237276	Coastal lowland/ floodplain	Batchelor, C.R., Elias, S., Young, D., Branch, N.P., Green, C.P. & Swindle, G.E. 2008. ST PAUL’S ACADEMY, ABBEY WOOD SCHOOL, EYNSHAM DRIVE, ABBEY WOOD, LONDON BOROUGH OF GREENWICH site code, AWS05., ENVIRONMENTAL ARCHAEOLOGICAL ANALYSIS. ArchaeoScapeTM Unpublished Report 2008.
AbbeyWoodSchoolSample3	Rob Batchelor	ABBEYWOOD3	0.105982955	51.49237276	Coastal lowland/ floodplain	Batchelor, C.R., Elias, S., Young, D., Branch, N.P., Green, C.P. & Swindle, G.E. 2008. ST PAUL’S ACADEMY, ABBEY WOOD SCHOOL, EYNSHAM DRIVE, ABBEY WOOD, LONDON BOROUGH OF GREENWICH site code, AWS05., ENVIRONMENTAL ARCHAEOLOGICAL ANALYSIS. ArchaeoScapeTM Unpublished Report 2008.
AlcatelTelegraphWorks	Rob Batchelor		0.005716804	51.49003901	Coastal lowland/ floodplain	Batchelor, C.R., Young, D. S., & Hill, T. 2017. Alcatel-Lucent Telegraph Works, London Borough of Greenwich. Geoarchaeological & Palaeoenvironmental Analysis Report. Quaternary Scientific QUEST. Unpublished Report April 2017; Project Number 095x14
AlchemyPark	Rob Batchelor		0.15964279	51.49993995	Coastal lowland/ floodplain	Batchelor, C.R., Morandi, L., Young, D.S., Green, C.P. & Hill, T. 2018. ALCHEMY PARK, CRABTREE MANORWAY NORTH,LONDON BOROUGH OF BEXLEY Geoarchaeological & Palaeoenvironmental Analysis Report. Quaternary Scientific QUEST. Unpublished Report April 2018; Project Number 201x15 .

AlchemyParkBH1	Rob Batchelor	ALCHEMY	0.15964279	51.49993995	Coastal lowland/ floodplain	Batchelor, C.R., Morandi, L., Young, D.S., Green, C.P. & Hill, T. 2018. ALCHEMY PARK, CRABTREE MANORWAY NORTH,LONDON BOROUGH OF BEXLEY Geoarchaeological & Palaeoenvironmental Analysis Report. Quaternary Scientific QUEST. Unpublished Report April 2018; Project Number 201x15.
AveleyMarshes North	Rob Batchelor	AVELEY	0.222632852	51.49156848	Coastal lowland/ floodplain	Batchelor, C.R. 2007. Middle Holocene environmental changes and the history of yew Taxus baccata L. woodland in the Lower Thames Valley. PHD Thesis.
AveleyMarshes South	Rob Batchelor	AVELEYS	0.219623379	51.4889276	Coastal lowland/ floodplain	Batchelor, C.R. 2007. Middle Holocene environmental changes and the history of yew Taxus baccata L. woodland in the Lower Thames Valley. PHD Thesis.
BarkingRiversidePollenFB1	Rob Batchelor	BARKING1	0.12465557	51.52216191	Coastal lowland/ floodplain	Batchelor, C. R., Green, C.P., Young, D.S., Brown, A., Austin, P., Cameron, N. & Elias, S. 2010. A Report on the Geoarchaeological Borehole Invesitgations and Environmental Archaeological Analysis on Land at Barking Riverside. Quaternary Scientific QUEST. Unpublished Report December 2010; Project Number 002x10.
BarkingRiversidePollenFB4	Rob Batchelor	BARKING4	0.12465557	51.52216191	Coastal lowland/ floodplain	Batchelor, C. R., Green, C.P., Young, D.S., Brown, A., Austin, P., Cameron, N. & Elias, S. 2010. A Report on the Geoarchaeological Borehole Invesitgations and Environmental Archaeological Analysis on Land at Barking Riverside. Quaternary Scientific QUEST. Unpublished Report December 2010; Project Number 002x10.
BarkingRiversidePollenH4	Rob Batchelor	BARKINGH4	0.12465557	51.52216191	Coastal lowland/ floodplain	Batchelor, C. R., Green, C.P., Young, D.S., Brown, A., Austin, P., Cameron, N. & Elias, S. 2010. A Report on the Geoarchaeological Borehole Invesitgations and Environmental Archaeological Analysis on Land at Barking Riverside. Quaternary Scientific QUEST. Unpublished Report December 2010; Project Number 002x10.
BarkingRiversidePollenRG10	Rob Batchelor	BARKING10	0.12465557	51.52216191	Coastal lowland/ floodplain	Batchelor, C. R., Green, C.P., Young, D.S., Brown, A., Austin, P., Cameron, N. & Elias, S. 2010. A Report on the Geoarchaeological Borehole Invesitgations and Environmental Archaeological Analysis on Land at Barking Riverside. Quaternary Scientific QUEST. Unpublished Report December 2010; Project Number 002x10.
BeamPark	Rob Batchelor		0.158288396	51.52585538	Coastal lowland/ floodplain	Young, D.S., Batchelor, C, R. & Allison, E. 2018. BEAM PARK RIVERSIDE PHASE 1 DEVELOPMENT INCLUDING SURCHARGING., LONDON BOROUGHS OF HAVERING AND BARKING & DAGENHAM. Environmental Archaeological Assessment Report. Quaternary Scientific QUEST. Unpublished Report May 2018; Project Number 216x16.

BeamPark	Rob Batchelor		0.158288396	51.52585538	Coastal lowland/ floodplain	
BeamPark	Rob Batchelor		0.158288396	51.52585538	Coastal lowland/ floodplain	
BearHouseBJH10	Rob Batchelor	BEARH	-0.101765084	51.50582062	Coastal lowland/ floodplain	Batchelor, C. R., Young, D.S., Green, C.P., Cameron, N., Allott, L., Asutin, P. & Elias, S. 2011. Bear House & Bear Lane, London Borough of Southwark, SE1 Site Codes, BJH10 & BLZ07., Environmental Archaeological Analysis Report.
BearLaneBLZ07	Rob Batchelor	BEARL	-0.101763174	51.50517312	Coastal lowland/ floodplain	Batchelor, C. R., Young, D.S., Green, C.P., Cameron, N., Allott, L., Asutin, P. & Elias, S. 2011. Bear House & Bear Lane, London Borough of Southwark, SE1 Site Codes, BJH10 & BLZ07., Environmental Archaeological Analysis Report.
BurnleyRoad BH102	Rob Batchelor	BURN	0.273193582	51.46541847	Coastal lowland/ floodplain	Batchelor, C.R., Young, D.S. & Hill, T. 2017. BURNLEY ROAD, WEST THURROCK, ESSEX Geoarchaeological Fieldwork & Assessment Report. Quaternary Scientific QUEST. Unpublished Report April 2017; Project Number 194x16 .
ButterHill	Nick Branch		-0.158909688	51.37138415	Coastal lowland/ floodplain	Branch, N.P. 2003. Environmental Archaeological Analysis at the Former Vinamul Site, Butter Hill, London Borough of Sutton BTG01. ArchaeoScape Unpublished Report 2003.
CanadaWater	Rob Batchelor		-0.050420972	51.49978959	Coastal lowland/ floodplain	Batchelor, C. R., Young, D. Y., Green, C.P., Allott, L., Cameron, N., Elias, S. & Brown, A. 2011. LAND AT SITE A1 TO SITE A4, CANADA WATER, SURREY QUAYS ROAD, ROTHERHITHE, LONDON SE16 SITE CODE, CQH10., ENVIRONMENTAL ARCHAEOLOGICAL ANALYSIS. Quaternary Scientific QUEST. Unpublished Report June 2011; Project Number 007x10
CanadaWater QBH10	Rob Batchelor	CANADA	-0.050420972	51.49978959	Coastal lowland/ floodplain	
CaxtonWorks	Rob Batchelor		0.012662942	51.51103486	Coastal lowland/ floodplain	Young, D.S. & Batchelor, C.R. 2014. CAXTON WORKS, THE MOSS BUILDINGS AND GOSWELL BAKERIES, CAXTON STREET NORTH, CANNING TOWN SITE CODE, CSN14., ENVIRONMENTAL ARCHAEOLOGICAL ASSESSMENT REPORT. Quaternary Scientific QUEST. Unpublished Report October 2014; Project Number 034x14.
CollingtreePark BH2	Nick Branch	COLLING	0.100391832	51.50236515	Coastal lowland/ floodplain	

CrossnessSewageWorks	Rob Batchelor	CROSSNESS	0.142536143	51.50385091	Coastal lowland/ floodplain	Batchelor, C.R., Branch, N. P., Elias, S., Green, C.P., Swindle, G.E. & Wilkinson, K.N. 2007. CROSSNESS SEWAGE WORKS, CROSSNESS, LONDON BOROUGH OF BEXLEY, ENVIRONMENTAL ARCHAEOLOGICAL ANALYSIS SITE CODE, EAW06. ArchaeoScape Unpublished Report 2007
CrownWharfIronWorks	Nick Branch	CROWN	-0.02186325	51.53740417	Coastal lowland/ floodplain	Branch, N.P., Green, C.P., Keen, D., Riddiford, N., Silva, B., Swindle, G.E. & Vaughan-Williams, A. 2005. ENVIRONMENTAL ARCHAEOLOGICAL ANALYSIS AT CROWN WHARF IRONWORKS, LONDON BOROUGH OF TOWER HAMLETS Site Code, DAC03. ArchaeoScape Unpublished Report 2005.
DesignDistrict	Rob Batchelor		0.006517991	51.49975541	Coastal lowland/ floodplain	Young, D.S. & Batchelor. 2018. DESIGN DISTRICT PLOT 11., GREENWICH PENINSULA, ROYAL BOROUGH OF GREENWICH Environmental Archaeological Assessment Report. Quaternary Scientific QUEST. Unpublished Report January 2018; Project Number 109x17
DocklandsNewham	Rob Batchelor		0.043178407	51.50859174	Coastal lowland/ floodplain	Young, D. S & Batchelor, C. R. 2013. A REPORT ON THE ENVIRONMENTAL ARCHAEOLOGICAL ASSESSMENT AND DEPOSIT MODELLING ON LAND AT PLOT 2.3, ROYALS BUSINESS PARK, DOCKSIDE ROAD, LONDON BOROUGH OF NEWHAM NGR, TQ 4189 8083. Quaternary Scientific QUEST. Unpublished Report November 2013; Project Number 008x13
DrapersGardens	Rob Batchelor		-0.087206256	51.51591654	Coastal lowland/ floodplain	Batchelor, C.R., Allott, L., Elias, S., Cambell, G., Branch, N.P., Green, C.P., Marini, N., Austin, P., Giorgi, J. & Jones. L. 2011. DRAPERS GARDENS, 12 THROGMORTON AVENUE, CITY OF LONDON, ENVIRONMENTAL ARCHAEOLOGICAL ANALYSIS SITE CODE, DGT06. Quaternary Scientific QUEST. Unpublished Report October 2011; Project Number 037x08
EnderbyWharf QBH1	Rob Batchelor	ENDERBY	0.003944139	51.49034809	Coastal lowland/ floodplain	Batchelor, C. R. Young, D. S & Green, C.P. 2015. LAND AT ENDERBY WHARF, CHRISTCHURCH WAY, LONDON BOROUGH OF GREENWICH SE10 0AG NGR, TQ 3925 7873., ENVIRONMENTAL ARCHAEOLOGICAL ANALYSIS REPORT. Quaternary Scientific QUEST. Unpublished Report May 2015; Project Number 140x13
EwerStreet Section200	Rob Batchelor	EWER	-0.098398856	51.5043003	Coastal lowland/ floodplain	Batchelor, C. R & Young, D.S. 2013. EWER STREET, LONDON BOROUGH OF SOUTHWARK, LONDON SE1 SITE CODE, EWE10., GEOARCHAEOLOGICAL ANALYSIS REPORT. Quaternary Scientific QUEST. Unpublished Report November 2013; Project Number 022x13
FerryLane	Rob Batchelor	FERRY	-0.043787871	51.5876805	Coastal lowland/ floodplain	Batchelor, C.R. & Young, D.S. 2017. FERRY LANE INDUSTRIAL ESTATE FOREST LANE LONDON BOROUGH OF WALTHAM FOREST

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FormerFordFactory	Rob Batchelor		0.150218167	51.52898024	Coastal lowland/ floodplain	Young, D.S., Batchelor, C.R. & Hill, T. 2017. FORMER FORD STAMPING FACTORY, KENT AVENUE LONDON BOROUGH OF DAGENHAM Environmental Archaeological Assessment Report. Quaternary Scientific QUEST. Unpublished Report December 2017; Project Number 190x16.
FriaryPlace	Rob Batchelor		0.496584054	51.39585034	Coastal lowland/ floodplain	Batchelor, C. R. 2016. Friary Place Stood, Kent. Quaternary Scientific Quest. Unpublished Report August 2016; Project Number 126x12.
GallionsReach	Rob Batchelor	GALLION	-0.245575288	51.3811041	Coastal lowland/ floodplain	
GolfersDriving Range	Rob Batchelor	GOLFERS	0.060223303	51.51394998	Coastal lowland/ floodplain	Batchelor, C.R. 2007. Middle Holocene environmental changes and the history of yew Taxus baccata L. woodland in the Lower Thames Valley. PHD Thesis.
GoresbrookPark	Rob Batchelor		38.86455035	39.18890341	Coastal lowland/ floodplain	Young, D.S., Batchelor, C.R. & Hill, T. 2017. GORESBROOK PARK, LONDON BOROUGH OF BARKING AND DAGENHAM Environmental Archaeological Assessment Report. Quaternary Scientific QUEST. Unpublished Report December 2017; Project Number 195x16.
GoresbrookPark	Rob Batchelor		38.86455035	39.18890341	Coastal lowland/ floodplain	Young, D.S., Batchelor, C.R. & Hill, T. 2017. GORESBROOK PARK, LONDON BOROUGH OF BARKING AND DAGENHAM Environmental Archaeological Assessment Report. Quaternary Scientific QUEST. Unpublished Report December 2017; Project Number 195x16.
GreatSuffolkStreet	Rob Batchelor		-0.101608182	51.50266169	Coastal lowland/ floodplain	Batchelor, C. R., Green, C.P., Young, D.S. & Cameron, No. 2011. 70 GREAT SUFFOLK STREET, LONDON BOROUGH OF SOUTHWARK SITE CODE, GUF10., ENVIRONMENTAL ARCHAEOLOGICAL ANALYSIS REPORT. Quaternary Scientific QUEST. Unpublished Report March 2011; Project Number 152x10
Greenwich Peninsula	Rob Batchelor		0.006973092	51.50257133	Coastal lowland/ floodplain	Young, D.S. & Batchelor, C.R. 2015. GREENWICH PENINSULA CENTRAL EAST, PLOTS N0205, N0206 AND N0207 SITE CODE, CTT15., ENVIRONMENTAL ARCHAEOLOGICAL ASSESSMENT REPORT. Quaternary Scientific QUEST. Unpublished Report August 2015; Project Number 067x15.
HaleWharf	Rob Batchelor		-0.055081049	51.58892932	Coastal lowland/ floodplain	Batchelor, C.R. & Young, D.S. 2018. HALE WHARF, TOTTENHAM LONDON BOROUGH OF HARINGEY Geoarchaeological and Palaeoenvironmental Assessment Report. Quaternary Scientific QUEST. Unpublished Report February 2018; Project Number 030x17 .

HortonKirby	Rob Batchelor	HORTON	0.245426464	51.40305593	Coastal lowland/ floodplain	Batchelor, C.R., Branch, N.P., Allison, E., Elias, S., Denton, K. & Williams, K. 2008. LAND AT THE FORMER HORTON KIRBY PAPER MILL, SOUTH DARENTH, KENT SITE CODE, KHKY06., ENVIRONMENTAL ARCHAEOLOGICAL ANALYSIS. ArchaeoScape Unpublished Report 2008.
ImperialGateway	Rob Batchelor	IMPERIAL	0.144603284	51.50214945	Coastal lowland/ floodplain	Batchelor, C.R., Branch, N.P., Christie, R., Elias, S., Young, D., Austin, P., Williams, K. & Wilkinson, K. 2008. IMPERIAL GATEWAY, BELVEDERE, ENVIRONMENTAL ARCHAEOLOGICAL ASSESSMENT. Quaternary Scientific QUEST. Unpublished Report December 2008; Project Number 056x08
KemsleyFields	Rob Batchelor		0.749975896	51.37143186	Coastal lowland/ floodplain	Batchelor, C.R., Branch, N.P., French, P., Cameron, N., Williams, K., Tyler, J. & Morgan, P. 2008. GAZELEY SITE, LAND AT RIDHAM, KEMSLEY FIELDS, SITTINGBOURNE, KENT SITE CODE, KT-GZK06., ENVIRONMENTAL ARCHAEOLOGICAL ANALYSIS. ArchaeoScape Unpublished Report 2008.
KentWharf	Rob Batchelor	KENT	-0.019914868	51.47927874	Coastal lowland/ floodplain	Batchelor, C.R., Young, D.S. & Hill, T. 2017. KENT WHARF DEPTFORD LONDON BOROUGH OF LEWISHAM Environmental Archaeological Analysis Report. Quaternary Scientific QUEST. Unpublished Report September 2017; Project Number 004x14.
LintonFuels	Rob Batchelor		-0.195747403	51.46087588	Coastal lowland/ floodplain	Batchelor, C.R. 2018. LAND AT LINTON FUELS, OSIERS ROAD, LONDON BOROUGH OF WANDSWORTH Geoarchaeological And Palaeoenvironmental Assessment Report. Quaternary Scientific QUEST. Unpublished Report February 2018; Project Number 085x17.
LondonCableCar NTBH3	Rob Batchelor	CABLE3	0.016866981	51.50800404	Coastal lowland/ floodplain	Batchelor, C.R., young, D.S., Green, C.P., Austin, P., Cameron, N. & Elias, S. 2012. A REPORT ON THE ENVIRONMENTAL ARCHAEOLOGICAL ANALYSIS OF BOREHOLES COLLECTED FROM THE LONDON CABLE CAR ROUTE, LONDON BOROUGHS OF NEWHAM AND GREENWICH site code, CAB11. Quaternary Scientific QUEST. Unpublished Report January 2012; Project Number 140x10
LondonCableCar SSBH1C	Rob Batchelor	CABLE1	0.016866981	51.50800404	Coastal lowland/ floodplain	Batchelor, C.R., young, D.S., Green, C.P., Austin, P., Cameron, N. & Elias, S. 2012. A REPORT ON THE ENVIRONMENTAL ARCHAEOLOGICAL ANALYSIS OF BOREHOLES COLLECTED FROM THE LONDON CABLE CAR ROUTE, LONDON BOROUGHS OF NEWHAM AND GREENWICH site code, CAB11. Quaternary Scientific QUEST. Unpublished Report January 2012; Project Number 140x10
LondonCityAirport	Rob Batchelor		0.048868603	51.50372631	Coastal lowland/ floodplain	Young, D.S., Batchelor, C.R. & Williams, K. 2018. LONDON CITY AIRPORT, HARTMANN ROAD, LONDON E16

LondonDistribution Park	Rob Batchelor	DISTRIB	0.351858446	51.46867788	Coastal lowland/ floodplain	Batchelor, C.R., Young, D.S., Stastney, P. & Cameron, N. 2013. LONDON DISTRIBUTION PARK, SOUTH ESSEX NGR, TQ 6120 7750., GEOARCHAEOLOGICAL ANALYSIS REPORT. Quaternary Scientific QUEST. Unpublished Report October 2013; Project Number 051x09
LondonDistribution Park	Rob Batchelor		0.351858446	51.46867788	Coastal lowland/ floodplain	Batchelor, C.R., Young, D.S., Stastney, P. & Cameron, N. 2013. LONDON DISTRIBUTION PARK, SOUTH ESSEX NGR, TQ 6120 7750., GEOARCHAEOLOGICAL ANALYSIS REPORT. Quaternary Scientific QUEST. Unpublished Report October 2013; Project Number 051x09
LondonDistribution ParkQBH3A	Rob Batchelor	DISTRIB3	0.351858446	51.46867788	Coastal lowland/ floodplain	Batchelor, C.R., Young, D.S., Stastney, P. & Cameron, N. 2013. LONDON DISTRIBUTION PARK, SOUTH ESSEX NGR, TQ 6120 7750., GEOARCHAEOLOGICAL ANALYSIS REPORT. Quaternary Scientific QUEST. Unpublished Report October 2013; Project Number 051x09
LongReach Sewerage	Rob Batchelor		0.234558045	51.4676452	Coastal lowland/ floodplain	Batchelor, C. R. Cameron, N. & Austin, P. 2014. Long Reach Sewerage Treatment works, Dartford, Kent, Palaeoenvironmental Analysis Report. Quaternary Scientific QUEST. Unpublished Report July 2014; Project Number 002x12.
LongReachSewerageBH6	Rob Batchelor	LONG	0.234558045	51.4676452	Coastal lowland/ floodplain	
MeadLane	Nick Branch	MEAD	-0.484478923	51.38542671	Coastal lowland/ floodplain	Branch, N.P., Armitage, P., Swindle, G.E., Vaughan-Williams, A. & Williams, A.N. 2003. Environmental History of Mead Lane, Chertsey, Surrey. ArchaeoScape Unpublished Report 2003.
Merrielands	Rob Batchelor	MERRIE	0.14578041	51.5299608	Coastal lowland/ floodplain	Batchelor, C.R., Young, D.S., Hill, T. & Austin, P. year. MERRIELANDS CRESCENT LONDON BOROUGH OF BARKING AND DAGENHAM Palaeobotanical Assessment Report. Quaternary Scientific QUEST. Unpublished Report August 2017; Project Number 086x17.
NewWolfsonWing	Nick Branch		-0.090771367	51.50338503	Coastal lowland/ floodplain	Williams, A. & Branch, N. Environmental Archaeological Assessment, New Wolfson Wing, Kings College London, London Borough of Southwark, SE1. ArchaeoScape Unpublished Report.
NineElmsQBH2	Rob Batchelor	NINE	-0.128893025	51.48097851	Coastal lowland/ floodplain	Batchelor, C. R. Young, D.S & Hill, T. 2018. LAND AT WANDSWORTH ROAD & PASCAL STREET, LONDON BOROUGH OF LAMBETH Geoarchaeological and Palaeoenvironmental Analysis Report Quaternary Scientific QUEST. Unpublished Report May 2018; Project Number 055x13.
NormanRoad	Rob Batchelor	NORMAN6	0.153825725	51.50552361	Coastal lowland/ floodplain	Batchelor, C.R., Elias, S., Green, C.P., Branch, N.P., Austin, P., Young, D., Wilkinson, K., Morgan, P. & Williams, K. 2008. FORMER BORAX WORKS, NORMAN ROAD, BELVEDERE, LONDON BOROUGH OF BEXLEY, ENVIRONMENTAL ARCHAEOLOGICAL ANALYSIS Site Code, NNB07. ArchaeoScape Unpublished Report 2008.

NormanRoadTR1	Rob Batchelor	NORMAN1	0.153825725	51.50552361	Coastal lowland/ floodplain	Batchelor, C.R., Elias, S., Green, C.P., Branch, N.P., Austin, P., Young, D., Wilkinson, K., Morgan, P. & Williams, K. 2008. FORMER BORAX WORKS, NORMAN ROAD, BELVEDERE, LONDON BOROUGH OF BEXLEY, ENVIRONMENTAL ARCHAEOLOGICAL ANALYSIS Site Code, NNB07. ArchaeoScape Unpublished Report 2008.
NormanRoadTR4	Rob Batchelor	NORMAN4	0.153825725	51.50552361	Coastal lowland/ floodplain	Batchelor, C.R., Elias, S., Green, C.P., Branch, N.P., Austin, P., Young, D., Wilkinson, K., Morgan, P. & Williams, K. 2008. FORMER BORAX WORKS, NORMAN ROAD, BELVEDERE, LONDON BOROUGH OF BEXLEY, ENVIRONMENTAL ARCHAEOLOGICAL ANALYSIS Site Code, NNB07. ArchaeoScape Unpublished Report 2008.
NorthBexley	Nick Branch		0.153016392	51.4969143	Coastal lowland/ floodplain	Branch, N.P., Silva, B. & Swindle, G. E. 2004. An Environmental Archaeological Assessment, North Bexley Drainage Improvements, Belvedere, Kent EWY01. ArchaeoScape Unpublished Report 2004.
OldSeagers Distillery	Rob Batchelor	OLD	-0.023065078	51.47303701	Coastal lowland/ floodplain	Batchelor, C.R., Allison, E.A., Brown, A., Green, C.P. & Austin, P.A. 2009. OLD SEAGERS DISTILLERY, DEPTFORD BRIDGE, LONDON BOROUGH OF LEWISHAM, ENVIRONMENTAL ARCHAEOLOGICAL ASSESSMENT SITE CODE, DEG00. Quaternary Scientific QUEST. Unpublished Report May 2009; Project Number 074x08.
PassivhausHousing Development	Rob Batchelor		0.185147202	51.52105044	Coastal lowland/ floodplain	Batchelor, C. R. 2013. Passivhaus Housing Development, New Road, Rainahm, Pollen Assessment Report. Quaternary Scientific QUEST. Unpublished Report January 2013; Project Number 230x13.
PearlClose	Rob Batchelor	PEARL	0.060813155	51.5129684	Coastal lowland/ floodplain	Batchelor, C. R. 2013. PEARL CLOSE, BECKTON, LONDON BOROUGH OF NEWHAM SITE CODE, PRL14., POLLEN ASSESSMENT REPORT. Quaternary Scientific QUEST. Unpublished Report June 2013; Project Number 133x14
PierRoad	Rob Batchelor		0.553511022	51.39706946	Coastal lowland/ floodplain	Batchelor, C.R., Branch, N.P., Elias, S., Tate, J. & Williams, K. 2008. FORMER AKZO NOBEL CHEMICAL WORKS, PIER ROAD, GILLINGHAM, KENT NGR, TQ 77700 69400., ENVIRONMENTAL ARCHAEOLOGICAL ANALYSIS. ArchaeoScape Unpublished Report 2008.
PirelliWorks	Rob Batchelor		0.166070328	51.49480335	Coastal lowland/ floodplain	Young, D. S., Batchelor, C. R., Green, C. P. & Braithwaite. 2012. Pirelli Works, Church Manorway, Erith Site Code, PWR12., Environmental Archaeological Assessment Report. Quaternary Scientific QUEST. Unpublished Report September 2012; Project Number 053x12.
PirelliWorks	Rob Batchelor		0.166070328	51.49480335	Coastal lowland/ floodplain	Young, D. S., Batchelor, C. R., Green, C. P. & Braithwaite. 2012. Pirelli Works, Church Manorway, Erith Site Code, PWR12., Environmental Archaeological Assessment Report. Quaternary Scientific QUEST. Unpublished Report September 2012; Project Number 053x12.

PirelliWorks	Rob Batchelor		0.166070328	51.49480335	Coastal lowland/ floodplain	Young, D. S., Batchelor, C. R., Green, C. P. & Braithwaite. 2012. Pirelli Works, Church Manorway, Erith Site Code, PWR12., Environmental Archaeological Assessment Report. Quaternary Scientific QUEST. Unpublished Report September 2012; Project Number 053x12.
PowerwindProject, ErithQBH1	Rob Batchelor	POWER	0.194752656	51.4782715	Coastal lowland/ floodplain	Batchelor, C. R & Young, D.S. 2013. Powerwind Project, Manor Road, Erith, London Borough of Bexley Site Code, PWW12.; Environmental Archaeological Analysis Report. Quaternary Scientific QUEST. Unpublished Report April 2013; Project Number 120x12.
PrestonRoad	Rob Batchelor	PRESTON	-0.008553099	51.50867226	Coastal lowland/ floodplain	Branch, N.P., Batchelor, C.R., Elias, S., Green, C.P. & Swindle, G.E. 2007. PRESTON ROAD, POPLAR HIGH STREET, POPLAR, LONDON BOROUGH OF TOWER HAMLETS SITE CODE, PPP06., ENVIRONMENTAL ARCHAEOLOGICAL ANALYSIS. ArchaeoScape Unpublished Report 2007.
PrioryRoad	Rob Batchelor		0.21367432	51.4523486	Coastal lowland/ floodplain	Batchelor, C. R & Young, D.S. 2014. PRIORY ROAD, DARTFORD, KENT, ENVIRONMENTAL ARCHAEOLOGICAL ASESSMENT REPORT . Quaternary Scientific QUEST. Unpublished Report February 2015; Project Number 193x14
ProjectIndigo	Rob Batchelor		-0.000645711	51.51219774	Coastal lowland/ floodplain	Batchelor, C. R 2015. PROJECT INDIGO, POPLAR, LONDON BOROUGH OF TOWER HAMLETS, POLLEN ASSESSMENT REPORT. Quaternary Scientific QUEST. Unpublished Report May 2015; Project Number 195x14
RamBrewery Phase1.	Rob Batchelor		-0.193170315	51.45796758	Coastal lowland/ floodplain	Young, D.S & Batchelor, C.R. 2015. RAM BREWERY PHASE 1., RAM STREET, LONDON BOROUGH OF WANDSWORTH Environmental Archaeological Assessment Report. Quaternary Scientific QUEST. Unpublished Report October 2015; Project Number 098x14.
RathboneMarket	Rob Batchelor		0.010659134	51.51625801	Coastal lowland/ floodplain	Young, D.S., Batchelor, C. R. & Green, C. P. 2015. Rathbone Market Phases 1 to 3, Canning Town, London Borough of Newham Site code, RBO10., Environmental Archaeological Assessment Report. Quaternary Scientific QUEST. Unpublished Report July 2015; Project Number 165x12.
RawalpindiHouse	Rob Batchelor		0.01190855	51.51975272	Coastal lowland/ floodplain	Young, D. S & Batchelor, C. R. 2014. RAWALPINDI HOUSE, HERMIT ROAD, LONDON BOROUGH OF NEWHAM E16 4PZ SITE CODE, HER14., ENVIRONMENTAL ARCHAEOLOGICAL ASSESSMENT. Quaternary Scientific QUEST. Quaternary Scientific QUEST. Unpublished Report December 2016; Project Number 012x14Unpublished Report November 2014; Project Number 037x14
RawalpindiHouse TP5	Rob Batchelor	RAW	0.01190855	51.51975272	Coastal lowland/ floodplain	Young, D. S & Batchelor, C. R. 2014. RAWALPINDI HOUSE, HERMIT ROAD, LONDON BOROUGH OF NEWHAM E16 4PZ SITE CODE, HER14., ENVIRONMENTAL ARCHAEOLOGICAL ASSESSMENT. Quaternary Scientific QUEST. Quaternary Scientific QUEST. Unpublished

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RenwickQBH1	Rob Batchelor	REN1	0.115849988	51.52780671	Coastal lowland/ floodplain	Batchelor, C. R., Young, D.S & Green, C. P. 2012. Thames View Estate, Renwick Road, Barking, Essex Site Code, TVE12., Geoarchaeological Assessment Report. Quaternary Scientific QUEST. Unpublished Report July 2012; Project Number 069x12.
RenwickRoad	Rob Batchelor		0.115849988	51.52780671	Coastal lowland/ floodplain	
RenwickRoad QBH5	Rob Batchelor	REN5	0.115849988	51.52780671	Coastal lowland/ floodplain	
RomanWay	Rob Batchelor	ROMAN	0.177903314	51.45077047	Coastal lowland/ floodplain	Batchelor, C.R., Allison, E., Maslin, S. & Morandi, L. 2018. ROMAN WAY CRAYFORD LONDON BOROUGH OF BEXLEY Palaeoenvironmental analysis Report. Quaternary Scientific QUEST. Unpublished Report January 2018; Project Number 064x16.
RoneoCorner	Rob Batchelor		0.184069893	51.56509961	Coastal lowland/ floodplain	Batchelor, C. R., Green, C. P., Young, D.S. & Austin, P. 2012. Roneo Corner, Romford Site Code, ROC12., Environmental Archaeological Assessment. Quaternary Scientific QUEST. Unpublished Report June 2012; Poject Number 104x12.
RoseHotel	Rob Batchelor		-0.095145192	51.50561437	Coastal lowland/ floodplain	Young, D.S., Batchelor, C. R., Green., C.P., Austin, P., & Elias, S. 2011. Southwark Rose Hotel, London Borough of Southwark Site Code, SDZ11., Geoarchaeological Assessment Report. Quaternary Scientific Quest. Unpublished Report September 2011; Project Number 078x11.
RotherhitheNew Road	Rob Batchelor		-0.063987528	51.48564413	Coastal lowland/ floodplain	Young, D.S & Batchelor, C. R. 2013. 387-399 ROTHERHITHE NEW ROAD, LONDON BOROUGH OF SOUTHWARK, LONDON SE1 SITE CODE, RON13., ENVIRONMENTAL ARCHAEOLOGICAL ASSESSMENT REPORT. Quaternary Scientific QUEST. Unpublished Report March 2013; Project Number 022x13
RoyalAlbertDock	Rob Batchelor		0.065308	51.50751166	Coastal lowland/ floodplain	Batchelor, C.R. 2007. Middle Holocene environmental changes and the history of yew Taxus baccata L. woodland in the Lower Thames Valley. PHD Thesis.
SouthPoint	Nick Branch	SOUTH	-0.103856083	51.50404694	Coastal lowland/ floodplain	Branch, N.P., Swindle, G.E. & Williams, A.N. 2002. Middle Holocene Environmental History of South Point, Blackfriars Road, Southwark, London. ArchaeoScape Unpublished Report 2002.
StHugh'sChurch	Rob Batchelor		-0.088946503	51.50119709	Coastal lowland/ floodplain	Batchelor, C. R., Young, D.S. & Austin, P. 2012. St Hugh's Church, 32 Crosby Row, London Borough of Southwark Site Code, SHC11.,

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StHugh'sChurchSection1	Rob Batchelor	STHUGH	-0.088946503	51.50119709	Coastal lowland/ floodplain	Batchelor, C. R., Young, D.S. & Austin, P. 2012. St Hugh's Church, 32 Crosby Row, London Borough of Southwark Site Code, SHC11., Environmental Archaeological Analysis Report. Quaternary Scientific QUEST. Unpublished Report July 2012; Project Number 145x11.
StroodRetailPark	Rob Batchelor		0.496454816	51.3958531	Coastal lowland/ floodplain	Batchelor, C.R. & Hill. T. 2017. STROOD RETAIL PARK COMMERCIAL ROAD, STROOD, ROCHESTER Palaeobotanical Analysis Report. Quaternary Scientific QUEST. Unpublished Report August 2017; Project Number 021x16.
StroodRetailPark	Rob Batchelor		0.496454816	51.3958531	Coastal lowland/ floodplain	Batchelor, C.R. & Hill. T. 2017. STROOD RETAIL PARK COMMERCIAL ROAD, STROOD, ROCHESTER Palaeobotanical Analysis Report. Quaternary Scientific QUEST. Unpublished Report August 2017; Project Number 021x16.
StroodRetailPark	Rob Batchelor		0.496454816	51.3958531	Coastal lowland/ floodplain	Batchelor, C.R. & Hill. T. 2017. STROOD RETAIL PARK COMMERCIAL ROAD, STROOD, ROCHESTER Palaeobotanical Analysis Report. Quaternary Scientific QUEST. Unpublished Report August 2017; Project Number 021x16.
SurreyHouse	Rob Batchelor	SURREY	-0.09824232	51.50494523	Coastal lowland/ floodplain	Batchelor, C.R., Green, C.P., Young, D.S., Walker, T. & Allott, L. 2012. Surrey House, 20 Lavington Street, London Borough of Southwark, SE1 0NZ Site Code, LVI11., Environmental Archaeological Analysis Report. Quaternary Scientific QUEST. Unpublished Report May 2012; Project Number 018x11.
TabardSquare	Naomi Riddiford	TABARD	-0.090646029	51.50052335	Coastal lowland/ floodplain	Riddiford, N.G. & Batchelor, C.R. 2012. TABARD SQUARE, 34-70 LONG LANE & 31-37 TABARD STREET, LONDON BOROUGH OF SOUTHWARK site code, LLS02., ENVIRONMENTAL AND VEGETATION HISTORY. Quaternary Scientific QUEST. Unpublished Report July 2012; Project Number 087x08
TarlingRoad	Rob Batchelor		0.013975254	51.51236124	Coastal lowland/ floodplain	Batchelor, C. R & Young, D. S. 2014. 105-107 Tarling Road, London Borough of Newham Site Code, TAR13., Geoarchaeological Assessment Report. Quaternary Scientific QUEST. Unpublished Report March 2014; Project Number 206x13.
Thameside	Rob Batchelor	THAMES	-0.172524834	51.48400468	Coastal lowland/ floodplain	Batchelor, C.R. 2017. HMP THAMESIDE EXPANSION, ROYAL BOROUGH OF GREENWICH Pollen Analysis Report. Quaternary Scientific QUEST. Unpublished Report July 2017; Project Number 086x15.
Thamesmead8J	Nick Branch		0.078817913	51.49690427	Coastal lowland/ floodplain	

TheAdelphi Building	Rob Batchelor		-0.122231773	51.50920756	Coastal lowland/ floodplain	Young, D.S., Green, C.P., Batchelor, C.R., Austin, P.J. & Elias, S.A. 2015. THE ADELPHI BUILDING, JOHN ADAM STREET, LONDON WC2 SITE CODE, JAD14., ENVIRONMENTAL ARCHAEOLOGICAL ASSESSMENT. Quaternary Scientific QUEST. Unpublished Report March 2015; Project Number 113x14.
TheNationalTheatre	Rob Batchelor		-0.114167863	51.50696493	Coastal lowland/ floodplain	Batchelor, C. R. & Young, D.S. 2014. THE NATIONAL THEATRE, SOUTH BANK, LONDON BOROUGH OF LAMBETH SITE CODE, NTH11., ENVIRONMENTAL ARCHAEOLOGICAL ASSESSMENT REPORT AND ADDENDUM. Quaternary Scientific QUEST. Unpublished Report February 2014; Project Number 132x11
ThePittsHeadPub	Rob Batchelor		0.017114499	51.5152389	Coastal lowland/ floodplain	Batchelor, C. R., Young, D.S., Austin, P. J. & Elias, S. A. 2013. The Pitts Head Public House, 2 Fords Park Road, London Borough of Newham E16 1NL Site Code, PHD12., Environmental Archaeological Assessment. Quaternary Scientific QUEST. Unpublished Report January 2013; Project Number 180x12.
TheReachQBH1	Rob Batchelor	REACH	0.090456116	51.498415	Coastal lowland/ floodplain	Batchelor, C.R., Young, D.S., Hill, T. & Green C.P. 2017. THE REACH, THAMES REACH, ROYAL BOROUGH OF GREENWICH Geoarchaeological & Palaeoenvironmental Analysis Report. Quaternary Scientific QUEST. Unpublished Report April 2017; Project Number 099x16.
TillburyFort	Rob Batchelor	TILL	0.37439812	51.45297093	Coastal lowland/ floodplain	Batchelor, C.R. 2007. Middle Holocene environmental changes and the history of yew Taxus baccata L. woodland in the Lower Thames Valley. Chapter 9. PHD Thesis.
TokenhouseYard	Nick Branch	TOKEN	-0.073712126	51.51497628	Coastal lowland/ floodplain	Branch, N.P., Allison, E., Vaughan-Williams, A., Silva, B., Austin, P., Green, C.P., Swindle, P., Armitage, P., Cameron, N., Keen, D. & Finch P. 2006. ENVIRONMENTAL ARCHAEOLOGICAL ANALYSIS AT 6-8 TOKENHOUSE YARD, CITY OF LONDON SITE CODE, THY01. ArchaeoScape Unpublished Report 2006
WestHamBus Garage	Rob Batchelor	WESTHAM	0.002940693	51.52430363	Coastal lowland/ floodplain	Batchelor, C.R., Branch, N.P., Allott, L. & Young D. 2010. WEST HAM BUS GARAGE THE FORMER PARCEL FORCE DEPOT., WEST OF STEPHENSON STREET, LONDON BOROUGH OF NEWHAM SITE CODE, WHQ09., ENVIRONMENTAL ARCHAEOLOGICAL ANALYSIS. Quaternary Scientific QUEST. Unpublished Report March 2010; Project Number 007x08.
WoodWharf Section11	Rob Batchelor	WOOD11	-0.010243683	51.50294565	Coastal lowland/ floodplain	Young, D.S., Batchelor, C.R. & Hill, T. 2016. WOOD WHARF, LONDON BOROUGH OF TOWER HAMLETS