Functional and epiphytic biodiversity differences between nine tree species in the UK.

Metadata for EIDC

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Summary of data
Globally there is increasing concern about the increase in tree pests and pathogens due to an increase in global trade and climate change. If individual tree species are lost or decline due to pests and pathogens then other tree species are likely to replace them. Trees deliver many functions and services and if the species of tree changes it is important to know if and how the functions, services and biodiversity supported will change. Using six sites across the UK, with multiple tree species at each site, we record the functioning and biodiversity (bryophytes and lichens) of three tree species currently threatened by disease in the UK: the British oak species *Quercus petraea* sessile oak and *Q. robur* pedunculate oak and *Fraxinus excelsior* common ash and six other tree species: *Acer pseudoplatanus* sycamore, *Castanea sativa* sweet chestnut, *Fagus sylvatica* beech, *Quercus cerris* Turkey oak, *Quercus rubra* red oak and *Tilia x europaea* common lime; which have previously been suggested as ecological replacements for *Q. petraea/robur* and/or *F. excelsior* (Mitchell et al. 2014, Mitchell et al 2019). The variables studied included nitrogen mineralization and decomposition rate, total soil carbon and nitrogen, loss on ignition, soil pH, soil temperature and the water holding capacity of the bark. We also recorded the presence of all lichen and bryophyte species and the bark characteristics of the tree: bark pH, ridge and furrow width, furrow depth, hardness and the bark patterning.

Experimental Design, Materials, and Methods
Site selection
Six sites were selected across the UK that were previously old country houses with large formal gardens and parklands and due to former historical management had a selection of old, often more than 150-year-old, trees. The sites were The National Trust gardens at Knightshayes Court (England) and Bodnant and Dinefwr (Wales), the national arboretum at Westonbirt (England), the National Trust for Scotland's garden at Crathes and the private garden Mount Stuart (Scotland). The sites were chosen to have as many as possible of the following species: *Acer pseudoplatanus*, *Castanea sativa*, *Fagus sylvatica*, *Fraxinus excelsior*, *Quercus cerris*, *Quercus petraea*, *Quercus robur*, *Quercus rubra* and *Tilia x europaea*. Table 1 provides details of the sites.

Tree data
In total 230 trees were recorded, with 35 to 40 trees recorded at each site (Table 2). The file "Trees" provides details of all the trees recorded while Table 3 provides the metadata. For each tree its girth and hence diameter at breast height (DBH, 1.3 m) was measured and the height of the tree measured using a clinometer (Suunto Opti Height Meter Clinometer PM-5).

The surrounding habitat of tree was recorded as "relatively shaded semi-natural woodland",

“relatively open grassland-parkland” or “garden with shrubs/plants”. The area around the tree was divided into four cardinal sectors. Within each sector the distance to the nearest tree (up to a maximum of 30m away) was recorded and the species and DBH of the tree recorded. The file “Habitat_structure” contains this information while Table 4 provides the metadata.

Decomposition

Decomposition was studied by burying at each tree four filter papers (Whatman filter paper No.1 diameter 5.5 cm) inside a single bag made of 300 microns nylon mesh and a wooden stick (manufactured and sold as lollipop sticks). The stick and bag were buried 3 m south of each tree. File “Decomposition” contains this data while Table 5 provides the metadata.

Soil temperature

Soil temperature was measured every hour using i-Button miniature temperature loggers (DS1922L, Maxim Integrated, San Jose, CA, USA) placed just under the soil surface next to the decomposition experiment, i.e. 3 m south of the tree. File “Temperature” contains this data while Table 6 provides the metadata.

Soil collection and analysis

Eight soil samples were taken per tree (diameter 25 mm, depth 100 mm) about 2 m from the trunk and evenly spaced around the tree. The samples were bulked per tree and kept cool until they were processed. On return to the lab each soil sample was homogenized and spilt into two. One half was passed through a 5 mm sieve and analysed for mineralized nitrogen following the method in Allen (1989). The other half was air dried at 30°C and passed through a 2 mm sieve and the following analyses performed. Soil pH was measured in both water and $CaCl_2$. A 15g soil sample was added to 45 ml water to assess pH(H_2O) and 5 mls of 0.1M $CaCl_2$ were added to the above slurry to measure pH($CaCl_2$), methods follow McLean (1982). A sub-sample of the 2 mm sieved soil was ball milled (MM22 Mixer Mill, Retsch) and analysed for total C and N following the method in Pella and Colombo (1973). File “Soil” contains this data while Table 7 below provides the metadata.

Soil FTIR

Fourier-transform infrared (FTIR) spectral measurements were also carried out on the ball milled soil samples. The FTIR spectra were recorded on a Bruker Vertex 70 FTIR spectrometer (Bruker, Ettlingen, Germany) fitted with a potassium bromide (KBr) beam splitter. A Diamond Attenuated Total Reflectance (DATR) sampling accessory, with a single reflectance system, was used to produce ‘‘transmission-like’’ spectra. Samples were placed directly on a DATR/KRS-5 crystal, and a flat tip powder press was used to achieve even distribution and contact. The FTIR spectra were recorded in the working range from 4000 to 400 cm^{-1} (resolution of 4 cm^{-1}) by averaging 128 scans for each sample. A correction was made to the ATR spectra to allow for differences in depth of beam penetration at different wavelengths, using OPUS software (Bruker, Ettlingen, Germany, version 7.2). The spectra were also baseline corrected. No correction was required for water vapour and CO_2 as the spectrometer is continuously flushed with dry air.

Prior to analysis the spectra were pre-processed using the second Savitzy-Golay derivative, to better discriminate the difference between the species and locations. Applying this derivative to the spectra helped to remove the baseline offset and to overcome the overlap between peaks. The pre-processing was performed using the Unscrambler® X 10.5 (Camo Software, Oslo, Norway). The pre-processed data are available in file FTIR and the metadata in Table 8.

Bark chemistry

A small bark sample was taken from each tree. On return to the lab the sample was air dried at 30°C and any epiphytes and surface debris removed with a small wire brush. The bark was cut into small chunks of c. 5 mm x 5 mm x 5 mm. Half the bark was used for water holding capacity and half for pH and conductivity. To measure the water holding capacity the chunks of bark were weighed. The bark volume was calculated by placing the bark chunks into a measuring cylinder and measuring the water required to fill the cylinder to 10 ml using an automatic dispensing pipette (Rainin EDP Plus, 20ml, id no K1067421F that was calibrated daily). The bark was then left in the water for 24 hours, patted dry and reweighed to enable the water holding capacity of the bark to be calculated as the difference between the wet mass and the dry mass divided by the volume of the bark (Ellis *et al.* 2015). The remaining half of the bark was ball milled (MM22 Mixer Mill, Retsch), mixed with distilled water at a ratio of 1:20 and left for 24 hours before the pH and conductivity was measured. File "Bark chemistry" contains this data while Table 9 below provides the metadata.

Bark physical characteristics.

On each cardinal aspect of the trunk a 30 x 30 cm quadrat was placed at one of four randomly allocated heights (low 0.5m-0.8m, lower-middle 0.8m-1.1m, upper-middle 1.1m-1.4m, upper 1.4m-1.7m above ground level). Within each quadrat the following the measurements were made. The bark pattern was classified as smooth, fissured, flaky, rugose or patterned. If vertical fissures were present the number and size of them were recorded. The width and depth of eight randomly selected furrows and the width of eight ridges were measured. The shape of the ridges (flattened, hollow, rounded or V-shaped) and furrows (V-shaped, found, square, irregular, compound, wavy or fenestrate) and the ridge alignment (vertical, oblique, reticulate or knobbly) were also recorded. Bark hardness was measured using a durometer (Tire Durometer Type A ASTM 2240) with eight measures per a quadrat. File "Bark_plot" contains this information with Table 10 below providing the metadata.

Lichen and bryophyte data

All lichen and bryophyte species on the trunk of the tree from ground level to 1.75m were recorded. In addition, lichens present on the branches and twigs of the tree were recorded where these could be safely reached from the ground, it was not possible to sample the branches and twigs of all trees (Table 2). Bryophyte and lichen names and authorities are held in the files Bryophyte_names and Lichen_names respectively while the corresponding metadata are in Tables 11 and 12. The data on bryophyte and lichen presence and absence are held in the two files Bryophytes and Lichens with the corresponding metadata in Tables 13 and 14.

Access database

The files listed above were constructed to be held in a relational database, e.g. a Microsoft Access database (Fig 1). Each file listed above is a separate table in the database and the files link to each other on the field ANS_Tree_code with the file "Trees" being the central table to which all the other files link. The only exceptions to this are the files "Lichen_names" and "Bryophyte_names" which link to the files "Lichens" and "Bryophytes" on the column heading Taxon_code.

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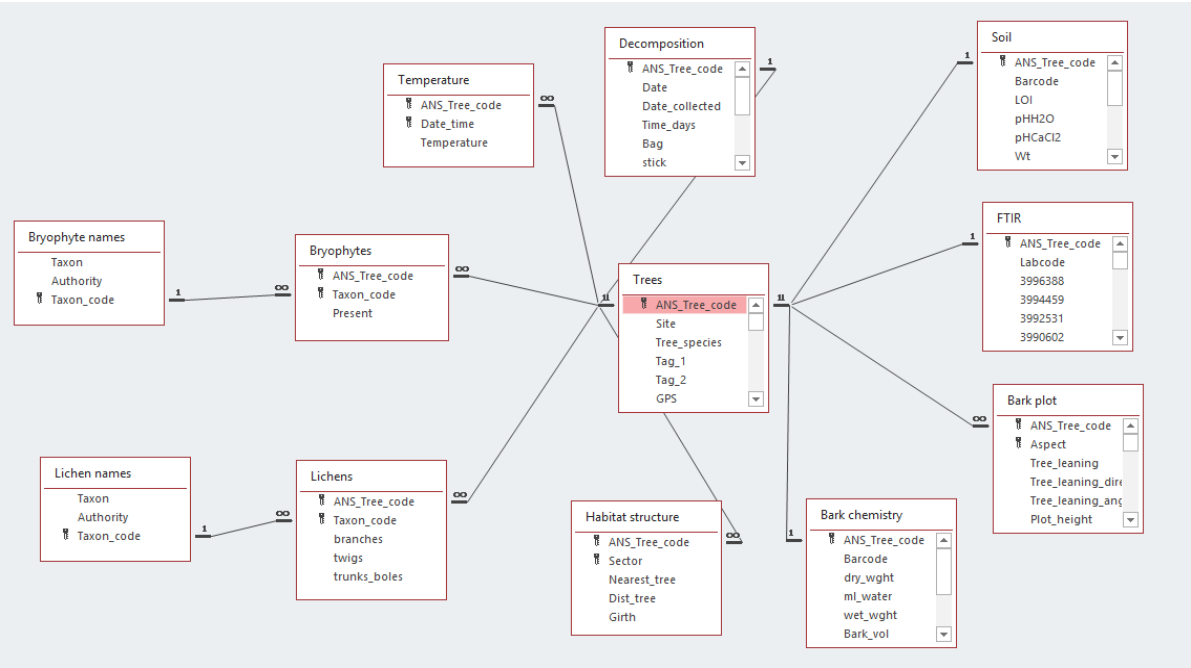

Figure 1. Diagram showing the relationships between the different files and how they can be used to recreate a relational database.

Table 1. Details of site locations, soil type and climate. Climate data are average annual data from 1981-2010 taken from the nearest UK Meteorological station all of which were <20 km away from the site.

Garden	Owner	Country	Latitude	Longitude	Total Area (ha)	Altitude (m)	Soil type	General Aspect	Rainfall (mm)	Maximum Temper-ature (°C)	Minimum tempera-ture (°C)
Bodnant	National Trust	Wales	53.23298	-3.7967	32	0-70	Clay, acid	South and west	1,100	13.7	7.6
Crathes	National Trust for Scotland	Scotland	57.05667	-2.42643	100	50-100	Acid	Southerly	780	12.2	3.5
Dinefwr	National Trust	Wales	51.88381	-4.0137	350	30-100	Acid	Southwesterly	1,323	14.2	6
Knightshayes Court	National Trust	England	50.92964	-3.47413	106	100-165	Acid red brown soil	Easterly	1,065	12.6	6.1
Mount Stuart	Mount Stuart Trust	Scotland	55.79212	-5.02124	40	0-50	Acid	Easterly	1,455	12.5	6.4
Westonbirt	Forestry Commission	England	51.60766	-2.21583	240	120-140	Loam, alkaline and acid	Mostly flat	840	13.4	5.6

Table 2. The number of trees of each species sampled at each site. The number of tree species where it was possible to sample the branches is given in parentheses.

Tree species	Sites						Total
	Bodnant	Crathes	Dinefwr	Knighthayes	Mount Stuart	Westonbirt	
Acer pseudoplatanus	6 (6)	5 (4)	6 (6)	4 (4)	6 (0)	5 (5)	32 (25)
Castanea sativa	4 (4)		6 (5)	4 (4)	5 (2)	5 (4)	24 (19)
Fagus sylvatica	5 (5)	8 (8)	6 (6)	5 (5)	6 (3)	5 (5)	35 (32)
Fraxinus excelsior	4 (2)	6 (5)	7 (7)	5 (5)	5 (3)	5 (4)	32 (26)
Quercus cerris				7 (7)	2(1)	5 (4)	14 (12)
Quercus petraea	8 (7)	5 (4)					13 (11)
Quercus robur	3 (2)	6 (5)	7 (6)	6 (6)	6 (2)	6 (5)	34 (26)
Quercus rubra	5 (3)			4 (4)	2 (2)	4 (4)	15 (13)
Tilia x *europaea*	5 (5)	5 (3)	5 (5)	5 (5)	6 (2)	5 (5)	31 (25)
Total	40	35	37	40	38	40	230 (189)

Table 3. Description of data in the file “Trees”.

Column heading	Description
ANS_Tree_code	A unique code per tree
Site	The site at which the tree was sampled
Tree_species	Latin name of tree species
Tag_1	Tree tag number used by garden, if any
Tag_2	Second tree tag number if present
GPS	British national grid reference of tree
X-cord	Easting using British national grid
Y-cord	Northing using British national grid
slope	Slope of area around tree classed as level, gentle, moderate or steep
Aspect	Aspect of slope recorded as a compass bearing
Height	Height of tree (m) as measured using a clinometer (Suunto Opti Height Meter Clinometer PM-5)
Girth	Girth of tree (cm)
DBH	Diameter at breast height in cm
Date	Date of recording of tree characteristics, soil sampling, lichen and bryophyte recording and when the litter decomposition was put out.
Rec	Recorders
Notes	Notes made while collecting data on intial visit
Semi-nat_woodland	x = recorded here if the tree was in a semi-natural woodland situation
grassland-park	x = recorded here if the tree was in a grassland/parkland situation
Garden	x = recorded here if the tree was in a garden situation
Hollow	x = recorded here if the tree was in a hollow
Knoll	x = recorded here if the tree was on a knoll
Bark	x = recorded here if a soil sample was taken
Soil	x = recorded here if a bark sample was taken
ibutton_number	Numbered ibuttons were placed 3 m south of each tree. The ibutton number was recorded. Due to limited resources not all trees had a working ibutton used. Some trees had a DUD ibutton used to enable relocation of the litterbags by a metal detector
Litter_bag	x = recorded here if a litter bag was placed.
Lollipop_stick	x = recorded here if a lollipop stick was burried for decomposition
soil_sampling_Notes	Notes on soil sampling
Date litter bag collected	Date when litter bag, wooden lollipop stick, ibutton and canopy measurements were taken
ibuttton_found	note if the ibutton was refound
Litter_bag_found	note if the litter bag was refound
Lollipop_stick_found	note if the lollipop stick was refound
N_canopy	% canopy cover on the north side of the tree, as assessed with the surveyor standing with their back to the tree using a spherical densiometer (Model-A).
E_Canopy	% canopy cover on the east side of the tree, as assessed with the surveyor standing with their back to the tree using a spherical densiometer (Model-A).

S_canopy	% canopy cover on the south side of the tree, as assessed with the surveyor standing with their back to the tree using a spherical densiometer (Model-A).
W_canopy	% canopy cover on the west side of the tree, as assessed with the surveyor standing with their back to the tree using a spherical densiometer (Model-A).
Notes_decomp	Notes made when collecting in decomposition experiment

Table 4. Description of the data in the file “Habitat-structure”

Column heading	Description
ANS_Tree_code	A unique code per tree, see trees table for details
Sector	The area around the tree was divided into four sectors based on cardinal compass points
Nearest_tree	The nearest tree or shrub within 30m. The first four letters of genus and the species recorded.
Dist_tree	Distance to nearest tree or shrub in m
Girth	Girth of nearest tree or shrub at 1.3m above the ground in cm

Table 5. Description of data in the file “Decomposition”.

Column heading	Description of column
ANS_Tree_code	A unique code per tree, see trees table for details
Date	Date litter bag and stick buried
Date_collected	Date litter bag and stick collected
Time_days	Number of days the litter bag was buried for.
Bag	Litter bag refound. Litter bag were composed of four filter papers inside a single bag made of 300 microns nylon mesh. The bags were buried 3m south of each tree.
stick	Stick refound. The wooden sticks (manufactured and sold as lollipop sticks) were sorted to ensure uniform colour and appearance and weighed. One stick was buried 3m south of each tree.
paper-weight	Weight of remaining paper in grams. Total weight of the four filter papers originally buried was 0.83g
K_paper	Decomposition rate K for the paper
Stick_weight	Weight of remaining stick in grams, a whole stick before being buried was 1.27 grams
prop_stick_area_found	If the stick was broken and not all the stick was found, the stick was scanned and the area of the stick calculated. The area of the stick found as a proportion of a whole stick was then calculated and taken into account when calculating decomposition rates
K_stick	Decomposition rate K for the paper
Notes	Notes on decomposition

Table 6. Description of data in the file “Temperature”.

Column heading	Description
ANS_Tree_code	A unique code per tree, see trees table for details
Date_time	Date and time of measurement
Temperature	Soil temperature, just below the surface in degrees Celsius.

Table 7. Description of data in file “Soil”

Column heading	Definition
ANS_Tree_code	A unique code per tree, see trees table for details
Barcode	Barcode used in lab
LOI	percentage Loss on ignition at 450 degrees celcius
pHH2O	soil pH in water
pHCaCl2	soil pH in C Cl2
Wt	Weight of soil used mg in analysis of total N and total C
Tot_N	Total N in soil % by weight
Tot_C	Total C in soil % by weight
TON-N_BI	TON-N mg/kg before incubation
NH4-N_BI	NH4-N mg/kg before incubation
TON-N_AI	TON-N mg/kg after incubation
NH4-N_AI	NH4-N mg/kg after incubation
N-Min	Mineralizable N mg/kg

Table 8. Description of the data in file “FTIR”

Column heading	Definition
ANS_Tree_code	A unique code per tree, see trees table for details
Labcode	barcode used in the lab for the analysis
3996.388 to 368.3931	The remaining column headings 3996.388 to 368.3931 are the FTIR spectra wavelengths

Table 9. Description of the data in file “Bark_chemistry”

Colum heading	Definition
ANS_Tree_code	A unique code per tree, see trees table for details
Barcode	The barcode used during chemical analysis
dry_wght	dry weight of bark sample used in grams to calculate water holding capacity
ml_water	mls of water to reach 10mls used to calculated volume of bark
wet_wght	wet weight of bark in grams after being soaked in water for 24 hours
Bark_vol	volume of bark mm3
Density	density of bark, grams per mm3
Water_holding	water holding capacity of bark - grams of water per mm3
pH	bark pH
Conductivity	bark conductivity

Table 10. Description of the data in file “Bark_plot”.

Column heading	Definition
ANS_Tree_code	A unique code per tree, see trees table for details
Aspect	Aspect of plot - four plots per a tree, one on each of the north, east, south, west aspects of the tree
tree_leaning	Yes = the tree is leaning
Tree_leaning_direction	Direction of lean - compass bearing
Tree_leaning_angle	Angle of lean away from vertical measured in degrees
Plot_height	Plot height - randomly assigned. The plot was a 30 x 30 cm quadrat was placed at one of four randomly allocated heights (low 0.5m-0.8m, lower-middle 0.8m-1.1m, upper-middle 1.1m-1.4m, upper 1.4m-1.7m above ground level).
Bark_pattern_smooth	x = the bark pattern was smooth
Bark_pattern_fissured	x = the bark pattern was fissured
Bark_pattern_flaky	x = the bark pattern was smooth
Bark_pattern_rugose	x = the bark pattern was flaky
other_bark_features_patterned	x = the bark pattern was another pattern not described above
other_bark_features_warts	x = warts were present
other_bark_features_burls	x = burls were present
other_bark_features_epi grow	x = epicormic growth
fissured_length	Length of fissures, long = >15 cm, short =< 15 cm
Shape_of_fissure_V-Shaped	x = shape of fissures was V shaped, multiple selections per plot were possible when several different fissure shapes were present (only recorded where the bark pattern was recorded as fissured).
Shape_of_fissure_round	x = shape of fissures was rounded, multiple selections per plot were possible when several different fissure shapes were present (only recorded where the bark pattern was recorded as fissured).
Shape_of_fissure_square	x = shape of fissures was square, multiple selections per plot were possible when several different fissure shapes were present (only recorded where the bark pattern was recorded as fissured).
Shape_of_fissure_irregular	x = shape of fissures was irregular, multiple selections per plot were possible when several different fissure shapes were present (only recorded where the bark pattern was recorded as fissured).
Shape_of_fissure_compound	x = shape of fissures was compound, multiple selections per plot were possible when several different fissure shapes were present (only recorded where the bark pattern was recorded as fissured).
Shape_of_fissure_wavy	x = shape of fissures was wavy, multiple selections per plot were possible when several different fissure shapes were present (only recorded where the bark pattern was recorded as fissured).
Shape_of_fissure_fenestrate	x = shape of fissures was fenestrate, multiple selections per plot were possible when several different fissure shapes were present (only recorded where the bark pattern was recorded as fissured).
Shape_of_fissure_Other	x = shape of fissures was not covered by the above, multiple selections per plot were possible when several different fissure shapes were present (only recorded where the bark pattern was recorded as fissured).

Ridge_allignment_vertical	x = allignment of the ridges is vertical (only recorded where the bark pattern was recorded as fissured).
Ridge_allignment_oblique	x = allignment of the ridges is oblique (only recorded where the bark pattern was recorded as fissured).
Ridge_allignment_reticulate	x = ridges are reticulate (only recorded where the bark pattern was recorded as fissured).
Ridge_allignment_Knobbly	x = ridges are knobbly (only recorded where the bark pattern was recorded as fissured).
Ridge_allignment_other	x = allignment of the ridges is not as described above (only recorded where the bark pattern was recorded as fissured).
ridge_shape_flattened	x = ridge shaped is flattened, multiple selections per plot were possible when several different ridge shapes were present (only recorded where the bark pattern was recorded as fissured),
ridge_shape_hollow	x = ridge shaped is hollow, multiple selections per plot were possible when several different ridge shapes were present (only recorded where the bark pattern was recorded as fissured),
ridge_shape_rounded	x = ridge shaped is rounded, multiple selections per plot were possible when several different ridge shapes were present (only recorded where the bark pattern was recorded as fissured),
ridge_shape_V-shaped	x = ridge shaped is V shapped, multiple selections per plot were possible when several different ridge shapes were present (only recorded where the bark pattern was recorded as fissured),
Bark_durometer_1	Bark hardness measured using a durometer (Tire Durometer Type A ASTM 2240) with eight measures per a quadrat. Measurement 1
Bark_durometer_2	Bark hardness measured using a durometer (Tire Durometer Type A ASTM 2240) with eight measures per a quadrat. Measurement 2
Bark_durometer_3	Bark hardness measured using a durometer (Tire Durometer Type A ASTM 2240) with eight measures per a quadrat. Measurement 3
Bark_durometer_4	Bark hardness measured using a durometer (Tire Durometer Type A ASTM 2240) with eight measures per a quadrat. Measurement 4
Bark_durometer_5	Bark hardness measured using a durometer (Tire Durometer Type A ASTM 2240) with eight measures per a quadrat. Measurement 5
Bark_durometer_6	Bark hardness measured using a durometer (Tire Durometer Type A ASTM 2240) with eight measures per a quadrat. Measurement 6
Bark_durometer_7	Bark hardness measured using a durometer (Tire Durometer Type A ASTM 2240) with eight measures per a quadrat. Measurement 7
Bark_durometer_8	Bark hardness measured using a durometer (Tire Durometer Type A ASTM 2240) with eight measures per a quadrat. Measurement 8
Number_vertical_furrows	Number of vertical furrows per plot
Fissure_notes	Notes on fissure features
width_of_vertical_furrows_1	Eight vertical furrows were randomly selected for the measurement of the width of the furrow (only recorded where the bark pattern was recorded as fissured). Measurements in mm. Measurement 1.

width_of_vertical_furrows_2	Eight vertical furrows were randomly selected for the measurement of the width of the furrow (only recorded where the bark pattern was recorded as fissured). Measurements in mm. Measurement 1.
width_of_vertical_furrows_3	Eight vertical furrows were randomly selected for the measurement of the width of the furrow (only recorded where the bark pattern was recorded as fissured). Measurements in mm. Measurement 1.
width_of_vertical_furrows_4	Eight vertical furrows were randomly selected for the measurement of the width of the furrow (only recorded where the bark pattern was recorded as fissured). Measurements in mm. Measurement 1.
width_of_vertical_furrows_5	Eight vertical furrows were randomly selected for the measurement of the width of the furrow (only recorded where the bark pattern was recorded as fissured). Measurements in mm. Measurement 1.
width_of_vertical_furrows_6	Eight vertical furrows were randomly selected for the measurement of the width of the furrow (only recorded where the bark pattern was recorded as fissured). Measurements in mm. Measurement 1.
width_of_vertical_furrows_7	Eight vertical furrows were randomly selected for the measurement of the width of the furrow (only recorded where the bark pattern was recorded as fissured). Measurements in mm. Measurement 1.
width_of_vertical_furrows_8	Eight vertical furrows were randomly selected for the measurement of the width of the furrow (only recorded where the bark pattern was recorded as fissured). Measurements in mm. Measurement 1.
Width_of_vertical_ridges_1	Eight vertical furrows were randomly selected for the measurement of the width of the furrow (only recorded where the bark pattern was recorded as fissured). Measurements in mm. Measurement 1.
Width_of_vertical_ridges_2	Eight vertical furrows were randomly selected for the measurement of the width of the furrow (only recorded where the bark pattern was recorded as fissured). Measurements in mm. Measurement 2.
Width_of_vertical_ridges_3	Eight vertical furrows were randomly selected for the measurement of the width of the furrow (only recorded where the bark pattern was recorded as fissured). Measurements in mm. Measurement 3.
Width_of_vertical_ridges_4	Eight vertical furrows were randomly selected for the measurement of the width of the furrow (only recorded where the bark pattern was recorded as fissured). Measurements in mm. Measurement 4.
Width_of_vertical_ridges_5	Eight vertical furrows were randomly selected for the measurement of the width of the furrow (only recorded where the bark pattern was recorded as fissured). Measurements in mm. Measurement 5.

Width_of_vertical_ridges_6	Eight vertical furrows were randomly selected for the measurement of the width of the furrow (only recorded where the bark pattern was recorded as fissured). Measurements in mm. Measurement 6.
Width_of_vertical_ridges_7	Eight vertical furrows were randomly selected for the measurement of the width of the furrow (only recorded where the bark pattern was recorded as fissured). Measurements in mm. Measurement 7.
Width_of_vertical_ridges_8	Eight vertical furrows were randomly selected for the measurement of the width of the furrow (only recorded where the bark pattern was recorded as fissured). Measurements in mm. Measurement 8.
Depth_of_vertical_furrows_1	Eight vertical furrows were randomly selected for the measurement of the depth of the furrow (only recorded where the bark pattern was recorded as fissured). Measurements in mm. Measurement 1.
Depth_of_vertical_furrows_2	Eight vertical furrows were randomly selected for the measurement of the depth of the furrow (only recorded where the bark pattern was recorded as fissured). Measurements in mm. Measurement 2.
Depth_of_vertical_furrows_3	Eight vertical furrows were randomly selected for the measurement of the depth of the furrow (only recorded where the bark pattern was recorded as fissured). Measurements in mm. Measurement 3.
Depth_of_vertical_furrows_4	Eight vertical furrows were randomly selected for the measurement of the depth of the furrow (only recorded where the bark pattern was recorded as fissured). Measurements in mm. Measurement 4.
Depth_of_vertical_furrows_5	Eight vertical furrows were randomly selected for the measurement of the depth of the furrow (only recorded where the bark pattern was recorded as fissured). Measurements in mm. Measurement 5.
Depth_of_vertical_furrows_6	Eight vertical furrows were randomly selected for the measurement of the depth of the furrow (only recorded where the bark pattern was recorded as fissured). Measurements in mm. Measurement 6.
Depth_of_vertical_furrows_7	Eight vertical furrows were randomly selected for the measurement of the depth of the furrow (only recorded where the bark pattern was recorded as fissured). Measurements in mm. Measurement 7.
Depth_of_vertical_furrows_8	Eight vertical furrows were randomly selected for the measurement of the depth of the furrow (only recorded where the bark pattern was recorded as fissured). Measurements in mm. Measurement 8.
Horizontal_crack_presence	Are horizontal cracks presence in the bark - recorded as abscent, partial or distinct
Horizontal_crack_width	Width of horizontal cracks recorded as <3mm or >3mm wide

Bark_Notes	Notes made while recording bark characteristics

Table 11. Description of data in file “Bryophyte_names”

Column name	Description
Taxon	Bryophyte name
Authority	Bryophyte name plus authority
Taxon_code	Short code for bryophyte

Table 12. Description of data in file “Lichen_names”

Column name	Column description
Taxon	Lichen name
Authority	Lichen name plus authority
Taxon_code	Short code for lichen

Table 13. Description of data in file “Bryophytes”

Column heading	Description
ANS_Tree_code	A unique code per tree, see trees table for details
Taxon_code	Taxon code for the bryophyte, see bryophyte names table for full name and authority
Present	x = bryophyte is present on the trunk of the tree between ground level and 1.75 m

Table 14. Description of data in file “Lichens”

Column name	Description
ANS_Tree_code	A unique code per tree, see trees table for details
Taxon_code	Short code for lichen
Taxon	Lichen name
branches	Lichen found on branches (only presence/absence recorded and only those branches that we could reach from the ground were recorded, so not all trees have data)
twigs	Lichen found on twigs (only presence/absence recorded and only those twigs that we could reach from the ground were recorded, so not all trees have data)
trunks_boles	Lichen found on the trunk of the tree up to 1.75 m in height (only presence/absence recorded).