Title	**Oak tree phenology**
General metadata	
Abstract	The leaf-out phenology of a proportion of tagged oak trees (*Quercus robur*) is annually monitored from March to June to register the date of six stages from bud burst to fully extended and hardened leaves.
Keywords	Leaf burst, oak, phenology
Is this part of a larger study?	Yes, these observations are part of the blue tits breading season study
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Funding	Imperial College London, Department of Life Science
Data set status and accessibility	
Status	Ongoing
Latest update	February 2024
Latest archive date	February 2024
Metadata status	October 2024
Accessibility	
Storage location and medium	"Research group space: SilwoodLTE", Imperial College London, ICT department
Usage rights	Open access
Geographic metadata	

Geographic description	The study site is Silwood Park Campus from Imperial College London, Buckhurst Road, Ascot, Berkshire SL5 7PY, United Kingdom. Silwood Park campus, with 70 ha, contains ancient woodlands and few-decades-old oak-dominated woodlands. Study oak trees have been set across the campus woodlands, which are classified as W10a, W10e and W16a using the National Vegetation Classification. Silwood Park experiences an average annual rainfall of 698mm with little seasonal pattern (1987-2022). Mean hourly temperature is 10ºC with July max of 23 ºC and January min of 1.4 ºC (1987-2022).
Bounding coordinates	General for Silwood Park. The specific location and detail information of trees can be found in file: trees.csv In 2020 part of the campus boundaries changed and this resulted in the loss of about 116 trees.
Latitude	51.411
Longitude	-0.647
UK National grid	
Square	SU
Easting	94196
Northing	68866
Temporal metadata	
Temporal description	Oak leaf bursting has been observed in a series of trees since 2007. Trees have been divided in those observed each year (Long term trees) or those observed every other year; in even (even trees) or odd years (odd trees). Trees enter the database to replace dead individuals in any category. Missing data: 2020
Begin	2007
End	Ongoing
Taxonomic metadata	
Taxonomic level: species	Table: NAMESP

Species	Species code
Quercus robur	quercus.robur
Quercus petraea	quercus.petraea
Quercus cerris	quercus.cerris
Unknown Quercus (not Q. robur)	quercus.sp
Fagus sylvatica	fagus.sylvativa
Populus sp.	populus.sp
Unidentified conifer	conifer
Castanea sativa	castanea.sativa
Carpinus betulus	carpinus.betulus
Betula pendula	betula.pendula
Alnus sp.	alnus.sp
Aesculus hippocastanum	aesculus.hippocastanum
Acer pseudoplatanus	acer.pseudoplatanus

	Juglans regia	juglans.regia
	Crataegus sp.	crataegus.sp
	Salix alba	salix.alba
	Fraxinus excelsior	fraxinus.excelsior
	Tilia platyphyllos x cordata	tilia.x.europaea
	Ulmus sp.	ulmus.sp
	Taxus baccata	taxus.baccata
Methods metadata		
General experimental design	Extracted from: Lopera Doblas (2017) Field Season Protocol -handbook.pdf There are approximately 3700 individually marked oak trees in Silwood, divided into three categories: long term oaks which are monitored every year, odd year oaks and even year oaks which are monitored in odd and even years respectively. Trees are marked at the beginning of the season with tape or paint in order to identify them from the distance. Trees are associated by distance to a named bird box. There is a network of woodcrete nest boxes across the campus' woodlands used to study the breeding phenology of blue tits. From 286 nest boxes in 2019, 32 were excluded from experiment due to the sale of campus land. 1 was removed by damage of tree. In 2022 there are 220 active nest boxes, 173 boxes have a small entrance (26 mm) that exclude great tits and 47 have a larger entrance (32mm). Every tree has a unique number called TreeID that might or might be not the same as the number written in the tag attached to the tree. Tree tags need to be replaced occasionally but TreeIDs do not change over time	
Data collection	Monitoring involves visiting every individual oak frequently from every other day to weekly. Visits start from March 20th onwards to look for signs of leaf development, and scoring them according to the scale below, until they reach stage 6  Figure: different stages of the leaves. Score 0 Leaf scales are close without signs of green 1 First sign of 'leaf burst' when green is first visible between brown bud scales 2 'Big bud' is when the bud has elongated and is green starting to show the tip of new leaves/flowers 3 Leaves and male flowers project beyond the tip of the bud but are still small and joined together on the base 4 'Leaf extension' is when individual bright green and soft leaves and anthers (male flowers) hang separately 5 'Anthesis' is when pollen is shed by anthers (Ignored some years)	

	6	'Full leaf expansion" is when tanning is deposit on leaves, they become dark green and hard Leaf bursting is not uniform across all branches of the tree. The score reflects the highest phenological state most of the leaves that can be assessed shown at the moment of collection. **Girth:** There is information of the circumference of some trees. The table Girth.csv contains measures taken 2007-2015, or between 2016-2019 without specific dates.
Quality control	Phenology observations have been done by different researchers over the years. A complete list can be found in file: observers.csv Curation of data files and creation of metadata has been done by Catalina Estrada since January 2018. Please read README_DataBaseOaks.txt to see specific issues and decisions.	
Data table metadata		
Number of tables	3	
Tables	trees.csv phenology.csv girth.csv	

File name	**trees.csv**		
Description	**Gives species and location information for trees in the oak phenology, blue tit experiment and veteran trees**		
Size	270KB		
Case sensitive	No		
Number or records	4024		
Number of attributes	8		
Orientation	Variables (attributes) included as columns		
Data table structure and attribute description			
Attribute name	Definition	Type	Attribute description
TreeID	Unique number given to each tree involved in this or other experiment in Silwood Park campus. Primary key	Integer	Count Min: 1, Max: 4055
species	Species of trees as Table: NAMESP above	String	Text NA: unknown species
northing	Great Britain, National Grid, northing (Ordnance Survey)	Floating point	Geographic coordinate NA: not available
easting	Great Britain, National Grid, easting (Ordnance Survey)	Floating point	Geographic coordinate NA: not available
latitude	Latitude: north-south position WGS84	Floating point	Geographic coordinate decimal degrees NA: not available
longitude	Longitude: east-west position WGS84	Floating point	Geographic coordinate decimal degrees

			NA: no available
SPlocation	Silwood Park named woodland or field where tree is located	String	Text following Silwood Park Site Plan 6/12/08- As field boundaries are not quite clear this location might not be always accurate
remarks	Any other relevant information about the tree	String	Text oak1 to oak30 is a foreign key related to table oak_acorn_oaks.csv table from different long term experiment

File name	**Phenology.csv**		
Description	**Gives information about the phenology codes for leave flushing through spring.**		
Size	3.4MB		
Case sensitive	No		
Number or records	107514		
Number of attributes	5		
Orientation	Variables (attributes) included as columns		
Data table structure and attribute description			
Attribute name	Definition	Type	Attribute description
VisitID	Unique number given to a visit to assess phenology, primary key, relate to visits.csv	Integer	Count Min: 2826, Max: 112283
TreeID	Unique number given to each tree, related to trees.csv	Integer	Count Min: 1, Max: 4019 NULL: TreeID not yet assigned
Score	Number representation for the stage of leaf flushing of the tree in a given visit.	String	Alphanumeric Numbers 0 to 6, sometimes along with signals < and > 0 = no sign of green 1 = green just showing 2 = budburst i.e., when the bud is elongated 3 = shaving brush leaves emerged 4 = leaves fully extended 5 = trees anthers shedding pollen 6 = leaves turned dark green and waxy (tanninised) Data from raw data files keep. This included values such as >, < score, and unknown scores or errors e.g. $, 8, 9, 10
Date	Day of visit of tree for phenology assessment (extracted from VisitID: visits.csv table)		Date dd/mm/yyyy

remarks	Any other relevant information about the tree or phenology	String	Text from field collection notes

File name	**girth.csv**		
Description	**Gives the girth or circumference of monitored trees in Silwood Park**		
Size	142KB		
Case sensitive	No		
Number or records	3504		
Number of attributes	7		
Orientation	Variables (attributes) included as columns		
Data table structure and attribute description			
Attribute name	Definition	Type	Attribute description
TreeID	Unique number given to each tree, related to table trees.cvs	Integer	Count Min: 1, Max: 3960
TreeForm	Basic architecture of tree	String	Text maiden: if tree stem is not divided at 1.3m height multistems: if tree stem is divided before 1.3 m height NA: information not available
Girth_cm	Circumference of the stem(s) at 1.3 m height. If multiple stems circumference was added	Integer	To the closest cm Min: 8, Max: 601
Stems	Number of stems measured and added in the girth value	Integer	Count Min: 1, Max: 4 NULL: Information not available
HeightGirth_cm	The height where stem's circumference was measured	Integer	To the closest cm Min: 20, Max: 130 < 130: if measured was done before the standard but there is not information of specific height base: if measured was done at the base of three but is not information of specific height NULL: information not available
Estimated	Whether or not the girth of stem could not be measured and was estimated	Integer	Nominal 0: no estimated, measured 1: estimated
Date	Date extracted from VistiID or range of time where girth measures were taken	String	Date dd/mm/yyyy Please see above: Data collection/girth