

Annexes



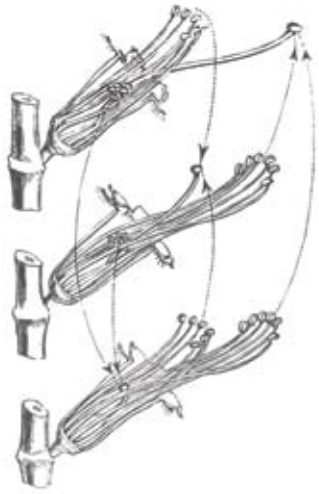


Illustration of Lythrum from 'The Different Forms of Flowers on Plants of the Same Species' (1877)



Lythrum salicaria

Darwin studied many floral mechanisms for cross-fertilisation (Cudham Valley, previous page)

'Charles Darwin is one of the several most important scientists of all time. His 'On the Origin of Species' is with certainty the most important book. The incubation of his thought and the field work he conducted there make Downe one of the world's greatest historical sites.'

Professor Edward O Wilson

Harvard University, world authority on biodiversity and author of 'The Diversity of Life' (1992).

Annexes

Annex 1

Darwin's paper on the 'General aspect' of Downe, 1843-1844 (English Heritage, Down House)

1843 - General Aspect

May 15. The first peculiarity which strikes a stranger unaccustomed to a hilly chalk country is the valleys with their steep rounded bottoms, not furrowed with smallest rivulet. On the road to Down from Keston a mound has been thrown across a considerable valley, but even against this mound, there is no appearance of even a small pool of water having collected after the heaviest rains. The water all percolates straight downwards, - ascertain average depth of wells, inclination of strata, & springs - does the water from this country crop out in springs in Holmsdale or in the valley of the Thames. Examine the fine springs in Holmsdale.

Commence with describing height & slope of Platform

The valleys on this platform sloping northward but exceedingly even generally run north & south; their sides near the summits generally become suddenly more abrupt & are fringed with narrow strips, or as they are here called "shaws" of wood; sometimes merely by hedge rows run wild. - This sudden steepness may generally be perceived as just before ascending to Cudham wood, & at Green hill, where one of the lanes crosses these valleys.

These valleys are in all probability ancient sea-bays & I have sometimes speculated whether this sudden steepening of the sides does not mark the edges of vertical cliffs formed when these valleys were filled with sea-water, as would naturally happen in strata such as the chalk.

In most countries the roads & foot paths ascend along the bottoms of valleys, but here this scarcely ever the case. All the villages & most the ancient houses are on the platform or narrow strips of flat land between the parallel valleys. Is this owing to the summits having existed from the most ancient time as open down & the valleys having been filled up with brushwood? I have no evidence of this, but it is certain that most of the farm-houses on the flat land are very ancient. There is one peculiarity, which would help to determine the foot paths to run along the summits, instead of the bottoms of the valleys, in that these latter in the middle are generally covered, even far more thickly than the general surface with broken flints. This bed of flints which gradually thins away on each side, can be seen from a long distance in a newly ploughed or fallow field as a whitish band. Every stone which ever rolls after heavy rain or from the kick of an animal ever so little all tend to the bottom of

the valley but whether this is sufficient to account for their number I have sometimes doubted, & have been inclined to apply to the case Lyell's theory of solution by rain water &c &c.

The flat summit land is covered with a bed of stiff red clay, from a few feet in thickness to as much, I believe, as 20 feet; this though lying immediately on the chalk <contains not a particle of lime> & abounding with great, irregularly shaped, unrolled flints, often with the colour & appearance of huge bones, which were originally embedded in the chalk, yet this bed contains not a particle of <chalk> carbonate of lime. This bed of red clay lies on a very irregular surface, & often descends into deep round wells the origins of which have been explained by Lyell. - In these cavities patches of sand like sea sand, & like the sand which alternates with the great beds of small pebbles derived from the wear & tear of chalk flints, which form Keston, Hayes & Addington Commons. - Near Down, a rounded chalk flint is a rarity though some few do occur & I have not yet seen a stone of distant origin, which makes a difference, at least to geological eyes, in the very aspect of the country, compared with all the northern counties. - The chalk flints decay externally, which according to Berzelius is owing to the flints containing a small proportion of alkali; but besides this external decay the whole body is affected by exposure of a few years so that they will not break with clean faces for building.

This bed of red-clay, which renders the country very slippery in the winter months from October to April, does not cover the sides of the valleys; these when ploughed show the white chalk, which tint shades away lower in the valley, as insensibly as a colour laid on by a painter's brush.

Nearly all the land is ploughed & is often left fallow, which gives the land a naked red look, not infrequently white, from a covering of chalk laid on by the Farmers - nobody seems at all aware on what principle fresh chalk laid on land abounding with lime, does it any good. - This, however is said to have been practice of the county, ever since the period of the Romans & at present the many white pits on the hill sides, which so frequently afford a picturesque contrast with the overhanging yew trees, are all quarried for this purpose.

The number of different kinds of bushes in the Hedge Rows, entwined by traveller's joy & the two Bryonies, is conspicuous, compared with the hedges of the northern counties.

March 25th. The first period of vegetation, & the banks are clothed with pale blue violets to an extent I have never seen equalled & with Primroses. A few days

later some of the copses were beautifully enlivened by *Ranunculus auricomus*, wood Anemone & a white *Stellaria*. Again subsequently large areas were brilliantly blue with blue bells. The flowers are here very beautiful: & the number of flowers, together with the darkness of the blue of the common little *Polygala*, almost equalled it to an alpine *Gentian*.

There are large tracts of woodland, cut about once every ten years; some of these enclosures seem to be very ancient; On the s. side of Cudham wood a beech hedge has grown to [Brobdignagian] size, with several of the huge branches crossing each other & firmly grafted together.

Larks abound here & their songs sound most agreeably on all sides; nightingales are common. - Judging from an odd cooing note, something like the purring of a cat, doves are very common in the woods.

June 25th. The sainfoin fields are now of the most beautiful pink, & from the number of Hive Bees frequenting them the humming noise is quite extraordinary. This humming is rather deeper than the humming over head which has been continuous and loud during all the last hot days, over almost every field. The labourers here say it is made of "air-bees" & one man seeing a wild bee in a flower, different from the Hive kind, remarked "that no doubt is a "air-bee." - This noise is considered as a sign of settled fair weather.

It wd be well worth while to find out how much insoluble matter in chalk with cold acid - to find out specific gravity of chalk & of clay. & to calculate how much of the surface has been lowered. Probably more as carbonic acid wd remove some iron & some of the silicates of potash, said to exist in flints.

Sept. 1843. Dug a sink in the yard - Clay 14 feet deep - after about 2 ft full of flints & with black patches of oxide of iron, hence thought by digger to be near chalk, wh. proved the case - Chalk was quite soft beneath and the crow bar - sunk right in it easily. - Flints hardly rounded, but many broken - some are broken in the chalk. - This clay full of minute rounded grains and I found one little pebble - the origin of this clay singular.

Plants of the gentian covered with abortive buds described *Gardeners Chronicle* Sept. 43.

I observe the Bramble in hedges do depend to earth, & the leading shoot is buried in grass - becomes white, & succulent, swells, leaflets not developed become covered with knobs, each knob, ultimately producing a root -

Found a nest supposed to be a golden-[?] wren, beneath a branch - fasten to twigs of arm of lower arm of spruce-fir -

October 1843 - Ladybirds numerous - they congregate in groups from 10 to 30 close together in angles of the cornices of our rooms. - remained whole of the month in same place. - I have never seen a swift here. - nut-hatches very numerous - Coming from Shropshire October 24th all the trees appear more autumnal than there - all over country south of London. -

Dec. 44 - In digging tank (Public) in village - only 8 ft deep - full half [?] [?] flints; some rounded others angular - cd see the slope of a more yellow sandy clay with a pipe on one side; in this many pebbles, like the Keston Common Pebbles. Laslett says invariably when clay rests on solid chalk, it becomes black with ? iron ? - Chalk soft where first met with, stained [?] in cracks by iron - I observed nearly all the large flints are broken; Laslett says this almost always the case.

Annex 2

Features of Darwin's work linked with natural life around Downe that can be seen today.

Aspects of Darwin's research at Downe that were important for his theory of evolution and his major contributions to botany, and can be appreciated by repeating the observations he made in the same places today.

Superfecundity of nature: Orchard and Holwood Park (Nomination document Section 2.a.xi f, 2.a.x)

Natural seedbanks: Sandwalk copse (2.a.xi k)

Struggle for existence: Flower garden, orchard and Great House Meadow (2.a.xi e, f, j)

Variation within species: Flower garden, orchard, kitchen garden and Downe Valley (2.a.xi e, f, g, 2.a.v)

Importance of cross-fertilisation: Kitchen garden and Downe Valley (2.a.xi g, 2.a.v)

Natural selection for adaptation to environments and co adaptation between species: Greenhouse, High Elms and Orchis Bank (2.a.xi h, 2.a.ix, 2.a.vii)

Dispersal of living organisms: Cudham School Pond and Keston Common (2.a.viii.49, 2.a.vii.43)

Inherited behaviour as a factor in evolutionary adaptation: Honey bees in garden laboratory (2.a.xi i)

Depth of geological time: View out over the Weald of Kent from North Downs escarpment (2.a.29)

Hybridism and the origin of new species: Downe and Cudham Valleys (2.a.iv, v)

Divergence of species in evolution: Flower garden, Great Pucklands (2.a.xi e, l)

Evolutionary relationships in taxonomic analysis: Old study, High Elms (2.a.xi a, 2.a.ix)

Web of complex relations in ecosystems: Great House Meadow and Orchis Bank (2.a.xi j, 2.a.vii)

Mechanisms of plant reproduction: Flower garden, kitchen garden, Downe Valley and Hangrove (2.a.xi e, g, 2.a.iv, 2.a.vi.33)

Plant adaptations for climbing and other forms of growth and movement: Study, drawing room, exterior walls of Down House, greenhouse (2.a.xi a, b,d, h)
Plant adaptations for catching and digesting insects: Greenhouse and Keston Common (2.a.xi h, 2.a.vii.43)

Role of earthworms in soil formation and erosion: Great House Meadow, Great Pucklands and Green Hill (2.a.xi j, l)

Aspects of Darwin's scientific approach that can be appreciated in his work on features of the nominated property that can be seen today.

Focus and accuracy in observation: Pollination of orchids in Downe Valley and on Downe Bank (2.a.iv, 2.a.vii)

Experimenting with natural life: Lawn patch experiment in the orchard (2.a.xi f)

Tracing and measuring imperceptible processes: Wormstone in garden (2.a.xi e)

Developing and testing hypotheses: Experiments with two forms of Primula in the kitchen garden (2.a.xi g)

Cooperation with other scientists and experts: Asa Gray's *Echinocystis lobata* in study and Fritz Müller's plants in greenhouse (2.a.xi h)

Local and global patterns: Orchids, climbing plants and insectivorous plants in greenhouse and on Orchis Bank (2.a.xi h, 2.a.vii)

Illustration for explanation: Food chain and other factors linking clover and cats (2.a.xi j)

Search for natural laws: Plant movement in study and greenhouse, principle of divergence and biodiversity in Great Pucklands (2.a. xi h, l)

Annex 3

Timelines for Darwin's place in history, his life and developments since

Precursors

Aristotle (384-322 BC). *His History of Animals* set the foundations for the scientific study of the natural world with his notions of a continuous scale of nature from the simplest to the most complex organisms, classification of all species in higher groupings and the explanation of their structures in terms of functions for living.

Carolus Linnaeus (1707-1778). Established in his *System of Nature* (1735) the Linnaean binomial method of classifying the plant and animal kingdoms, providing a framework for the systematic analysis of the relations between species in genera, orders and classes.

Georges, Comte de Buffon (1707-1788). Produced in his *Histoire Naturelle, Generale et Particuliere* (1749-1804) the first ordered survey of the whole natural world based on the study of living animals and plants in their natural surroundings. Studied the geographical distribution of species and inaugurated the modern approach to the history of natural life with his identification of extinct forms and his ordering of geological facts in a sequence of epochs.

Dr Erasmus Darwin (1731-1802). Grandfather of Charles Darwin. Set out an evolutionary explanation of the relations between plant and animal species in his *Zoonomia, or the Laws of Organic Life* (1794, 1796) and *The Temple of Nature* (1803). He based his theory of common descent on the idea that 'all species undergo perpetual transformations' but had no persuasive explanation of any mechanisms for change.

Georges, Baron Cuvier (1769-1832). Pioneer of comparative anatomy and its use for explaining the major groupings of animal organisms, the functions of their different body parts and the relations between fossil and living species.

Reverend Thomas Malthus (1766-1834). Political economist who pointed out in his *Essay on the Principle of Population* (1798) that populations, if unchecked, will expand more rapidly than the means of subsistence and there will therefore be constant competition for survival. This observation gave Darwin the key to explaining how organisms might evolve through natural selection in the struggle for existence.

Jean-Baptiste, Chevalier de Lamarck (1744-1829). Biologist who in his *Philosophie Zoologique* (1809)

advanced a theory of transformation of species by adaptation through the inheritance of acquired traits.

Alexander von Humboldt (1769-1859). Naturalist and explorer whose *Personal Narrative of Travels to the Equinoctial Regions* inspired Darwin to travel to the Americas. Pioneering figure in the development of physical geography and biogeography with a global perspective.

Contemporaries

Etienne Geoffroy St Hilaire (1772-1844). French comparative anatomist who emphasised the importance of 'unity of type' or anatomical homology in relations between species, and introduced evolutionary ideas as a minor theme in some of his writings about animal forms.

Louis Agassiz (1807-1873). Swiss-born American ichthyologist and glaciologist who made a major contribution to comparative zoology but opposed Darwin's theory of evolution in favour of 'special creation'.

Federico Delpino (1833-1905). Leading Italian botanist who wrote in support of Darwin's botanical work.

Ernst Haeckel (1834-1919). German zoologist and evolutionist who was a leading advocate of Darwinism. His evolutionary approach to the taxonomy of marine invertebrates yielded many insights.

Sir Joseph Hooker (1817-1911). Botanist and Director of the Royal Botanic Gardens, Kew. Close friend of Darwin from the early 1840s and his most important advisor and collaborator throughout his years at Downe.

Thomas Henry Huxley (1825-1895). Scientist and public figure. Darwin's leading advocate after the publication of *The Origin of Species* (1859).

Sir Charles Lyell (1797-1875). Geologist who set out in his *Principles of Geology* (1830-1833) an explanation of the history of former changes of the earth's surface by reference to the continual operation of natural processes.

Paolo Mantegazza (1831-1910). Italian physiologist and anthropologist who developed a Darwinian 'natural history of man' at the University of Florence in the 1870s.

Sir Richard Owen (1804-1892). Comparative anatomist and Director of the Natural History Museum, London. Leading opponent of Darwin and Darwinian evolution after the publication of *The Origin of Species* (1859).

Hermann Müller (1829-1883). German botanist whose work on the fertilisation of flowers provided important support for Darwin's evolutionary theories.

Karl Ernst von Baer (1792-1876). Russian embryologist who taught in St Petersburg. His four laws of animal development published in 1828 provided an important stimulus for Darwinian thinking about branching evolution.

Alfred Russell Wallace (1823-1913). British naturalist and explorer who independently of Darwin in 1858 identified the process of natural selection and wrote to Darwin for help in publishing his paper, not knowing about Darwin's own private views. It was arranged for his theory to be announced together with Darwin's at a meeting in London in July 1858, and Darwin published *The Origin of Species* in the following year. In later years Wallace and Darwin collaborated closely in work on shared interests.

Darwin's Life and Achievements

1809 Born in Shrewsbury, England.

1825-1827 Studied medicine at Edinburgh University.

1827-1831 Studied for holy orders at Cambridge University.

1831 Inspired to travel abroad as a naturalist by the writings of the German explorer Alexander Von Humboldt.

1831-6 Accompanied Captain Robert FitzRoy on the voyage of HMS *Beagle* to South America and the Pacific, Indian Ocean and Atlantic islands.

1835 Examination of birds he had collected on the Galapagos Islands suggested to him that species might not be immutable.

1837-42 Lived in London, employed as Secretary of the Geological Society of London. Developed hypothesis of evolution through descent with modification, keeping his ideas secret to avoid controversy.

1838 Identified natural selection as possible mechanism for evolutionary adaptations, and came to believe that humans had animal ancestry.

1839 Published *Journal of Researches into the Geology and Natural History of the Various Countries Visited during the Voyage of HMS Beagle round the world*.

Marriage to Emma Wedgwood.

Corresponded with Humboldt, starting a life-long exchange of information, specimens and ideas with fellow naturalists in Europe, North and South America, Asia and the Pacific.

Birth of first son, William.

1841 Birth of first daughter, Anne.

1842 Wrote first 35-page sketch of evolutionary hypothesis.

Moved with his young family to Down House at Downe in Kent.

1842-82 Lived with his family at Down House, supported by his and his wife's inherited wealth. Gave all his working time to natural science using his home and grounds as his workplace and laboratory.

1844 Revealed his theory of evolution by natural selection in private to Joseph Hooker, the botanist. Wrote first full statement of the theory in a 231-page essay.

1845 Published second edition of *Journal of Researches during the Voyage of HMS Beagle* with fresh treatment of the wildlife of the Galapagos in which he hinted at the possibility of species change.

Robert Chambers published anonymously an evolutionary history of life on earth, which drew much attention but lacked an explanation of the mechanism and was attacked on religious grounds. The fierceness of the controversy was a factor in Darwin's decision to delay publication of his theory until he had developed persuasive arguments for it and had gathered conclusive evidence.

1846-54 Carried out a survey of all fossil and living species of barnacles and published a definitive taxonomy based on an evolutionary view of relations between species.

1851	Death of Darwin's daughter Annie from tuberculosis, leading to his final loss of Christian faith.		how new adaptations arise in evolution by the modification of existing parts, and the first exploration of the extent and intricacy of co-adaptation between species, an essential feature of natural life which Darwin was able to explain convincingly with his theory.
1854-1859	Developed the theory of evolution through reading, discussion with other naturalists and observations and experiments in his grounds and the countryside around, to investigate the mechanisms of inheritance and variation, the struggle for existence, natural selection and the geographical distribution of species.	1865	Gregor Mendel, a monk in Moravia, published his paper on the hybridisation of sweet peas, which identified principles of biological inheritance which underlie evolution. The significance of the paper for the understanding of evolution was not recognised by scientists at the time.
1855	Carried out first focused survey of biodiversity of a defined area in a field at Downe and developed the principle of divergence as a global principle explaining the extent of biological diversity in all natural habitats.	1865	Darwin published <i>The Movements and Habits of Climbing Plants</i> , based on his work with wild and cultivated plants at Downe. The book showed how different plants had evolved a number of ways to climb for light using different elements of their structure.
1856	Started work on the first long version of <i>The Origin of Species</i> . Discovery in Germany of remains of Neanderthal man, a human species with features which supported Darwin's belief that <i>Homo sapiens</i> had evolved from ape-like ancestors.	1868	Published <i>The Variation of Animals and Plants under Domestication</i> which provided the detailed evidence for many of the statements made in <i>The Origin of Species</i> .
1858	Alfred Russell Wallace, a young naturalist working in the Malay Archipelago, wrote to Darwin proposing an explanation of species change apparently identical to Darwin's theory of natural selection. His and Darwin's ideas were announced jointly at a meeting of the Linnean Society in London.	1871, 1873	Published <i>The Descent of Man and The Expression of the Emotions in Man and Animals</i> setting out his arguments for applying the theory of evolution to humans as well as animals, and suggesting how the distinctive features of human nature might have evolved from ape-like ancestors.
1859	Darwin published <i>The Origin of Species</i> drawing on his observations during the voyage of HMS Beagle, information he had gathered from other naturalists since, and his observations and experiments at Down House.	1875	Published <i>Insectivorous Plants</i> , again based on his work with wild and cultivated plants at Downe, showing how plants of different kinds had evolved similar methods of capturing and digesting insects for survival in habitats poor in plant nutrients.
1860	Meeting of British Association at Oxford University in which scientists and churchmen argued about evolution, highlighting the controversy about the implications of the theory for human origins.	1876, 1877	Published <i>The Effects of Cross and Self Fertilisation in the Vegetable Kingdom and The Different Forms of Flowers on Plants of the Same Species</i> , again based on his work with wild and cultivated plants at Downe. The works demonstrated the fundamental significance of genetic variation and cross-breeding for the evolution of all species.
1862	Darwin published <i>The Various Contrivances by which Orchids are Fertilised by Insects</i> based on his observations of wild orchids growing in the countryside around Down House. The book was the first analysis of	1880	Published <i>The Power of Movement in Plants</i> , again based on his work with wild and cultivated plants at Downe. The work revealed the common evolutionary basis

	of many fundamental aspects of plant growth and movements, and adaptations for survival in different environments.	1953	Francis Crick and James Watson identified the molecular structure of DNA.
1881	Published <i>The Formation of Vegetable Mould through the Action of Worms</i> based on his research on the behaviour of earthworms in soil around Downe and elsewhere, and the gradual effects of their excavations on the composition and movement of the soil.	1955-77	Frederick Sanger, Sydney Brenner and others developed the techniques for deciphering the genetic code of living organisms leading to the tracing of the evolutionary patterns of genetic inheritance and divergence between all taxa.
1882	Died at Down House. Buried in Westminster Abbey.	1992	Adoption of the UN Convention on Biological Diversity. Rio Earth Summit declared importance of developing ecological understanding and maintaining biodiversity for global survival.
Developments Since			
1900s	Development of a new Mendelian theory of inheritance by Hugo de Vries, T H Morgan and others, based on a fresh appreciation of the fundamental importance of Mendel's research on cultivating sweet peas.	2002	Johannesburg Earth Summit reviewed progress towards Rio targets and adopted programme for action on sustainable development.
1908	G H Hardy published a paper laying the mathematical foundations for population genetics.	2003	Completion of Human Genome project enabled comparison of genetic make-up of <i>Homo sapiens</i> with all other living creatures for understanding of their evolutionary relationships.
1920-26	Nikolay Vavilov, Russian plant geneticist, developed a Darwinian theory of hereditary variation of cultivated plants that was used with his major plant collection for agricultural improvement.	2005	UN Millennium Ecosystem Assessment concluded that the ways human societies have obtained their food, fresh water, timber and fuel over the last 50 years have seriously degraded the global environment. The UN Secretary-General, Kofi Anan said: "Only by understanding the environment and how it works can we make the necessary decisions to protect it. Only by valuing all our precious resources can we hope to build a sustainable future."
1918-32	Development by R A Fisher, J B S Haldane and Sewell Wright of the 'modern synthesis' of Mendelian genetics with Darwinian natural selection using population statistics to explain the survival and elimination of different traits.	2009	200th Anniversary of Darwin's birth and 150 years since the publication of <i>The Origin of Species</i> .
1935	Arthur Tansley introduced the word 'ecosystem' to denote the physical and biological components of an environment considered in relation to each other as a unit. This was a step in the development of the science of ecology in which he played a role.	2010	Many countries of the world came together for the World Summit on Sustainable Development in 2002 and promised to 'achieve by 2010 a significant reduction in the current rate of loss of biological diversity' Countdown 2010 is a powerful network of active partners working together towards the 2010 biodiversity target
1937	Theodosius Dobzhansky's <i>Genetics and the Origin of Species</i> laid the foundation for the 'new synthesis' of Darwinian evolution with population genetics that was developed in Ernst Mayr's <i>Systematics and the Origin of Species</i> (1942) and George Gaylord Simpson's <i>Tempo and Mode in Evolution</i> (1944).		

Annex 4

Points in *The Origin of Species* and other works by Darwin and Lubbock based on or linked with observations at Downe

a. Books by Darwin

The Origin of Species (1859)

(Page references to penguin Classics edition, 1985)

Laws of inheritance and variation: correlation in pelargonium (184); rudimentary features in antirrhinum (197); reversion in pigeons (85); variation on hybridisation (285).

Dependence of organisms on others: mistletoe living on trees, pollinated by insects and seeds dispersed by birds (67).

Artificial selection: pigeons (82, 424); flowers, vegetables and fruit (89).

Anatomical variability within species: scale insect (102).

Species merging with varieties: wild flowers (112).

Struggle for existence: predation (115); seedlings in earth (120); nutriment in seed for survival (128).

Ecological relations between organisms: orchids, heartsease, clover, bumble-bees, field-mice and cats (123).

Instinct: cats (138), great tit (215), hive bees' comb-making (248 ff, 447), cuckoo (263), aphids and ants (237).

Co-adaptation: hive and humble-bees and common red and incarnate clover (141); aphids and ants (237).

Out-breeding: *Lobelia fulgens*, cabbage, radish and onions (144); holly and bees (140).

Divergence: plant species in pasture (157).

Practical imperfections of evolution: fir trees (230).

Kin selection: vegetables (258).

Geological time: the Weald (296).

Dispersal of species beyond apparent physical boundaries: seeds (354 ff, 377); fresh-water shells (375); land shells (385).

Natural history: understanding (457); botanical experiment (269, 457).

Evolution of the whole natural world: entangled bank (459).

The Various Contrivances by which British and Foreign Orchids are Fertilised by Insects (1862)

Co-adaptation.

Mechanisms for cross-fertilisation.

The Movements and Habits of Climbing Plants (1865)

Different adaptations of plant forms for climbing.

The Variation of Animals and Plants under Domestication (1868)

Variation within species.

Adaptation by selective breeding.

Insectivorous Plants (1875)

Sensitivity to movement.

Digestive mechanisms.

The Effects of Cross and Self Fertilisation in the Vegetable Kingdom (1876)

Significance of cross-fertilisation for plant evolution.

The Different Forms of Flowers on Plants of the same Species (1877)

Adaptations for cross-fertilisation.

The Power of Movement in Plants (1880)

Mechanisms for movements.

The Formation of Vegetable Mould through the Action of Worms (1881)

Earthworms' mental capabilities and habits.

Cumulative effects of action of earthworms on soil formation and flow.

b. Sir John Lubbock

'On the digestive and nervous system of Coccus hesperidum', Proceedings of the Royal Society Vol. ix, 1858, [pp.]

Variations in insect anatomy.

Pre-Historic Times (1865)

Coexistence of prehistoric humans with extinct mammals.

Monograph on the Collembola and Thysanura (1871)

Taxonomy of Collembola.

The Origin and Metamorphoses of Insects (1873)

Insect transformations in growth.

On British Wild Flowers Considered in relation to Insects (1875)

Links between plants and pollinators.

Ants, Bees and Wasps (1882)

Behaviour of social insects.

Chapters in Popular Natural History (1886)

Observations in countryside.

On the Senses, Instincts and Intelligence of Animals, with special reference to Insects (1888).

Ant and wasp behaviour.

Latin Name	English Name	UK Red Data Book Species	UK SCC	UK Scarce	UK BAP Priority	London BAP Priority Species	Bromley BAP Species	Comments	Current Location
Vascular Plants									Unspecified vascular plant records det. J. Pitt
<i>Aceras anthropophorum</i>	Man orchid			Yes				Legal Status: Cites	High Elms, Downe Valley, Hangrove slopes in Cudham Valleyslopes in Cudham Valley
<i>Carex binervis</i>	Green-ribbed sedge							Rare in London	Keston Bog ¹
<i>Carex echinata</i>	Star sedge							Rare in London	Keston Bog ¹
<i>Carex laevigata</i>	Smooth-stalked sedge							Rare in London 5	Just above Keston bog on west side
<i>Carex pallescens</i>	Pale sedge							Rare and decreasing in London 5	Padmall Wood
<i>Carex panicea</i>	Carnation sedge							Rare in Greater London, KRDB 1	Keston Bog ¹
<i>Carex pilulifera</i>	Pill sedge							Declining in North London 5	Keston
<i>Cephalanthera damasonium</i>	White helleborine	VU						Rare in Greater London	High Elms, Downe Bank, Footpath from Church Hill into Cudham Valley
<i>Convallaria majalis</i>	Lily-of-the-valley							Rare in Greater London 5	Padmall Woods
<i>Cuscuta epithymum</i>	Common dodder	VU						Rare in Greater London	Downe Valley
<i>Daphne mezereum</i>	Mezereon	VU						UK scarce, Rare in Greater London	Berry's Green chalk slope. Last seen 2001
<i>Erica cinerea</i>	Bell heather							Rare in Greater London	Keston ¹
<i>Erica tetralix</i>	Cross-leaved heath							Rare in Greater London	Keston Bog ¹
<i>Eriophorum angustifolium</i>	Common cotton sedge							Rare in Greater London, Kent RDB 1	Keston Bog ¹
<i>Euphorbia exigua</i>	Dwarf spurge	NT							Cudham Valley
<i>Euphrasia pseudokernerii</i>	Chalk eyebright	EN		Yes		Yes			Cudham Valley South
<i>Genista tinctoria</i>	Dyer's greenweed							Decreasing in London 5	Cudham Valley. Last seen 1998

Latin Name	English Name	UK Red Data Book Species	UK SCC	UK Scarce	UK BAP Priority	London BAP Priority Species	Bromley BAP Species	Comments	Current Location
<i>Hyacinthoides non-scripta</i>	Bluebell		Yes					WCA Schedule 8 Globally threatened	High Elms, Padmall Woods, Downe Scout Camp, Downe Valley, Holwood, Keston ¹
<i>Hydrocotyle vulgaris</i>	Marsh pennywort							Rare in Greater London, KRDB 1	Keston Bog ¹
<i>Hydrocharis morsus-ranae</i>	Frogbit	VU						Introduced to High Elms nature garden pond	High Elms nature garden pond
<i>Juncus squarrosus</i>	Heath rush							Rare in Greater London, KRDB 2	Keston
<i>Juniperus communis</i>	Common juniper				Yes	Yes			Downe Bank
<i>Melampyrum pratense</i>	Common cow wheat							Rare in Greater London	Keston Common
<i>Moenchia erecta</i>	Upright chickweed			Yes				Rare in Greater London	Keston
<i>Monotropa hypopitys</i>	Yellow bird's nest	EN						Rare in Greater London 5	High Elms
<i>Narthecium ossifragum</i>	Bog asphodel							Rare in Greater London, KRDB 1	Keston Bog ¹
<i>Neottia nidus-avis</i>	Bird's-nest orchid	NT						Rare in Greater London	High Elms
<i>Onobrychis viciifolia</i>	Sainfoin	NT (native form only)						European introduced cultivar	Downe Valley
<i>Ophrys insectifera</i>	Fly orchid	VU						Rare in Greater London	High Elms, Downe Bank, Downe Valley, The Shaws, Berry's Green chalk slope, Cudham Valley below Hazelwood
<i>Platanthera chlorantha</i>	Greater butterfly orchid	NT						Rare in Greater London	High Elms, Hazel bank below Hazelwood, Cudham Valley
<i>Polygala amarella</i>	Dwarf milkwort	VU4		Yes		Yes		KRDB 3	Blackbush Shaw clearing. Last seen 2001 ? extinct
<i>Polygala calcarea</i>	Chalk milkwort							Rare in Greater London	Downe Valley, Downe Bank
<i>Polystichum setiferum</i>	Soft shield fern							Rare in Greater London	Keston

Latin Name	English Name	UK Red Data Book Species	UK SCC	UK Scarce	UK BAP Priority	London BAP Priority Species	Bromley BAP Species	Comments	Current Location
<i>Potamogeton polygonifolius</i>	Bog pondweed							Rare in Greater London	Keston Bog
<i>Potentilla argentea</i>	Hoary cinquefoil	NT						Rare in Greater London 5	Keston
<i>Ranunculus hederaceus</i>	Ivy-leaved water-crowfoot							Rare in Greater London 5	Keston
<i>Ranunculus lingua</i>	Greater spearwort							Rare in Greater London	Keston
<i>Saxifraga granulata</i>	Meadow saxifrage							Scarce in Greater London	Keston, opp war memorial on grass verge. At Holwood (on well drained slope of acid grassland behind mansion with waxcaps and Polytrichum juniperum (J. Pitt, pers comm.)
<i>Scutellaria minor</i>	Lesser skullcap							Rare in Greater London, UK decline	Keston (may now be extinct, J.Pitt (pers comm))
<i>Stellaria pallida</i>	Lesser chickweed							Scarce in Greater London (Rodney Burton)	Keston
<i>Stratiotes aloides</i>	Water soldier	NT						Introduced to High Elms nature gdn pond	
<i>Tilia cordata</i>	Small-leaved lime							KRDB 2	Holwood (South Park Estate) Old trees but likely
<i>Trifolium striatum</i>	Knotted clover							Declining in Greater London 5	Keston
<i>Ulex minor</i>	Dwarf gorse							Rare in Greater London	Keston1
<i>Vaccinium myrtillus</i>	Bilberry							Rare in Greater London	Keston1
<i>Verbascum lychnitis</i>	White mullein							Reported as UK scarce in KRDB	High Elms between Burnt Gorse and Cudham Valley farmland where clearance of secondary woodland occurred 2003

Latin Name	English Name	UK Red Data Book Species	UK SCC	UK Scarce	UK BAP Priority	London BAP Priority Species	Bromley BAP Species	Comments	Current Location
Mosses and Liverworts									det. J. Hendey
<i>Aulacomnium palustre</i>	Bog Groove-moss							Kent RDB status 3	Keston Bog 1991 and 1995.
<i>Sphagnum capillifolium</i>	Red Bog-moss							Kent RDB status 1	Keston Bog 1991 and 1995.
<i>Sphagnum cuspidatum</i>	Feathery Bog moss							Kent RDB Status 1	Keston Bog 1991 and 1995.
<i>Sphagnum magellanicum</i>	Magellanic Bog-moss							Kent RDB Status 1	Keston Bog 1991 and 1995.
<i>Cephalozia connivens</i>	Forcipated pincerwort							Kent RDB Status 3	Keston Bog 1991, not 1995.
Algae									
<i>Chara virgata</i>								Kent RDB 2	Keston ponds
Fungi									det. J. Weight man, J. Pitt
<i>Amanita crocea</i>								Kent RDB 3. 9 Kent records (BMSDB 2005), but 328 in UK	High Elms Golf Course
<i>Clavaria incarnata</i>								5 Kent; 39 UK records (BMSDB)	Down House
<i>Clitocybe houghtonii</i>				Notable in Kent				Kent RDB 2. 11 Kent records (BMSDB)	High Elms, Downe Bank, Downe Valley
<i>Enteloma serrulatum</i>								1 of 6 known sites in Kent	Buckston Browne front lawn, adjacent to Down House, Shaws Camp site
<i>Hemimycena delectabilis</i>								3 Kent; 46 UK records (BMSDB)	Down House
<i>Hericius erinaceus</i>		RDB2			Yes			8 Kent; 281 UK records (BMSDB)	High Elms 1990
<i>Hydnellum zonatum</i> (= <i>Hydnellum conrescens</i>)								1 or 2 records for Kent, 361 for UK (BMSDB)	Keston Common and/or Holwood 1976

Latin Name	English Name	UK Red Data Book Species	UK SCC	UK Scarce	UK BAP Priority	London BAP Priority Species	Bromley BAP Species	Comments	Current Location
<i>Hygrocybe calyptriformis</i>		VU			Yes				Down House lawn 1982
<i>Hygrocybe cantharellus</i>		European provisional RDB list C						1 of 4 known sites in Kent	Buckston Browne front lawn, Down House
<i>Hygrocybe citrinovirens</i>								4 Kent records (BMSDB)	Down House
<i>Hygrocybe fornicata</i>								Kent RDB 2, 10 Kent records (BMSDB)	High Elms conservation field, Downe Valley, Shaws Camp site
<i>Hygrocybe insipida</i>		European Provisional RD list C						29 Kent; 1144 UK records (BMSDB), but rare in Europe	High Elms, Down House, Buckston Browne, Shaws Camp site
<i>Hygrocybe intermedia</i>								Kent RDB 1. 6 Kent records (BMSDB)	Down House
<i>Inocybe jurana</i>								7 Kent; 141 UK records (BMSDB)	Down House
<i>Inonotus cuticularis</i>								Kent RDB 1. 4 Kent; 146 UK records (BMSDB)	High Elms 1999
<i>Leucoagaricus badhamii</i>		RDB 2						Kent RDB 2	High Elms
<i>Mycena adonis</i>								5 Kent records; 213 UK records (BMSDB)	High Elms, Downe Bank
<i>Mycena diosma</i>								4 Kent; 27 UK records (BMSDB)	Downe Valley
<i>Mycoacia nothofagi</i>		RDB (non-categorised)						1 Kent; 30 UK records	Keston Common
<i>Podoscypha zonarius</i>								5 Kent; 172 UK records (BMSDB)	Down House
<i>Porpoloma spinulosum</i>		RDB						7 Kent; 12 UK records (BMSDB)	Holwood House

Latin Name	English Name	UK Red Data Book Species	UK SCC	UK Scarce	UK BAP Priority	London BAP Priority Species	Bromley BAP Species	Comments	Current Location
<i>Pulcherricium caeruleum</i>								8 Kent records (BMSDB)	Downe Bank
<i>Russula gigasperma</i>								2 Kent; 21 UK records (BMSDB)	Holwood House
<i>Russula knautia</i>								7 Kent; 26 UK records (BMSDB)	Down House
<i>Russula melzeri</i>		RDB (non-categorised)						7 Kent; 18 UK records (BMSDB)	Downe Valley
<i>Russula solaris</i>								5 Kent; 55 UK records (BMSDB)	Holwood House
<i>Russula viscida</i>		RDB						Kent RDB 2 8 Kent; 29 UK records (BMSDB)	Downe Down House
<i>Scytinostroma portentosum</i>		RDB						4 Kent; 43 UK records (BMSDB)	Downe Bank
<i>Squamanita paradoxa</i>		Provisional RDB						Kent RDB 1; 9 UK records (BMSDB)	Downe Valley (only record in Kent)
<i>Sowerbyella radiculosa</i>		RDB (non-categorised)						6 Kent; 61 UK records (BMSDB)	Down House
<i>Xerocomus armeniacus</i>								6 Kent; 18 UK records (BMSDB)	Holwood House
Invertebrates									
Beetles									
<i>Aphthona euphorbiae</i> (Shrank)	a green flea beetle			Notable (Nb)					Downe Bank ²
<i>Aphthona herbigrada</i> (Curtis)	a green flea beetle			Notable (Nb)					The Shaws North ²
<i>Bruchidius cisti</i> (Fabricius)	small black bean weevil			Notable (Nb)					Downe Bank ²
<i>Ceutorhynchus constrictus</i> (Marsham)	a small grey weevil			Notable (Nb)					Downe Bank ²

Latin Name	English Name	UK Red Data Book Species	UK SCC	UK Scarce	UK BAP Priority	London BAP Priority Species	Bromley BAP Species	Comments	Current Location
<i>Cryptocephalus hypochaeridis</i> (Linn)	a green leaf beetle			Notable (Nb)					High Elms ²
<i>Cryptocephalus moraei</i> (Linn)	black and yellow leaf beetle			Notable (Nb)					Downe Bank and The Shaws North ²
<i>Diplapion stolidum</i> (Germar)	a minute black weevil			Notable (Nb)					Downe Valley ²
<i>Diplocoelus fagi</i> (Guerin-Meneville)	a small grey beetle			Notable (Nb)					High Elms ²
<i>Drilus flavescens</i> (Fourcroy)	a small brown beetle			Notable (Na)					Footpath between Downe Bank and The Shaws ²
<i>Hippodamia variegata</i> (Goeze)	the Adonis ladybird			Notable (Nb)					Downe Valley ²
<i>Lampyris noctiluca</i>	Glow worm						Yes	Rare in Greater London, declining (John Taylor, pers comm.)	Downe and Cudham Valleys ²
<i>Longitarsus anchusae</i> (Paykull)	a yellow flea beetle			Notable (Nb)					Downe Bank ²
<i>Longitarsus parvulus</i> (Paykull)	Flax flea beetle			Notable (Na)					Cudham School Grounds ³
<i>Lucanus cervus</i>	Stag beetle			Yes	Yes	Yes	Yes		Keston Common
<i>Malthinus balteatus</i> (Suffrian)	beetle			Notable (Nb)					Cudham School Grounds ³
<i>Meligethes solidus</i> (Kugelann)	a minute black flower beetle			Notable					Downe Bank ²
<i>Metabletus truncatellus</i> (Linn)	a small brassy ground beetle			Notable (Nb)					High Elms ²
<i>Mitoplinthus caliginosus</i> (Fabricius)	Hop root weevil			Notable (Na)					Cudham School Grounds ³
<i>Mordellistena neuwaldeggiana</i> (Panzer)	a skipping flower beetle	DD (=RDB K)							High Elms ²
<i>Ocypus fuscatus</i> (Gravenhorst)	a large rove beetle			Notable (Nb)					High Elms ²

Latin Name	English Name	UK Red Data Book Species	UK SCC	UK Scarce	UK BAP Priority	London BAP Priority Species	Bromley BAP Species	Comments	Current Location
<i>Onthophagus joannae</i> (Goljan)	a black dung beetle							Very local	Downe Bank ²
<i>Phyllopertha horticola</i> (Linn)	a large brown-bronze chafer							Once common, now diminishing	The Shaws North ²
<i>Platydracus latebricola</i> (Gravenhorst)	a large black and red rove beetle			Notable (Nb)					Downe Bank ²
<i>Rhagonycha lutea</i> (Muller)	a black and yellow soldier beetle			Notable (Nb)					The Shaws North ²
<i>Stenus niveus</i> (Fawvel)	a small black rove beetle			Notable (Nb)					High Elms ²
<i>Varimorda villosa</i> (Shrank)	a black skipping flower beetle			Notable (Nb)					High Elms ²
Diptera-flies									
<i>Chorisops nagatomii</i> (Rozkosny)	a small soldier fly			Notable					High Elms ²
<i>Coenosia atra</i> (Meigan)	small black fly			Notable (Nb)					Cudham School Grounds ³
<i>Cordylura similis</i> (Siebke)	a black dung fly	RDB 3							Downe Bank ²
<i>Disomyza incurva</i> (Fallen)	a small black fly							Very local	The Shaws, Downe Valley ²
<i>Ernestia puparium</i> (Fabricius)	a large grey parasitoid fly	EN							Downe Bank ²
<i>Ictericia westermanni</i> (Meigen)	a pink picture-winged fly			Notable					Downe Bank ²
<i>Lejogaster tarsata</i> (Megerle)	a hoverfly							Very local	Downe Valley ²
<i>Leptarthrus vitripennis</i> (Meigen)	a dark grey robberfly	VU (RDB 2 and 3)							Downe Bank, High Elms The Shaws North and South ²
<i>Macronychia ungulans</i> (Pandelle)	a mottled grey blowfly			Notable					High Elms, Downe Bank ²

Latin Name	English Name	UK Red Data Book Species	UK SCC	UK Scarce	UK BAP Priority	London BAP Priority Species	Bromley BAP Species	Comments	Current Location
<i>Microdon devius</i> (Linn)	a lge grey hoverfly	EN (RBD2)							The Shaws North ²
<i>Sapromyza quadricincta</i> (Becker)	small orange fly			Notable (Nb)					Cudham School Grounds ³
<i>Tephritis matricariae</i> (Loew)	fruit fly	DD							Cudham School Grounds ³
<i>Volucella inanis</i> (Linn)	a lge black and brown hornet mimic hoverfly			Notable					High Elms ²
Hemiptera-bugs and plant-hoppers									
<i>Eurygaster maura</i> (Linn)	a lge tortoise bug			Notable (Nb)					Downe Valley ²
<i>Tingis reticulata</i> (Herrich-Schaeffer)	a small lacebug			Notable (Nb)					High Elms ²
Hymenoptera-bees, wasps, ants									
<i>Bombus humilis</i> Illiger	a lge tawny bumblebee							Once more widespread, now declining rapidly	Downe Bank ²
<i>Ectemnius dives</i> (Lepeltier and Brulle)	a small solitary wasp							Scarce	High Elms ²
<i>Hylaeus pictipes</i> Nylander	a small solitary bee			Notable (Na)					The Shaws South ²
<i>Nysson trimaculatus</i> (Rossius)	solitary wasp			Notable (Na)					Cudham School ³
<i>Osmia bicolor</i> (Shrank)	a small mason bee			Notable (Nb)					The Shaws South ²
<i>Stigmus pendulus</i> (Panzer)	small black solitary wasp	DD							Cudham School ³
Butterflies and Moths									
<i>Argynnis aglaja</i> (Linn)	Dark green fritillary		Yes			Yes	Yes	Very local, declining	High Elms, Downe Bank
<i>Cupido minimus</i>	Small blue butterfly		Yes			Yes	Yes		Downe Valley
<i>Satyrum w-album</i> (Knoch)	White letter hairstreak						Yes		High Elms, Cudham Valley

Latin Name	English Name	UK Red Data Book Species	UK SCC	UK Scarce	UK BAP Priority	London BAP Priority Species	Bromley BAP Species	Comments	Current Location
Aranaea-spiders									Spiders det. Edward Milner
<i>Agroeca brunnea</i>									High Elms
<i>Atypus affinis</i>								Rare in London	High Elms
<i>Ballus chalybeius</i>								Uncommon in London	High Elms (ancient woodland)
<i>Coelotes terrestris</i>				Notable (Nb)				Uncommon in London	High Elms
<i>Ero falcata</i>									High Elms
<i>Haplodrassus silvestris</i>				Notable (Nb)				Not seen in London for 50+ years	High Elms
<i>Neon reticulatus</i>								Only in ancient woodland	High Elms
<i>Philodromus praedatus</i>				Notable (Nb)				Rare in London Lower tree branches	High Elms
<i>Trachyzelotes pedestris</i>				Notable (Nb)				Chalk grassland only London record	High Elms
<i>Xysticus bifasciatus</i>								Uncommon in London	High Elms
<i>Xysticus nemoralis</i>				Notable (Nb)				Only London record	High Elms
Mollusca									
<i>Helix pomatia (Linnaeus)</i>	Roman snail							RDB EN 1987, not on list (Bratton, 1991) London SCC	Cudham Valley, High Elms, Downe Bank, Musk Orchid Bank
Birds									det. D.McWalter/R. Francis, F.O' Hare
<i>Alauda arvensis</i>	S Skylark	RSPB amber list							Small numbers in fields throughout site e.g. between Great House Meadow and Hangrove Woods
<i>Carduelis cannabina</i>	Linnet	RSPB red list							Shire Lane

Latin Name	English Name	UK Red Data Book Species	UK SCC	UK Scarce	UK BAP Priority	London BAP Priority Species	Bromley BAP Species	Comments	Current Location
<i>Delichon urbica</i>	House martin	RSPB amberlist						Locally scarce, declining	Nesting in small numbers throughout Site
<i>Dendrocopos minor</i>	Lesser spotted woodpecker	RSPB red list							High Elms
<i>Emberiza citrinella</i>	Yellowhammer	RSPB red list							Shire Lane and North End Lane, Nash Farm, Keston
<i>Muscicapa striata</i>	Spotted flycatcher	RSPB red list			Yes				High Elms 2005 Nested at Cudham nr Church 2004
<i>Parus palustris</i>	Marsh tit	RSPB red list							Downe Bank, High Elms
<i>Passer domesticus</i>	House sparrow	RSPB red list				Yes			Throughout Site in small numbers. e.g. Downe, Cudham, Keston
<i>Pyrrhula pyrrhula</i>	Bullfinch	RSPB red list			Yes				Throughout Site in small nos. e.g. Down House Estate
<i>Sturnus vulgaris</i>	Starling	RSPB red list							Nesting in small numbers throughout Site
<i>Turdus philomelos</i>	Song thrush	RSPB red list			Yes		Yes		Nested at Holwood Farm 2005
Reptiles									det. Kent Reptile and Amphibian Group
<i>Anguis fragilis</i>	Slow worm		Yes			Yes		WCA Schedule 5 Sections 9(5) and 9(1)	Cudham Valley, Downe Bank, Down House Estate, Buckston Browne, Great Pucklands
<i>Lacerta vivipara</i>	Common lizard							WCA Schedule 5	High Elms, Cudham Valley, Buckston Browne
<i>Natrix natrix</i>	Grass snake							WCA Schedule 5	Downe Valley (1996)

Latin Name	English Name	UK Red Data Book Species	UK SCC	UK Scarce	UK BAP Priority	London BAP Priority Species	Bromley BAP Species	Comments	Current Location
<i>Vipera berus</i>	Adder					Yes		Mid 1980s, WKGC, not since. Kent RDB, WCA Schedule 5 Section 9(5)	Downe Valley, not seen since mid 1980s, Downe Bank (2000)
Amphibians									
<i>Bufo bufo</i>	Common toad							WCA Schedule 5 Section 9(5)	High Elms, Bottom Barn Farm
<i>Rana temporaria</i>	Common frog							WCA Schedule 5 Section 9(5)	Cudham School Pond, High Elms, Keston top pond, Bottom Barn Farm
<i>Triturus helveticus</i>	Palmate newt							WCA Schedule 5 Section 9(5)	Pond on Ravensbourne, near wet meadows, Keston
<i>Triturus vulgaris</i>	Common (smooth) newt							WCA Schedule 5 Section 9(5)	High Elms, Bottom Barn Farm, Buckston Browne
Mammals									
<i>Erinaceus europaeus</i>	Hedgehog						Yes		Occasional throughout
<i>Muscardinus avellanarius</i>	Dormouse	RDB			Yes		Yes	WCA Schedule 5 and European protected species	High Elms, Cuckoo Wood and Blacklands, Downe Bank, West Hill (Garden of 'Homefield') 2002
<i>Meles meles</i>	Badger							Badger's Act	Occasional: data protected
Bats									
<i>Eptesicus serotinus</i>	Serotine	RDB 2	Yes	Yes		Yes	Yes	KRDB 3	High Elms, Holwood
<i>Myotis daubentonii</i>	Daubenton's bat	RDB	Yes			Yes	Yes	KRDB 2 Small numbers found regularly hibernating in Ice Well	Keston ponds

Latin Name	English Name	UK Red Data Book Species	UK SCC	UK Scarce	UK BAP Priority	London BAP Priority Species	Bromley BAP Species	Comments	Current Location
<i>Myotis nattereri</i>	Natterers	RDB 2	Yes			Yes	Yes	KRDB 2 Small numbers found regularly hibernating in Ice Well	High Elms
<i>Myotis sp.</i>									
<i>Pipistrellus pipistrellus</i>	Common pipistrelle	RDB			Yes	Yes	Yes		Found throughout Site
<i>Pipistrellus pygmaeus</i>	Soprano pipistrelle	RDB			Yes	Yes	Yes		Found throughout Site
<i>Plecotus auritus</i>	Brown long-eared bat	RDB	Yes			Yes	Yes	KRDB 2	Holwood

Key

RDB = UK Red Data Book
KRDB = Kent Red Data Book

EN = endangered (= RDB1)

VU = vulnerable (=RDB2)

NT = Near Threatened

RDB3 = Rare

DD = Data Deficient = RDB K

Notable (Na) = estimated to occur in 16-30 10 km squares

Notable (Nb) = estimated to occur in 31-100 10 km squares

LBAP = London Biodiversity Action Plan

BBAP = Bromley Biodiversity Action Plan

WCA = Wildlife and Countryside Act; Schedule 5

Kent RDB Status 1 = 1-2 tetrads in Kent, Status 2 = 3-5 tetrads in Kent, Status 3 = 6-10 tetrads in Kent

BMSDB = British Mycological Society Database

pers comm. = personal communication

det. = determined (identified by)

RSPB = Royal Society for the Protection of Birds

Bibliography

- 1 Dayton, N. & Brandon-Jones (2001) NVC Assessment of non-wooded SSSI within Essex, Hertfordshire & Greater London: Keston & Hayes Commons
- 2 Jones, R.A. (2003) Chalking Up London's Downs: Invertebrate Survey Report
- 3 Clemons, L. (2005) Invertebrate Survey of Cudham School
- 4 Wiggington, M. J. (ed) (1999) Red Book Data Vascular Plants, 3rd Edition, JNCC, Peterborough
- 5 Burton, R.B (1983) Flora of the London Area, The London Natural History Society(=RB) Cheffings, C.M. & Farrell, L. (Eds) 2005 The Vascular Plant Red Data List for Great Britain. Species Status 7, pp. 1-116. JNCC Peterborough

London Biodiversity Action Plan - Species of Conservation Concern and Priority Species for Action 2004

Stace, C. (1995) New Flora of the British Isles, CUP

The Bromley Biodiversity Partnership (2005) The Future of Darwin's Wildlife in Bromley: Bromley Biodiversity Action Plan (3rd Edition 2006-2008)

Waite, A. (Ed.) (1999) Provisional Red Data Book for Kent

Annex 6

Unitary Development Plan Policies

Policy G1 – The Green Belt

Within the Green Belt, as defined on the Proposals Map, permission will not be given for inappropriate development, unless very special circumstances can be demonstrated that clearly outweigh the harm by reason of inappropriateness or any other harm.

The construction of new buildings or extensions to buildings on land falling within the Green Belt will be inappropriate, unless it is for the following purposes:

- (i) agriculture and forestry (unless permitted development rights have been withdrawn);
- (ii) essential facilities for outdoor sport and outdoor recreation and open air facilities, and other uses of land which preserve the openness of the Green Belt and do not conflict with the purposes of including land in it;
- (iii) limited extension, alteration or replacement of existing dwellings
- (iv) limited infilling or redevelopment in accordance with the guidance in Planning Policy Guidance 2 Annex C within the designated major developed site (MDS) at Biggin Hill Airport.

The material changes of use of land, engineering and other operations within the Green Belt will be inappropriate unless they maintain the openness and do not conflict with the purposes of including land in the Green Belt.

The re-use of a building in the Green Belt will be inappropriate unless it meets all of the following criteria,

- (i) It will not have a materially greater impact than the present use on the open character of the land
- (ii) Use of the land surrounding the building and boundary treatments will not harm the openness of the land or conflict with the purposes of including land in the Green Belt
- (iii) The building is of permanent construction and capable of conversion or re-use without extensive or complete reconstruction
- (iv) The form, bulk and design of the buildings are in keeping with surroundings
- (v) The proposed use does not entail storage of materials, plant or machinery
- (vi) The proposed use has no adverse effect on the recreational enjoyment or appearance of the countryside

The openness and visual amenity of the Green Belt shall not be injured by any proposals for development within or conspicuous from the Green Belt which might be visually detrimental by reasons of scale, siting, materials or design

The appropriate uses referred to in Policy G1 accord with the guidance given in PPG2 (para 3.4). The restriction of new development to those uses will enable the main purposes of the Green Belt, referred to in para 8.1 above and in PPG2, to be fulfilled. Development which falls outside the appropriate uses is, by definition, harmful to the Green Belt. It is for the applicant to show what very special circumstances exist to warrant permission being granted. Such circumstances justifying inappropriate development will not exist unless the harm by reason of inappropriateness, and any other harm, is clearly outweighed by other considerations. In view of the presumption against inappropriate development, the Secretary of State will attach substantial weight to the harm to the Green Belt when considering any planning application or appeal concerning such development (PPG2 para 3.2)

The Green Belt in Bromley includes some isolated pockets of residential development. It is not intended to permit any further new development in the villages located within Bromley.

PPG2 recognises that Green Belts often contain existing major developed sites (e.g. hospitals, airfields) which may be in continuing use or be redundant. If such a major developed site is specifically identified in the UDP, infilling or redevelopment which meets certain criteria is not inappropriate development. Such impact should have no greater impact on the green belt than the existing development. Infilling means the filling of small gaps between built development. The Council will have regard to the detailed criteria set out in PPG2 Annex C in determining applications relating to proposals with the designated MDSs.

The majority of Biggin Hill airport is located in the Green Belt and has been identified as a major developed site for the purposes of PPG2 Annex C. Much of the site is open grassland, runways and taxiways, which allow both local and more distant views across the Airport. The control tower, hangars and other operational buildings (including the former RAF quarters with conservation area status) occupy the perimeters of the Airport to the west and south and to a lesser extent in the east. Infilling and redevelopment within the MDS, having regard to the advice in PPG2 Annex C and the detailed policies in Chapter 12 of the UDP, will need to reconcile Green Belt and amenity objectives with the Airport's activities and operations.

Very special circumstances to justify inappropriate development will not exist unless the harm by reason of inappropriateness, and any other harm, is clearly outweighed by other considerations. In view of the presumption against inappropriate development, the Secretary of State will attach substantial weight to the harm to the Green Belt when considering any planning application or appeal concerning such development (PPG2 para 3.2).

Where proposals are designed for or are necessary to achieve compliance with new environmental, hygiene or welfare legislation, the need for the development will be taken into account in determining planning permission.

Policy NE5 – World Heritage Site

In considering proposals in or adjoining the proposed World Heritage Site, as defined on the Proposals Map, the likely impact on the Site's cultural and natural heritage will be assessed. Where appropriate, management and enhancement of the Site will be sought and secured by the use of conditions or planning obligations.

Under its Convention concerning the Protection of the World Cultural and Natural Heritage, UNESCO seeks the identification, protection, conservation and presentation of the world's natural and cultural heritage of outstanding universal value. A member country nominates sites proposed for inclusion on the World Heritage list.

The latest UK list of proposed sites (April 1999) includes Charles Darwin's home at Down House and the surrounding countryside. This was the setting for his life and work during the forty years of his main scientific and natural history achievements culminating in the publication of his theory of evolution.

No additional statutory controls follow from the inclusion of a site in the World Heritage List. Inclusion does, however, highlight the outstanding international importance of the site as a key consideration to be taken into account by local planning authorities in determining planning and listed building consent applications, and by the Secretary of State in determining cases on appeal or following call-in. In this context, PPG15 advises local planning authorities to formulate specific planning policies for protecting World Heritage sites.

This policy will act as a focus for the management plan for the area, which will be developed by working with local residents, landowners and other interested parties, and the co-ordination of other relevant policies within the plan for the areas contained within the proposed

World Heritage Site. The designation on the Proposals Map remains "tentative" until the World Heritage Site is confirmed.

Policy BE9 – Conservation Areas

In order to preserve or enhance the character or appearance of conservation areas, a proposal for new development, for engineering works, alteration or extension to a building, or for change of use of land or buildings within conservation areas will be expected to:

- (i) Respect or complement the layout, scale, form and materials of existing buildings and spaces;
- (ii) Respect and incorporate in the design existing landscape or other features that contribute to the character, appearance or historic value of the area
- (iii) Ensure that the level of activity, traffic, parking services or noise generated by the proposal will not detract from the character or appearance of the area.

BE9A (Demolition in Conservation Areas)

A proposal for a development scheme that will involve the total or substantial demolition of an unlisted building in a conservation area that makes a positive contribution to its character or appearance will not be permitted unless then following can be demonstrated:

- (i) there is clear and convincing evidence that reasonable efforts have been made to continue the present use or to find a viable use for the building and these efforts have failed and it is demonstrated that preservation of the building as part of the scheme or in some form of charitable or community ownership is not possible or suitable, or
- (ii) the costs of repairs or maintenance of the building cannot be justified against its importance or the value derived from its retention, provided that the building has not be deliberately neglected, or
- (iii) there will be substantial planning benefits for the community from redevelopment which would decisively outweigh loss from the resulting demolition.

Acceptable and detailed plans for a replacement scheme will be required, even if it will involve total or substantial demolition of an unlisted building in a conservation area that makes little or no contribution to the character or appearance of that area.

A condition will be imposed on a planning permission granted, to ensure that demolition shall not take place until a contract for the carrying out of the development works has been made.

BE9A (Development Adjacent to a Conservation Area))
A development proposal adjacent to a conservation area will be expected to preserve or enhance its setting and not detract from view into or out of the area.

Each Conservation Area, as shown on the Proposals Map, consists of a group or groups of buildings and trees in a particular setting. The Council is required to pay special attention to the desirability of preserving or enhancing the character or appearance of conservation areas, and will do so by maintaining strict control over development. Detailed guidelines for each are contained in published policy statements, as required under s71 of the planning (Listed Buildings and Conservation Areas) Act 1990. Reference will also be made to the English Heritage publication 'Streets for All'. Detailed plans will be expected to accompany applications in conservation areas. Outline applications that cannot be assessed against the requirements of the policy couple be refused for lack of detail.

The Council has the power to control total or substantial demolition in conservation areas. There will be a general presumption in retaining buildings that the Council considers make a positive contribution to the area's character or appearance. Reference will be made to the relevant government guidance documents, including "Conservation Area Practice: English Heritage guidance on the management of Conservation Areas" (English Heritage, 1995) when assessing if a building makes a positive contribution to a Conservation Area. Proposals for demolition of buildings will be assessed against the same broad considerations as for demolition of listed buildings (see Policy BE7 above).

Where new development takes place, within or adjoining conservation areas, a good and sympathetic design is vital to maintain existing standards. Applicants are encouraged to seek advice from the Council prior to making application and to obtain professional advice on design. Such considerations as to the height, bulk, materials and landscaping for a building are especially important to the acceptability of schemes in conservation areas. Outline applications should be accompanied by illustrative details of the proposed development.

In commercial parts of conservation areas, the design, form and materials of shop fronts, signs and fascias, make an important contribution to local character. The Council will seek to ensure that a high standard of design and materials is achieved in any replacement shop front and advertisements in such areas. The retention or reintroduction of traditional features can add significantly to the character and appearance of the host building and the conservation area in general, and will be encouraged. Under Section 71 of the Planning (listed

Buildings and Conservation Areas) Act 1990, the Council is required to prepare scheme for the preservation and enhancement of conservation areas. These will be carried out in association with local residents and interest groups.

The Council is required to review conservation areas from time to time, with changing attitudes to styles of architecture and environmental quality. Calls to designate further conservation areas during the plan period will be considered on their merits in the light of national guidance (para 4.2 of PPG15). The Council will consider making Article 4 directions where appropriate and where expedient to do so, will make use of its enforcement powers.

Policy L4 – Horses, Stabling and Riding Facilities

Stable blocks, loose boxes and other essential buildings an associated works connected with equestrian activities will generally only be permitted if:

- (i) the sitting, scale, form and materials of such developments would not have any adverse visual impact on the open or rural character of the Green Belt or areas of Metropolitan Open Land (MOL); and
- (ii) such developments would not result in any detriment to the amenities enjoyed by the occupants of any adjoining residential properties; and
- (iii) they are, wherever possible, sited close to any existing built development on the site; and
- (iv) they are suitably sited in relations to their surroundings; and
- (v) they are adequately screened; and
- (vi) the proposal will not adversely affect areas which are of importance for nature conservation; and
- (vii) the proposal will not result in an unacceptable intensification of horse-related activities.

Policy L5 - Horses, Stabling and Riding Facilities

Where several land holdings containing equestrian activities exist in close proximity or where new or replacement buildings are proposed, the Council will encourage joint applications which incorporate rides through the land involved and a communal jumping area, if required subject to other policies of the Plan.

The Council recognises the increasing demand for horse riding and the keeping of horses as a pastime and that the associated buildings and uses can be an integral part of the rural environment. The popularity of this activity, however, has given rise to a number of problems. The

location, standard and intensity of buildings required in connection with equestrian activity threatens to spoil the appearance and the character of the Green Belt and other open areas. Other problems include untidy jumping areas, over-intensive grazing and riding on footpaths, all of which the Council wishes to discourage in order to safeguard other uses of the countryside and to prevent the landscape becoming unsightly. Conditions will be imposed where appropriate to control the storage and removal of horse-related waste. Encouragement for schemes which amalgamate facilities on adjoining land in different ownerships should help to minimise visual intrusion and result in a better design and layout.

Applications for stables or loose boxes will only be considered acceptable if there remains a commensurately large area of associated open land adjacent, for the grazing of horses. In this regard, the Council will require the designated paddock land to remain in the same ownership as, or under the control of, the operator of the stables and should be a minimum ratio of 0.4 ha per horse. The British Horse Society's recommended standard of 0.4 ha per horse is considered to be a minimum requirement for grazing horses. Where the proposed stables or loose boxes are within the curtilage of an existing livery stable or riding school, the number of horses kept and exercised in the locality, the intensity of use of local bridleways and the effects on the surrounding countryside of horse-related activities will be taken into account.

Annex 7

World Heritage Committee documents relating to the Heritage of Science

1. Decisions of the 29th session of the World Heritage Committee (Durban 2005)

Decision 29 COM 5B

The World Heritage Committee,

1. Having examined Annex 1 of Document WHC-05/29.COM/5,
2. Approves the World Heritage Programme for Small Island Developing States (SIDS) and the World Heritage Marine Programme;
3. Requests the Director of the World Heritage Centre to further explore the thematic initiative “Astronomy and World Heritage” as a means to promote, in particular, nominations which recognize and celebrate achievements in science;
4. Approves a biennial budget of US\$20,000 for the World Heritage Programme for Small Island Developing States and US\$50,000 for the World Heritage Marine Programme, to be financed through the World Heritage Fund, as proposed in Document WHC-05/29.COM/16.

2. Decisions Adopted at the 31st Session of the World Heritage Committee (Christchurch 2007)

Global Strategy for a Representative Balanced and Credible World Heritage List

9. Discussion on the Outstanding Universal Value

Decision: 31 COM 9

The World Heritage Committee,

1. Having examined Document WHC-07/31.COM/9,
2. Recalling Decision 30 COM 9 adopted at its 30th session (Vilnius, 2006),
3. Takes note of the progress reports by ICOMOS and IUCN on the first compendium on outstanding universal value and the inscription of proposed properties by criteria on the World Heritage List;
4. Requests ICOMOS and IUCN to harmonize their reports to include detailed analyses of criteria, lists of sites inscribed under each criterion, landmark cases as well as reflections on authenticity, integrity and management practices;

5. Requests the World Heritage Centre to:
 - (i) send electronically the draft compendium during the year to receive preliminary comments; and
 - (ii) prepare an overview introduction of the reports of the Advisory Bodies;
6. Requests ICOMOS to give consideration in the final report to archaeological sites and their threshold for inscription on the World Heritage List;
7. Requests ICOMOS and IUCN, in consultation with the World Heritage Centre, to finalize the first compendium for consideration by the Committee at its 32nd session (2008);
8. Accepts the offer of the United Kingdom to host an expert meeting on the recognition of the heritage of science and technology in the World Heritage Convention during late 2007.

3. United Nations Educational, Scientific and Cultural Organisation Convention Concerning the Protection of The World Cultural and Natural Heritage World Heritage Committee 32nd Session (Quebec City, Canada, 2 – 10 July 2008)

World Heritage 32 COM

Distribution Limited WHC-08/32.COM/INF.10 A
Paris, 22 May 2008

Original: English/French

Item 10 of the Provisional Agenda: Global Strategy for a representative, balanced and credible World Heritage List

Science and technology, an expert workshop within the framework of the global strategy for the global, balanced and representative World Heritage List

Summary

This document has been prepared to facilitate the World Heritage Committee’s debate on issues linked to scientific and technological heritage within the framework of the World Heritage Convention and its Global strategy, following the international expert workshop held in London, 21-23 January 2008

Further information (including the agenda, the list of participants) is available on internet www.unesco.org.uk/Science_Heritage_Meeting and www.whc.unesco.org/en/activities/

4. Decisions Adopted at the 32nd Session of The World Heritage Committee (Quebec City 2008)

10a. Progress Report on Thematic Studies

Decision: 32 COM 10A

The World Heritage Committee,

1. Having examined Document WHC-08/32.COM/10A,
2. Recalling Decisions 31 COM 13 and 31 COM 17 adopted at its 31st session (Christchurch, 2007),
3. Thanking the Government of the United Kingdom for having hosted the Science and Technology expert workshop, which took place from 21 to 23 January 2008 in London, as well as all the experts who contributed to it,
4. Noting the results and recommendations of the Science and Technology expert workshop within the framework of the Global Strategy,
5. Takes note of the progress report on the global thematic studies undertaken by ICOMOS and IUCN;
6. Requests IUCN and ICOMOS to continue to develop their work on thematic studies, in relation to priorities identified in Document WHC-08/32.COM/10A;
7. Noting the underfunding of this significant activity for identifying properties with or having potential Outstanding Universal Value;
8. Takes note of the need for additional resources to be provided to support priority work by ICOMOS and IUCN on thematic studies, including updating existing studies, the application of criterion VII and new initiatives, and to promote their effective use by States Parties;
9. Invites States Parties to the Convention to consider providing extra-budgetary assistance to support the work outlined in paragraphs 6 and 7 above;
10. Thanks the government of France for its generous offer to fund a thematic study on Agro-pastoral Cultural Landscapes.
11. Thanks the government of Spain for its generous offer to fund a thematic study on prehistoric sites;

5. Revision of Operational Guidelines (Quebec City 2008)

Decision: 32 COM 13

The World Heritage Committee,

1. Having examined Document WHC-08/32.COM/13,
2. Recalling Decision 31 COM 16 adopted at its 31st session (Christchurch, 2007),
3. Takes note of the amendments compiled in the Annex of the Document WHC-08/32.COM/13;
4. Requests the World Heritage Centre, in close cooperation with the Advisory Bodies, to draft the amendments to the Operational Guidelines proposed in Document WHC-08/32.COM/13 taking account of the debate at the 32nd session and the Committee's reflections, and in cooperation with the Chairperson of the World Heritage Committee, to develop a screening process for the Operational Guidelines to ensure consistent references between the different proposals for submission to the Committee at its 33rd session in 2009;
5. Establishes an informal working group to review and propose revisions to Chapter VIII of the Operational Guidelines, as well as clear procedures and tools to promote consistent and appropriate use of the World Heritage emblem, for the consideration of the Committee at its 33rd session in 2009;
6. Requests the World Heritage Centre, notwithstanding Decision 31 COM 16, to publish the updated English and French versions of the Basic Texts of the Convention following the 33rd session of the Committee in 2009.

