About the trail

The trail begins and ends at Westerham Road Car Park, only 2 miles (3.5kms) from Down House where Charles Darwin lived and worked from 1842 till his death in 1882. It leads you through the acid grassland and heath of Keston, past the valley mire of one of London's few sphagnum bogs, wet meadows, sweet chestnut coppice and along a public footpath through the Holwood Estate. All these places were familiar and important to Darwin's work and life, providing him with different plants and animals to study from those of the chalk and clay-with flints closer to his home. Some are indicated as you follow the trail, others are more difficult to spot or may be anywhere along the route and are shown in the pictures opposite. Tick the circles and see how many you can find. ✔

Places you'll pass

Holwood House. An earlier house than the one you will see was the home of Prime Minister William Pitt between 1785 and 1802 but when Darwin and his family first moved to Downe, Holwood House belonged to Lord Cranworth. A Whig politician and twice Lord Chancellor, he contributed to the Downe Friendly Society of which Darwin was the Treasurer and which helped support local villagers. The house was later the home of Lord Derby who wrote of Darwin that he was "*the greatest scientific discoverer of our age,* [yet] *free from envy, jealousy or vanity in any form*" and was one of the pall-bearers at his funeral. Charles and Emma regularly dined at Holwood and visited the park. After Charles' death Emma wrote to their son, William, *'Yesterday I drove to Keston to see Mrs Wright & walked back through Holwood Park – it was looking lovely – but seemed too full of memories, & I thought how you all used to race down the pretty green slope at the end – I was glad to think that I walked thro' it w. your father not so very long ago – we used generally to finish a drive with that charming bit of walking.'* Holwood is also the site of an iron age settlement thought to date back to about 200BC. Built on high ground, it consists of 3 rings of ditches and banks enclosing an area of about 100 acres.
Keston Bog was an important source of the insectivorous plant, round-leaved sundew, which Darwin studied; he sampled mud from Keston Ponds as part of his experiments on the geographical distribution of seeds and he investigated the distribution of earthworms in the different heathland habitats.

How to get around

The complete trail is 3¼ miles (5 km) long, but the walk can easily be shortened in several ways *(see map)*. There are 2 pubs at Keston which serve refreshments. The trail involves a small amount of road walking, please take great care and face oncoming traffic. Paths may be muddy and slippery at times with steps as shown on the map and some gradients of >20%. Please follow the Country Code, keep to the footpaths and remove your dog waste.

Species Darwin Saw or Studied


Diagram of leaf


A

A Round-leaved Sundew Darwin began his studies of this plant when he noticed how many insects were caught on its leaves. This led him to investigate how it trapped and digested insects, pioneering work which led to the publication of *'Insectivorous Plants'* in 1875. His major source for sundew was Keston Bog where it was then common. He explained how insects supplied the plants with nitrogen making it possible for them to survive in poor soil, but the plants also needed plenty of water because to digest the insects it was necessary to secrete an acid fluid from, *'glands, sometimes as many as 260, exposed during the whole day to a glaring sun.'* The falling water table in Keston Bog together with increased shading and nutrient levels has caused its local extinction here, but work is underway to restore the habitat.

Leaf


Flower

Spring


B

B Meadow Saxifrage (Saxifraga granulata) Now rare in Kent, Darwin described its glandular hairs, some of which appeared similar to those of sundew, *'Saxifraga granulata (Holwood Park) short pink Hairs mixed with longer ones some with small viscid Head & some without'*. He went on to see if it was also able to absorb nitrogen (in the form of ammonium carbonate) but his results showed that it absorbed little if any. He also looked at its flower structure, reporting that the male and female part of a flower matured at different times which increased the chance of cross pollination.


H


C

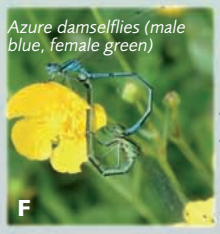
C Nightingale Listen for these well-camouflaged birds (easier to hear than see) which live in scrub feeding mainly on insects. Emma Darwin wrote about going out in the evening to listen for nightingales, returning home to Down House for bread and cheese. Please let us know if you hear one in the area.

D Sticklebacks In the Descent of Man, Darwin wrote how during the breeding season, male sticklebacks become brightly coloured which makes them more successful in attracting females.

Summer


E

E Duckweed You can find this in ponds everywhere in summer.
In 1881 Darwin experimented with the effect of immersing duckweed in various solutions, at different strengths, to see the effect these had on cell contents.


Azure damselflies (male blue, female green)
F

F Dragonfly. Look for dragonflies and damselflies around the ponds. Darwin wrote how in males *'the appendages at the tip of the tail are modified in an almost infinite variety of curious patterns to enable them to embrace the neck of the female.'*


F
Four spotted Chaser dragonfly (male)

Autumn

Common Earthworm


G

G Earthworms Like Darwin, look for worm casts (usually made by black-headed worms here) and little heaps of stones (middens) which show where the common earthworm has been making deep burrows. In Darwin's book, *'The Formation of Vegetable Mould Through the Action of Earthworms'* published in 1881 he described the results of years of research including the examination of slopes and bogs at Holwood, heath, acid grassland, pathsides and gulleys on Keston Common, all of which he investigated as he tried to find out which habitats were best for earthworms.


G
Black-headed Earthworm,

H Pigmy Shrew. Darwin observed, *'both sexes possess abdominal scent glands and there can be little doubt, from the rejection of their bodies by birds and beasts of prey, that the odour is protective.'*

Winter


I
Mallard Duck (male)

I Ducks
On his voyage around the World in 'The Beagle' Darwin noticed the similarity between species of freshwater plants and animals found in widely separated ponds. Observing how ducks may emerge from a pond covered in duckweed and how newly hatched freshwater snails could survive 12-20 hours in damp air and would cling to duck's feet so tightly that they were difficult to remove, he wrote *'in this length of time a duck or heron might fly at least six or seven hundred miles, and would be sure to alight on a pool or rivulet, if blown across sea to an oceanic island or to any other distant point.'*

J Freshwater snails


J
Great Pond Snail


J
RamshornSnail

16 Cross Westerham Road at traffic island

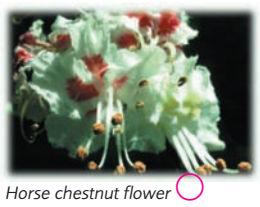
Follow Downe Road, looking for herb bennet on the left. Darwin wrote how it produced ten times more pollen than necessary. Its seed heads with their hooked seeds are beautifully adapted for dispersal by animals. Another weed species growing along the hedgeline is cleavers which Darwin found produced just as many seeds covered or uncovered. He also observed how it climbed by means of hooks and showed 'no spontaneous revolving movement'. **Turn L onto Public Footpath**


Herb Bennet: flower


Cleavers: flower and leaves


Herb Bennet: seedhead

17 On your R are several horse chestnut trees. Darwin studied this species at Holwood, in particular examining their flower structure, noting that *'many male flowers open before females'*, which aids cross-pollination. **Walk up the footpath which crosses part of the Holwood Estate and was no doubt used by Darwin on some of his many visits here.**


Horse chestnut flower

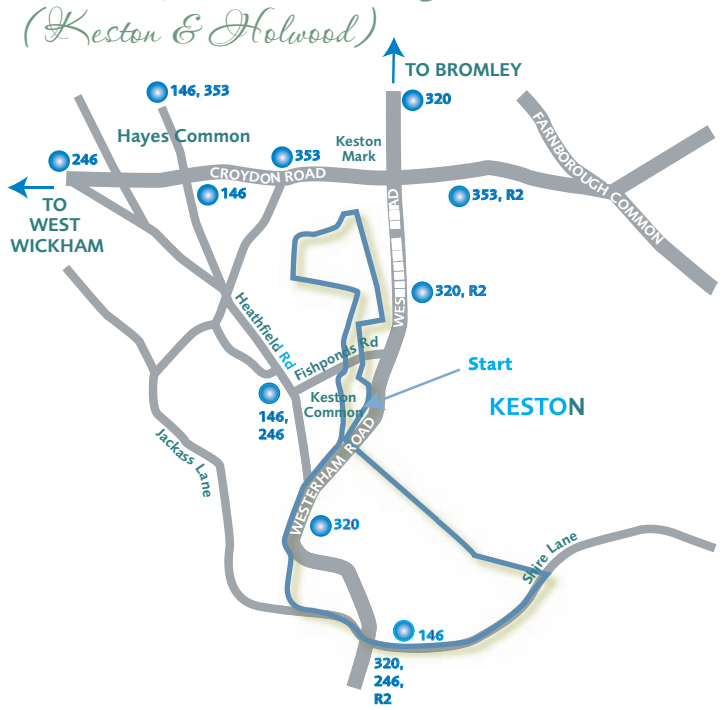
18 In summer and autumn look for woody nightshade beside the path. Darwin wrote that it, *'is one of the feeblest and poorest of twiners: it may often be seen growing as an upright bush, and when growing in the midst of a thicket merely scrambles up between the branches without twining..... I placed sticks round several plants, and vertically stretched strings close to others, and the strings alone were ascended by twining. The stem twines indifferently to the right or left..... We may suspect that .....[it has] as yet only partially acquired the habit of twining.'* **Continue along path, up 6 shallow steps, cross driveway and walk to the seat near the site of the Wilberforce Oak overlooking the Vale of Keston.**


Woody Nightshade

19 An entry in William Wilberforce's diary for 1787 states, *'At length, I well remember after a conversation with Mr. Pitt in the open air at the root of an old tree at Holwood, just above the steep descent into the vale of Keston, I resolved to give notice on a fit occasion in the House of Commons of my intention to bring forward the abolition of the slave-trade.'* **Continue up footpath to the Westerham Road**

20 Cross road with care and turn R, following a footpath parallel to the road along a gulley made through gravel extraction. Look at the flint pebbles of the exposed Blackheath Beds here; 60 million years ago they formed part of an offshore pebble bank under the sea, where they were worn down to their present rounded shapes. In places they are loosely cemented together by an iron oxide cement. The path leads you back to the top pond car park.

How to Reach Darwin Trail 3 (Keston & Holwood)



The Trail starts at Westerham Road Car Park, Keston but can be begun and ended at different points. Access to the trail is via the following bus routes:-

R2 (Mon-Sat) Petts Wood to Biggin Hill Valley via Orpington Stn & Keston
146 (Mon-Sat) Bromley to Downe via Hayes and Keston
246 Bromley to Westerham via Hayes Station, Keston and Biggin Hill
320 Bromley to Biggin Hill Valley via Bromley Common, Keston & Leaves Green
353 Orpington (Ramsden Estate) to Addington via Orpington Stn, Locksbottom, Keston Mark & Hayes Station

Trains: Nearest Station: Hayes

Correct at time of going to press. For up-to-date information about train and bus times phone Traveline on 020 7222 1234 or see http://journeyplanner.tfl.gov.uk

For more information about Darwin's life and work around Downe, including walks and events in the area and how you can become involved, see www.darwinswildlife.co.uk or www.darwinatdowne.co.uk.
To read Darwin's publications on line see, 'The Writings of Charles Darwin on the Web' at http://pages.britishlibrary.net/charles.darwin or http://darwinlibrary.amah.org. More information can also be found in the World Heritage Site Nomination Document (2006) at your local library.

EMERGENCY PHONE: 020 8464 4848

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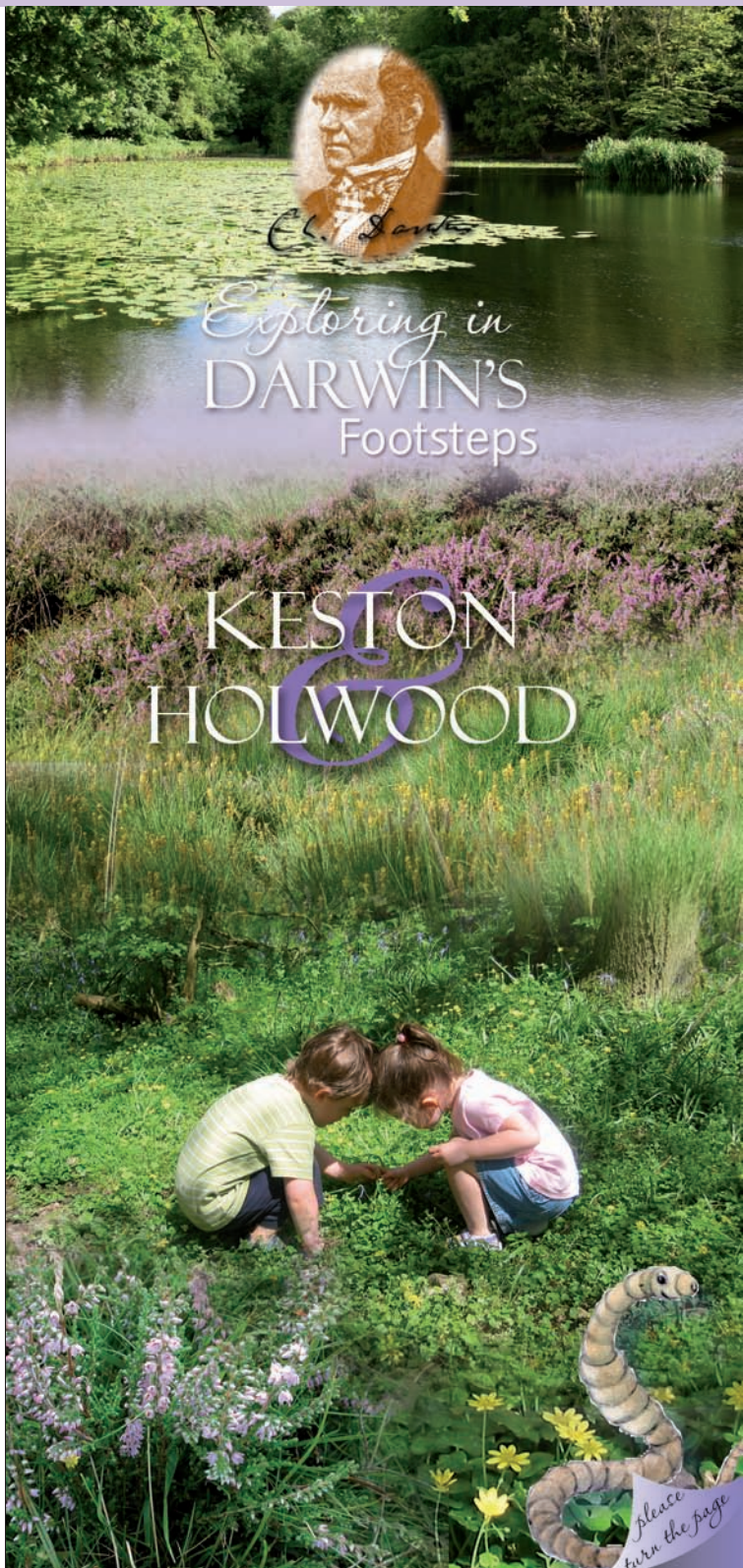
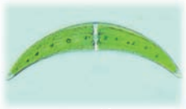
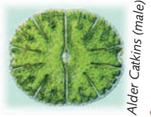


Starting at Westerham Road car park, walk down 20 steps to 'Caesar's Well' which marks some of the springs which arise at the junction of Blackheath Pebble Beds with orange, loamy Woolwich Beds. These feed Keston Ponds.

1 According to the European Magazine of 1792 there was a bath-house near Caesar's Well.In Darwin's time the well was well-known to Victorian microscopists as a very interesting site for freshwater algae including *Closterium moniliferum, Micrasterias denticulata* and *Draparnaldia mutabilis (which used to be called D. plumosa);* all still found here today.


Closterium moniliferum

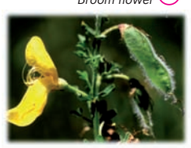

Draparnaldia mutabilis


Micrasterias denticulata

Walk alongside the water runnel where brooklime grows in summer.


Brooklime

2 Continue by the side of the top pond. Excavated into Woolwich Beds, or possibly clay-lined, it may originally have been a source of sand but was later a reservoir for Holwood House. Look for broom on the right, flowering in May/June. Darwin investigated how pollen was deposited by short stamens onto the abdomen of visiting bees, then 1-2 days later, longer stamens deposited pollen on their backs. He also noted how the stigma changes position as the flower ages so it receives pollen from different parts of the bee helping to ensure cross pollination takes place. Look for water betony next to the pond in summer. With its square stems Darwin observed that this was one of only 3 plant species in Britain pollinated by wasps.


Broom flower

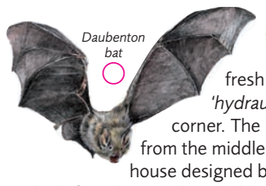

Water Betony


Chara Virgata

3 In spring moorhens are among the water birds which nest on the pond, building elaborate island nests to help keep the eggs and young away from predators. As you approach the dam between the top and middle ponds notice the smell of ironweed (Chara virgata) in summer. This large green alga has a whirled branching pattern and is uncommon locally.


Moorhen

Walk across the dam and turn right (R) following west bank of middle pond.


Daubenton bat

4 This pond supplied Holwood House with fresh water by means of an *'hydraulic ram'* at the north-east corner. The hydraulic ram forced water from the middle pond uphill to a new house designed by Decimus Burton and built for John Ward, a wealthy London merchant who bought the Holwood Estate in 1823. On summer's evenings look for Daubenton's bats skimming over the water as they hunt for flies.

Cross Fishponds Road and continue past 3rd pond. Turn R over dam. Continue along path with River Ravensbourne on your left (L)


Alder leaves

5 Look for alder trees growing in the wet soil. In early spring the blue buds, new cones and catkins are very distinctive. The big house (on your right) was the home of the Bonham-Carter family from 1853-1862, after which they moved to nearby Keston House. Friends of the Darwins, surviving letters to them include some from Elinor Bonham-Carter in which she describes the expressions of her dog and newborn niece/nephew, presumably associated with the publication of, *'The Expression of the Emotions in Man and Animals'* by Darwin in 1872.


Alder Catkins (male)

6 When you reach the small red-brick wall with the drain, turn R and follow the river into Padmall Wood, which has been managed as sweet chestnut coppice for many years. Note the different ages of trees in different blocks of sweet chestnut woodland. Traditionally blocks of sweet chestnut woodland were cut on a 15-20 year cycle. The wood was used for fencing, panelling and sometimes furniture.

Sweet chestnut

After 90m there is a bridge on L, but continue for a further 150m before turning L


water mint

7 As you approach bridge look in wetter areas for water mint, flowering from July until October. On your right look for wild angelica. This tall plant with its very distinctive sheathing leaf bases also grows well in damp places. Darwin noted how its stems were hairy at the base but in other areas were covered in a bloom which rubbed off.


Wild Angelica


Wild Angelica (leafstalk)

Cross bridge

8 on your left is a clump of wood sorrel. The photograph shows how its leaves fold at night or in strong sunshine. Experiments by Charles Darwin and his son, Francis, showed that if its leaves were prevented from moving in this way they were more likely to be killed by frost. In, *'The Power of Movement in Plants'* (1880) Darwin also reported that experiments by Professor Batalin showed that preventing them from folding also damaged leaflets exposed to sunlight.


Wood Sorrel

KEY

Grassland
Woodland
Public or Permissive bridlepath
Trail
Pond

Turn L. At T-junction turn R onto 3 Commons Trail and walk through woodland. Pass concrete post 11 & 12, then cross meadow towards standing dead tree, an important habitat for invertebrates, fungi and birds.


Nuthatch

9 Look for nuthatch climbing down the tree, searching for insects. Darwin wrote of its remarkable climbing instinct.

Turn L, following path, and pass 3 tall, thin lombardy poplar trees on your left. Continue downhill, across dry meadow to bridlepath.


Marsh Marigold

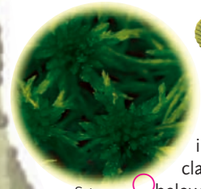
10 Ahead and left of the bridlepath is a wet meadow, a severely threatened habitat in the UK. Please do not trample the meadow but look left to see the bright yellow flowers of marsh marigold in spring and the pink of ragged robin in summer. Also present is the greater birdsfoot trefoil. Darwin remarked how in this species, like the wood sorrel, the leaves move at night; in this case the leaflets rise up and press against the stem. This is made possible by the presence of small cells at the base of the leaflet stalks which through the intake and loss of water act as a hinge.


Ragged Robin


Greater Birdsfoot Trefoil

Turn R, cross bridlepath and another meadow, passing into woodland via an old boundary bank marked by big veteran trees. Turn L and after 50m turn R to walk through the remains of a Scots pine plantation.


Common Cow Wheat


Sphagnum

11 After 60m, Keston Bog is on your R. The bog is here due to the presence of impermeable Eocene clays at a depth of 3 feet below the surface. One of London's few sphagnum bogs and home of some rare plants and animals, in Darwin's time it was much more extensive. Look R to see the waving cottony heads of cotton sedge in June and July, the bright yellow flowers of bog asphodel in July and August and cross-leaved heath which flowers into September. In the wettest places different types of sphagnum and other mosses grow. Please help us look after this very special place by not walking on it and keeping your dogs to heel or on a lead here. Work to restore the bog for the rare plants and animals that live here is being undertaken. If you would like to help please contact the Rangers at High Elms on 01689 862815.


Bog Asphodel (with Skipper butterfly)


Cotton Sedge


Cross-leaved Heath with bee

When you reach road, cross with care and continue for 30m, then turn R and walk about 100m along a path through pine woodland. Turn L into a clearing above the top pond.


Red Dead Nettle


Heather

12 In Darwin's time this area was open and grazed. Since grazing stopped in the mid 20th century, trees have colonised; first birch, then oak, but beneath your feet look out for patches of heather still remaining.

Using heather as an example, Darwin described how insects visit flowers of the same species as long as they can, which aids cross pollination. He also remarked how later in the flowering season bees frequently sucked the nectar from these flowers after biting holes in them and so avoided transfering pollen between flowers.The grasses growing here on the thin, poor soil are typical of acid grassland and include fine-leaved sheep's fescue.


Fine-leaved Sheep's Fescue

Turn R and walk in a southerly direction for about 100m across clearing, turning L by forked pine tree onto a main path. Turn R. After 50m you reach an iron age earthwork, thought to have been built slightly earlier than the main fort at Holwood. Cross earthwork into open area of relict heathland, gorse and acid grassland. Continue on pebbly path with gulley on your L.


Gorse

13 Look for common cow wheat, the food plant of the rare heath fritillary butterfly and the beautiful wavy hair grass. Also growing here is gorse. Darwin remarked how the very young leaves of gorse are pinnate or divided like the ordinary leaves of many other plants in the legume family to which they belong, such as acacias and vetches.


Leptopterna dolabrata on Wavy Hair Grass

Where footpaths meet, continue south, parallel to the road on your L until you reach the junction of Westerham and Heathfield Roads. Cross Heathfield Road with care and walk south down Westerham Road. On your right is the site of a Roman farmstead and burial place overlooking the valley. This was deserted in the 4th Century AD and later occupied by AngloSaxons who named the area *'Cystaninga'*, literally, *'field of stone coffins,'* giving Keston its name.


Ground Ivy


White Dead Nettle

14 After about 400m, take public footpath on your R down 22 steps, passing scrub which provides food and shelter for a variety of minibeasts and birds. In spring look for white dead nettle, red dead nettle and ground ivy at path and roadsides between here and Holwood. As with heather, Darwin reported how individual bees visiting these plants where they grew together always visited the same species. Because the pollen of these 3 plants differs in colour the examination of captured bees confirmed that each only had pollen from one of the three species.

When you reach the end of the pat turn L into Church Road. Take care to face the oncoming traffic.

Pass Keston Church on the R which was built about 1250 on the site of an earlier building.

please turn the page