The future for English woodland

A Woodland Trust paper for *Tomorrow's England*
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England is near the bottom of the European tree league:

- In England, ancient woodland is defined as areas wooded since at least 1600 AD. Before this planting was uncommon, so a wood present in 1600 AD is likely to have developed naturally.

- Distribution of ancient woodland in England is as follows (we can break it down to county and district level too):

Ancient Woodland in England by English Region	**Total AW (ha)**	**AW Percentage**	**Land Area (ha)**
England	341100	2.57	13297778.96
East Midlands	23306	1.49	1582218.94
East of England	27197	1.42	1956673.98
London	2571	1.61	159839.96
North East	11849	1.38	868225.24
North West	23076	1.64	1491116.81
South East	123607	6.48	1941697.73
South West	73664	3.09	2440239.42
West Midlands	39612	3.04	1300909.89
Yorkshire & the Humber	23436	1.52	1556856.99

- Ancient woodland is irreplaceable, having taken many centuries to evolve. It has been suggested that extinction-prone species include most of those of original, natural conditions and that they are now found mainly in stable habitats (Terborgh, 1974). If this is the case extinction-prone species are more likely to occur in woodland than in any other habitat in the UK and particularly in ancient woodland, which is the most stable woodland type (Peterken, 1993).

- This assumption is supported by the UK Biodiversity Action Plan, which identifies that broadleaved woodland supports almost twice as many species of conservation concern (232) as any other habitat. It has 78 globally threatened and rapidly declining species, and 46 species have been lost in the last 100 years, both higher than for any other habitat. (Biodiversity: The UK Steering Group, 1995).

- Many species with poor powers of dispersal have now been identified as characteristic of ancient woodland. Some occur in almost no other habitat, particularly epiphytic lichens (Rose 1976, Rose 1992, Hodgetts 1992), saproxylic beetles (Harding & Rose 1986) and woodland flies (Marren 1990). A significant number of vascular plants are associated with ancient woodland to a lesser or greater degree (Peterken 1974, Peterken & Game 1984, Rose 1999, Peterken 2000), as are some mosses and liverworts

- Of the ancient woodland that survives, only 56% of ancient woodland that appears on the both the Forestry Commission’s National Inventory of Woods and Trees and the government conservation agencies ancient woodland inventories survives in its semi-natural state (ancient semi-natural woodland (ASNW)). The remainder has been converted to plantations (planted ancient woodland sites (PAWS)) in which overall, conifers occupy 60% of the tree canopy. However despite the dense shade cast by the closely planted trees, even conifer PAWS often continue to support species characteristic of ancient woodland, particularly along rides and in glades.

- The loss of so much woodland over the past centuries now results in England being one of the least wooded parts of Europe (despite the fact that woodland cover is more than double what it was in 1900), with 8.4% cover of woodland as opposed to an average across Europe of 36% cover (Forestry Commission 2001).

- Ancient woods are small and often isolated from other semi-natural habitats. That ASNW which does remain does so in small, isolated blocks. 80% of ancient woods are between 2-20ha (Spencer & Kirby 1992) and furthermore 85% of all ancient woodland, including five of the twelve largest ancient woodlands in England, has no legal designation at all.

- Given the irreplaceable nature of ancient woodland as a habitat and the fact that it contains more species of conservation concern than any other habitat in the UK, it is perhaps surprising that more is not done to protect the resource, particularly within current planning legislation (Woodland Trust, 2002). However perhaps the greatest threat now faced by ancient woodland is climate change. In their current state ancient woods are simply not sustainable in a time of rapid environmental change given the immobile nature of many of their most characteristic species, locked in by the hostile landscape in which the woods now exist and the fact that the very importance of ancient woodland as a habitat is based on its relative ecological stability.

Impacts of climate change on woodland and biodiversity

Here are some observations on the effects of climate change on ancient woodland and woodland species:

Phenology (nature's calendar)

Observations of natural phenomena like budburst and nesting - the science of phenology – "the study of the times of recurring natural phenomena especially in relation to climatic conditions" is an old and respected discipline, which is now finding an important new focus as a result of climate change.

- In Britain, there are records dating as far back as 1736, due to the interests of a landowner and pioneer scientist Robert Marsham, who collected data until his death in 1798, leaving an invaluable archive of information. His family continued his work, resulting in a dataset of over 200 years of information.

- Phenology provides the longest written biological record in Britain, providing a unique source of information about changes in seasonality. When this is linked with another long-running scientific data set about climate, we can use information collected over two centuries to uncover patterns relating to climate change.

- See attachment for breakdown of data of species which we have good historical data in each region and these are a good phenological indicator regional of climate change. Other information from phenology recording is included throughout the rest of this document too. See also www.naturescalendar.org.uk for live maps and much more information.

Increases in pests and diseases

- Pests and invasive species may develop new ranges in our changed climate arriving in England and spreading. It should be noted that many of these pests are introduced as a result of humans moving increased numbers of materials around the planet as opposed to being directly related to climate change, but they do show the sorts of things that could happen as the climate warms:

- Generally warmer conditions could lead to an increase in a range of pests currently existing in low numbers. In addition, some non-native pests may increase or colonise, with examples including the pinewood nematode, gypsy moth and Asian longhorn beetle, three exotic pests that have recently been found in southern Britain.

- The spread of Phytopthora ramorum (sudden oak death disease) a fungal parasite, amongst several tree species has also been linked with the changing climate. in November 2003, the first P. ramorum infected tree outside the USA was confirmed on a mature specimen of Quercus falcata in Sussex. Since then, the Dutch have confirmed infection on several Quercas rubra trees. By early December 2005 a range of tree species in Cornwall – beech, horse chestnut, sessile oak and sycamore have been found with potentially lethal infections. In the UK, and elsewhere across Europe, there is already oak mortality and dieback of complex cause known as ‘oak decline’. This is fairly widespread; although individual pockets can be localised and intense. In some cases the decline is associated with infection by other Phytophthoras, but these are mainly root infecting species whereas P. ramorum causes stem cankers. Oak decline also involves recurrent episodes of drought, other root infecting fungi, repeated insect defoliation and scale insect attack.[1]

- In Alaska, warmer conditions have led to a series of dramatic and unprecedented infestations of spruce bark beetle over 20 million hectares of forest. While natural pests play a valuable role in the forest ecosystem, invasive or exotic pest species, without any naturally occurring predators or pathogens of their own, can cause irreparable damage. For example, Dutch Elm Disease virtually eliminated what was once an important woodland and hedgerow species in the UK.

- Warmer weather conditions favour the **Asian longhorn beetle**, a devastating pest of many hardwood trees. Increased trade with China, where the insect is a major problem, raises the chances of pests entering the UK and several infestations have already occurred. Asian Longhorn beetles spend most of their two-year life as inch-long larvae, living and eating inside a living tree until it dies. The adults lay up to 60 eggs in several trees, travelling up to 200 metres from where they emerge. The only sure method of preventing spread is to remove and completely destroy the tree. It may in the future be possible to use beetle diseases or insecticide, but these will prove ineffective if the pest has become well established. The beetle is already causing extensive damage in the USA. First discovered in New York in 1996, it caused a serious infestation in Chicago in the summer of 1998. Maple producers in Vermont fear that if the beetle becomes established in the state it could devastate the industry. Investigations by Forestry Commission inspectors found over 50 incidents in England and Wales involving imported material from China that is either infested or shows evidence of the insects’ bore holes. Attempts to hide the holes with wood filler have also been detected. The government warns that the Asian Longhorn beetle could do "extensive damage" to the UK’s

[1] http://www.forestry.gov.uk/pramorum

woods. A Pest Risk Assessment concludes that the beetle could survive in many parts of the country and cause damage to trees such as horse chestnut, poplar, willow and some fruit trees.

- **Arrival of the harlequin ladybird in Britain, *Harmonia axyridis*, the most invasive ladybird on Earth.** The harlequin ladybird was introduced to North America in 1988, where it is now the most widespread ladybird species on the continent. It has already invaded much of northwestern Europe, and arrived in Britain in summer 2004.[2]

New arrivals and departures?

New species will arrive, but others may be threatened:

- Winged species such as moths or birds will find it easy to move northwards. Less mobile species will be spread by rare and chance dispersal events hitching a lift with other animals including birds and humans.

- Clouded yellow butterfly has started to overwinter in Dorset.

- Chaffinch and blackcap both now overwinter in increasing numbers.

- Other candidates for new animal and plant species include the black kite, cattle egret and hoopoe.

- New moths include the flame brocade and Spanish carper – both of these are already established on the channel islands and expansion to the UK is highly plausible.

- Two species of butterfly once present in Britain but now extinct may be able to re-establish themselves – the black veined white and the mazarine blue.

- The red-admiral is finding hibernation in this country increasingly successful – previously it migrated. In contrast rarer species such as the heath fritillary are less mobile and have specific requirements for habitat, geology and vegetation. These species will be susceptible to environmental pressure including floods and drought and will find it hard to adapt to climate change.

- Plant species that may achieve a firm footing on the mainland include water bent, water primrose and bay.

Storms and extreme weather events

- Occasional storms and heavy rainfall are a natural part of any climate, and the damage that they cause can play a positive role in woods and forests over the long term by opening up the canopy and encouraging new growth.

- However, if storms increase in degree and regularity, what was previously a benign or positive event could become damaging, if for example, woodland ecosystems are not given the time to recover or if delicate, fragmented woodland remnants are repeatedly disrupted.

[2] More on this species in good summary form at http://www.harlequin-survey.org/factfile/concern.htm

- Increased rainfall is expected to be a particular problem in the North and West of Britain. Riverside woods are particularly under threat if floodwater stands for long periods or the soil becomes saturated.

Drought and water shortages

- The 1976 drought in the UK severely affected the health of trees, including weakening of broadleaved tree species and "tinselling" (premature needle loss) in conifers; its impact was increased by air pollutants like sulphur dioxide and ozone. Susceptible species such as the beech took years to recover from this drought.

- One of the likely effects of climate change is a marked increase in the frequency of major droughts – perhaps to as much as an average of one every ten years. In practice this means that two severe droughts could occur in quick succession, leading to a cumulative impact that is hard to predict, but likely to be catastrophic.

- Water shortages can also occur because of longer dry seasons, and the higher rates at which water is drawn up from the soil and released through the leaves of plants under warmer conditions. While many tree species have compensatory mechanisms, such as leaf shedding, to help survive occasional drought, long-term changes could change their competitive ability and alter the composition of the UK's woods.

Changes to where species are able to live

In order to survive the rapidly changing temperature, the distributions of large numbers of species are going to have to move, as much as 150 kilometres (94 miles) north or 100 metres uphill with each 1C rise in temperature. It would appear that following the last Ice Age most trees spread across the UK at a rate of one kilometer (0.6 miles) per year.

While this will be by no means fast enough to keep pace with expected temperature changes, many ancient woodland species are far less mobile. In any case existing habitat loss will often prevent species from dispersing, as will barriers such as intensive farmland, road networks, and towns, as well as differences in soils and underlying geology.

Species with poor powers of dispersal finding themselves in habitats that have become unsuitable will literally have nowhere to go unless rare one-off events lead them to be re-located far away. For example, a berry being eaten by a bird that flies a long distance before depositing the seed, or an insect being trapped inside someone's car only escaping once the driver has reached their destination. More mobile species, including some butterflies, are already showing signs of reacting to warmer conditions, with a general northward movement recorded in Europe during the second part of the twentieth century. Recent research shows evidence that both the comma and the speckled wood butterfly are currently moving north in the UK. Predicted future events include changes in the numbers of generations of some species of insects and changes in interactions, including those between predators and their prey. Some birds and mammals are also expected to move northwards, including the lesser horseshoe bat, which is currently confined to the south.

- The natural distribution of the **beech** was pushed to the south of Britain during the last Ice Age and it has gradually been expanding north, century by century, ever since. Now, computer modelling shows that the favourable habitat of beech could move north much more quickly, with its natural distribution reaching the Lake District and warmer parts of Scotland as soon as 2020; some scenarios even show it reaching parts of western Scotland.

As beech has been planted widely in the north of Britain, it could, in theory, quickly spread out from these sites, although as with other species barriers due to land-use will severely limit natural expansion. Increased drought and water stress mean that parts of London, East Anglia and the Midlands might become unsuitable for beech in the near future. Beech woodland has already experienced dieback in parts of East Anglia and southern England during recent droughts and such problems are likely to occur with increasing frequency.

Unfortunately drought is not the only hazard faced by beech in England. A failure to meet its winter chilling requirements might also drive the species out of much of the South West. In worst-case scenarios, beech could soon be absent from large areas of the South.

- Spring comes roughly six days earlier for every 1 degree C.
- Life cycles of many species are responsive to temperature. For example the development rates of caterpillars and the growth of plants speed up in warmer conditions.
- In the last 50 years oak-leafing has advanced by three weeks and in southern England leaves now start to emerge in late March. Different species respond at different rates – for example oak leafing is changing more than ash and sand martin migration has advanced more than that of the swallow.
- Insects tend to be capable of a greater response to temperature than vertebrates which is big implications – all species will not advance ion union and differential responses may disrupt the complex linkages and interdependency in nature
- Frog spawning has occurred pre-Christmas for years in milder parts of Cornwall but now some records are coming in of spawning as early as October and as far north as Northern Ireland
- Flowering season of the white dead nettle is no longer restricted to spring qwith observations of this and the daffodil on Christmas Day
- Grass now grows all year with people recording mowing their lawns year round.
- Several species have already started moving northwards as temperatures have risen:
    - Long winged conehead cricket formerly restricted to South Coast but now spread more than 100km northwards
    - Gatekeeper, comma and speckled wood butterflies are already spreading northwards.
- Has been decline of some bird species associated with cold environments for example the capercaillie, snow bunting and arctic alpine flowers all stand to suffer
- Many of the plants that are characteristic of ancient woodland, such as great woodrush and wood horsetail, may be unable to respond fast enough and are likely to become scarce, or even extinct locally.
- Other woodland species at the southern edge of their range, such as whorled solomons seal and wood cranes-bill will literally have nowhere else to go.

Regional breakdowns:

UKCIP REGIS study is a good place for regional breakdowns. REGIS: Regional Climate Change Impact Response Studies in East Anglia and North West England. Authors: Holman, I.P., Loveland,P.J., (eds.). Date: 2002 Technical report on the REGIS project to develop an integrated assessment of climate change impacts on East Anglia and the North West of England

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