

Practical Guidance

Ancient tree guide 5:

Trees and climate change

December 2008



WOODLAND
TRUST



An age of difference

Ancient trees change in structure and shape as they age and may react differently to climate impacts than younger trees. Their trunks, branches and roots decay and become hollow. Deadwood may accumulate in the canopy and on the ground. The extent of the root system will also be changing but little is known about how the roots decay with age.

Ancient trees can be found in gardens and streets as well as in the countryside. They are important in their own right culturally, historically and aesthetically. They are also host to many rare and special species of wildlife which rely solely on ancient trees for their survival.

Climate change will bring both incremental changes and more frequent extreme events. Ancient trees may respond differently from younger trees. Understanding the strengths and weaknesses of ancient trees will help those with responsibility

for their management to ensure their continued survival and assess any health and safety risks.

It is crucial that we take action on two fronts. Firstly, we must protect all existing ancient trees from avoidable harm to ensure they live as long as possible. Secondly, we must create successor generations of ancient trees to replace those that will inevitably be lost in the future.

This guide is for anyone with a responsibility for, or interest in, ancient trees, including owners and land managers, tree officers, arboriculturists and foresters. Information is drawn from a number of sources in order to:

- Suggest characteristics which may make ancient trees more or less resilient to climate change
- Highlight areas where impacts are unknown but potentially significant
- Identify what you can do to help trees live their lives to the full.

Young trees damaged by the 1987 storm...



...while an ancient tree stands firm



Change is happening



Will ancient trees see snow in a changed climate?

Climate change is happening and it is incontrovertible that much of this is human-induced. Temperatures are rising and rainfall patterns are changing in different ways across the UK. But in addition to the incremental pattern of change over time, there are irregular extreme events, such as floods, drought and gales.

These incremental changes can be monitored and their impact seen through earlier flowering in plants or changes in species distributions as a response to temperature. It is important to remember that these changes are happening very fast. This means many species will not be able to adapt quickly enough especially given the increasing isolation of habitats.

Globally, there appears to have been a dramatic increase in extreme weather events and it is these which can have the most sudden and apparent impacts. Species pushed to their geographical or phenological¹ limits, by incremental climate change could be catastrophically affected by extreme weather events. It is this combination of incremental climate change and extreme weather events that is potentially so damaging to wildlife. When we consider the impacts of climate change

The Facts

Evidence for accelerating climate change has built over the last decade. Global average temperatures have increased from 13.7°C to 14.3°C in the last 100 years. The 1990s was the warmest decade in the last 1,000 years; many ice sheets and glaciers worldwide are retreating and the frequency of floods, droughts and storms is increasing. The populations, ranges, migration patterns, and seasonal behaviour of animals and plants are changing.



Oak is leafing earlier

Examples of climate-induced impacts include beech suffering from increased summer drought stress, particularly in south-east England, and oak which is coming into leaf three weeks earlier than in the 1950s.

Furthermore, it is clear that even if CO₂ emissions were reduced by 60 per cent overnight, the accelerated warming would continue due to current levels of atmospheric CO₂. So, while it is crucial that efforts are made to reduce CO₂ emissions, adaptation to the change that has already begun must start now.

on ancient trees we therefore have to look at both the incremental changes and extreme events.

It is also important to consider unintended consequences from other responses to climate change, for example biofuel planting could have impacts on our land use which in turn may affect ancient trees.

Some trees can live in the ancient stage of their lives for centuries. By the end of the 21st century our ancient trees of today, and their successors, will have to live in a very different climate.

¹ Phenology: The study of recurring natural events in relation to climate e.g. timing of plant flowering or leafing.

Ancient tree resilience

The size of the crown often decreases as trees become ancient. This means they offer less lever arm to the wind and are less likely to be blown over by gales.

Lichens in the crown or on the trunk are able to withstand dry periods and may be able to cope in times of drought.

If an ancient tree is facing catastrophic collapse, some crown reduction can help to reduce the 'sail' effect of the crown and reduce the possibility of limbs being lost or total loss of the tree.

Ancient trees often have relatively large diameter trunks in relation to their height and even when hollow, they have greater stability in high winds.

Insect larvae inside the wood of the tree may be protected from the extremes of heat and cold by the insulating effects of the wood.

In times of flood the tree species might be more important than age. Some species such as willows are able to withstand waterlogging longer than others.

Limbs in contact with the ground and also attached to the tree may act as natural props providing stability.

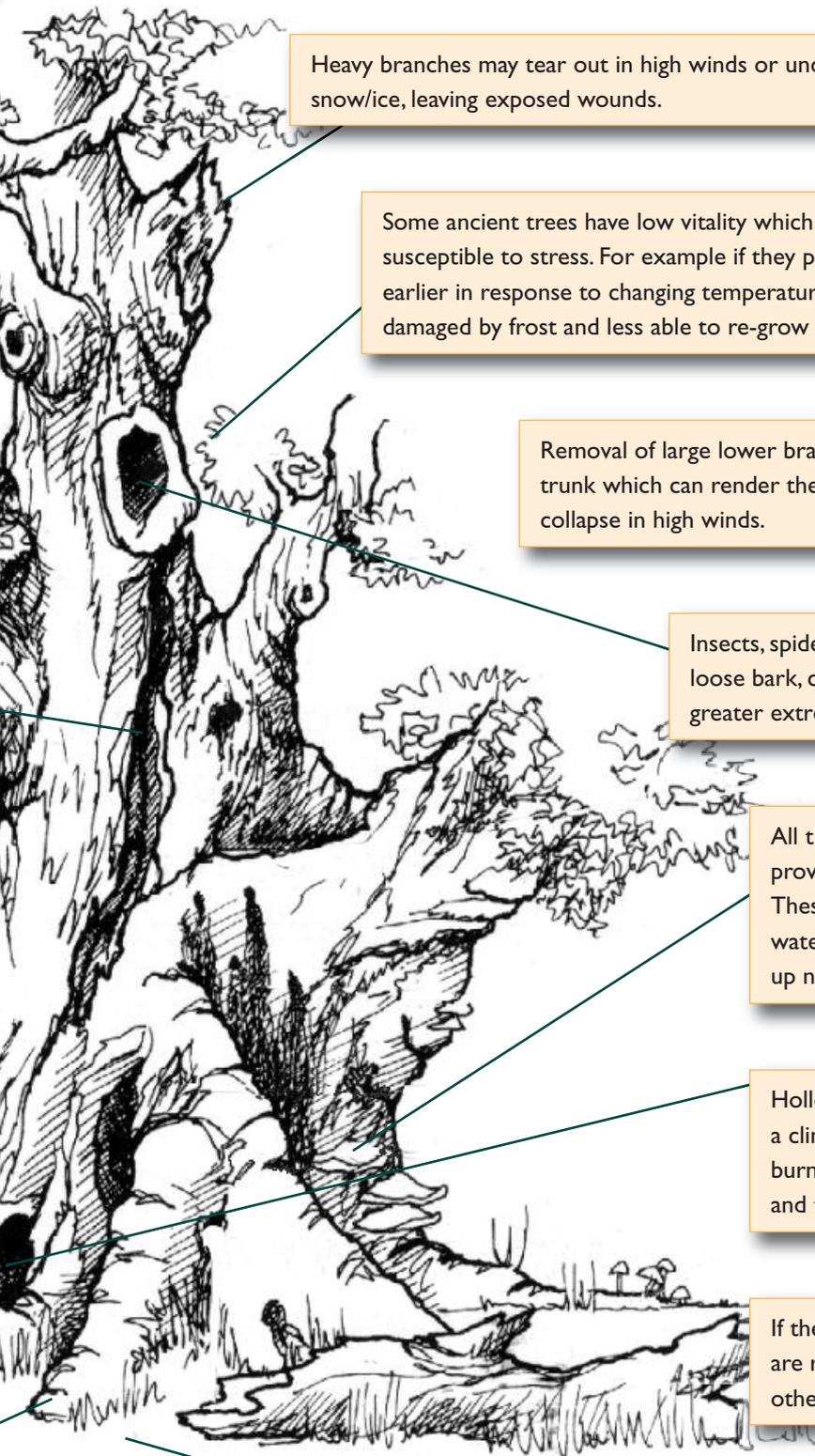
Trees blown over by storms may grow new stems if some of the roots are undamaged. The age of the tree is not important in this process. The amount of roots remaining in the ground is the most important factor.

Ancient trees in the open may survive better in times of water shortage because they have deeper roots to take up water than grass and other short vegetation and fewer trees to compete with for water than in a woodland.

Ancient trees in the open are more likely to have roots in all directions around the tree which spread out much further than the crown of the tree. This helps anchor them more firmly in the ground in high winds. In the 1987 storms many ancient trees in the open remained standing while plantation trees were blown over.

These pages identify possible impacts based on current knowledge. More

Ancient tree weaknesses



Heavy branches may tear out in high winds or under heavy snow/ice, leaving exposed wounds.

Some ancient trees have low vitality which means they are susceptible to stress. For example if they put out leaves earlier in response to changing temperature they may be damaged by frost and less able to re-grow new ones.

Removal of large lower branches can accelerate decay in the trunk which can render the tree more prone to catastrophic collapse in high winds.

Insects, spiders and bats living in small open cavities, such as loose bark, could be affected by increased temperatures and greater extremes in temperatures.

All trees, young and old rely on fungi in and on their roots to provide nutrients and help them resist pathogens. These mycorrhizal fungi may be susceptible to drought or waterlogging and without them the tree is less able to take up nutrients and resist diseases.

Hollow ancient trees are more likely to be damaged by fire if a climate induced drought causes surrounding vegetation to burn. This is because the hollow trunk could act as a chimney and the dead wood fuels the fire.

If the tree catastrophically collapses the habitats for wildlife are rapidly changed. Some species will have to rely on finding other suitable trees nearby in order to survive.

Gales do not just affect the crown, the roots may be strained with rocking of the tree in high winds. This could damage the roots leaving the tree with less anchorage in the next extreme event.

evidence is needed to determine general trends from individual examples.

Unknown quantities

Knowledge and experience helps identify some of the impacts of climate change on ancient trees, but some things cannot be predicted.



Horse chestnut affected by leaf miner

Pests and diseases are a serious problem in forestry and horticulture and could become a much bigger issue for all trees and woods. As the climate changes the numbers and behaviours of existing pests and diseases will change. New pests and tree diseases may also arrive from outside the UK.



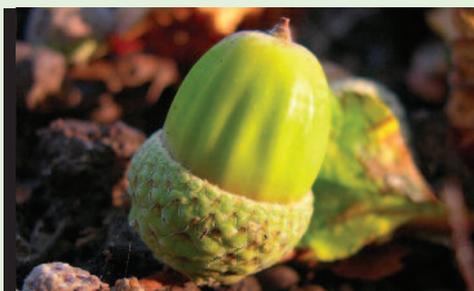
Tree stressed by damage

Ancient trees which are under stress may lack the ability to respond to damage and put out new growth. Stresses induced by the effects of climate can add to other pressures which ancient trees face. However trees often show surprising resilience.



Will non-native trees be able to cope?

It is difficult to determine which species or individual trees may be best able to cope with a changing climate. Our native trees are growing in many other parts of the world despite different climates, latitudes and seasons. It could also be helpful to think of the features of different trees and how these may help them adapt, whether they are native, non-native, broadleaf or coniferous, pollarded or standard.



Genes of the future?

Perhaps our ancient trees hold the key to the future- does their survival indicate genes which will be able to cope with future changes? Trees that have survived the 'little ice age' and the 'medieval warming' of the past must carry genes which enabled them to cope with change. These trees have been producing pollen and seed for their whole lives so passing their genes onto other trees currently in our landscape.

Mini case study: Oak mildew



Oak mildew is found across the UK. Will it increase in the drier east while increased rainfall in the west deters this dry-loving species?

Mini case study: Oaks in Oz



Pedunculate (or English) oak appears to be growing well in some parts of Australia despite very different conditions.

Ancient trees of today and tomorrow

- Protect our existing trees from avoidable loss – this includes both existing ancient trees and trees that will be ancient by the end of this century
- Establish new native trees with adequate space, creating successor generations, so the wildlife reliant on ancient trees has somewhere to go in the future.

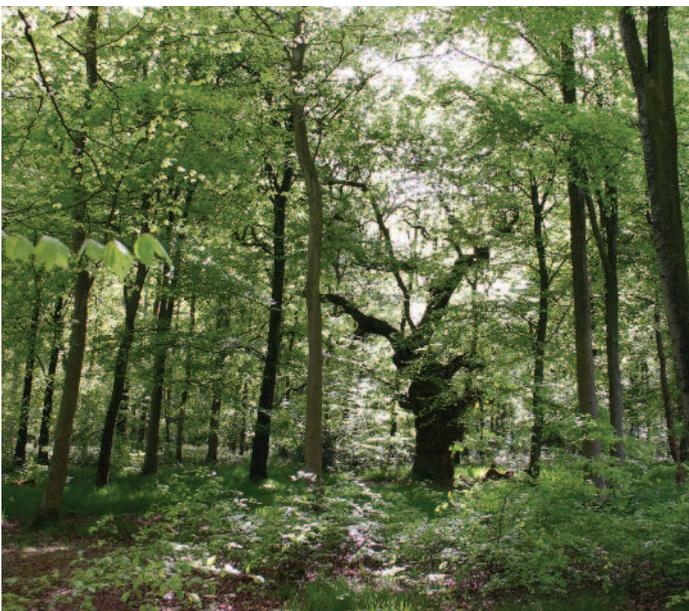
Help trees to help themselves

Ancient trees will be best able to cope with the impacts of climate change if they are in a healthy environment and not already stressed and weakened by adverse conditions.

Things to avoid:

- Compaction or other damage to roots
- Loss of roots from construction and trenching
- Damage to root fungi (mycorrhizae) from agricultural chemicals and animal dung
- Overshadowing by other trees which compete for light and nutrients
- Inappropriate cutting or tree surgery.

Ancient Tree Guides 1 to 3 give more guidance (see back page).



Gradually release ancient trees from overshadowing



Planting future ancient trees

And if the wind doth blow

- Don't assume ancient trees are a greater health and safety risk; they may be more resilient than younger trees
- Avoid removing major lower limbs as this may weaken the trunk increasing the risk of catastrophic collapse
- Use a competent person to assess ancient and veteran trees for safety. Where possible move the target at risk (people and property) rather than manage the tree. For example, move a path away from a tree
- Tree surgery should be a last resort where there is no alternative
- Balance the risk of cutting ancient trees against the benefits – a small reduction of the crown greatly reduces its wind resistance
- Take note of how ancient trees cope with extreme events such as high winds and compare it to younger trees in the area, so that you know how the tree may react in future.

More information

This leaflet is the fifth in a series about ancient trees:

Ancient Tree Guide no.1: Trees and Farming.

Ancient Tree Guide no.2: Trees in Historic Parks and Landscape Gardens.

Ancient Tree Guide no.3: Trees and Development.

Ancient Tree Guide no.4: What are ancient, veteran and other trees of special interest.

They are available from the Woodland Trust or can be downloaded (as a pdf file) in English and Welsh from www.ancient-tree-forum.org.uk.

Mae'r daf len hon ar gael yn Gymraeg fel pdf o wefan.

Further reading

Veteran trees: A guide to good management (2000) ed H. Read.

Published by English Nature (now Natural England).

No longer available in hardcopy, only as a pdf from their website at www.naturalengland.org.uk

Advice and information on ancient and veteran trees:

www.ancient-tree-forum.org.uk

Tell us about a tree you have found or find one at:

www.AncientTreeHunt.org.uk

Tell us about a wood or tree under threat and get lots more information about fighting a threat:

www.woodsunderthreat.org.uk

Further information about climate change:

www.ipcc.ch

Further information about historic environment management: www.helm.org.uk

To contact a qualified arboriculturist:

www.trees.org.uk



The Woodland Trust

Autumn Park
Grantham
Lincolnshire NG31 6LL

Telephone: 01476 581111

The Woodland Trust Wales

(Coed Cadw)
3 Cooper's Yard, Curran Rd
Cardiff CF10 5NB

Telephone: 08452 935860

The Woodland Trust Scotland

South Inch Business Centre
Shore Road
Perth, PH2 8BW

Telephone: 01738 635829

The Woodland Trust in

Northern Ireland
1 Dufferin Court, Dufferin Avenue
Bangor, County Down BT20 3BX

Telephone: 028 9127 5787

Website: www.woodlandtrust.org.uk **Email:** enquiries@woodlandtrust.org.uk

Ancient Tree Forum c/o The Woodland Trust, Autumn Park, Grantham, Lincolnshire, NG31 6LL Tel 01476 581135

The Woodland Trust is a charity registered in England and Wales no. 294344 and in Scotland no. SC038885

A non-profit making company limited by guarantee. Registered in England no. 1982873

The Woodland Trust logo is a registered trademark. The Ancient Tree Forum is a registered charity no. 1071012

All photography: WTPL/Ted Green except, oak leafing (page 2) & acorn (page 6): WTPL/Pete Holmes; horse chestnut leaf miner (page 6): RHS/Entomology; larch pine cone (page 6): WTPL/Keith Huggett; ancient beech tree (back page): WTPL/Michael Clarke 3954/12/08