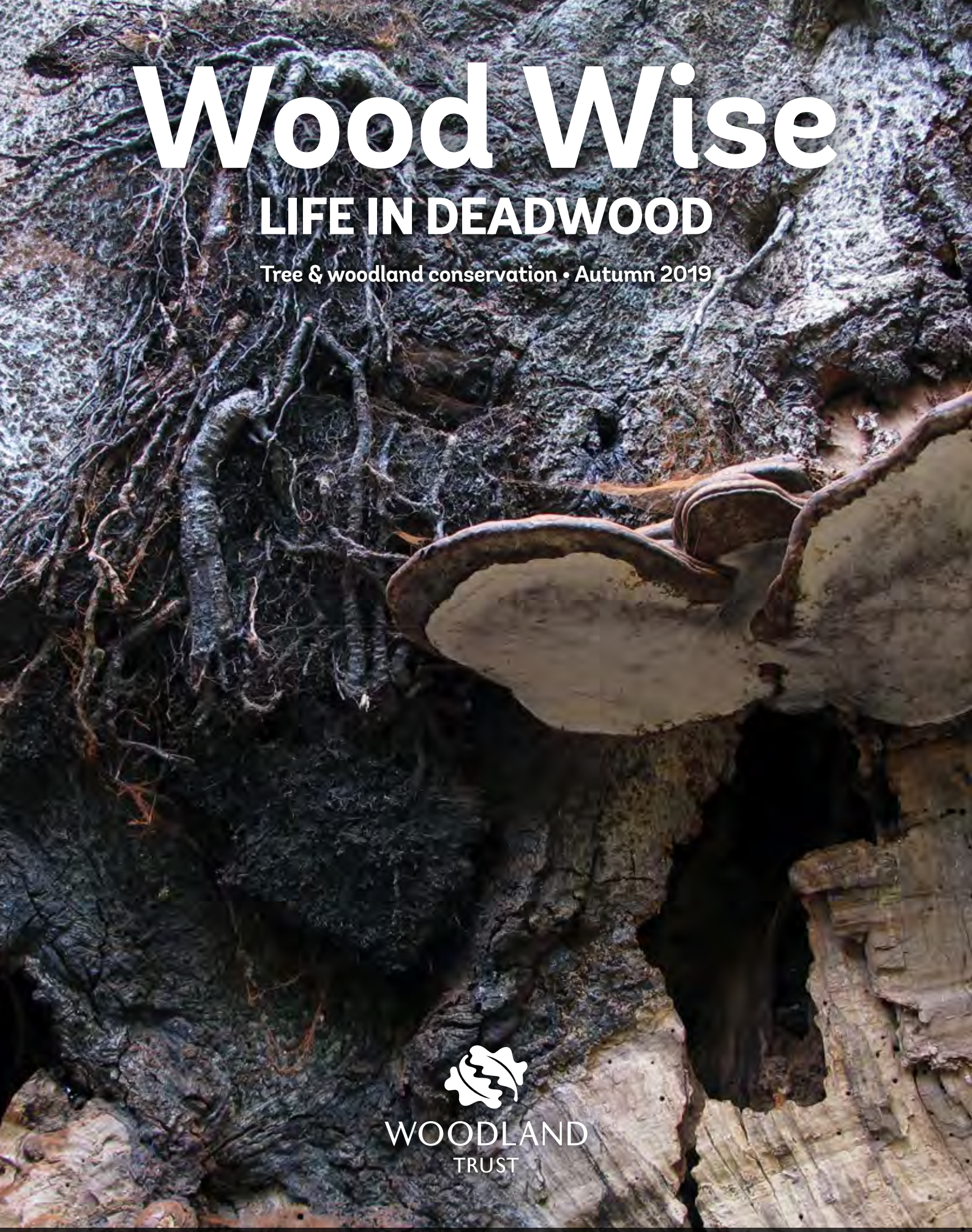

Wood Wise

LIFE IN DEADWOOD

Tree & woodland conservation • Autumn 2019

WOODLAND TRUST

THE ECOLOGY OF WOOD DECAY

USING TOOLS INSTEAD OF TIME

WOODY DEBRIS IN STREAMS AND RIVERS

MANAGING DEAD AND DYING ASH

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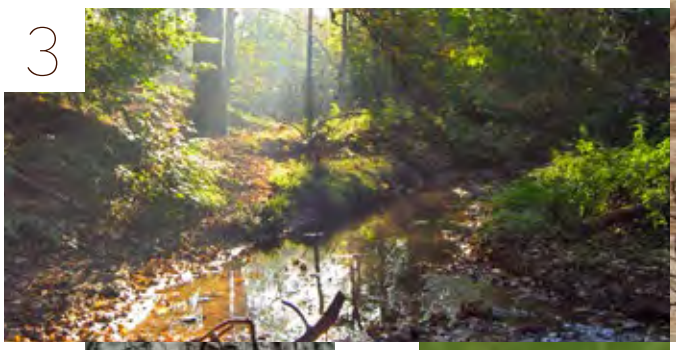


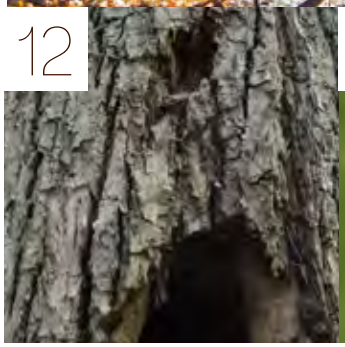

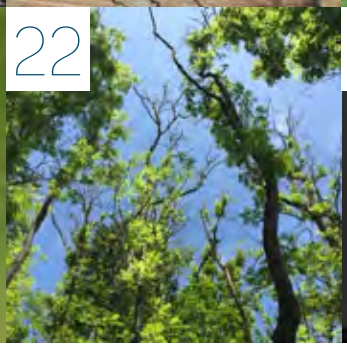
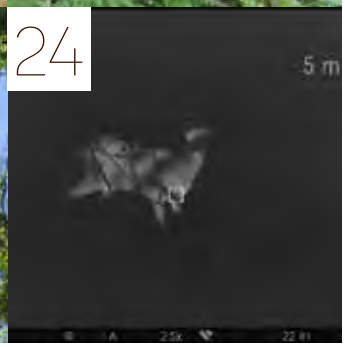

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Stephen Highfield/WTML

Deadwood in the limelight

Dead and decaying wood can have negative connotations. When walking through a wood, people may see rotting logs or broken branches and think that the woodland is unhealthy or dangerous. In actual fact, the risks to people posed by decaying wood are usually small, yet the value to ecosystem health is enormous.

This issue aims to dispel any myths about deadwood and raise awareness of its disproportionate importance to people and wildlife. Wood is a vast resource, and removing dead and decaying wood components would deprive woodlands of a reservoir of vital nutrients. The issue begins with a detailed explanation of the ecology of wood decomposition – one of nature's essential recycling processes.

Fungi are the main agents of wood decay, but the sheer number of species across multiple taxa that are dependent on decaying wood for part of their lifecycle is mind-blowing. The diversity of life in deadwood, particularly in old decaying standing trees, is brought into focus, as well as the serious issue of declines in these habitats. There are, however, ways in which we can speed up the aging of trees to ensure continuity of decaying wood habitats, some of which are discussed.

Probably less well-known is the importance of wood for river health, and the plethora of organisms whose existence depend on woody debris in streams and rivers. Fortunately there are fresh water ecologists on the case, restoring rivers and raising awareness of the benefits for wildlife, flood defence and water quality to name a few. You'll be taken on a journey along a river from source to floodplain, and the influence of fallen trees and associated woody debris at key stages will become abundantly clear.

While the risk that dead and dying trees pose to people and property is usually low, ash dieback is accelerating the death and decay of one of the UK's most common and widespread species. When making decisions on retention versus felling of diseased ash trees, woodland managers must weigh up the safety risks against their ecological value. Considering the importance of deadwood, the resulting increase due to ash dieback could actually be a positive consequence of this devastating disease.

Dr Karen Hornigold is the Woodland Trust's conservation evidence officer and editor of *Wood Wise*.

Wood – a vast resource

Lynne Boddy

Professor Lynne Boddy is a fungal ecologist, teaching and researching at Cardiff University

The term dead wood is used in connection with humans to mean nothing much is going on. This could not be further from the truth in the natural world. Decaying wood is a hive of activity, food and home to a plethora of fungi, thousands of invertebrate species, and even birds and mammals.

Wood, as we all know, is the main structural part of trees, supporting the canopy of leaves with twigs, branches and the vertical trunk. Wood is also found below ground in large roots that anchor trees in soil. Forests and woodlands contain vast quantities of wood in standing trees, 150 billion tonnes being produced and an equivalent amount being decomposed world-wide every year.

Besides standing living trees, wood is also present as dead attached parts, dead standing trunks, hollowing trunks, and as fallen or felled wood on the woodland floor. This wood contains a reservoir of nutrients locked up in the walls of the woody tree cells. If wood did not decay, our woodland ecosystems would soon run out of nutrients, so wood decomposition is an essential recycling process. Vital nutrients are released that can be used again by trees for growth – maintaining a healthy ecosystem.

What is wood made of?

Trunks, branches, twigs and woody roots are made up of both dead and living cells. The water-conducting tissue – called xylem – has some living cells for storage of food, defence against microbial attack, and other life processes. It also has a preponderance of dead, hollow cells (vessels in broadleaf trees, and tracheids in conifers) connected together to form long pipes along which water moves from the roots to the leaves. The walls of these dead cells are thickened for strength and support, and are composed of chemical molecules called hemicelluloses, cellulose and lignins.

Cellulose and hemicelluloses in plant tissues are relatively easy to breakdown. Indeed, many animals, including us, feed on them in fruits, vegetables and herbaceous vegetation, and use them as food, typically with the help of microbes in the gut. Lignins, on the other hand, are probably the most complex naturally produced organic molecules on the planet, and are especially difficult to break down into their component parts. In fact, not many organisms can break them down with any efficiency, and those that can are just a relatively few species of fungi.

Wood-decay fungi include some of the basidiomycetes, such as those that produce brackets, crusts and skins, puffballs and some fleshy mushrooms. Some ascomycetes are also able to decay wood, including those that form saucers and cups, or minute flasks embedded in bark, or warty fungal structures. The mushrooms and brackets that are so iconic of fungi are just the tip of the iceberg. They are equivalent to the flowers/fruits of flowering plants. They produce spores (equivalent to seeds) that spread the fungus. The main body of the fungus (called the mycelium) is hidden in whatever the fungus is feeding on. It is made up of a network of fine, microscopic filaments called hyphae (hypha singular).

How is wood broken down?

The fungi that grow in wood bring about a variety of different types of decay. Some fungi are only able to use the contents of cells that were recently living, and are unable to feed on woody cell walls. They often stain the wood a dark, blotchy, unpleasant-looking colour due to the colour of their hyphae and/or spores. Some fungi, with slightly greater decay abilities, produce beautiful colours in the wood on which they are feeding. The green elf cup, *Chlorociboria aeruginascens*, turns the wood a lovely green colour, and this wood was often inlaid into the lids of small wooden boxes called Tunbridge Ware. The rich, brown-coloured oak wood caused by the beefsteak fungus, *Fistulina hepatica*, is much prized by furniture makers.

There are three broad types of decay – white rot, brown rot and soft rot – but there is a spectrum among these types, and they are not mutually exclusive. Nonetheless, these three categories illustrate well some of the main types of decay that we encounter in woodlands.

With white rot, the fungi involved break down all of the chemical components of wood into carbon dioxide and water, releasing nutrients, such as nitrogen and phosphorous, that were locked within. As decay proceeds the wood takes on a bleached appearance, often becoming fibrous and stringy.

White-rotted oak branch

Beefsteak fungus, *Fistulina hepatica*

With brown rot, on the other hand, the fungi only break down the simple sugars, hemicelluloses and cellulose. They may alter the lignin slightly but little more. Consequently, the wood becomes brown, cubically cracked and crumbly. It was once thought that, as these fungi do not break down lignin, they must be less evolved than those fungi that cause white rot. Not so. Brown-rot fungi have evolved from white rotters. As it is energetically costly to break down the extremely complex lignin molecules, the brown rotters have evolved ways to get at the cellulose and hemicellulose that is masked by the lignin, without having to break down the lignin first.

Soft rot is another type of decay, typically caused by ascomycete fungi, and often in environments where moisture content fluctuates. As the name suggests, the wood is often, but not always, soft. Lignin is broken down to some extent, and the wood is a white colour. Sometimes soft rot is superficial, but can occur throughout wood, and although the overall amount of decay is usually less than can be brought about by white-rot fungi, this type of decay can rapidly cause loss of strength in the wood.

Brown rot.

Communities in wood

Although white-rot fungi can decompose all of the components of wood, it is extremely rare to find a single fungus completely decaying wood on its own. Usually, several or many individuals of the same or different species of fungi are involved, decaying wood together at the same time and forming a community, the composition of which changes over time. The presence, and location, of individual decay fungi within wood can often be clearly seen when a branch or log is cut. Lines – called interaction zone lines – are often evident. These are typically black or brown, but sometimes orange or other colours.

These lines demarcate the territory of fungal individuals within wood, in a manner somewhat analogous to the fences, walls or hedges that we humans often erect around our homes and gardens. If the fungus can prevent a neighbour from entering its territory, it can feed on the wood within at its leisure. All wood-decay fungi fight with each other. Those that are well matched 'deadlock' and can remain as neighbours. However, some fungi are more combative than others and can replace opponent fungi they encounter, leading to a change in the composition of the fungal community.

While other organisms are (on the whole) unable to digest wood, they can capitalise on the remarkable decomposer abilities of the fungi. Some bacteria 'steal' the sugars produced when fungal enzymes break down the complex molecules of wood before the fungi are able to absorb them all into their bodies. Some also attack fungal hyphae. Likewise, many invertebrates graze directly on the nutrient-rich fungal hyphae or fruit bodies, or consume them along with wood as they burrow their way through. Grazing by invertebrates can dramatically affect the growth of fungi and the outcome of fungal battles with each other. Some fungi fight back by producing toxic chemicals that deter feeding or even kill those invertebrates foolish enough to eat them. But some fungi have evolved mutualistic partnerships, meaning that both the fungus and invertebrate benefit from their interaction. For example, higher termites in Africa cultivate and protect specific fungi in their underground nests and bring particles of wood and other plant material to the fungi. The fungi decompose this dead organic matter and produce rounded structures called mycotêtes (literally meaning fungus head), that the termites eat.

Interaction zone lines in a felled beech tree


© Lynne Boddy

Indivdual hyphae aggregate together to form cords.

Fungi that explore

It is natural to think of wood-decay fungi as being confined to wood, only being able to spread to new pieces of wood as spores shed from their fruit bodies. However, some fungi are able to grow out of wood in search of new woody resources. When they do this, individual hyphae typically aggregate together to form cords on the surface of soil and within the layer of fallen, rotting leaves.

These cords form networks that are resilient to damage, and respond when they discover a new woody resource or one has landed on them. Messages are sent around the mycelium changing the direction of search, and thickening cords attached to the new resources, thus incorporating the food sources into the network. Nutrients can be sent around the network, so if part is foraging through an area with little food or water, it can be supported by the rest of the mycelium.

These networks can be long-lived and extensive, covering many square metres of forest floor. In fact, the largest organisms on the planet are honey fungi *(Armillaria* species), single individuals of which can span many hectares of forest floor and live for hundreds of years.


© Patrick Hickey

Rhizomorphs of honey fungus

Life abounds in deadwood

Emma Gilmartin

Emma Gilmartin is the Woodland Trust's conservation adviser for trees. Decay communities in standing beech trees were the subject of her PhD research.

Deadwood is an unfortunate misnomer, because it is cumulatively occupied by millions of living organisms. Dead and decaying wood takes many forms; we most often experience it as a rotting log or stump on the ground, but this is far from the full story.

The diversity of species in decaying wood is incredibly high, and are collectively termed saproxylic, from the Greek *sapros* meaning 'rotten' and *xylon* meaning 'wood'[1]. Animals and plants, together with fungi and other microorganisms, can be saproxylic, encompassing many lifestyles. They may utilise wood for habitat (breeding or larval development) as well as food (the wood components or fungal mycelia).

Keystone structures in the landscape

Wood decay begins in the standing, living tree and progresses for many years or centuries before a tree dies or falls to the ground. Living trees with decay eventually begin hollowing and are regarded as keystone structures. They play a disproportionate role in maintaining ecological processes, and support many species.

Much happens to trees during their lives. First they grow, and some branches may die as they are shaded out by others, but remain attached to the tree. Maturing trees become part of their surroundings and might serve as excellent scratching posts for animals, or be crashed-upon by neighbouring trees as they fall. During storms, lightning strikes to trees can kill significant portions of wood and produce large cracks from the canopy down through the trunk. In high winds, tree limbs twist and contort, giving rise to damage types such as tear-outs, blown-tops and hazard beams.

Emma Gilmartin

Hazard beam oak

Emma Gilmartin

Hollow oak in Sherwood Forest

All of these life events give rise to gnarly trees of the future, rich with habitats in the form of trunk and limb cavities, dead branches and water-filled pockets. Trees with such features are called veterans, reminiscent of an experienced or embattled fighter, though they may still be quite young. As trees become older and larger, they accumulate more features, and trunks may become completely hollow.

Hollows and cavities

Fungi are the principal agents of decay in wood, breaking it down via secretion of enzymes. Some decay fungi are most likely seen on dead bark, such as the beech woodwart, ***Hypoxylon fragiforme***, or appear only along branches, like the waxy crust, ***Vuilleminia comedens***. Other species, such as chicken of the woods, ***Laetiporus sulphurous***, or the beefsteak fungus, ***Fistulina hepatica***, are typically confined to the inner trunk of a tree. These belong to a group known as heart rot fungi, which are implicated in the formation of hollows and cavities.

Emma Gilmartin

Lapsed beech pollard in Epping Forest

Emma Gilmartin

Water-filled pocket in hollow root.

Decaying wood is full of creatures. Invertebrates play a crucial role in wood decomposition. They may directly consume and digest wood, but they also physically degrade it by tunnelling through it or by breaking it into smaller, finer fragments. These are an integral part of the saproxylic food web, acting as detritivores, fungal-feeders, scavengers, parasites and predators.

Springtails, mites, beetles, flies and parasitoid wasps are particularly frequent groups, but it isn't unusual to find the humble earthworm living metres-high in a tree cavity. Research has found 500 arthropod individuals per litre of wood from dead branches[2], and an average density of 2,500 arthropods per kg of 'wood mould' (the loose, soily wood and other debris that accumulates in hollows)[3]. Though distribution and density of animals varies, decaying wood and cavities can be fantastically rich; recent work found an average of 280 invertebrate animals from 13 families in one large handful of rot-hole contents[4].

Flat-backed millipede

Stone centipede

Springtail

Glossy glass snail

Images: Jordan Cuff

Tree cavities provide nest and roost sites for birds and bats. In Europe, an estimated 30% of forest-dwelling birds use tree cavities[5], and it is well known that the availability of cavities – in number and type – is a limiting factor of bird-population size[6]. We quietly acknowledge the lack of tree cavities in our landscape every time we put up a nest or bat-box. The research, however, is starting to suggest that these are not adequate replacements for natural hollows and cavities. Trees have more stable microclimates than boxes, buffering against temperature fluctuations.

Diversity begets diversity

Why does decaying wood support so many species? Part of the explanation might lie in the many kinds of microhabitats available. The myriad combinations of decay type, extent and location in different tree species, contexts and climates, are almost innumerable.

Many decay fungi are regarded as generalists, but some, especially heart rotters, are most frequently observed on particular tree species. Some associations within decay communities can be very strong. For example, species of beetle that are only known from one species of fungal fruiting body, such as the larvae of *Dorcatoma ambjoerni* which so far are only known from the clustered bracket, *Inonotus cuticularis*.

Often, the niche requirements of individual species are not fully understood, but it is possible to see that whole communities vary between cavities with broadly different features, such as wide or narrow cavity entrances, difference in sun exposure or angle to the sky. Decaying wood can be wet or dry, crumbly to flaky or spongy. This influences and, in-turn, is influenced by the organisms that live in it!

Deadwood continuity

Beetles are the best-studied component of saproxylic communities and the presence of some species is an excellent indicator of the state of our woods and trees. Last year, the IUCN Red List for saproxylic beetles identified 18% of species in Europe as threatened with extinction, citing loss of veteran trees and habitat as the major cause[7].

Consider a veteran tree near you, perhaps in your town or within a hedgerow. For several species it may be the last refuge in the area, isolated from the next suitable veteran tree should this one disappear. Decaying wood, whether on the ground or in a tree, is dynamic and transient. For a saproxylic species, availability of decaying wood habitat in the right place at the right time is vital. To conserve the diversity of life in deadwood we must ensure the next generation of veteran trees is already growing and cared for. Unfortunately, new tree planting will do little in the short-term to benefit saproxylic organisms. Such young trees will not provide those veteran features for many years and so there's urgent need to bridge the gap between decaying wood habitats of the present and those of the future. Above all though, we must value our current veteran trees and prevent their loss wherever possible.

Great spotted woodpecker

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Ringbarking a branch to encourage decaying wood and cavity formation

Vikki Bengtsson has had a long career in conservation, dealing with issues relating to wood pastures and ancient trees. She has been working with veteranisation for more than 20 years.

Veteranisation: using tools to speed up habitat production in trees

Vikki Bengtsson

Photography: Vikki Bengtsson

Not everyone subscribes to the idea of damaging young trees for nature conservation gain – a practice known as veteranisation. There are, however, many sites across Europe with few ancient trees and a large age gap between the existing old trees and their successors. Usually, we have to wait for trees to develop the dead and decaying wood habitat associated with ancient trees and the biodiversity they support. Veteranisation is worth considering to help speed up this process.

What is veteranisation?

Veteranisation is a term used to describe a technique whereby younger trees are intentionally 'damaged' in a way which may speed up the development of valuable habitats which otherwise would only be found on ancient and other veteran trees. This is nothing new. We have been veteranising trees for centuries by pollarding them, for example, which we know encourages the trees to hollow more quickly than unmanaged trees. The idea behind veteranisation is to try to mimic nature but using tools. The techniques used should not kill the trees, but instead encourage the decay process to develop at a younger age, thus potentially shortening the development time for habitats usually only found in old trees. These techniques should NEVER be carried out on ancient or other veteran trees as they already contain valuable habitat. Veteranisation should thus be a complementary nature-conservation tool, when time is not on our side. It will never replace veteran trees, but it may help bridge an age gap.

Where is veteranisation suitable?

Veteranisation is generally most suitable on sites where there are plenty of younger trees, which would otherwise be removed, and where there is a big age gap between the oldest trees and the next generation. Removal of the younger trees may be desirable to reduce competition and increase the level of light to favour other younger individuals or existing ancient trees. Veteranisation means that you make use of the existing tree resource instead of removing it. It is also suitable in plantations, where the trees are even-aged, to encourage variation in structure and habitat in the stand.

Veteranisation has been carried out (intentionally at least) for the last 20 years at places such as Hatfield Forest, Windsor and Burnham Beeches in the UK. The level of follow up has, however, been somewhat limited and there are difficulties in evaluating the techniques. At Hatfield Forest, some of the trees were damaged relatively mildly by tools such as climbing spikes or by boring small holes, and the 'damage' is almost impossible to spot today. Some of the trees were more severely damaged by methods such as hitting the base with a sledgehammer, or being topped (large branches cut leaving stubs), and these are now showing signs of decay and are developing hollows. This highlights the fact that young trees can cope with minor damage quite well.

How do you do it?

Most of the inspiration has come from observing natural processes. A broken top or branch is like storm damage, while artificial holes can be created to look very natural and damaging the base of a tree may impact on the roots and encourage basal decay. An international trial was set up in 2012 to try to evaluate the impact of veteranisation on a more scientific basis using almost 1,000 oak trees[1]. The techniques used in this larger scale trial (20 sites in Sweden, England and Norway) included creating woodpecker holes, breaking or ringbarking large lower branches, partially ringbarking the base and creating a nest box.

Oak burned in 2007.

The same oak tree in 2017, which has now been colonised by tree ants.

The idea with these techniques was to primarily create dysfunctional wood, which in turn will hopefully be decayed by fungi. The holes and nest boxes can potentially be used by birds and bats soon after they are created and by insects in the longer term once the decay processes have got going. Ted Green has long been renowned for his work re-erecting trees and filling them with leaves, sawdust, woodchips and dead animals! These kinds of 'wood-mould boxes' have been successful in Sweden and attract around 70% of the insect fauna normally associated with white decay.

Freshly created nest box in a young oak.

Inside the same nest box after two years, with nesting material.

Does veteranisation work?

Trees topped at Hatfield have now developed holes in the stubs that were left, and a hollow has developed in at least one of the trees hit with a sledgehammer. It is, however, difficult to evaluate fully the work done at Hatfield Forest in the late 1990s as it was done on an ad-hoc basis, like many other sites. Regarding the larger trial in Sweden, England and Norway, some groups of species responded very quickly. For example, over 60% of the nest boxes were used by birds in the first spring following their creation. Evidence of use by bats was also found in a small proportion of the boxes and 45% of the woodpecker holes have been used by birds for roosting or nesting. Hornets have been seen feeding from the sap runs in relation to climbing spikes, as well as making nests in the holes. Woodpeckers have taken advantage of areas of dead bark on ringbarked branches which have clearly attracted bark beetles.

Vane traps were set up in 2014 to investigate the insect fauna potentially attracted to the treatments. Whilst the data has not yet been fully analysed, the results look promising. At least 14 Red Data Book species were recorded from the traps associated with the woodpecker holes and nest boxes. Many species of flies, bees and wasps were also found, particularly species associated with sap runs, wet hollows and decaying wood, such as the yellow-ringed comb-horn cranefly.

But of course, it is the fungi – the true drivers of the decay processes – that we are really interested in. In 2018, sawdust samples were taken from the partially ringbarked trunk, the woodpecker hole, the nest box and some control trees. The results of this work are currently being analysed. However, a real surprise was the number of species that were recorded from the DNA analysis: in the region of 700 different species of which only 10% had been known of on the sites before. The oak trees are truly hiding a secret world of fungi with a huge diversity. What was clear from this work was that relatively little decay had taken place, despite it being six years since the work was done. Work elsewhere has been looking into inoculating the trees with fungi and this is likely to be a promising avenue, perhaps in combination with damaging the tree.

Even if all the analyses have not yet been completed, we do have strong indications that this work is on the right track, but it is likely to take many years before we fully understand what treatments benefit which species. So watch this space! In the meantime, what do we have to lose other than perhaps a small timber value, if the trees would have been removed anyway? Whilst veteranisation is a great complementary tool, it will never be a replacement for our ancient trees which have developed over hundreds of years through natural processes.

The lowest hole was created using a chainsaw 5 years ago. The two holes above were create by woodpeckers since.

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Further reading

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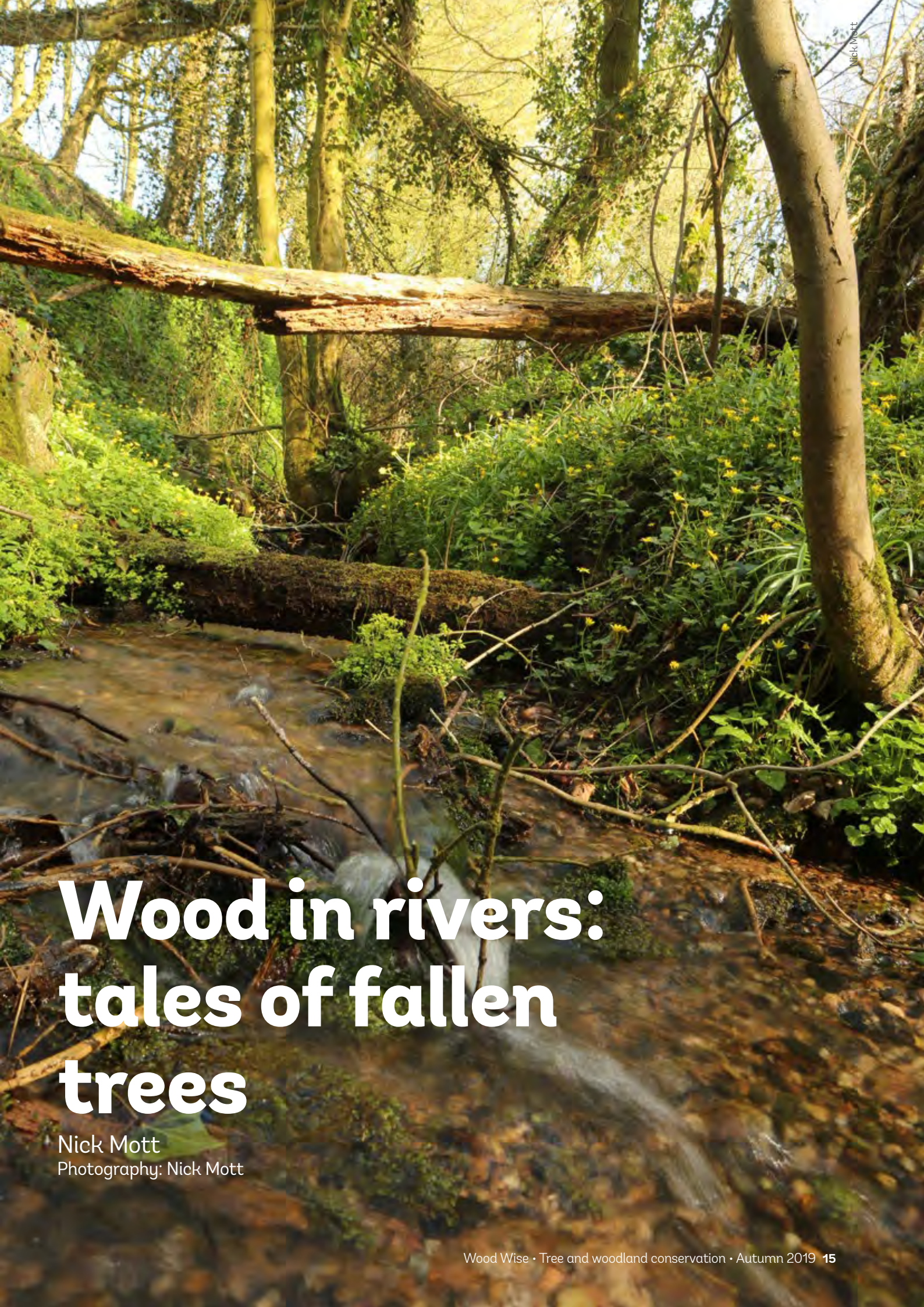


Wood in rivers: tales of fallen trees

Nick Mott
Photography: Nick Mott

Nick Mott is a freshwater ecologist and the river restoration manager at Staffordshire Wildlife Trust

Wood is a vital component of river health. Just as standing, dead and fallen trees in woodland and wood pastures are important for a range of species, the same is true for stream and river channels, their margins and their floodplains. For specially adapted wildlife, the collapse of a tree is not the end of the story – it is just the beginning.

Not long ago, woody debris in rivers was seen as a big problem. The language used to describe it – blockage, blocker, jam, snag – conjured up a situation that necessitated immediate human intervention with chainsaw and drag line. It was widely seen as a cause of channel instability, a barrier for fish movement, and a major cause of flooding.

Following decades of research, woody debris is now viewed in a completely new light, as a free and easy way to naturally restore our degraded river catchments. It is considered to be vital in supporting different life stages of fish and invertebrates, vital for slowing the flows to provide natural flood defence, and vital for improving water quality through filtering pollutants.

The input of downed trees, limbs and branches into our rivers is a natural process. There may, however, be some instances where woody debris requires ongoing management. For example, poorly designed culverts, bridges or screens that accumulate debris at their inlets which can indeed result in localised flooding.

Left to their own devices, most watercourses will naturally accumulate decent volumes of woody debris. The architecture of this material – with its splits, hollows and microtopography – is a fantastic habitat for wildlife! Tiny organisms, including algae, microbes and invertebrates, colonise these cavities to provide the base of the aquatic food chain. In turn, the complex of microhabitats that form around the log jams (including deadwood, leaf packs, silt benches, gravel deposits, sand bars and scour pools) provide a range of ecological niches for a wealth of wildlife. Invertebrates include white-clawed crayfish, shrimp, caddisflies, stoneflies, mayflies, craneflies, dragonflies and water beetles; fish include bullhead, brook lamprey, brown trout and salmon; birds include dippers and the kingfisher and grey wagtail; and mammals include water shrew and otter.

The influence that fallen trees and associated 'woody debris' have at key stages of a river is brought into focus by going on a journey from source to floodplain

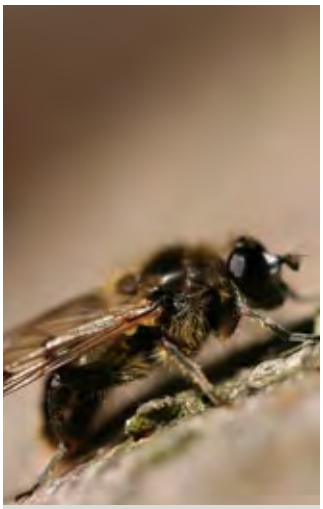
The headwaters

Compare a mighty oak to a river system. The trunk is a wide, meandering river; the larger branches and limbs are all the tributaries; while the rest – the myriad of smaller branches, twigs and leaves – are the headwaters, and their source wetlands.

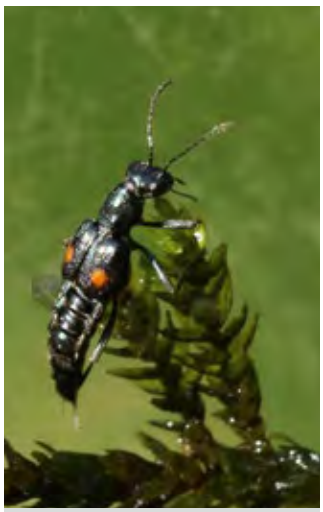
Headwater streams make up over 80% of the total channel length of river networks. They are the key to the overall health of our main rivers. Sadly, many have been lost or been heavily degraded by human activities. We can, however, draw inspiration from surviving examples. Typical settings are the heads of wooded valleys where springs, seeps and flushes gradually form into recognisable stream channels. Due to their geography and inaccessibility, many are left unmanaged. As a result it is often possible to get a 'mini-wilderness experience' when visiting these intoxicating places.

They are characterised by a tangle of fallen trees and woody debris at various stages of decomposition. There is a wealth of secretive wildlife associated with this heady mix of woodland seepages, deadwood, moss and channels, including giant lacewing, *Osmylus fulvicephalus*, giant cranefly, *Tipula maxima*, and the waterfall beetle, *Dianous coerulescens*.

White-clawed crayfish *Austropotamobius pallipes*

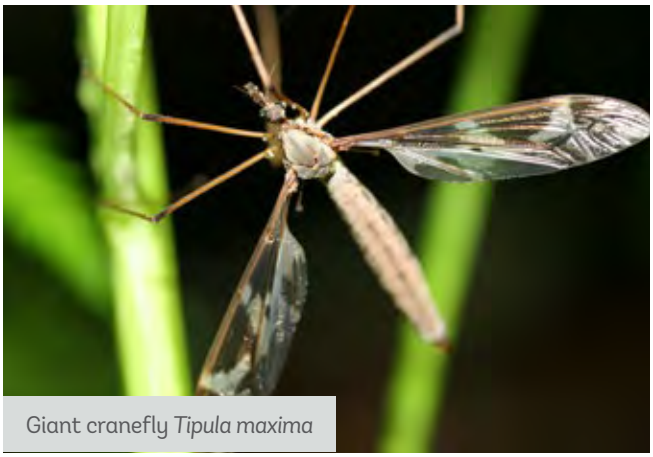


Logjammer hoverfly
Chalcosyrphus eunotus



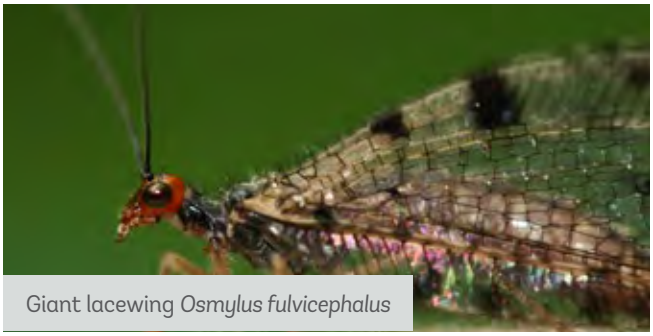
Rove beetle
Dianous Coeurelscens

Dipper *Cinclus cinclus*



Giant cranefly *Tipula maxima*

Yellow splinter cranefly *Lipsothrix remota*



Giant lacewing *Osmylus fulvicephalus*

Kingfisher *Alcedo atthis*

European beaver *Castor fiber*

Headwater stream. A 'biodiversity hotspot' in The Weaver Hills, Staffordshire..

A riot of wood and water! A vast log jam on the River Dane, Cheshire.

Tributary streams

As streams continue to join up within these steep-sided valleys, they increase in size and power. These watercourses are often encompassed by woodlands and are known by evocative names in different parts of Britain: dingles, drumbles, ghylls, sprinks, cloughs and combes. It is here that the influence of fallen trees is at its most pronounced.

The collapse of an average-sized mature tree often spans the width of a channel. Many continue to grow and re-sprout from their horizontal position. Others die, decay, fragment, drift and accumulate once again as log jams further downstream. They have a profound influence on the watercourse, effecting diversions, split channels, scour pools and fresh gravel deposits. These natural processes generate ecological niches for a wide range of wildlife. Research carried out in the UK identified 147 invertebrate species with strong associations with saturated woody debris[1]. 'Flagship species' include the logjammer hoverfly, *Chalcosyrphus eunotus*, and yellow splinter craneflies, *Lipsothrix* sp.

> The collapse of a mature tree has a profound influence on the watercourse, effecting diversions, split channels, scour pools and fresh gravel deposits. These natural processes generate ecological niches for a wide range of wildlife.

Willow acting as an 'ecosystem engineer'. River island development on the River Trent.

Floodplains

As rivers reach their floodplains, they increase in width and depth. Wood also has an important role to play in large rivers as it collects in backwaters and margins. The lowland riffle beetle, *Macronychus quadrituberculatus*, has a larval stage which develops in submerged woody debris in deep river pools. Sometimes, living willow branches, or whole trees, will wash up and settle in shallow riffles. Given enough time, they send down adventitious roots into the substrate of the river. This helps form mid-channel bars which can, in turn, fully evolve into wooded river islands. Thus, drifting trees and willow fragments act as 'ecosystem engineers'. Further complexity is provided by beavers, the ultimate landscape architect. These 'miracle' creatures are the missing catalyst for the restoration of the UK's rivers and floodplains. If we do nothing else, we should ensure the return of this native!

References

1. Godfrey, A. (2003). A review of the invertebrate interest of coarse woody debris in England. (English Nature Research Report Number 513). Natural England.

Further reading

Linstead, C. and Gurnell, A.M. (1999). Large woody debris in British Headwater Rivers. Environment Agency Research & Development Technical Report W 181.

Mott, N. (2006). Managing Woody Debris in Rivers, Streams & Floodplains. Staffordshire Wildlife Trust, George Street Press, Stafford, UK.

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Managing deadwood as a result of ash dieback

Mark Feather

Mark Feather is a UK estate manager at the Woodland Trust, focusing on tree-risk management in woodland

In many areas of the country, ash is one of the most common species of tree. The loss of ash from woods and hedgerows due to ash dieback disease, *Hymenocyphus fraxineus*, will have a devastating impact on the visual appearance of our countryside. While the biodiversity impacts are also overwhelmingly negative, the resulting increase in deadwood habitat and structural diversity in woodlands could actually benefit some species.

Woodland managers across the county will no doubt be rising to the challenge of responding to the impact of ash dieback. As well as concerns over reduced timber value, the increased risk that dead and dying trees pose to people and property will be a primary concern. In high risk areas, where dying trees are adjacent to roads and properties, the removal of trees will be the most appropriate action.

Footpaths within woods are generally considered to have a much lower safety risk and normally the occasional dead or dying tree would not be a major concern. Sadly, for woods heavily dominated by ash with ash dieback, the risk factor to users of footpaths is greatly elevated. Rather than a path having the occasional dead and dying tree, it may have hundreds. Many woodland owners may decide to fell all dead and dying ash as a precaution; in some circumstances that might be the only option. However, it is essential to recognise the ecological value of dead and dying ash trees, and for owners to consider management options for their retention.

Sustainable deadwood habitats

Given the high ecological value of deadwood, the UK Woodland Assurance Standard (UKWAS) makes recommendations for deadwood management as part of its certification standards for sustainable woodland, namely:-

- The owner/manager shall plan and take action to accumulate a diversity of both standing and fallen deadwood over time in all wooded parts of the woodland management unit, including felled areas.
- The owners/managers shall identify areas where deadwood is likely to be of the greatest nature-conservation benefit, and shall plan and take action to accumulate large dimension standing and fallen deadwood and deadwood in living trees in those areas.

Generally, the more deadwood within a woodland, the greater the biodiversity value. The Forestry Commission guidance suggests around 20 cubic metres per hectare, which would be similar to a lorry load, or five to 10 mature trees. The size and distribution of deadwood has to be considered also. Larger diameter timber (over 10cm) and an irregular distribution are considered to be of greater ecological value.

The continuity of deadwood is very important and sustaining deadwood habitats is often not easy to achieve. With ash dieback there will be a glut of dead and dying trees, although currently there appears to be some variation in the decline of ash trees. Even within small areas, healthy trees can stand alongside dead trees. This gives hope that the full impact of the disease will be spread over a long period of time, thereby contributing to continuity of deadwood.

Structural and age diversity

As well as an increase in deadwood as a direct result of ash dieback, there will be other benefits to woodland biodiversity. Open space created by the loss of trees could enable seedlings to establish (known as natural regeneration) or provide space for new planting. In even-aged woodland, this could improve the structural and age diversity. The opportunity for other tree species to develop or be planted might also improve tree-species diversity.

Managing deadwood and risk

The opportunity to increase deadwood habitat should be seen by landowners as positive, but may in some instances need to be measured or balanced alongside the safety concerns over the retention of dead and dying trees.

Careful individual assessment of trees adjacent to high risk areas will be required. In some instances, it might be possible to retain individual trees by pruning to create a weight bias away from paths and roads. Then, if the tree does subsequently suffer catastrophic failure from the base, it would fall back into the woodland.

In lower-risk situations, such as footpaths and tracks, other management options might be available. The temporary closure or diversion of permissive footpaths away from ash trees may be justified where significant tree removal is necessary to maintain safety. It could be a cost-effective solution to permanently divert a path rather than fell numerous mature ash trees. If such options are available, then the value of the deadwood habitat needs to be included in the decision process, rather than just the cost of the operation or value of the timber.

In some situations, dead and dying trees may be left with no action where they represent a relatively low risk to footpath users.

Planning management operations

It is important to consider management options at an early stage in respect of retaining or removing dead and dying trees. If felling is necessary, then a licence from the Forestry Commission may be required. A new guidance document[1] was issued this August which relates to trees outside woodland. The guidance also provides details of 'Dangerous Tree Exceptions' under the Forestry Act 1967, which covers the removal of trees where they represent a danger to the public. In such circumstances, the greater part of a tree's crown must be dead and the tree be within falling distance of highways and spaces with frequent public use. These trees may be exempt from requiring a felling licence, but you should contact the Forestry Commission in the first instance.

> It is essential to recognise the ecological value of dead and dying ash trees, and for owners to consider management options for their retention.

While selected individual trees as described above would be considered exempt, larger scale operations would require a licence. It takes time to prepare and submit a licence application and await the decision, so forward planning is necessary.

Forward planning is also required in respect of contractor safety. The felling of dead and dying trees has increased risks and is a major concern for contractor safety. Work must be undertaken at an early stage of decline in the health of the trees. Therefore, trees which require only pruning to enable long-term retention should have the work undertaken when the trees show the first signs of the disease. The options of whether to close or divert a path should also be considered at an early stage so that management is not delayed where work is required by contractors.

References

1. The management of individual ash trees affected by ash dieback (2019). Guidance note 46a. Forestry Commission

woodlandtrust.org.uk/publications

Key Points

- Woodland owners and managers should view ash dieback as an opportunity to increase deadwood habitat, as well as the structural, age and tree-species diversity of woodlands.
- Management options to retain dead and dying trees should be considered at an early stage of the disease. This is to ensure that where management works are required, they can be undertaken safely by contractors.
- Early planning and preparation of woodland-management operations is essential to allow time to prepare felling-licence applications and engage contractors.

Wood Wise update

Latest happenings in tree and woodland conservation

Thermal imagery aids wildlife management

Ben Harrower *– UK estate manager, wildlife management*

The Woodland Trust has recently acquired a pair of thermal imaging binoculars to aid our understanding of population dynamics and wildlife movements on our estate.

The technology can be used day or night, although night time typically provides better results as the woods come to life when humans retreat. Some of the Trust's recent survey work has included counting fallow deer in Wales and roe deer in Scotland; and soon, a survey of Chinese water deer in Bedfordshire. While our aim to understand the herbivores on our estate is important for woodland health, the camera also provides important records for the conservation of species, such as pine martens, owls and badgers.

The thermal imagery is capable of taking short video clips and low-resolution photographs clear enough for identification purposes or population data. This technology is already gathering a lot of data and there is plenty more survey work planned for this winter season. Watch this space for updates!

Red squirrels return to Scottish wood

Ross Watson *– site manager*

Red Squirrels are back at Ledmore and Migdale after an absence of 15 to 20 years.

Ledmore and Migdale is The Woodland Trust's most northerly site. It is a stunning mix of pine and oak woodland, and there are no grey squirrels, so it should be teeming with reds. So why isn't it?

Our native squirrels cannot move far across open ground. When the highlands were covered in woodland from coast to coast the animals could move around freely, and fill in any local population gaps as they arose. These days there are just fragments of woodland left. If there is a local extinction – from a disease outbreak, harsh weather, or just a particularly skilled bird of prey – there is no way for the species to come back without assistance.

The charity Trees for Life has been moving squirrels around to recolonize various highland sites, and we partnered with them to return reds to Ledmore and Migdale. By late November, 20 squirrels had been translocated into the wood.

These squirrels have been placed in four mini translocation zones, usually in groups of two males and two or three females. These are spread through the designated pinewood and planted ancient woodland areas of the woodland and is hoped this will increase the rate of spread through the suitable habitat. Beyond the pinewood is an extensive Site of Special Scientific Interest and Special Area of Conservation oakwood, as well as areas of hazel, making the site ideal for the year round needs of these new arrivals.

Photos: Ross Watson/WTML

Their arrival has been aided by our 'Squirrel Squad' of local volunteers who will be monitoring the animals over the coming years and feeding them for a few months while they settle in. With 19 volunteers that is nearly one per squirrel! These members of the local community have been absolutely vital to the success of this project, being part of the team carrying boxes, installing feeders, keeping feed topped up, speaking to members of the public, and being advocates for the translocation and the wood in the wider community.

Some brilliant new interpretation has gone in to reflect the work, plus some lovely squirrel artworks. It has created a real buzz of interest in the wood and we have had lots of families through for tours and education work. This includes a bench hand-carved from a single oak tree from the oakwood, felled for safety reasons, and three giant willow weaved squirrels that run, eat and climb their way to the translocation zones.

Oak processionary moth update

Spray control of a woodland boundary.

Dr Matt Elliot – *policy advocate, tree health and invasives*

Oak processionary moth (OPM) is a pest of oak trees which has been in London since it was first accidentally imported on oak trees in 2005. The caterpillars of this moth are covered in hairs which can cause allergic reactions in susceptible people and animals. For this reason, a management programme, run by the Forestry Commission, has been underway in Greater London since 2013 (see Wood Wise summer 2019 for more background).

This pest doesn't spread very far naturally because the egg-laying females don't tend to fly far, perhaps 500 metres from the tree where they spent their time as a caterpillar. Therefore, the objective of the management programme is to stop OPM spreading out of London and into the rest of England and Wales. This is achieved by spraying trees with an insecticide or removing nests by hand.

However, this programme will only be effective if no more OPM is imported into the country outside of the management area. Unfortunately, in July 2019, the UK Plant Health Service realised that a large number of infested oak trees had been imported from the Netherlands and Germany and planted out. Around 70 interceptions were made, mostly in England but also three in Wales and five in Scotland.

Action is being taken by the Forestry Commission, Animal and Plant Health Agency and the devolved administrations to eradicate these recent interceptions, including tracing recent imports of oak trees, on-the-ground surveillance, and the destruction of caterpillars and infested trees. It remains to be seen whether this action will be successful or whether OPM has now spread across Britain.

The expense of managing this pest now and into the future could have been avoided if they weren't imported in the first place. The Woodland Trust has developed a UK-Sourced and Grown Assurance Scheme which enables purchasers to source trees from within the UK, thereby avoiding importing such pests. All of the trees that the Woodland Trust plant and sell have been produced within the UK and are free from exotic pests and diseases.

The Government is asking that you check any large imported oak trees (girth >8cm at 1.2m above the root collar), and report any findings of OPM to the Forestry Commission. For more information on what to look for, Forest Research has developed the OPM manual which can be accessed at **forestresearch.gov.uk/tools-and-resources/pest-and-disease-resources/oak-processionary-moth-thaumetopoea-processionea/**


John Bridges/WTML

UK Squirrel Accord launches new website

Kay Haw – *UKSA director*

The UK Squirrel Accord (UKSA) is a UK-wide partnership of 37 leading conservation and forestry organisations, government agencies and companies with links to voluntary red-squirrel conservation groups. UKSA has just launched its new and refreshed website: **squirrelaccord.uk**.

The site aims to communicate knowledge on red squirrel conservation, tree health and grey-squirrel management. It will act as a hub for sharing information and expertise from across different sectors, organisations and individuals involved in delivering the aims of the UKSA, so as to:

- secure and expand UK red squirrel, *Sciurus vulgaris*, populations beyond current thresholds
- ensure UK woodlands flourish and deliver multiple benefits for future generations of wildlife and people.

Woodland Trust research update

Research update

Dr Christine Tansey – *conservation research co-ordinator*

This autumn, several new PhD students supported by the Woodland Trust will be starting work on some exciting new research.

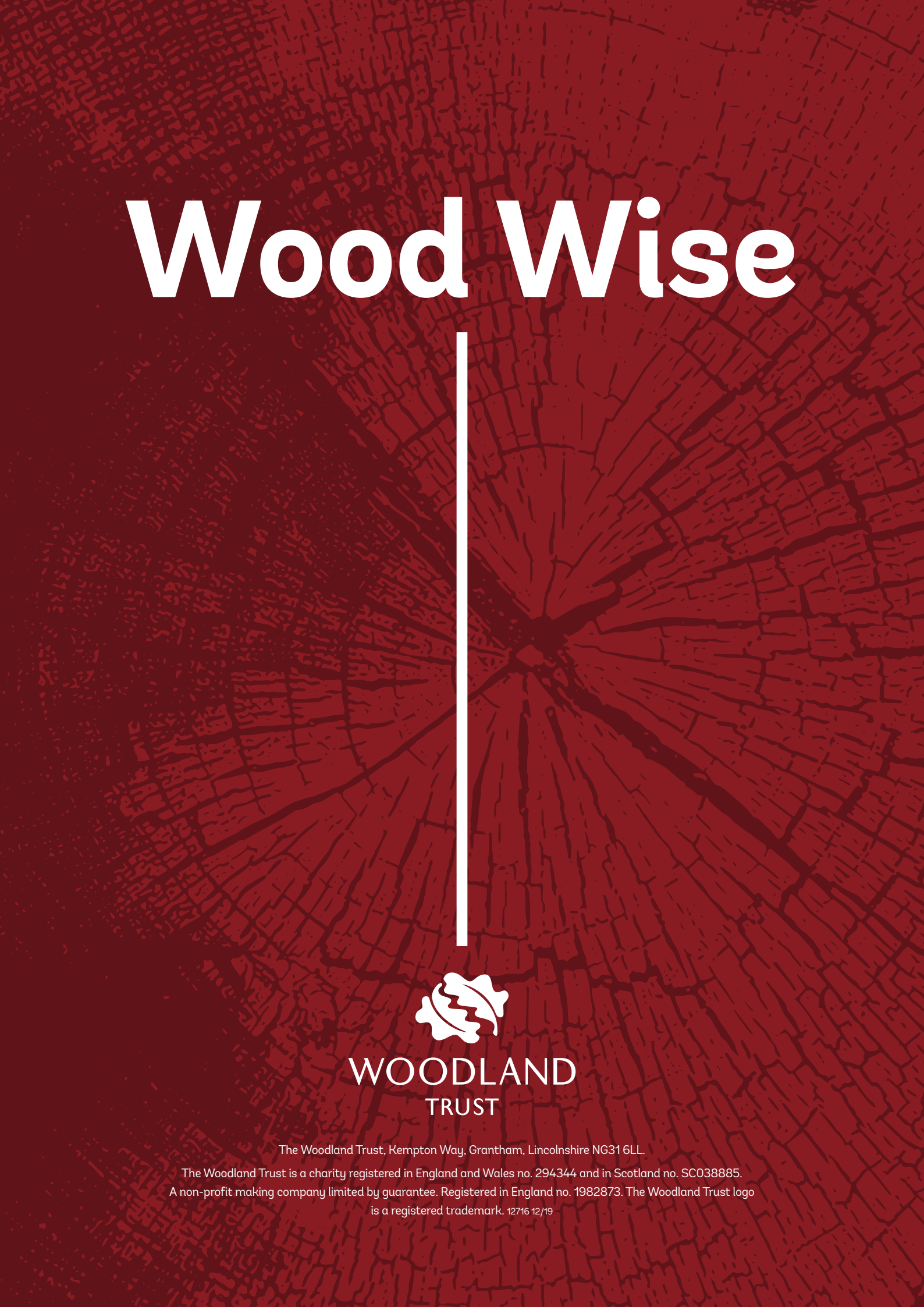
At the University of Stirling, Sarah Watts will be working with the Woodland Trust and National Trust for Scotland to look at different methods of restoring montane scrub woodland. The Woodland Trust Scotland's Glen Finglas, part of the Great Trossachs Forest, will be one of her key field sites.

At the University of Leeds, Jack Houston will be working at a number of sites within the Northern Forest area to look at how trees on farms can impact on soils. He will be working with farmers who the Woodland Trust has supported to increase tree cover on their farms.

At the James Hutton Institute, and with the University of Aberdeen, Fiona Plenderleith will be examining the impacts of ash dieback on landscape connectivity for wildlife. She will be radio-tracking several insect species to investigate how the loss of ash may impact on those invertebrate populations.

Back issues of Wood Wise are available online. woodlandtrust.org.uk/woodwise

Wood Wise



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