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Arboricultural ASSOCIATION
trees.org.uk

ASSOCIATION STAFF

JOHN PARKER
Chief Executive
E: **john@trees.org.uk**

HANIF BHULA
Financial Controller
E: **hanif@trees.org.uk**

KATE BEAMISH
Financial and Publications Administrator
E: **hanif@trees.org.uk**

LARA WEPENER
Business Administrator
E: **lara@trees.org.uk**

SIMON RICHMOND
Senior Technical Officer
Editor of The ARB Magazine
E: **simon@trees.org.uk**

FRANÇOISE HENRION-BROWN
Business Development Manager
E: **fran@trees.org.uk**

PAUL SMITH
Technical Officer
E: **paul@trees.org.uk**

POLLY STONE
Business Administrator, Contractor Accreditation Schemes
E: **polly@trees.org.uk**

SARAH BRYCE
Business Administrator, Registered Consultant Scheme
Production Editor of The ARB Magazine
E: **sarah@trees.org.uk**

SARAH JACKSON
Training, Events and Fundraising Manager
E: **sarah.jackson@trees.org.uk**

RACHEL BECKETT
Business Administrator, Training
E: **rachel@trees.org.uk**

ANDREW STEWART
Business Administrator, Events
E: **andrew@trees.org.uk**

STEVE HODSMAN
Marketing and Communications Manager
E: **steve@trees.org.uk**

JANE STUART
Business Administrator
E: **jane@trees.org.uk**

JASON WARD
Designer and webmaster
E:webmaster**@trees.org.uk**

JESSICA PALFREYMAN
Membership and Systems Controller
E: **jess@trees.org.uk**

RICHARD THOMPSON
Business Administrator, Membership
E: **richard@trees.org.uk**

ARBORICULTURAL ASSOCIATION
The home of tree care
The Arboricultural Association is a registered charity no. 1083845.

The Malthouse, Stroud Green, Standish, Gloucestershire, GL10 3DL
+44 (0) 1242 522152 admin@trees.org.uk
www.trees.org.uk

Arboricultural ASSOCIATION

trees.org.uk

ABOUT THE HOME OF TREE CARE

Arboriculture can be described as the science and practice of the cultivation, establishment and management of amenity trees for the benefit of society. In other words, arboriculture is tree care.

The Arboricultural Association is the leading organisation in the UK for tree care professionals working in all areas of arboriculture, including central and local government, consultancy, contracting, management, production, policymaking, research and education. It has more than 3000 members in the UK and around the world, and is increasingly recognised as an international, as well as a national, leader in arboriculture. The Association is dependent on its members, its volunteers – including Trustees, Committee members and Branch officials – and a dedicated staff team operating out of the Malthouse in Stonehouse, Gloucestershire.

Regarded by UK central government departments, local government and sector partners such as the Royal Horticultural Society as the focal point for best practice in tree care, the Association is unique in that its membership operates across the entire spectrum of the profession. It represents its members on numerous projects, working parties and groups, and collaborates closely with international partners such as the European Arboricultural Council, the European Forum on Urban Forestry and the International Society of Arboriculture.

The Association is a charity as well as a membership organisation, working to advance the science of arboriculture and raise awareness and knowledge of tree care globally, inspiring the general public about the importance of amenity trees and the arboricultural professionals who care for them. Much of this work is done through participation at community and public events, school membership, political engagement and, most recently, via the Tree Care Supporter initiative and public-facing content.

Membership grades are available to suit all arboricultural professionals, to whom the Association offers a wide range of services and benefits. Training courses for members at all stages of their professional career are held in a range of topics, in-person around the country and also, in many cases, online. A busy calendar of events includes the ARB Show, the Annual Amenity Conference – the main UK arboricultural conference of the year – and a packed online programme including an acclaimed webinar series enjoyed by viewers worldwide in more than 140 countries.

The Approved Contractor, Utility Approved Contractor and Registered Consultant Accreditation Schemes help raise professional standards and increase awareness of arboriculture, and the Association publishes best practice guidance documents and two quarterly publications – the *ARB Magazine* and *Arboricultural Journal*. The Association has worked for the good of our members, for the profession and for wider society for more than 50 years, and will continue to do so into the future.

OUR VISION

Inspiring, supporting and promoting the tree care community for a society that better appreciates and cares for trees.

THE ASSOCIATION WILL:

INSPIRE

INCLUSIVITY AND DIVERSITY
Creating a culture in our organisation and the wider profession in which everyone feels welcome and accepted into the tree care community, and in which our profession better reflects the society within which we live, work and play.

TREE CHAMPIONS
Empowering and supporting our members, Tree Care Supporters and the wider profession to become champions of tree care excellence, inspiring their communities to appreciate and value their trees and the arboricultural profession.

SUCCESSION
Encouraging the next generation of arboriculturists by showing that arboriculture is a fantastic career. Working in partnership with schools and colleges to inspire young people searching for a vocation, students and those considering a career change.

VOLUNTEERS AND STAFF
Ensuring that our volunteers – including Trustees, Committee members and Branches – and Association staff team are respected, valued and given the opportunities for develop-ment that they need, inspiring them so that they are able to inspire others.

SUPPORT

MEMBERSHIP
Working with our members across all grades, in the UK and internationally, to support them in their professional development and to offer them a professional home in the tree care community which delivers their needs and represents their interests.

ACCREDITATIONS
Continuing to grow and develop the Approved Contractor, Approved Utility Contractor and Registered Consultant Schemes in order to raise standards across the profession and give assurance to the public and other tree owners when they are engaging an arboricultural professional.

RESOURCES
Producing high-quality technical resources including technical guides, publications, arboricultural materials, the *ARB Magazine* and the *Arboricultural Journal*, available as hard copies and/or digital versions.

TRAINING
Delivering high-quality, affordable and relevant continuous professional development across a wide range of subjects in accessible formats, whether in-person, online, live or pre-recorded content, for all levels of knowledge and experience.

PROMOTE

EVENTS
Holding a range of events to promote arboriculture, building and fostering a vibrant tree care community and providing the opportunity to share ideas and experiences, through in-person gatherings such as the ARB Show and Amenity Conference, and online content such as the Wednesday Webinar series.

ENGAGEMENT
Promoting the work of our members and the arboricultural profession to the general public, our communities, politicians, policymakers and allied industries, ensuring arboriculture is represented as a key profession in its own right and collaborating with other professional organisations.

TREE CARE SUPPORTERS
Offering the general public the opportunity to become involved in, and support, the Association's charitable objectives, promoting tree care and tree care professionals and furthering the understanding of the science and practice of arboriculture.

WEBSITE & COMMUNICATION CHANNELS
Continuing to grow, strengthen and fully utilise our social media following, and engaging an ever-wider audience through redesigned websites, with **trees.org.uk** supporting the membership and **treecare.org.uk** acting as the public face of the Association.

AN INTRODUCTORY GUIDE TO YOUNG TREE ESTABLISHMENT

LANDMARK NEW PUBLIC-FACING GUIDANCE DOCUMENT LAUNCHED

In the spring 2022 issue we announced the expansion of the Association's new young tree establishment series. At the time of writing, we're pleased to tell you that the next step of this process is now in its final stages. **An Introductory Guide to Young Tree Establishment** will provide advice and ideas for a non-professional audience, as well as signposting readers towards other useful resources. It is not intended as a comprehensive guide, nor a replacement for specialist advice, but it will be an important tool in our efforts to tell the general public about arboriculture and tree care: communicating some of the key messages of the Association and hopefully helping people learn more about tree planting and aftercare.

The key areas covered include **Where to plant a tree?**, **What tree to plant?**, **How to plant a tree**, **Young tree aftercare** and **Tree watering**, with free downloadable posters available for each theme. As the introduction to the new document says:

> ***"Unsurprisingly, the Arboricultural Association believes that trees are good and that we need more of them. However, planting a tree is just one small part of the story. Arboriculturists work in tree time, not human lifespans or political cycles. If you consider the first 100 years of a tree's life, then the act of planting might make up half an hour or so, or 0.000058%. It is undoubtedly a very important part of the process – a critical one – but there is so much more to the story…"***

You can download and view all young tree establishment posters by visiting **www.trees.org.uk/YoungTrees**

Issue 191: Winter 2020

MORE THAN 300 CONTRACTORS NOW ARB APPROVED

The ARB Approved Contractor scheme has surpassed 300 accredited businesses for the first time in its history. Congratulations to Northamptonshire-based Vegetation Management Services, which became number 300 following a successful assessment in September.

This is an important milestone for the scheme, which welcomed its first contractor over 40 years ago and has become the national standard for arboricultural contracting businesses. It remains the only accreditation of its kind for tree work contractors in the United Kingdom and is supported by a dedicated group of assessors and independent auditors who help to improve and refine its standards.

Growing interest in the scheme is testament to the work of the accreditation team and of our ARB Approved Contractors who strive to raise the standard in their local areas. Both the Amenity and the Utility accreditation, which was launched in 2018, have been awarded to a healthy spread of businesses across the UK, with small businesses employing between one and five staff making up over 60 per cent of the total. Work by the accreditations team over the past few years eans that the ArbAC standard is increasingly recognised and required by local authorities and other large commercial organisations.

Commenting on the milestone, Accreditation Schemes Manager Paul Smith said, 'Whilst reaching 300 ACs is a great achievement, there is still much work to be done to attract other good arb contractors to the scheme, to help raise the profile and awareness further and to give them the professional recognition they deserve.'

Coronavirus has seen the support team quickly adapt procedures to allow more desktop and socially distanced assessments. Unfortunately, ARB Approved Contractor workshops, which are usually held monthly, have been a casualty of the lockdowns, but we are taking steps to move these online, with interest in the scheme now beginning to rise rapidly.

With no government regulation, and the evergrowing range of 'find-a-tradesman'-style online directories, promotion outside of the sector is critical. The Association continues to raise public awareness of the accreditation, with the online Approved Contractor directory now attracting over 10,000 visits per month. These figures have grown markedly over the last two years, thanks to a combination of multi-channel online advertising campaigns and the AA's own social media channels, which now reach over 50,000.

With interest in trees greater than ever and an industry often renowned for its share of unscrupulous contractors, it is important that the public can rely on sound advice in relation to trees given by reliable professionals. You can find out more about what it takes to become approved at **trees.org.uk/accreditation**.

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HENRY GIRLING 1936–2021

It is with great sadness that we announce the death of Henry Girling, on 29 March, one of the longest-standing members and a Vice President of the Association, a renowned plantsman, arboriculturist, consultant and raconteur extraordinaire.

We will publish a full obituary for Henry in the autumn issue of the ARB Magazine, but here we briefly pay tribute to this kind, intelligent and devoted friend of the Association and of very many individuals in our industry. Not long before he died, he sent us the piece below and his article on sycamore, which appears on pages 36–37.

Our thoughts are with Janet, his wife of 49 years, and his family. He will truly be deeply missed, not least at our annual Conference, where, for at least the last 20 years, he has donated a tree, in most cases grown by him from seed, to be planted to commemorate the event.

Henry joined the Association in 1967. He worked as a tree surgeon and tree officer and became an AA Registered Consultant and Fellow member. He will be remembered for his robust stance in representing the Association and the whole industry but, above all, for his encyclopaedic knowledge and love of trees – a plantsman at heart. **May you rest in peace, Henry.**

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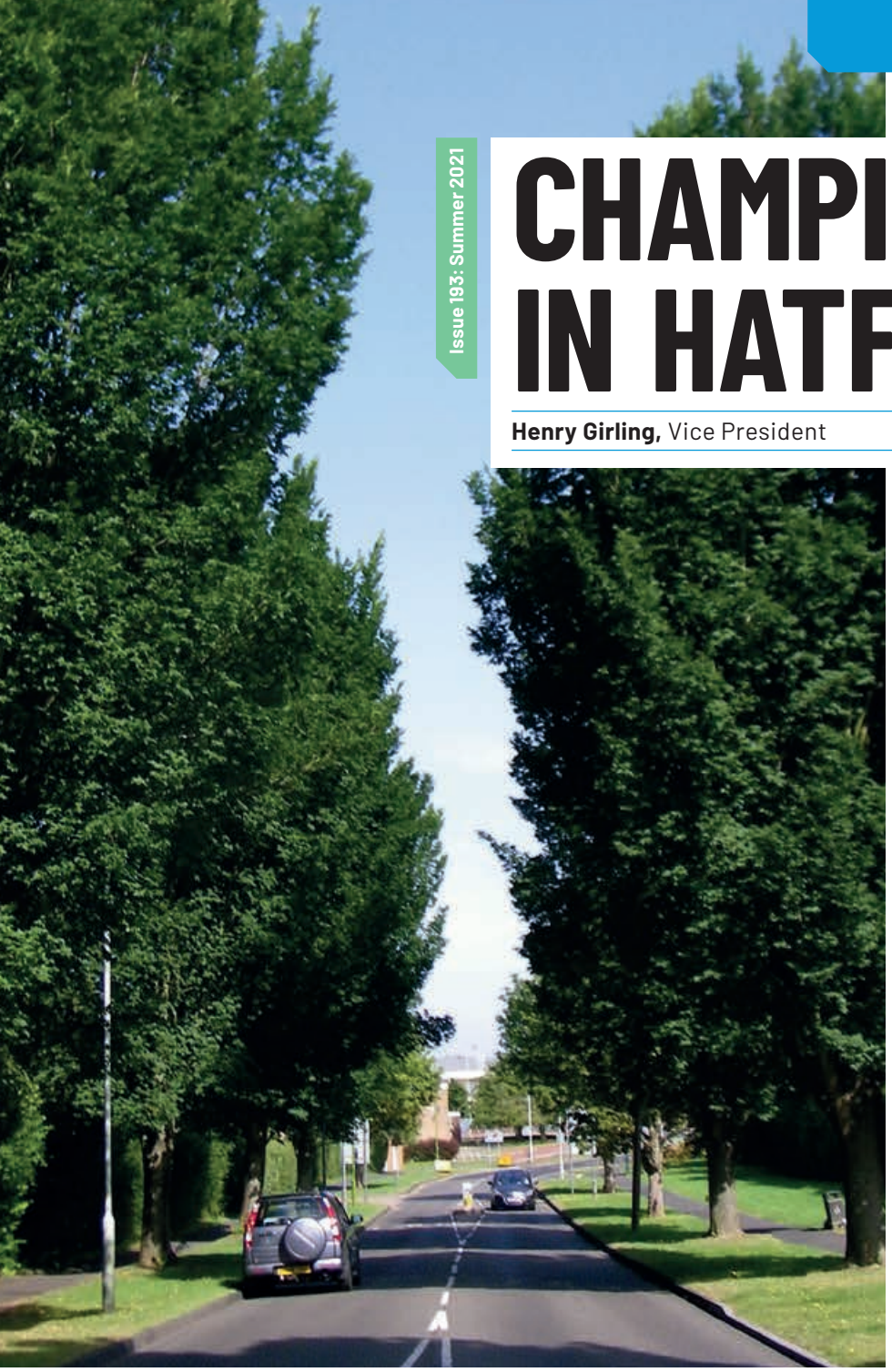
CHAMPION ELMS IN HATFIELD

Henry Girling, Vice President



The elms planted by Henry Girling in Woods Avenue, Hatfield, in the 1980s and photographed by him in 2012.

In the summer 2013 edition of the ARB Magazine appeared an article entitled 'Trust not in experts', and it was largely concerned with the planting of three clones of disease-resistant elms.

These trees were raised at the Willie Commelin Research Laboratories in Holland between the World Wars as part of a breeding programme. A small number were introduced in the 1970s, and the author planted a number in the Ealing area before he took a post at what was then Welwyn Hatfield District Council. In the early 1980s, an opportunity arose to obtain another parcel of disease-resistant elms, and these were planted in Woods Avenue, Hatfield, where, despite being vandalised, they grew away strongly.

Following a recent visit by David Alderman, Director of TROBI (Tree Register of the British Isles), the trees were found to be of champion and potential champion status. A 'Dodoens', at 22m height × 258cm circumference, is the largest and tallest in Britain, and a 'Lobel', at 21m height × 225cm circumference, is the second tallest, behind a tree at Westonbirt which is 23.5m high.

Interestingly, the genetic mix of the Hatfield trees is similar to the two clones currently on offer, 'Vada' and 'Lutèce', being based on the Exeter elm crossed with Himalayan wych elm and this was crossed with selected European elms.

Dear Henry

Champion Elms in Woods Avenue, Hatfield

Following your message about the elm you planted in Woods Avenue we agree they must certainly have been one of the very first street plantings of modern disease-resistant elm clones, if not the first. 'Lobel' and 'Dodoens' are seen in the greatest numbers around Brighton of course, but here they tend to be on the grass around the council estates and in the public parks.

As you know, Ealing has good numbers in various streets and the same clones occur around Rye Avenue in Norwich, which may have more trees but these are mostly younger plantings...

Last week I managed to visit Woods Avenue and to re-measure the trees you measured in 2012. The good news is that the 'Dodoens' on either side of the pedestrian crossing by St Philip Howard Catholic Primary School (20.5m × 272cm & 22m × 258cm) are now the largest and tallest in Britain.

Out of the *Ulmus* 'Lobel' the first tree on the left (east) as you travel along Woods Avenue is the 2nd largest and tallest in Britain (21m × 225cm). Measuring by laser I couldn't find any of these that have reached 22m although 21m is rounded down and several trees have individual branches that are closer to 21.5m. The tallest tree in Britain is currently 23.5m (2014) in Westonbirt Arboretum.

It is not everyone who can say they have planted trees, particularly street trees, that have grown to become British champions! They certainly look impressive and worthy of that accolade! We will highlight these in our next newsletter.

Kind regards

David Alderman
(Hon.) Director
The Tree Register
www.treeregister.org

Issue 193: Summer 2021

NEW REGISTERED CONSULTANTS

We are delighted to welcome two new Registered Consultants who have recently successfully completed their application assessment and interview. Congratulations to Simon Cox from Gloucestershire and Trevor Heaps from Hampshire! Here Simon and Trevor share their thoughts on the journey to AARC.

SIMON COX

Over a decade ago, I came up with a plan to become an arboricultural consultant. After a few fits and starts, I have now achieved another of the credentials I set out to earn. Some might call it the 'pinnacle', others the 'platinum' or 'gold' standard; for me, I'm just happy to say I meet at least the minimum standards expected of the scheme – a scheme which I hold in high regard.

I enjoyed the scrutiny of the assessors throughout the process, particularly the interview. If you are open minded enough to acknowledge your practice could be improved, then go for it. Those involved with the scheme helped by steering me in the right direction, which is of great credit to them. Quite a few people have helped me over the years: an encouraging word here, a kick up the backside there. Thank you to all of them; hopefully you know who you are.

So, I cannot encourage enough anyone who calls themselves a 'consultant' to go through this process, which starts by meeting the eligibility criteria. All that time ago, those are the eligibility criteria I researched and started working towards.

TREVOR HEAPS

My journey to AARC started in 1995 after I spotted an advert in the local paper for a 'trainee tree climber'. I applied, got the job and loved it from the start.

Part of the job involved attending college (first in 1997) to study for a City and Guilds Phase 2 Qualification. I enjoyed it, so went back for another year (in 2000) to study for Phase 3. I was then offered a job at Hillingdon Council as a tree officer (managing council-owned trees). I worked at Hillingdon for two years before heading off to Australia for a year in 2002. The Aussies thought it very funny that I wore my full protective clothing in 40-degree heat! I reluctantly left Australia in 2003 and managed to get my job back at Hillingdon, where I settled down again as a tree officer.

In 2008, I started a three-year online course studying for my Foundation degree. Afterwards, I spent a further two years topping this up to a Bachelor's degree, completing it in 2010, about the same time I was offered a different job at Hillingdon – as a trees and landscape officer (dealing with private trees). It was only at this point (quite late on in my career) that I realised arboricultural consultants even existed! I began looking at how to become one myself, and signed up for the AA Consultancy Course. It was about this time I also signed up to become Chartered with the ICF.

It was at the AA course that Jim Quaife offered to mentor me through the AARC Scheme. Who better, as Jim had been a Lead Assessor for the scheme. I remember sending off my first report to him: there were lots of issues that meant it wouldn't have even got through the first stage of the process – it didn't even have a contents page! But, after several long discussions with Jim, I managed to get my first report up to standard.

I left Jim in peace at this point, and gradually spent the next few years putting my portfolio together. It took a while because I was also building up my own consultancy practice (I left Hillingdon in 2015). I finally submitted the portfolio in November 2020 and was delighted to find out it had been accepted.

One last hurdle: the interview ... I had two weeks to prepare, so I started swotting up. It wasn't until the day before that I noticed that the AARC application guide provided advice on what to expect. So, better late than never, I downloaded the various documents and an app that turned text into speech and spent the next day driving between sites listening to a loop of the recordings.

I was very nervous about the interview, but the team put me at ease from the outset. I thought it went well, and I was very relieved to receive the call to say that I am finally a Registered Consultant.

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A PLANT HEALTH OPPORTUNITY

Keith Sacre

Over recent years, the issue of biosecurity and plant health has become increasingly important. There is a general acceptance that improved biosecurity measures are critical and necessary. Specifiers now have a reference point which they can use to ensure that the trees and plants they use are healthy and free from invasive/imported pests and diseases: the Plant Healthy certification scheme.

The scheme, run by the Plant Health Alliance and supported by Defra, is now available for specifiers to reference. Certification is awarded to nurseries and others who have subjected their biosecurity procedures and practices to rigorous external audit. This audit is repeated annually.

Plant Healthy

PHCS – 0003 - UK

Barcham's Plant Healthy certification.

Barcham Trees has just been awarded Plant Healthy status and hopes that many other UK nurseries and businesses involved in the tree and plant procurement and supply chain will join the scheme. Details of the scheme and the work of the Plant Healthy Alliance can be found at **www.planthealthy.org.uk**.

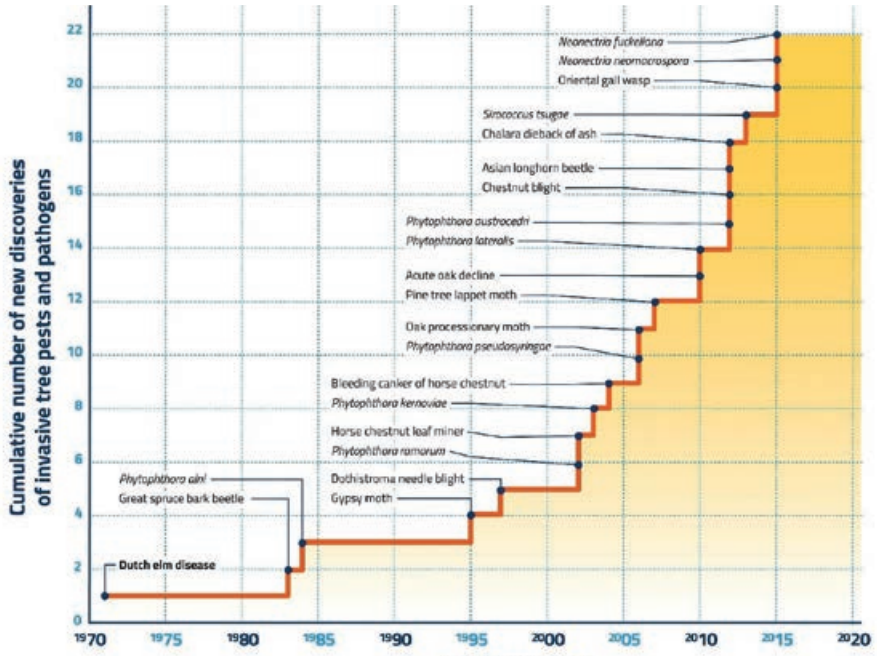
The threat to our tree populations posed by imported pests and diseases has been a constant topic of discussion and concern within the industry for the past 10 years or more. The need for biosecurity has never been greater, a fact recognised across all disciplines and supported by the work of Defra and the admirable Chief Plant Health Officer, Nicola Spence. Many organisations have contributed to the discussion and to raising awareness around the whole issue. The Arboricultural Association has produced comprehensive guidance for its members and devoted its 2017 conference to biosecurity. The Landscape Institute, in 2019, produced and launched a Biosecurity Toolkit for landscape consultants.

The Plant Health Alliance was proposed at a plant health conference at Highgrove in February 2018. Since its formation, the Alliance, under the chairmanship of Sir Nicholas Bacon, has grown in strength. It is a crosssectoral group with membership organisations spanning ornamental horticulture, forestry and general land management, as well as trade associations, environmental NGOs and government. Its purpose is to promote and enhance plant health and biosecurity measures to protect plant species and associated ecosystems (natural capital) in the United Kingdom and beyond. The need for such an Alliance is reflected in the chart below which outlines the increased threats to our plants and trees from imported pests and diseases.

Barcham Trees has been part of the Alliance since its formation. The company, along with many others, has constantly reviewed its biosecurity procedures in line with developing research and information. It was the first company to publish and promote a specific biosecurity policy back in 2014, a policy which was referred to by Lord Framlingham in a House of Lords debate in January 2015.

Independent accreditation

One of the missing links in the biosecurity debate has always been a lack of independent accreditation. How can the judicious purchaser of plant material be assured that the supply chain they are involved in is biosecure?



(Source: Arboricultural Association Guidance Note 2: Application of Biosecurity in Arboriculture)

Up until now assurance has been primarily *self*-assurance. The Plant Healthy Certification Scheme moves beyond this, with companies involved in the plant supply chain voluntarily subjecting themselves and their biosecurity policies to independent and annual audit.

Managing Director Mike Glover in a recent blog commented, 'At Barcham we do not trade any plants for immediate resale. All of our saleable stock is vitality checked and passed as healthy by Defra before they are released onto the market each September, having been grown here at Barcham.'

He continued, 'Ironically the need for greater genus diversity puts pressure on demand and triggers more imports but it you go with a nursery with accredited Plant Healthy status you will be on the right side of things.'

For Barcham Trees, accreditation is in many ways the culmination of work on biosecurity which began in 2014 and the launching pad for continuous improvement but the commercial advantage is obvious and here lies the dilemma referred to in the opening paragraph. If biosecurity is to be achieved, the need for an accreditation scheme such as the Plant Healthy Certification is obvious and, in many ways, critical to success. Short-term commercial gain may be inevitable but in the long term has no merit if plant health and biosecurity are the true objectives.

What is needed is wholesale acceptance of the certification scheme and for all UK companies involved in plant and tree movement to subject themselves to external audit with certification becoming the new norm. Let us hope that many more UK nurseries and other businesses get involved with and use the Plant Healthy Certification Scheme and give the UK a more biosecure future.

For more information and the Plant Healthy Alliance's directory of Plant Healthy Certified businesses, visit **www.planthealthy.org.uk**.

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ASH DIEBACK RISK GROUP SCOTLAND

Paul Hanson

The recognition of ash dieback (AD) in 2012 as a new, aggressive, tree-killing disease on our shores and its appearance in the national headlines seems a long time ago. Since then AD has marched through the UK and now affects trees countrywide. The signs and symptoms have been dramatic in England, especially in southern counties; the early symptoms of the disease are now being experienced throughout Scotland.

BTo assess AD in both individual trees and broader ash tree populations, a common approach has been reached to categorise the progression of the disease, based on a broad estimate of the foliage remaining (see below). Trees in Class 2 were noted widely in Scotland in 2019; this year has seen a marked increase in trees at Class 3 and Class 4 in parts of Scotland, particularly in the Central belt, Tayside and Aberdeenshire.

Following the preparation of the GB Chalara control plan in 2012, the Scottish government established the Scottish Tree Health Advisory Group (one of the few good things to come from AD) to advise on diseases with the potential to affect Scottish trees, including AD. The seemingly slow progress of the disease, coupled with some scepticism that it would be as bad as experts had suggested, dampened the initial sense of urgency, at least in some areas of GB, to be proactive in managing ash trees ahead of significant symptoms emerging, particularly as there was a need to identify any trees that appeared to have natural resistance to the disease.

In 2014 an assessment of Chalara's potential impact in Scotland was commissioned.[1] Initially, it was hoped that, by taking statutory control action to remove infected, newly planted trees, the disease could be kept out of a 'Sheltered' area in the north-west of Scotland. However, it soon became apparent that the disease was more widespread in older trees and statutory action was no longer appropriate. In 2020 every county in Scotland has a significant number of infected ash trees across all age ranges.

Impact of AD in Scotland

The likely impact of Chalara includes the loss of urban ash trees, those in the wider landscape, and the ash components of Scotland's woodlands. A corresponding reduction in Scotland's current biodiversity should be expected, along with dramatic financial costs to tree owners, infrastructure operators and

1. 'An Assessment of the Potential Impacts of Ash Dieback in Scotland', Rick Worrell, January 2013, **www.forestry.gov.scot/images/corporate/pdf/chalara-impact-report-scotland.pdf**.

Class 1 (100%–76%)

Class 2 (75%–51%)

Class 3 (50%–26%)

Class 4 (25%–0%)

Images: Gary Battell/Suffolk Canopy Description

local authorities, and with landscape and societal costs in rural and urban environments to follow. To date local authorities in England have incurred AD-related costs in the order of £100,000s with a projected UK spend running to millions before it is all over.

Some of the original aspirations of the Chalara management plan have lost relevance in the current AD situation. It is right that Scotland now continues towards identifying natural resistance to the disease within the native ash population; continues to encourage landowners, citizens and industry to take proportionate actions in tackling the disease and to avoid the negative consequences from inappropriate actions; and works to build economic and environmental resilience in woodlands and associated sectors.

Research to develop understanding of the etiology, pathology, and epidemiology of Chalara in Scottish conditions may be useful in the development of a protocol to identify resistant ash trees, hopefully providing future breeding material. It could then be feasible to form a seed-bank for key Scottish ash populations.

Managing infected trees

The issue of how to address AD-infected trees is now a real issue in Scotland. Roadside ash trees, those close to essential infrastructure (e.g. powerlines and rail track) and trees overhanging or within falling distance of inhabited or otherwise occupied structures are suffering from AD and in some cases becoming hazardous, a condition that becomes worse with repeated infections.

Our industry is familiar with tree hazards presenting risks to property and the general public, and arborists have been dealing with Dutch elm disease (DED) for decades. The scale of AD is so significant it far outweighs even the most severe outbreaks of DED,

and the loss of ash trees in the next 5–10 years across Scotland could match that seen in DED control in the last 3 decades. Our industry is not prepared for the potential workload required to deal with essential hazard tree management in the infected ash population: commercial tree work operators do not currently have the capacity to embark on the scale of action required nationally. The Ash Dieback Risk Group (ADRG) has identified a labour and skills shortage in the tree work industry in relation to undertaking AD-infected ash tree management.

FISA[2] has produced useful guidance on practical aspects of commercial tree felling works in relation to AD-infected trees and our own AA has guidance[3] specifically addresses arboricultural operations. Anecdotal evidence suggests that ash trees, already known to be challenging to work on, are increasingly hazardous to work with as AD progresses and secondary pathogens (honey fungus in particular) begin to take advantage of the stressed trees and promote further and speedy decay.

Utility arboriculture has an additional challenge in that the majority of large AD-infected trees within falling distance of overhead electricity networks and rail track are owned by third parties who may not wish to have them pruned or felled.

The extra financial burden in managing AD would never be welcome but is even less so in the current human health pandemic. There is a major challenge for tree owners and managers faced with funding operations to make safe or remove Scotland's dying ash population.

I hope control of the movement of AD has been recognised as a lost cause. The best we can hope for is to save trees where it is safe to do so in the hope that a few will demonstrate some resistance. Scotland's publicly funded tree managers will need to find creative ways to access money for the management of AD as they compete with the pressures on funding exercised in the response to Covid-19.

Get in touch with the ADRG

Scotland's ADRG is looking to provide a central point of contact for information on managing AD. Please contact the ADRG through Clarinda.Burrell@forestry.gov.scot in the first instance to update the group on the spread of AD and to share any innovations in practical approaches in addressing risks presented by ash trees affected by the disease.

2. Essential information on the felling of diseased ash: **www.ukfisa.com/Safety/Safety-Alerts/essential-information-on-the-felling-of-diseased-ash**.
3. Ash Dieback Guidance for Tree Owners, Managers, Contractors and Consultants, **www.trees.org.uk/Help-Advice/Public/Ash-Dieback-%E2%80%93-Practice-Guidance**.

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ACTION TO COMBAT *PHYTOPHTHORA PLUVIALIS*

The Forestry Commission is urging anyone working with trees to remain vigilant following findings of *Phytophthora pluvialis* in areas across England.

Extensions to demarcated areas in Devon and Cornwall were made in February and April following further identifications of the pathogen in these areas. New demarcated areas have also been set up in Surrey and Gloucestershire (following further findings along the border with Wales) to combat any potential spread. As reported in the last ARB Magazine, the disease has also been found near Loch Carron in north-west Scotland.

Phytophthora pluvialis is a fungus-like pathogen known to affect a variety of tree species, including western hemlock, Douglas fir, tanoak and several pine species (in particular radiata pine). It is reported to cause needle cast (where needles turn brown and fall off), shoot dieback and lesions on the stem, branches and roots.

Phytophthora pluvialis has been detected on mature western hemlock and Douglas-fir trees at the affected sites, and has been confirmed as the direct cause of the observed symptoms.

Forestry Commission, Forest Research and the Animal and Plant Health Agency are continuing to conduct further surveillance and diagnostic analysis to understand more about the pathogen and ensure that any required control measures are swiftly undertaken to stop its spread. This includes extensive ground and aerial surveillance as part of a UK-wide survey, and comprehensive research and modelling to explore factors such as climatic and potential species susceptibility and to help inform the management response.

Example of *Phytophthora pluvialis* lesions on a western hemlock stem.
(© Forest Research, Crown copyright)

Nicola Spence, the UK's Chief Plant Health Officer, said, **'We are taking robust and swift action against the findings of *Phytophthora pluvialis* at these sites, as part of our well-established biosecurity protocol for tree pests and diseases. I urge all sectors to support efforts to tackle this pathogen by checking the health of western hemlock and Douglas fir trees. Key symptoms to look out for are lesions on the stem, branch or roots. Any sightings should be reported to the Forestry Commission via its TreeAlert online portal.'**

Further information: www.forestresearch.gov.uk/tools-and-resources/fthr/pest-and-disease-resources/phytophthora-pluvialis/

TreeAlert: www.forestresearch.gov.uk/tools-and-resources/fthr/tree-alert/

Issue 197: Summer 2022

MOST FALLEN TREES CAN STAY WHERE THEY ARE

Simon Richmond, Senior Technical Officer

After a series of late-winter storms, the Association sent out social media posts reminding arborists, landowners and their advisors that many of the resulting fallen trees and branches can simply be left where they lie, as they will encourage biodiversity. The message received a great response and was shared or retweeted widely.

Of course, fallen trees that are causing inconvenience by blocking roads, paths and some formal areas do need to be cleared and checks on remaining trees in high occupancy areas should be carried out following a logical priority.

However, other fallen trees, away from public thoroughfares and safe from further collapse, make fantastic homes for all sorts of biodiversity, and the space in the canopy they have vacated allows germination of plants that have been just waiting for this moment to arise.

Fungi, too, are all ready to explore new food sources and, in the process, offer new habitats for invertebrates and other insects, . creating opportunities for entire new ecosystems to evolve and develop.

Don't let our obsession with tidiness extend beyond the absolutely necessary – let nature do the rest!

As storms Dudley, Eunice and Franklin tore through the UK between 16 and 21 February, Arboricultural Association CEO John Parker acknowledged the efforts of arborists on social media: 'This weekend many skilled, hardworking arborists will be out in sometimes dangerous conditions to help clear up the damage left by Storm Eunice. The Arboricultural Association would like to acknowledge the efforts of these professionals who help keep the country safe and moving.

'We would also urge members of the public to avoid fallen trees and remember that arboriculture is a skilled job, and it is always safest to engage a suitably qualified and experienced professional rather than trying to tackle the problem yourself.'

Issue 194: Autumn 2021

THE VALUE OF FOLKLORE FOR THE OBJECTIVES OF URBAN FORESTRY

Ruthe Davies

Hawthorn

Aspen

Blackthorn

Birch

Oak

Trees have always been central to the lives of humans, so many folk tales feature trees. In this age of mass media, the cultural significance of folklore is reducing. But for the urban forester, it can be a valuable tool for achieving our professional objectives.

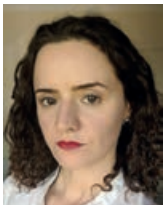
Trees are not only props in folk stories, and the roles and characters given to them are not arbitrary. They often play upon the botanical characteristics of a species. For example, the birch is the tree of renewal and regeneration because it is a pioneer tree, transforming open land into forest. Its ease of proliferation on poor soils brings an association with fertility and birth. The aspen has flat petioles which cause it to flutter and whisper in the lightest of breezes while other trees are still, and this has led to a cultural relationship between the aspen and themes of communication, speech and eloquence.

Other times the stories relate to a tree's history of human usage. The yew's association with death starts with its poisonous foliage, but further relates to its use in guarding cemeteries, where its nutrient-hungry roots feed on the decomposing flesh of the dead. Tales of the protective qualities of hawthorn and blackthorn tell us of their use for security purposes. The traditional use of the oak for manufacturing navy boats at the height of the British empire has earned it a special esteem as a national treasure, an icon of British identity.

In this way, these tales are not only entertaining stories, but have an educational role, providing insights about the physiology of a species, its value to humans and our history with it. Bringing people and trees together is the fundamental aim of urban forestry. Storytelling is a powerful way to change perceptions and we can harness the stories of our ancestors to achieve this aim. Stories speak to people on a level that lectures and lessons cannot. When I was a child my mother told me a story – passed down from her Irish family – that fairies live where tree canopies meet over a road, and as you pass underneath you should make a wish. This shaped my perception of trees in a way that has persisted into adulthood.

So how can folklore be applied, on a practical level, by the urban forester? It can influence species selection in planting schemes, such as when a rowan is planted by a household to protect from witchcraft. It can provide material for tree walks and interpretation boards. It can bring trees to life in forest school sessions and other children's activities. Locally significant stories are some of the most valuable, and can be a hook for community engagement and an inspiration for placemaking. Veteran trees often have their own local folk tales attached, which can be used to raise awareness of and justify protection for them.

It is a tool to be deployed with moderation and care – invoke folklore in the wrong context and you will be taken for a crackpot. But it has its place in our profession. As managers of our urban forests, we should recognise the value and importance of this aspect of our cultural heritage and our role in the continuation of an ancient tradition.



Ruthe Davies is a Chartered Arboriculturist and a Tree Officer with the planning team at City of Edinburgh Council. You can find her on Twitter **@MsTreeRa** (like She-Ra, but with trees).

Image credits: aspen by I, Hugo.arg, CC BY-SA 3.0 via Wikimedia Commons; blackthorn, birch and oak by Manfred Richter from Pixabay; hawthorn by Thomas B from Pixabay.

Figure 1: Adult emerald ash borer.
Source: https://www.daera-ni.gov.uk/articles/emerald-ash-borer-agrilus-planipennis.

Issue 191: Winter 2020

EMERALD ASH BORER
A BRIEF OVERVIEW

Sam Rivers

With ash trees in the UK already under pressure from Chalara ash dieback (*Hymenoscyphus fraxineus*), a new threat emerging from North America and Asia could have devastating effects on our UK ash population.

Emerald ash borer (*Agrilus planipennis* Fairmaire (*Coleoptera:Buprestidae*)) is one of the most serious pests of ash (*Fraxinus* spp.) trees in North America, causing approximately $10 billion in economic damage and resulting in the widespread mortality of ash resources throughout the US. Emerald ash borer (EAB) is yet to arrive in the UK. However, importation of wood from areas where it is present increases the risk of introduction.

Emerald ash borer is indigenous to eastern Asia and is predominantly a pest of ash trees. Populations were first detected in the United States and Canada in 2002. Based on dendrochronology studies, EAB was likely first introduced in the early 1990s in Detroit, Michigan, believed to have been in ash wood used to secure crates on freight ships from Asia. It can easily infest both healthy and stressed ash trees in North America, where native ash species have not co-evolved with EAB. Within the beetle's native range in China, species of Asian ash are usually resistant to EAB except during prolonged periods of environmental stress such as drought.

The beetle readily infests nearly all size diameters of ash trees from 5cm dbh (diameter at breast height) saplings to mature larger ash trees in both open-grown and interior forests. In China, native hosts of emerald ash borer include *Fraxinus mandshurica* and *F. chinensis*. North American ash species susceptible to the beetle include *F. americana* L, *F. nigra* Marshall, *F. pennsylvanica* Marshall, *F. profunda* Bush and *F. quadrangulata*.

Life cycle

The life cycle of the beetle is primarily completed in one year but two years are often required, particularly in cooler climates or when eggs are laid late in the season. The adult flight season usually begins in May or June and peak flight occurs from June to July, ending in September. Emerald ash borer adults are most active on sunny days when temperatures exceed 25°C. During cooler or wet weather, adults will often rest in bark crevices or leaves. Adults consume foliage and live for up to several weeks under favourable conditions. To locate suitable hosts and potential mates, adults use olfactory and visual cues. Shades of purple and green are highly attractive to adults. Volatiles from ash bark and foliage have been shown to elicit positive responses in adults under laboratory conditions. Adults copulate on branches, foliage and the trunk of host plants. Oviposition occurs 5–10 days after adult emergence. Eggs are laid individually or in small clusters between layers of bark and in bark crevices along the trunk, major branches and sometimes exposed roots.

Under laboratory conditions, average emerald ash borer adult male longevity is 43 days; adult female longevity is seven to nine weeks with total fecundity averaging between 40–74 eggs per female, with a maximum of 307 eggs. Depending on temperature parameters, egg hatch occurs after 7–18 days. Neonate larvae chew through the surface of the egg that is in contact with the tree and tunnel directly though the outer bark to the cambial region where they feed on the inner bark (phloem) and outer sapwood, creating frass-filled galleries.

EAB has four larval instars; the head capsule and the sclerotized processes called the urogomphi located at the terminal end of the abdomen can be measured to distinguish the larval instars. For individuals completing their life cycle in one year, larvae overwinter as mature fourth instars. For individuals developing over two years, the first winter is usually spent as early instar larvae. Once a larva completes its feeding as a fourth instar, it constructs a pupal cell, usually in the outer sapwood of thin-barked branches of trees or in the outer bark of thick-barked trees. Before a pupal cell is created, fourth instar larvae bore a tunnel extending close to the surface of the outer bark that will be used as an exit hole for an emerging adult. In the pupal cell, a fourth instar larva folds itself into a J-shape before overwintering. In spring, larvae that overwintered in pupal cells develop into prepupae by gradually unfolding their body. Prepupae molt into exarate pupae (that is, pupae without a cocoon – they look like a very compressed, discoloured adult). Pupation occurs in late spring/early summer and can last for three to four weeks. After eclosion, the pharate (fully developed) adult remains in its pupal cell for approximately one week before it chews its way out of the tree by enlarging the exit tunnel, which is typically D-shaped and can be used as an indicator of infestation.

The impact of infestation

In North America there are 16 *Fraxinus* species. It is estimated that there are approximately 8.7 billion *Fraxinus* trees and saplings throughout the continental USA, all potentially susceptible to emerald ash borer. Over smaller spatial scales, *Fraxinus* spp. are essential components

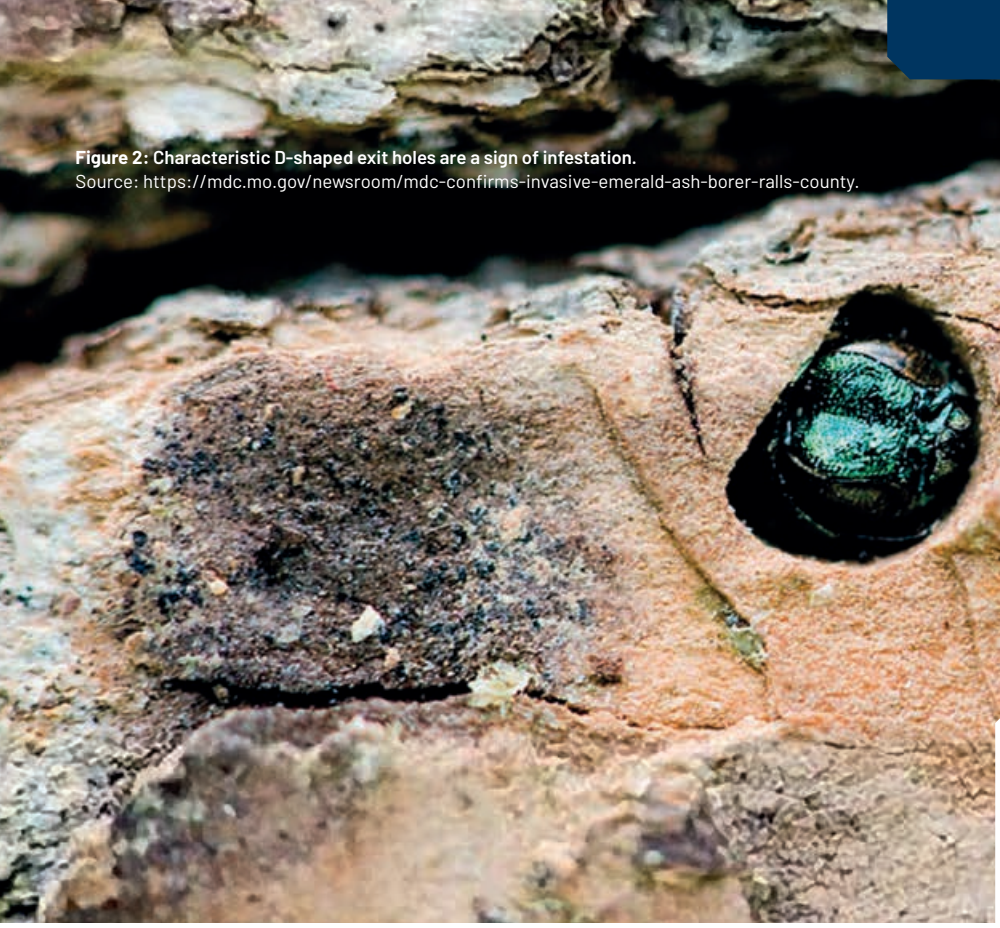


Figure 2: Characteristic D-shaped exit holes are a sign of infestation.
Source: https://mdc.mo.gov/newsroom/mdc-confirms-invasive-emerald-ash-borer-ralls-county.

in forests and woodlands as a dominant or co-dominant species. In the UK, ash species were the second most commonly planted genus, and ash makes up nearly 15% of all UK broad-leaved woodland.

Trees often die after 1–3 years of successive infestation: mortality often begins in the crown branches, moving downward to the main trunk. Epicormic branches often develop along the lower trunk and are considered a sign that the tree is about to die.

As *Fraxinus* species die, gaps in the forest canopy occur allowing light penetration further towards the forest understorey. Significant ecological impacts of the beetle will be determined by what plant associations establish post-invasion. In areas where EAB was first documented, green ash (*Fraxinus pennsylvanica*) has been replaced by spicebush (*Lindera benzoin* L.), pawpaw (*Asimina trilobal* Dunal) and prickly ash (*Zanthoxylum americanum* Mill). It is uncertain what post-invasion forests will look like: in many regions where EAB has impacted communities there is still regeneration of Fraxinus saplings and seed banks documented in the soil. The introduction of natural enemies and in some instances chemical treatment may reduce EAB density and allow regenerating ash to retain its ecological importance. Where significant forest structure changes occur as a result of EAB invasion, the biota, species interactions, hydrology, light regimen, nutrient cycling, vertebrate food value and other integral ecosystem characteristics will be altered. Structural changes may alter the suitability of the forest as a habitat for resident vertebrates and invertebrates. Canopy gaps, for instance, are shown to cause microclimate changes impacting ground beetle populations and encouraging invasive plant species, which would otherwise be limited by light availability.

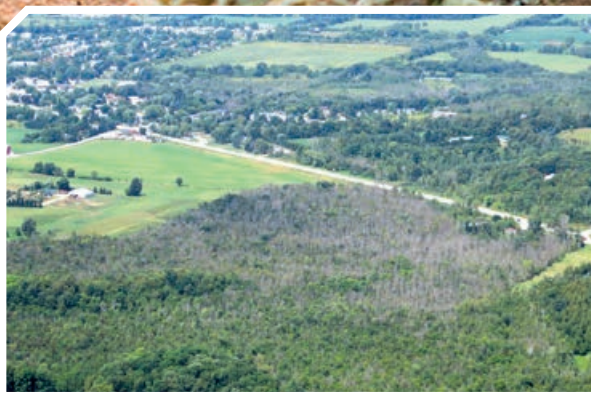


Figure 4: Ash mortality caused by emerald ash borer.
Source: https://www.bigotree.com/emerald-ash-borer-attacks-staunton-region/

Figure 3: Emerald ash borer larvae feeding on *Fraxinus* spp. phloem tissue.
Source: Author's own.

If you think you have spotted signs of emerald ash borer anywhere in Great Britain, you must tell Forest Research immediately using the TreeAlert pest reporting tool: **www.forestresearch.gov.uk/tools-and-resources/tree-alert/**. Suspected sightings in Northern Ireland should be reported using TreeCheck: **www.treecheck.net/**

Sam Rivers currently works as a technical sales manager for ICL UK. Sam has a broad range of practical experience which includes working for a forest entomology lab in the US and as a senior horticulturalist at Cambridge University. He holds a National Diploma in horticulture, a BSc (hons) in Horticulture and an MSc in Entomology.

ANCIENT TREE FORUM

A CONTRACTOR'S APPROACH TO ENSURING ANCIENT AND VETERAN TREE CONTINUITY

Tom Hamments

A veteran ash, Gloucestershire.

Issue 191: Winter 2020

There exists a fundamental divide among ancient and veteran trees with regard to their history and how they became so.

On one side are the trees which have been left to their own devices, not worked by mankind historically or currently, nor heavily influenced by the intensive management of the surrounding area; their features are manifestations of completely natural processes and weather events. On the other side are trees which have been cut, pruned or otherwise altered for some purpose. These purposes vary, but can include to produce one-off or cyclic wood fuel or simply to create an access for farming or other reasons. I suspect the slight majority of ancient trees (defined by age for species) fall into the former category and the slight majority of veteran trees (defined by their individual features or other especially high value) fall into the latter category, but there are many examples of overlap.

Both natural ageing and human intervention can instigate similar physiological processes which create the features and characteristics we recognise in these trees (broadly speaking). Physiological processes caused by natural ageing tend to be in harmony and are, at some stage, accompanied by relative structural change; these processes complement each other and work to prolong the life of the tree. Physiological processes caused by human intervention are often abrupt changes that other parts of the tree were not ready for, nor necessarily needed. Typically, these cause a far quicker and more crude result and are not always conducive to longevity. When we consider the management of existing ancient and veteran trees – and of trees with the potential to become ancient or veteran – it is important to understand these processes, if only at a rudimentary level. Here is an overview of the difference between natural and induced tree system and structure changes.

Natural reduction of crown area (syn. retrenchment)

In maturity, shoot extension gradually decreases in a linear relationship with root performance, rhizosphere size and resource availability. Hydraulic resistance increases as a result of the natural filtration through narrowing xylemic pathways between successional terminal bud scars until such a point that hydraulic resistance is too much and the peripheries of the crown start to die back. Plant hormones (mainly auxin, cytokinin and ethylene) are then responsible for gradually rebalancing a root-to-shoot ratio, with a combination of the growth of dormant or adventitious buds into new shoots lower down the tree and the death of roots no longer required. Conversion of sapwood now surplus to requirements ensures the tree is servicing no more functional cells than it needs to, plus a contingency.

Induced reduction of crown area

When photosynthetic capacity is reduced by crown reduction, the tree system has fewer resources to do more work. The tree must sustain maintenance respiration of live tissue as a priority, as well as renewing xylem and phloem and producing flowers and seeds.

On top of this, it must now compartmentalise and produce wound-wood, restore translocational pathways and protect itself from disadvantageous decay and occlude the wounds. The tree can seldom do this using energy being produced at the time (kinetic energy) and must rely on using energy stored in sapwood (potential energy) to overcome these hurdles. With many species of tree (and even genetic differences within the same species), the parameters of tolerance are small. If too much crown is removed, the tree may use up its stored energy before completing some or all of these processes. Wherever significant parts of the crown are removed, an amount of sapwood will die as it is no longer needed to service a smaller crown/root volume.

Natural fungal decay

Fungal decay in trees is entirely purposeful. A tree ageing in a natural way will have been converting sapwood to heartwood or ripewood as the inner circumference of sapwood becomes obsolete as a result of secondary growth. The tree does not need its whole cross-sections to be active;

Resilient Cumbrian hawthorn.

indeed, it could not sustain the maintenance respiration requirements of such a large area of live tissue. Fungal propagules exist latently in trees, and these propagules are able to activate and begin the decay process when conditions are right. This may be after they have been transferred into heartwood or ripewood or while they are in sapwood if areas of sapwood become dysfunctional in resource translocation (and therefore desiccate) as a result of crown loss or direct injury. When the decay process begins as a result of the retrenchment process, in the overwhelming majority of cases the rate of decay does not exceed the rate of retrenchment, i.e. the risk of structural failure from a reduction in stem volume is mitigated by a continual and gradual reduction in the forces applied there.

Induced fungal decay

When fungal decay is induced after (usually severe) pruning, it often has a much larger volume of wood available to it. Sapwood does not have the same chemical composition as heartwood: dysfunctional sapwood arising from an abruptly reduced demand for resource translocation is more vulnerable to colonisation and at a quicker rate. Fungal hyphae may then move readily into heartwood or ripewood (depending on the situation), and some species may work outwards from dysfunctional sapwood into functional sapwood where they may shut the tree system down (though most would preferentially degrade desiccated tissue first).

Moreover, where decay is onset after human intervention, the reduction in stem volume may not be mitigated by whatever pruning has already been done, and the tree could be more liable to failure going forward – particularly if decay has onset in a stem which hosts a crown proliferating growth to replace lost photosynthetic capacity!

Natural hollowing

While natural hollowing heavily overlaps with fungal decay, we can identify a common key difference in the way it occurs. When the crown of a tree retrenches naturally, it is still growing in girth (secondary growth). In order to perform secondary-growth functions, the tree requires energy produced by the crown and, of course, the water and nutrients needed to photosynthesise in the first place. This creates a conflict: girth increase vs. photosynthetic capacity decrease. In practice, this results in ever-decreasing annual rings of laid down wood, until the point where the laid down wood does not create a full ring. Cork cambium and therefore bark are not produced in that area, and an ingress into the structure is created. Heartwood or ripewood is then exposed, allowing the fungal propagules within it to activate and begin the hollowing process. Remember, at this stage retrenchment has been occurring in a steady fashion – natural hollowing is rarely a cause for concern of structural failure as, by now, the crown is small and forces on the structure are low. As the middle of the tree decays, valuable nutrients are available to the tree again. It is a perfect cycle which, in essence, is infinite.

Induced hollowing

Where a vigorous tree continues to grow on a hollowing stem (typical species include *Salix* spp. and *Populus* spp.), failure is likely (if a limiting factor does not slow or halt crown growth). Most of us working in practical roles have, on more than one occasion, cleared failed lapsed willow pollards. The decay and subsequent hollowing process begin in earnest after the first pollarding. If the cycle is kept up, there may not be an issue, but if the pollard is left to lapse, the forces applied to the hollowing stem by a heavy crown often result in failure. This type of hollowing can be easily induced in any species when the crown of a functional unit is pruned – a functional unit being a tree within a tree: a part of the crown serves a part of the roots and vice versa, not requiring resources from other parts of the crown or roots respectively. This functional unit system may be efficient, but because it is utilising only a proportion of the circumference of sapwood, it is liable to be damaged when its associated crown is pruned or removed, even if the rest of the crown is left untouched. When this unit is shut down by severe pruning, we get vertical strips of dysfunction visible on the stem which can lead to hollowing. The risk of failure here is that the rest of the crown is possibly still growing ...

Ancient sweet chestnut (home to an array of epiphytes: its own ecosystem!).

Natural reduction of root area (syn. retrenchment)

As explained above, crown and root retrenchment are relative when they occur naturally. There is little risk to the physiological and structural condition of the tree if retrenchment of the roots is linear to retrenchment of the crown. Typically, the deeper and more vertical roots die off first; the shape of the rhizosphere of an older tree is usually shallower and wider than the wine-glass shape of the rhizosphere of a younger tree. Death of structural roots can be an instigator for fungi latent in the wood or soil to colonise and decay vertically into the root crown and subsequently the heartwood or ripewood of the tree, leading to hollowing with little or no open cavitation in the stem. This habitat is valuable where access exists via small branch cavities or through insect galleries etc.

Induced reduction of root area

One of the most prolific causes of tree death, particularly in ancient and veteran trees and those with the potential to become ancient or veteran, is human activity leading to root dysfunction. Compaction by vehicles, plant or footfall (including grazing animals) creates anaerobic conditions in the soil so roots cannot respire, renders water unable to penetrate or move within the rhizosphere, and inhibits root exploration. Mycorrhizal fungi are also negatively affected by damaged roots or a damaged rooting area. Because the vast majority of roots are in the top layers of soil, this can quickly cause a loss of available resources for the tree system. It is my opinion that fungi such as Armillaria mellea and Meripilus giganteus revel in such conditions, easily colonising or activating in desiccated roots. The tree system is weak from a lack of resources, and it cannot always respond adequately.

Aim to retain

This article is intended as an overview. There are many occasions when we will absolutely want to contradict the advice implied here. Indeed, there are occasions when we will actually want to cause some of the issues outlined above if the potential benefits outweigh the negative impacts. However, if we take time to understand a tree's system, look at it in detail when deciding on management, assess its history, and think about whether we consider our observations to be features or defects, we will probably find ourselves making different judgements to those which spring to mind in the first few seconds of standing in front of it.

It is my belief, based on my experience, that there is a disadvantageous disparity between ideal work specifications (including doing nothing and planting!), which would help us maintain a sufficient level of ancient and veteran trees, and the work specifications which are actually administered, and this disparity hinders continuity. I think this is often a result of risk perception, client demands and/or financial gain (or loss). Many operators working in tree surgery roles began a career in this industry because they enjoy tree climbing and using power tools, as I did. These same operators are (in situations where there has been no input from a consultant) the same people deciding specifications of work to trees, and in doing so they are already balancing many factors which often come before consideration of whether the tree has current or potential ancient or veteran status and/or could be retained with tolerable risk. If every company in the UK retained one extra (suitable) tree per month, that would be a monumental benefit to our ancient and veteran stock in generations to come.

Subjects which I will leave for another article, such as local and higher-level policy frameworks and land use conducive to ageing trees, are also important factors consistent with ancient and veteran tree continuity. However, I hope that if you are a contractor making decisions about trees, you will find this article useful when deciding work specifications.

Tom Hamments leads ATF Gloucestershire and is Managing Director of ARB Approved Contractor Stockwell Davies Tree Contractors Ltd.

Flammulina velutipes on horse chestnut.

Ganoderma australe on sycamore.

Ulmus 'New Horizon'

Ulmus 'Rebona'
(and pictured above)

Issue 191: Winter 2020

THE PLANTSMAN'S CHOICE

ELM AS A FUTURE URBAN TREE: IS IT POSSIBLE

Dr Henrik Sjöman and **Dr Andrew Hirons**

Ulmus 'New Horizon'

The high tolerance of many elms to challenging urban conditions, combined with their ease of establishment, meant that they were widely appreciated across Europe and North America until their near-complete demise as a result of Dutch elm disease (DED). Today, as we seek long-term sustainable tree species for our towns and cities, there is a great desire to make the elm part of our urban treescape once again.

In Europe and North America, the elm (*Ulmus* spp.) was historically one of the most common urban trees until the end of the 20th century. Parts of Amsterdam in the Netherlands had over 70% elm along their streets and in their parks. Cities such as Malmö in Sweden were also proud of their majestic elms. It seems that in the eyes of some policy makers there was no reason to break a winning concept: all other trees were worse in comparison; it had to be elm on elm. However, these cities experienced the catastrophic effects of over-reliance on one type of plant material as the DED epidemic struck. Such widespread mortality of such a profoundly dominant tree was a bitter blow to many towns and cities. The effects of these losses can still be observed today.

Therefore, proposing elm once again as a city tree may seem unthinkable, but thanks to the hard work of tree breeders, it is now a realistic prospect. We know that many Asian species of elm are resistant to the serious type of DED, which has led them to be used in extensive hybridization work to produce DED-resistant trees. Many of these selected cultivars are of North American origin, including two that we have a substantial experience of now: the so-called Resista® elms, 'New Horizon' and 'Rebona'. In order to succeed with them, however, you must know their background, so that you can more easily understand their capacity for growing in urban environments, as well as the care they may require.

Both cultivars are American hybrids from the University of Wisconsin and both have the Siberian elm (*Ulmus pumila*) and Japanese elm (*Ulmus davidiana* var. *japonica*) as their parents. It's important to note that the characteristics of Siberian elm are such that its genes might be considered something of a mixed blessing.

In fact, some of what is said about the Siberian elm would not be polite to put into print. Suffice to say that some consider its weed-like growth, which results in an untamed, wild crown perched atop a stick, makes it one of the worse trees you can grow. However, the advantage of the species is its outstanding tolerance for hot and dry conditions, attributes that have served it well in its native regions around the edges of the Gobi Desert in northern China. So, having Siberian elm as a parent in these cultivars means that you get trees that are tolerant to the most challenging of urban environments and that quickly establish and grow fast. On the other hand, you also get trees with a rather messy crown structure, which is particularly difficult to manage at a young age when branching can be very dense and irregular. This means that it is wise to buy larger plant material (trunk size at least 25–30cm circumference at 1m) where the nursery has already done the difficult and extensive work of building an even and attractive crown structure.

Ulmus 'New Horizon'

Early-mature trees of the cultivar develop with an oval crown, 10–12m high and 4m wide, but over time they can become significantly wider, usually with a continuous single trunk and a dense but fairly evenly distributed branch structure. The dimensions of the mature tree are listed by German nurseries as 25m × 10m. The cultivar enjoys heat and is a really good inner-city tree; its wind resistance also makes it a good tree for planting adjacent to highways. The autumn colour is not spectacular though. The variety has been around for 25 years in European cultivation and in the USA for another 10–15 years and is considered completely resistant to DED.

Ulmus 'Rebona'

This cultivar is similar to 'New Horizon' but has a stronger tendency to develop a consistent single trunk with a more even crown density. The leaves are also slightly larger in 'Rebona' compared to 'New Horizon'. Trees of the cultivar are very fast growing and initially develop a narrow pyramidal growth pattern, 10–15m high and about 4m wide, while older trees become significantly wider. Here, too, German data describe final sizes of 25m × 10m. 'Rebona' is also heat tolerant, wind resistant and it has proven to be resistant to flooding. The cultivar is somewhat newer and thus has not been tested as long as 'New Horizon', but it has shown remarkable tolerance for inner-city environments.

Dr Henrik Sjöman is a Lecturer at the Swedish University of Agriculture Sciences and a Scientific Curator at Gothenburg Botanic Garden.

Dr Andrew Hirons is a Senior Lecturer in Arboriculture and Urban Forestry at University Centre Myerscough.

Issue 192: Spring 2021

ARE 'DEFECTS' A DESIGN FOR LONGEVITY?

Ted Green, MBE

Asking this question has led me through a layman's life amongst trees, often with tree people, to gradually come to this conclusion and proposal: 'Nature does not follow or adhere to man-made definitions, constructs or laws.'

Can we say that in the tree industries, the overarching reasons for the work that's done are the care of trees, promoting their health *and* our perception or concept of the perfect tree? For the forestry profession the explanation for this is very simple: they want healthy trees for better production performance and a perfect growth form for timber processing. With the ongoing destruction of the world's natural forests, especially hardwood trees, and the change in our trading position in the world, we will certainly need our foresters. However, in the rest of the tree world the perception of the perfect tree is perhaps best described as a lollipop throughout its whole lifespan.

A classic open-grown, hollow, Eiffel tower tree. Regardless of its age, the form shows it has spent its whole life in the open and experienced many threats in its long life like gales, ice storms and droughts. Every thinking arb should see it.

The Wye Oak, Maryland, USA, and lunching arbs in the background.

Whilst articles by Dr Giovanni Morelli and Dr Stefania Gasperini[1] and Tom Hamments[2] are full of information and good examples of how trees can grow, as laymen, can we explore the vocabulary of the terms used?

To attain and maintain the lollipop form, the arb and forestry industries have developed a whole vocabulary of terms such as defect, fork failure, sound and unsound wood, included bark and so on. The terms pests and diseases, and that word pathogens which is so frightening to tree people at the moment, should have an article of their own.

Under normal circumstances, most pests, diseases and pathogens do not obviously kill their hosts; it is illogical for them to do so. Interestingly, how few times do you read or hear 'it might occur' or 'it can occur'? It is always a straight one way or the other: you hear that it does kill or it doesn't. There is seldom any hesitation in these statements, so people assume there must be clarity, but that is not always the case. As Alan Rayner once said when talking about fungi in wood, 'People are expecting black and white answers to grey questions.' And Lynne Boddy simply says 'We don't know.' The time is long past when arbs as the front-line, daily observers in the tree world should have started asking scientists 'What about the web of causation? And why does susceptibility in trees appear to be on the increase?' That will make them start scratching their heads.

Nowhere is the striving for the 'perfect' tree more important than in the USA, and a very good but very sad example of the perfect lollipop tree, together with very commendable arboricultural efforts to maintain it, is the famous Wye Oak in Maryland. It was on a visit to the tree – said to be the largest white oak remaining in the USA – with about 100 International Society of Arboriculture members that we were shown the expensive and positive management taking place. The giant lollipop had miles of cable bracing, formative pruning and weight reduction; the hollow trunk cavity was filled with concrete; there was wood mulch to the drip line and a protective kick rail. No expense spared.

And nothing but praise from the group until I said, 'It will blow down.' Half the group laughed and said, 'Go on, Ted.' The other half? Complete silence, until someone said, 'When was the last lynching in the USA?' This was one time in my life when wish I had been wrong, because within a year it had snapped and the crown was on the floor. So how did a layman Brit in a foreign country have the confidence to say to a hundred arbs 'It will blow down'? Not being an arb might be a start.

Natural ageing processes

Many years ago, I got the phrase 'trees growing downwards' from Chris Baines when he was commenting on ongoing appalling new tree plantings. Later, just looking at the growth form of the gnarled, fat, stunted old oaks at Windsor – several of them well over 500 years old and survivors of the rigours of high winds, extreme weather and all the other adverse conditions they will have experienced in their long lives – was enough to make me apply this description. This was endorsed in 1996 when I heard what John Dryden wrote over 300 years earlier: 'The monarch oak, the patriarch of the trees, Shoots rising up, and spreads by slow degrees; Three centuries he grows, and three he stays, Supreme in state, and in three more decays.' Another version is 'An oak tree grows for 300 years, rests for 300 years and spends 300 years gracefully expiring.' Change 'gracefully expiring' to 'growing downwards' and you get the idea.

Nev Fay got it in one and went on to devise a management process to mimic growing downwards for the conservation of old trees. His work and observations can be said to be ground-breaking and exploratory, and the results advanced our understanding of tree care. The results of his work several years on have led to some ongoing healthy debates.

Three centuries ago, what John Dryden and perhaps other observers were describing was what perhaps could be best called a natural ageing process, and perhaps it is reasonable to assume that in those times very few ancients, if any, received tree care. Compared with most countries that practise arboriculture, the UK is still blessed with examples of old and ageing trees and we now have a great wealth of experience in their care and how they have arrived at their present condition and form. We

1. 'The morphophysiological approach to tree management', ARB Magazine 190, autumn 2020, pages 24–32.
2. 'A contractor's approach to ensuring ancient and veteran tree continuity', ARB Magazine 191, winter 2020, pages 53–56.

Pagoda pines *Pinus nigra* in Bosnia: natural plateauing out.

Fifty Brains. One of the meetings primarily for arbs held at Windsor to encourage debate about our ancient trees.

are very fortunate to have had the opportunity to have interesting discussions at many outdoor arb meetings under very old open-grown trees, especially ancient oaks, and during those discussions you hear the word defect repeatedly. The perceived defects are large fallen lower limbs, exposed trunk scars, stub ends, deadwood in the crown indicating retrenchment, the main trunk virtually hollow and so on.

But the tree is still there and producing acorns!!

How would the debate proceed if we stood, for example, admiring an ancient oak the shape of a traffic cone, all its large lower limbs long gone and hollow, in the knowledge that its form had occurred naturally? Imagine using our current negative descriptions such as defect in a positive manner and any tree work to remove 'defects' is in fact what might have occurred naturally sometime in the future.

Leave stub ends

I maintain, though, that some tree work is not natural and that is cutting to the branch collar. Alex Shigo said 'Go out and look', and I am sure if he was here today he would now be advocating leaving stub ends as the most natural way to remove limbs. Of course, his work on cutting to the branch collar was an advance on the damaging flush cutting of the day. It was only a direct response to the tired, middle-aged, tidy brigade who do not like the look stub ends. But I am told his reasons for not leaving branch stubs originated from the need to prevent excessive discolouration in veneer timber.

If you think about it, stubs ends could be said to be a perfectly natural break which presumably fractured and left the exposed cells intact, as with cleft wood and its durability. Perhaps your ancestors got the idea of cleaving wood from this observation.

This is the twenty-first century and you are still doing what the Victorians insisted on! Stub ends are not ugly: they are natural. Go and look at storm-damaged trees and see the proportion of stub ends compared to limbs split away at the trunk (though this can also happen when a limb falls from above).

Claus Mattheck had me trying to measure stub ends on the living tree – the diameter of the limb and the length of the stub and the fallen limb. It was impossible for me as I'm no climber, and often the fallen limb had been removed, but this would be a nice, very obvious research project for a thinking and climbing arb. There is abundant evidence out there from our frequent storms and we could learn a lot to help our understanding of the natural ageing process, trees' responses and perceived defects. And not forgetting that the time has arrived to consider broken and damaged roots resulting from high winds.

The UK's unique opportunity

This article started with a question and an observation. To my mind, arbs in the UK, because we are such a small nation, are in a unique situation with easy access to many

What can we learn from an old oak with so many 'defects?' Over the past centuries it has developed stub ends resulting from high winds and ice storms, developed natural hollowing, survived more than one lightning strike, undergone retrenchment from maybe the natural ageing process, and experienced root breakage as a result of high winds or the deep ploughing of ancient wood pasture, followed by intensive farming for 20 years from the 1940s and the inevitable changes in the biodiversity of the soil. In the UK, arbs are so fortunate to have such classrooms. Please don't take them for granted. Remember, Alex Shigo said, 'Go out and look.' I wonder where we would be today if tree greats like Alex Shigo, Claus Mattheck and others had had their formative years wandering amongst the ancient oaks growing downwards at Windsor.

examples of old trees in the countryside where groups can meet and debate that question and many others. Having spoken – sometimes several times – about old trees in 12 countries in Europe and in Australia, New Zealand, Canada and the USA, I can assure UK arbs that it is very clear that the knowledge and experience of old trees are right here. Questioning and observing are more important than ever if we are to explore the longevity of trees, especially old trees remaining in the UK.

It must be stressed that there has been no intention in this piece to question any of the practices being carried out throughout the arboricultural world and especially no mention of health and safety. I like to think that I am one of the first people to point out that the vast proportion of workers went into arboriculture because of their love of trees. However, one quote of my mine is directly your concern: 'The UK's major obligation to European conservation of biodiversity is the care and conservation of our ancient trees.' If you love trees, be proud of our ancients, and think about the question 'What is a tree?' Begin to be an Arboricultural Ecologist, right here and now.

Many arbs will react quite rightly and say on reading this piece that virtually all their tree care is already mimicking the ageing process. I agree, but why use terms like defect then? Find positive terms for this tree work done by a profession that truly cares about trees.

There is a saying that 'There is only one car and that is a Rolls Royce and the rest are mere imitations.' Of course, I must add there is only one tree too: the oak. However, I have a great affection for another tree and that is the black pine *Pinus nigra*. It has several sub-species that stretch from virtually the shores of the Atlantic Ocean through the European mountain ranges to Turkey and the Crimea. Having walked amongst all the sub-species growing in those great landscapes, trees of all ages and especially the ancient ones, I came to call them the pagoda pine because of their shape with their sweeping curved side limbs and flat top. Twice locals have said the flat tops were a result of heavy snow, presumably over quite long periods, which sounds very reasonable but it does not explain that you can find the same flat top form in the UK with only infrequent light snowfall. Reg Harris and me now talk about trees plateauing out, as you'll see in the pages that follow.

Open-grown Scots pine damaged after heavy and perhaps prolonged snow fall that may have remained on the limbs for a long period. The lower limbs may have snapped at the main stem as a result of the extra weight from limbs above falling on them.

Ted Green MBE is a founder of the Ancient Tree Forum. As Tree Ecologists, Ted and Reg Harris created the Thinking Arbs days.

Issue 194: Autumn 2021

CAN WE TRUST TREE NURSERIES TO DELIVER RELIABLE TREES?

Henrik Sjöman and **Harry Watkins**

The expression 'the right plant in the right place' is something that we in the industry often use when we try to select a tree for a particular site and climate so that it can have successful and long-term growth.

Despite these ambitions, we all too often see projects where plants are forced into situations where they cannot handle the conditions – it can be too hot, dry or in an excessively cold winter climate, or in a successional[1] situation which the species cannot handle, for example where a late successional tree is planted in a location that is too exposed and has extensive weed competition.

To address these widely acknowledged issues, we see more and more publications and resources which can help us to choose the right plant material for the location, climate and purpose in question, but a blind spot remains. Every forester knows that provenance plays a critical role in performance and yet this is almost impossible for us to take into account when we try to specify urban trees, so the question we must ask ourselves is whether the plant material that ends up being delivered to site is suitable for its intended purpose or whether, regardless of the choice of species, it might yet fail. In this article we present a recently completed study in which we investigated how much the largest tree nurseries in Germany, Holland and England know about a crucial question: the origin of the plant material they have in production.

Origin

In Sweden, the devastating winters of the 1930s and 1940s showed us how important it is to grow ornamental trees with the right provenance, by which we mean both the geographical location from which the seed material originates and where the parents of the seed have developed over generations in the prevailing natural conditions. A suitable provenance is one where the same seasonal rhythms and the temperature conditions exist in the climate where the seed parent grows as at the place where the tree is to be planted. Failure to take this into account can result in the tree dying or being seriously damaged and more easily affected by diseases or pests.

Urban foresters may be less familiar with the concept of ecotypes (i.e. the unique ecosystem that the seed source originates from), but recognising the role played by environmental factors offers us a useful way of addressing complex questions of provenance. There is extensive research which shows that if a seed source originates from a warm and well-drained southern slope, it is significantly more heat- and drought-resistant than a seed source that originates from a cool and moist northern slope, regardless of whether they occur in the same geographical region with a similar climate. For a future climate (with predicted warmer and drier conditions) or for inner-city environments, the ecotype originating from the hot and dry southern slope is of greater value, of course, which means that knowledge of which ecotype is in cultivation is, and will continue to be, of great importance for creating long-term sustainable plantings.

Provenances and ecotype are particularly important for species with a large geographical distribution, where the species occurs in many different climate types and ecosystems. Figure 1 shows some examples of species with large geographical distributions where you can see the breadth of climate represented by different places in their distribution. This makes it possible to see which place in the species' distribution matches, for example, London today and in future climate scenarios.

Knowledge-of-origin information among Europe's tree nurseries

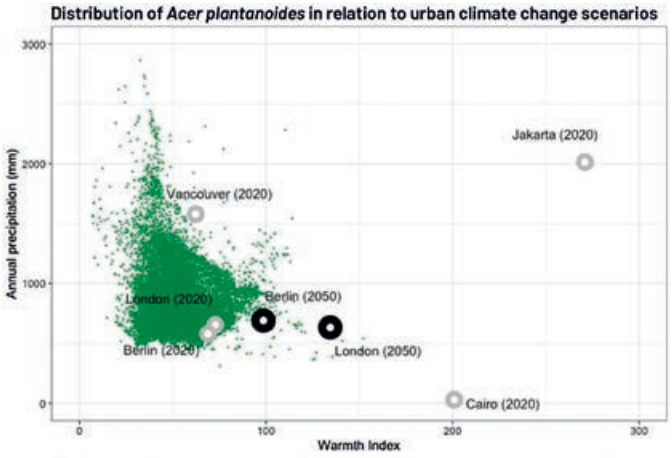
Given that we know that the origin of plants is crucial for long-term sustainable growth, we carried out a survey of the largest tree producers in Germany, the Netherlands and the UK, asking three simple questions about some of our most commonly planted urban trees. The selected species were Norway maple (*Acer platanoides*), red maple (*Acer rubrum*), silver birch (*Betula pendula*), hornbeam (*Carpinus betulus*) and tulip tree (*Liriodendron tulipifera*), all of which represent species common in public plantations in northern Europe, and have a large natural distribution in many different climates (Fig 1).

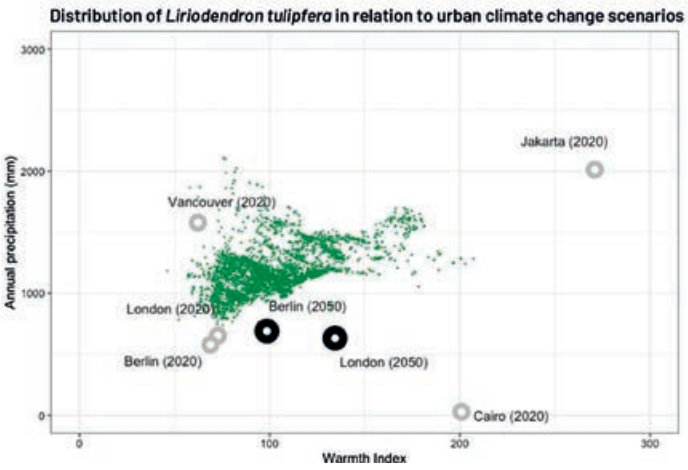
The tree nurseries that were surveyed were in two categories: (a) nurseries that produce nursery stock liners from seed which are then sold on to (b) tree nurseries that grow and sell the trees to the end users.

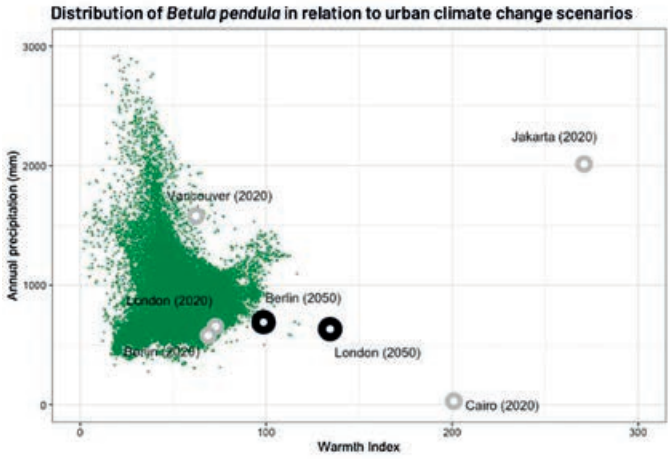
1. Successional: the ecological processes of species being replaced over time.

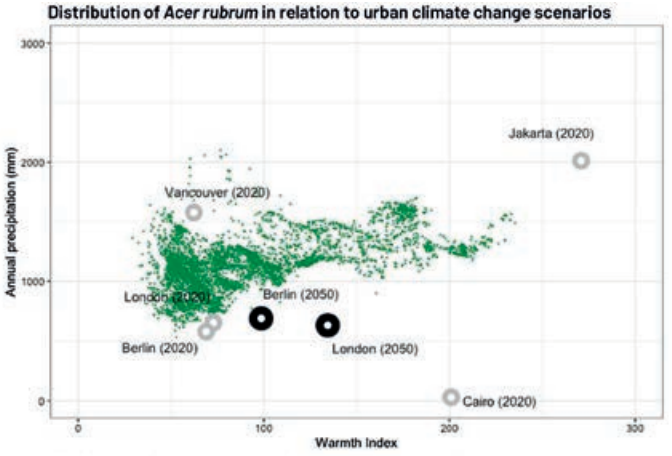

Acer platanoides


Acer rubrum









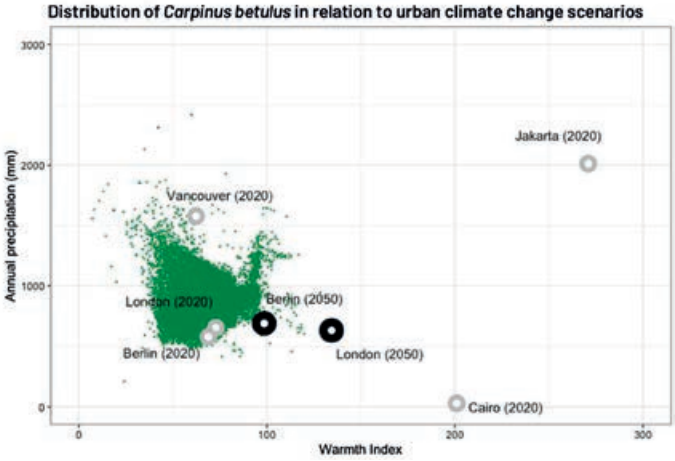
We asked each nursery the following three questions:

1. **Do you have information from which geographical area the genetic material of the species you have in your production comes from?**
2. **Do you know from which type of ecosystem the genetic material for the species you have in your production comes from?**
3. **Where was the plant material propagated?**

In total, 24 tree nurseries were interviewed (8 category (a) nurseries, and 16 category (b) nurseries) – and all were promised total anonymity. In the tables opposite, it can be seen that information about provenance knowledge varied greatly between the nurseries and between the different species in the study. For nurseries supplying nursery stock liners, knowledge of the origin of the species was better, at least for the European species; however, for red maple and tulip trees the origin information was non-existent. Among nurseries that grow and sell trees to end users, the information about provenance was relatively limited or very general, for example, the name of the country where the seed source originated, which in itself can mean many different types of climate. Knowledge was non-existent about the ecosystem origin of the plant material of the species they have in production, regardless of the nursery category.

Ordering trees is a lottery

Looking at our study, you realise that it is a lottery to order a tree from Germany, the Netherlands or the UK, as you really do not know the background information of the plant material. An example is the North American tulip tree (*L. tulipifera*), which has a huge natural distribution from south-eastern Canada in the north to northern Florida in the south. For Sweden and the north of the UK, it is obvious that it is the northern type of the species that is of value to us, but many nurseries grow a more southern type as it is more vigorous than the northern ones, which means that they can get a ready-to-market tree faster. This may result in trees that are not winter hardy for the place where they are planted and



so will suffer extensive winter damage, which may mean tree plantings with a limited capacity to deliver the desired ecosystem services etc.

In order to meet the demands of future climates, it will be even more important to be able to predict a species' growth at a given site and to tailor plant material to that site: this means that we must be able to know about the provenance of the trees that are grown in nurseries. For example, climate-matching research shows that in the future Swedish inner-city environments will require more southern or eastern types of Norway maple or hornbeam which will be able to handle the warm microclimates, but without any reliable source information, this new research is impossible to translate into practice and our plant specification becomes a gamble where the odds are unknown ... until it's too late.

If you want to read more about the study on which this article is based, see: Sjöman, H., Watkins, J.H.R. (2020). What do we know about the origin of our urban trees? – A north European perspective. *Urban Forestry & Urban Greening* 56, 126879.


Carpinus betulus


Liriodendron tulipifera

Table 1: Summary of the results of the survey of 24 of the largest tree nurseries in northern Europe.

Question	Summary of responses
1. Do you have information from which geographical region the genetic material of the species you have in your production originates from?	In the large majority of cases (63%), this was unknown. In some cases (11–12%), the nurseries identified sources at the country level (e.g. Netherlands or Germany).
2. Do you know from which type of ecosystem the genetic material of the species you have in your production originates from?	None of the nurseries in either category knew from which ecotypes their material originated.
3. Where was the plant material propagated?	77% of material propagated in the Netherlands and 19% in Germany. A small amount was propagated in Belgium (5%) and the UK (<1%).

Table 2: The survey results from the category 1 nurseries.

Nursery	Question 1	Question 2
German 1	*Acer platanoides* – Northern Germany *Acer rubrum* – No (maybe Canada) *Betula pendula* – Northern Germany *Carpinus betulus* – Northern Germany *Liriodendron tulipifera* – Seeds from planted trees in southern Germany, no more information	No
German 2	No	No
Holland 1	*Acer platanoides* – Hungary *Acer rubrum* – No *Betula pendula* – Holland *Carpinus betulus* – Holland and Hungary *Liriodendron tulipifera* – No	No
Holland 2	*Acer platanoides* – Holland *Acer rubrum* – No *Betula pendula* – Holland *Carpinus betulus* – Germany and Hungary *Liriodendron tulipifera* – No	No
Holland 3	*Acer platanoides* – Holland *Acer rubrum* – No *Betula pendula* – Holland *Carpinus betulus* – Holland *Liriodendron tulipifera* – No	No
Holland 4	*Acer platanoides* – Several seed sources from UK, Germany, France and Holland *Acer rubrum* – No *Betula pendula* – Germany and UK *Carpinus betulus* – Holland *Liriodendron tulipifera* – No	No
Holland 5	All over Europe from different seed sources – differ from year to year	No
England 1	*Acer platanoides* – Several seed sources in UK *Acer rubrum* – No *Betula pendula* – Several seed sources in UK *Carpinus betulus* – Several seed sources in UK *Liriodendron tulipifera* – No	No

Table 3: The survey results from the category 2 nurseries.

Nursery	Question 1	Question 2
German 1	No	No
German 2	No	No
German 3	No	No
German 4	*Acer platanoides* – Local source, northern Germany *Acer rubrum* – No *Betula pendula* – Local source, northern Germany *Carpinus betulus* – Local source, northern Germany *Liriodendron tulipifera* – No	No
German 5	No	No
German 6	No	No
Holland 1	*Acer platanoides* – Holland, Belgium or Germany *Acer rubrum* – No *Betula pendula* – Holland, Belgium or Germany *Carpinus betulus* – Holland, Belgium or Germany *Liriodendron tulipifera* – No	No
Holland 2	No	No
Holland 3	Holland, Belgium or Germany	No
Holland 4	No	No
Holland 5	No	No
Holland 6	No	No
Holland 7	No	No
England 1	No	No
England 2	*Acer platanoides* – Local source, Kent, UK *Acer rubrum* – No *Betula pendula* – Local source, Midlands & Scotland UK *Carpinus betulus* – Local source, Kent, UK *Liriodendron tulipifera* – USA (no more detailed info)	No
England 3	No	No

Dr Henrik Sjöman is a Lecturer at the Swedish University of Agriculture Sciences and a Scientific Curator at Gothenburg Botanic Garden.

Harry Watkins is Director of St Andrews Botanic Garden. He researches distributions and physiologies of plants, with a particular interest in translating research into green infrastructure practice and as part of this, is actively involved in developing species selection and biosecurity guidance for industry.

Issue 195: Winter 2021

Menai whitebeam – fewer than 50 individuals in the wild. (Photo: Robert Blackhall-Miles)

TAKING ACTION TO CHANGE THE STATE OF THE WORLD'S TREES

Megan Barstow

The Global Tree Assessment (GTA) is an initiative to produce conservation assessments for all the world's tree species. Work began on it in 2015, and in September 2021 the results were published in the world's first *State of the World's Trees* report.

The report revealed that one third of the world's tree species are at risk of extinction in the wild, equivalent to 17,500 species. This includes 440 trees with fewer than 50 individuals in the wild. The report also identified that the three major threats to the world's trees are agricultural expansion, logging and livestock grazing. Due to these threats and a variety of others, 142 tree species are already assessed as Extinct.

The State of the World's Trees compiles the work of over 500 individuals and 60 institutions, including botanists, taxonomists, university students and researchers, hosted in the world's botanic gardens, arboreta, forestry institutes, museums, herbaria, universities and conservation organisations. This collaboration has led to an additional 30,000 assessments for trees over the last five years.

Additionally, the report gave us a unique opportunity to perform a gap analysis for global tree conservation efforts. Optimistically, it found that 30% of threatened tree species were found in ex situ collections and 64% were found in protected areas.

The Global Tree Assessment and the State of the World's Trees report were led in partnership by Botanic Gardens Conservation International (BGCI) and the IUCN Species Survival Commission (SSC) Global Tree Specialist Group (GTSG). The former coordinates a network of over 500 of the world's botanic gardens, arboreta and botanical institutions, while the latter is a group of over 100 experts with regional, taxonomic or general tree expertise. The coordination of these networks enabled one of the largest conservation assessments ever to be achieved.

More data for tree conservation

The increase in the number of tree assessments available is essential to provide a roadmap for conserving threatened trees in the wild. It ensures that the most threatened trees can be prioritised for conservation, as well as raising awareness of the plight of trees. The report shows that we need to be protecting trees in our woodlands and forests as well as planting and restoring tree populations.

Conservation of trees is required to tackle major threats to the species, including land-use change for cropland and pasture, as well as logging. The State of the World's Trees report also identifies residential and urban expansion, as well as an increased occurrence of fire, as major threats to trees, while others may be impacted by invasive pests and diseases.

These threats are not impacting specific tree groups or regions but globally, representing an array of threats impacting all trees. In particular it was highlighted that climate change is an emerging threat and hence tree conservation needs to begin now to protect these species and future proof tree conservation activities.

As the temperature and weather of the world change, many trees risk losing areas of suitable habitat. This affects species in both temperate and tropical habitats, with Cloud Forest tree species of Central America being at particular risk. At least 180 tree species

What can we learn from an old oak with so many 'defects?' Over the past centuries it has developed stub ends resulting from high winds and ice storms, developed natural hollowing, survived more than one lightning strike, undergone retrenchment from maybe the natural ageing process, and experienced root breakage as a result of high winds or the deep ploughing of ancient wood pasture, followed by intensive farming for 20 years from the 1940s and the inevitable changes in the biodiversity of the soil. In the UK, arbs are so fortunate to have such classrooms. Please don't take them for granted. Remember, Alex Shigo said, 'Go out and look.' I wonder where we would be today if tree greats like Alex Shigo, Claus Mattheck and others had had their formative years wandering amongst the ancient oaks growing downwards at Windsor.

are directly threatened by sea level rise and severe weather events. This threat is most severe to island species, including magnolias in the Caribbean.

Call to action

The *State of The World's Trees* report provides a call to action to look after the world's threatened trees and five key actions needed to achieve this:

- Extend protected area coverage for threatened tree species.
- Ensure that all globally threatened tree species, where possible, are conserved in botanic garden and seed bank collections.
- Increase availability of government and corporate funding for threatened tree species.
- Expand tree planting schemes, and ensure the targeted planting of threatened and native species.
- Increase global collaboration to tackle tree extinction by participating in international efforts such as the Global Conservation Consortia.

BGCI and the IUCN SSC GTSG are already working towards these goals and are putting in place systems to help practitioners in their tree conservation efforts.

Tracking conservation status and action for trees

The data from the Global Tree Assessment summarised in the *State of the World's Trees* report can be found in BGCI's GlobalTree Portal. This online database collates data from GlobalTreeSearch, a list of the world's tree species and their country-level distribution, and ThreatSearch database, the largest collection of plant assessments including national, regional and global assessments for plant species.

The portal also includes the tree Conservation Action Tracker which shows which conservation activities are in place for each tree species. This is compiled from a variety of sources including BGCI's GardenSearch and PlantSearch databases. The latter is a regularly updated list of plant collections (living material, seeds, germplasm etc.) held in the world's botanical facilities. Additional data can also be provided for tree conservation efforts such as in situ, restoration and propagation activities.

Using the GlobalTree Portal, you can find a species' country-level distribution, conservation status on the IUCN Red List or ThreatSearch assessment and the conservation action in place. It is also searchable at country and global level, to identify which countries have the most trees, the level of threat per country and the overall extent of the conservation of endemic trees per country. This tool can be used to leverage governments and policy makers to take action for their nation's trees.

All data compiled for the Global Tree Assessment (and made available via the GlobalTree Portal) is regularly updated, with new assessments being added as they are published on the IUCN Red List of Threatened Species and tree names being added or edited in the light of new taxonomic or geographic information. Currently the portal documents 58,497 tree species, of which 33,910 have an assessment on the IUCN Red List.

Taking action for threatened tree species

Botanic Gardens Conservation International and GTSG not only assess the conservation status of trees, they also provide expertise and lead on numerous on-the-ground, practical tree conservation activities. Therefore, following the results in the *State of the World's Trees*, we are now ready to take action for the world's threatened tree species.

This work is carried out through the Global Trees Campaign (GTC), a joint initiative between BGCI and Fauna and Flora International which has the goal of eliminating tree extinction. Over the past 20 years GTC has worked to conserve 400 threatened tree species in more than 50 countries through on-the-ground partnerships.

The Global Trees Campaign provides training in collection, nursery and propagation management for trees across the globe, building capacity and creating jobs for local communities. These efforts have led to the increase in wild population size for 60 tree species, managed and reduced threats for 200 species and planting over 700,000 seedlings of threatened trees globally.

Global Trees Campaign projects are tailored and flexible to the needs of the project partners and the tree. They work on a species-by-species level to make sure no tree goes extinct, and GTC is the only organisation globally taking this approach. Working at this level means that several species which had previously been considered not able to be propagated now persist in nurseries and planted in situ.

In September, the GTC published its own report highlighting the different approaches to tree conservation it has honed over the last two decades: *Securing a Future for the World's Threatened Trees – A Global Challenge*.

Restoring the Atlantic Rainforest

In Brazil, GTC funded work with Jardim Botânico Araribá (JBA) to protect the Brazilian Atlantic Forest. Despite its status as an important biodiversity hotspot, the Atlantic Forest is recognised as one of the most

Mulanje cedar seedlings ready for planting. (Photo: BGCI)

degraded ecosystems on the planet. The JBA is situated on a 30-hectare site in one of the few remaining fragments of this forest and the team has been working since 1987 to maintain and restore it.

Their current restoration efforts intend to restore not only specific plant species, but also the ecosystem as a whole. So far, 20 hectares have already been brought under restoration with native species. After 30 years of restoration practices, four headwaters have reappeared which feed the closest city from the botanic garden (Amparo – São Paulo, Brazil). The restored forest protects the river banks, preventing silting and protecting the river water quantity and quality.

JBA integrates threatened tree species into restoration, including the Endangered *Paubrasilia echinata*, Vulnerable *Cedrela fissilis*, Critically Endangered *Chloroleucon tortum* and Vulnerable *Zeyheria tuberculosa*. The plants used for restoration projects are grown in partnership with a commercial nursery, Ambiental mudas, which also supplies these native tree seedlings to customers for planting in their local area. As a result, the species are becoming part of the local supply chain of native tree species in Sao Paulo.

Saving Malawi's national tree

The Save our Cedar project aims to protect Malawi's national tree in the wild. The Critically Endangered Mulanje cedar – *Widdringtonia whytei* – is one of the flagship GTC Programs and highlights the benefit of protecting a single keystone tree species in its habitat.

Mulanje cedar is found naturally only on Mount Mulanje in the south-east of Malawi. The tree is highly valued for its durable and fragrant timber and has been commercially exploited since the 1890s. Mulanje cedar recently reached the point of near extinction due to illegal logging, driven by limited employment opportunities in the region for local communities. This removed the natural future seed source from the mountain, whilst increasing man-made fires have reduced recruitment of remaining seedlings and young trees.

The Save our Cedar project is led by the Mulanje Mountain Conservation Trust, the Forestry Research Institute of Malawi and BGCI. It has set up eight community nurseries around Mount Mulanje with more than 80 community members taught how to propagate Mulanje cedar seedlings, ready to be planted back onto the mountain.

Over 400,000 seedlings were purchased from community nurseries and planted on the mountain by local people, providing employment opportunities and vital income. Restoration experts from the Ecological Restoration Alliance of Botanic Gardens are also helping to improve planting practices so that more trees survive and grow better. An extensive network of firebreaks is maintained on the mountain to protect planted seedlings.

Alternative sustainable uses of Mulanje cedar trees are being investigated that could provide additional benefits to local people. This includes investigation into the production of essential oils from the tree's wood and leaves.

Scaling up tree conservation

BGCI and GTC are further scaling up tree conservation through the establishment of a suite of Global Conservation Consortia (GCC). The GCC aim to catalyse groups of institutions and experts to collaboratively develop and implement comprehensive strategies to prevent the extinction of priority threatened tree groups.

The GCC are mobilising botanic gardens and related partners across the world to work to conserve threatened tree species. Target genera include those that are technically challenging to manage, including those that cannot be seed banked, as well as tree groups that are overlooked by other sectors and those that provide opportunities to build capacity for tree conservation in centres of diversity.

Primary objectives include coordinated *in situ* and *ex situ* conservation efforts and dissemination of species recovery knowledge. So far there are consortia for *Acer*, Cycads, Dipterocarps, *Magnolia*, *Nothofagus*, oaks and *Rhododendron*. Currently these groups include more than 800 threatened species and the model is now also being applied to highly threatened non-tree groups, including *Erica* species.

Final words

It is essential that we take care of our trees. The *State of the World's Trees* report finds that 1 in 5 trees has a recorded use, the most common recorded on the IUCN Red List of Threatened Species being for construction. At least 3716 species are employed for this purpose. Other uses recorded for trees are medicinal, ornamental, fuel, food and handicrafts or household goods. Trees often have strong cultural values for local peoples.

As well as the physical goods trees provide, they are essential to life on Earth and the root of many global systems. They help regulate the climate, weather, soil and carbon and are ecosystem engineers, providing habitat to thousands of plant, animal, fungal and microbial species. It is for these services that trees are broadly getting more attention in the press and media.

As a community of botanists, arborists and conservationists, it is important that we make sure this attention is correctly placed – that it uplifts communities and individuals already succeeding in tree conservation efforts and

who already have the knowledge to save and care for trees.

We need to ensure the right trees are being planted in the right place, benefitting both people and the planet in these activities.

The next stages of the Global Tree Assessment are to complete assessments for the remaining tree species that do not have them and ensure all tree assessments on the IUCN Red List of Threatened Species are up to date.

The information currently available in *The State of the World's Trees* and *Securing a Future for the World's Threatened Trees – A Global Challenge* provides the evidence and framework with which to save the world's tree species.

For more information

Botanic Gardens Conservation International. **www.bgci.org**, Twitter: **@gtsg_gta**

Global Tree Assessment: **www.bgci.org/our-work/projects-and-case-studies/global-tree-assessment/**

Global Tree Portal: **www.bgci.org/resources/bgci-databases/globaltree-portal/**

IUCN Red List of Threatened Species: **www.iucnredlist.org/**

Global Trees Campaign: **globaltrees.org/**

Megan Barstow is a Conservation Officer. She works on the Global Tree Assessment producing global red list assessments for timber species and different taxonomic groups. She also supports GTA partners in Papua New Guinea and the Southeast Asian region.

HOW CAN YOU HELP TO SAVE THREATENED TREES?

There are very few trained tree climbers across the African continent and tree climbing equipment is limited.

Fancy a holiday? You'll need to pay for your flights and insurance, but BGCI will be able to set up an experience of a lifetime, putting your tree climbing skills to the test helping to collect seed from Africa's threatened tree giants.

Calling all suppliers of tree planting equipment! We can make sure a donation of ropes and other equipment gets to a good home and helps to save threatened tree species.

Please get in touch with globaltrees@bgci.org

LOVE THY NEIGHBOUR?

A SAD STORY OF NEIGHBOURS AT WAR

Elizabeth Nicholls

When a serious dispute arises between neighbours, it can quickly result in them going 'to war' with each other. What are the common issues encountered and how can these effectively be resolved?

'A man's home is his castle' as the saying goes, and never a truer word was spoken. In these days when many people do not know their neighbours or have any real interaction with them, things can get a little heated when issues regarding property arise. What starts out as a relatively small issue, from an outsider's point of view, can turn into a lengthy neighbour dispute, continuing for several years and even decades.

According to the Metropolitan Police, the top five causes of dispute between neighbours are:

1. noise, such as loud music and barking dogs
2. parking
3. property boundaries
4. overgrowing trees and hedges
5. children playing in the street[1]

Anecdotal evidence from local authorities suggests that since Covid-19 and lockdown, there has been a marked increase in reported neighbour disputes. Small disagreements can become big issues, and in the absence of communication to resolve the dispute, people feel they have no option but to commence legal action.

Japanese knotweed (JK)

How would you feel if a group of triffids moved into your prize-winning garden? This is how most people feel when they discover they have been invaded by 'the weed'. JK's potential to damage can affect the desirability and the value of a property significantly. There may be

1. Metropolitan Police 'Disputes with Neighbours': **www.met.police.uk/advice/advice-and-information/asb/asb/antisocial-behaviour/disputes-with-neighbours/**

issues with getting insurance and sometimes a mortgage. JK can spread vast distances and it must be handled as controlled waste. It is classed as a controlled plant under the Wildlife and Countryside Act 1981, Section 114 (2). It is not illegal to have JK on your property, but it is against the law to cause or allow the plant to spread in the wild. The Anti-social Behaviour Crime and Policing Act 2014 also provides for criminal sanctions for those who ignore their responsibilities in preventing the spread. No-one wants to have JK on their property and when it does arise, neither side of the fence wants to have responsibility for it. This may cause a dispute over who should pay for treatment.

Trees

Everyone reading this article is interested in trees and will no doubt be highly familiar with neighbour disputes arising from them. Trees provide considerable benefits to all and are beautiful to some. To others, however, trees in and around their property are a menace and a nuisance. Neighbour issues arising from trees are highly factually dependent, that is, they depend on the specific facts of the case.

Often people think it is all about the law being black and white; it isn't. Nuisance cases more often than not turn on facts. For example, what area is the nuisance in? Is it a grimy industrial area, is it in the countryside, or is it in an urban residential area and what impact does it have? Who actually owns the tree can often be a factual issue to be determined. When faced with issues around trees, neighbours can (and often do) lose any ability to think rationally. Threats of resolution by chainsaw (with no appropriate PPE or training!) are hurled over the fence for the other side to consider. Trees know no boundaries, of course. High hedges, overhanging branches, root encroachment, subsidence, dried up lawns and casting shadows, to name but a few, are serious issues which can become conflated with other areas of dispute.

Knowing your boundaries

Boundary issues are among the most contested neighbour disputes and often the most difficult to resolve. Unfortunately, Land Registry plans may not be as helpful as hoped, and frequently there are disputes over fence posts, gateposts and where the 'red line' ultimately should be. The red line has clearly washed away since the property was built (although many still seek it out). Now the neighbours are left with either working it out or slugging it out, with lawyers and surveyors investigating the 'scene of the crime'. Clients feel wounded and 'invaded' by the neighbour who has crept over to their side in the middle of the night and ultimately 'stolen' some of their land. Concrete patios, overhanging or incorrect extensions and simply moving the fence line can all be the starting point for a little battle that can brew into a war. Sometimes as little as 10cm is in dispute, but size does not matter here.

Other nuisance

Nuisance knows no limits and anything is possible. Burning waste in the garden (often by tradespeople), building extensions (that go on for years), children breaking windows with tennis balls (deliberately), chickens and cockerels making noise (in the country), people smoking in the garden (how dare they?), playing a musical instrument (badly) – basically anything and everything that could potentially get on someone's nerves – these are all things that cause disputes between neighbours. Who wants noise? No-one, except when they themselves are the creator. Is digging up your own back garden with a 30-tonne digger a nuisance? Yes, if someone else is affected by it.

The final straw

It is easy to see why neighbour disputes can cause so much turmoil. It is not only the implications for land, property and money that are considerable, but the emotional cost to the parties involved. The longer the dispute continues, the worse it is likely to get. For those involved it becomes a focus, sometimes a hobby, sapping their mental and emotional energy and often exhausting their finances.

By now, relationships have, more often than not, completely broken down, parties can no longer communicate effectively, if at all. One party says, 'Enough is enough!' and they start looking for legal advice to take the matter to court. They picture themselves giving text-book evidence to the Judge, whilst the other side is tied up in knots by a barrister's skilful cross-examination.

But what is the alternative?

Civil mediation can resolve disputes without going to court. The mediator is a neutral person who assists the parties to reach a conclusion that they all agree with. The mediator encourages the parties to rethink their approach and reality-test their assumptions.

It can take place quickly, and at any time during the battle (the sooner the better, quite often). The mediation could take one day, the costs of which are shared between the parties. Professionally run, mediation can be used for a dispute of any kind, including contract, neighbour disputes, building disputes and employment law issues. These can be of any value; complex and high-value disputes are regularly settled by mediation. If necessary, a mediation can take place on site, examining the issues in situ with third-party or expert input if necessary. In mediation, the parties control the process and a settlement agreement is usually drawn up the same day – perfect for resolving knotty, branchy, nuisance-causing, war-making problems between neighbours.

Should you wish to refer a matter or a client that you are dealing with to mediation, or have any other question relating to trees, planning, or any other legal issue, please contact the clerks at 4-5 Gray's Inn Square.

Elizabeth Nicholls is a barrister, civil mediator and arbitrator specialising in chancery work at 4-5 Gray's Inn Square, London. She is also a member of the Arboricultural Association. She can be contacted on 020 7404 5252 or clerks@4-5.co.uk

1. A black poplar near Pontrilas on the English/Welsh border; it is estimated to be roughly 120 years old.

2. An experimental footway widening in Newport city centre, south Wales.

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IS THERE A PLACE FOR ANCIENT STREET TREES?

Neil Davies

Like many arboriculture professionals, even after 25 years in the industry, I still have questions about trees that I don't know the answer to.

'While surveying street trees recently a thought occurred to me that although there is great work being done across the country to retain and maintain our urban street tree stock, are there any long (really long) term plans for them? If we are to retain these wonderful green assets, they will, by their nature, increase in value and on reaching ancient status they may be considered as irreplaceable habitat. (For the purposes of this article we'll take ancient to refer to both ancient and veteran trees.)

The many benefits of trees are well known here so I'll not preach to the choir but as trees are a hot topic at the moment, could it be a good time to raise a tricky question? Is there a place for ancient trees in our towns and cities?

I hope so, but to try and understand the question, I split it into several points: are there any existing examples, is there opportunity to have ancient urban trees, and what should we do about it?

I'm all for learning from others so I started with the Ancient Tree Hunt's web-map to see if there are any ancient urban street trees within reasonable distance of my South Wales home. My hope was that I could visit the tree and perhaps contact the tree officer to discuss its

management. I also asked my local tree officer, who, like many others, has an exceptional knowledge of her area. Other than trees in churchyards, public open spaces and formal planting away from the streets, there were no ancient urban street trees to be found. This is likely due to bombing during the Second World War throughout Cardiff, Swansea and some of the surrounding area. In the haste to clear up and rebuild, it appears tree preservation was not high on the agenda. The urban street trees in the area are less than 90–100 years old. There are exceptions in more rural areas, such as the native black poplar in photo 1. However, if there are any good examples out there, I'd love to hear about them.

Future ancients?

So it appears that we may not have any ancient urban street trees at the moment but we do have large mature urban street trees that have potential to become ancient given sufficient space and consideration. This leads on to the second point. Large mature street trees clearly need space above and below ground. For these trees, buried services, CCTV sight lines, public footways and conflicts with building and highway maintenance all impact the space available to them. In addition, urban trees are typically kept at a higher state of maintenance than their rural counterparts, having their deadwood, epicormic growth and any significant undesirable feature removed or otherwise addressed promptly. Ancient trees are likely to exhibit cracks, splits, deadwood and other features that may, to the unaware, appear to be indications that the tree is dangerous, in decline and a candidate for removal.

There are of course two elements to consider here. The first is allowing space for existing mature trees by considering approvals and permissions for adjacent land use. Given the various areas of legislation, case law and the value of space in our urban streets, affording future veterans enough space will be difficult, which will require support and enforcement from planning authorities. Secondly, although allowing sufficient space within new schemes for existing ancient and veteran trees is less complicated thanks to the provisions of the National Planning Policy Framework, space for future ancient trees falls to the will and budget of the scheme being developed.

This second point may be trickier as the lifespan of ancient trees may well exceed the design life of the scheme being developed. Thanks to the work of organisations such as the London Tree Officers Association (LTOA), the Trees and Design Action Group (TDAG) and the Arboricultural Association (AA), the understanding of urban trees among engineers, designers and non-arb managers of large trees stocks has hugely improved in the last decade and rightly so. However, it would appear that providing sufficient space for large ancient street trees is still uncommon.

What next?

So what can be done? I don't think there is a single answer. However, I am sure that as arboriculture professionals it's down to us to work together with disciplines outside of our own to understand their constraints and opportunities while communicating those of the tree. We should be ambassadors for skills sharing. Gone are the days of engineers and 'tree huggers' fighting. Collaborative working will be key. For example, rain gardens and SuDS schemes include suitable space but changes to soil hydrology may not be suitable for all existing trees. As active travel routes and cycle lanes become more favourable, the space they occupy may decrease the impact that vehicular traffic has on existing trees. In turn this may lessen the target value when considering the risk posed by adjacent trees. Photo 2 shows an experimental footway widening that incorporates traffic calming and affords more space for the trees.

Perhaps this could be a topic for the forthcoming AA seminars?

If you know of any examples where ancient urban street trees are being successfully managed, I'd be interested to hear from you. You can contact me at **N.Davies@tr33.co.uk**.

Neil Davies is Consultancy Manager at TR33 Ltd in Cardiff. Neil has been in the tree care industry for over 25 years. Although he still works on a wide variety of projects, he is now able to spend more time, with his dog Woody, on sharing arboriculture and countryside knowledge, mentoring and providing informal vlogs for kids and amateurs to learn more about trees and the countryside.

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STEP ONE IN IDENTIFYING FLOWERING CHERRIES

Steve Cox

Cherries are heralds of spring. The earliest *Prunus* species flower while winter still grips the land, but they also mark our progress out of winter and are the main blossoms that are celebrated in spring, the season of hope.

The cherry blossom season extends from February to the end of May, depending on latitude (how far north you are) and altitude (height above sea level). Last year I wanted to learn more about the order of flowering of cherries and so made a series of visits to Dorset and Hampshire gardens to take a look. This article is the result of that initial investigation.

In identifying cherry species, the order of flowering, flower colour and flower type are helpful to bear in mind. There are other blossom trees that follow the cherries: first *Amelanchier*, then *Pyrus*, then *Malus*, then Crataegus and Sorbus, all these genera being of the rose tribe (Rosaceae family).

The first blossoms of spring are the cherry plums, *Prunus cerasifera* (photos 1–3 – all further photo reference numbers appear in brackets). The foliage of these is either green or purple – but the flowers blossom before the leaves open. Never mind, just remember that the green-leaved trees have white flowers and the purple-leaved ones have pink flowers which open slightly later and the pink fades to blush (*Prunus cerasifera* 'Nigra') or white (*Prunus pissardii*/*Prunus cerasifera* 'Atropurpurea'). The flowers are generally small and single,[1] meaning they have only one layer of petals, usually five in number. For me, it's enough to be able to say they are 'cherry plum', or 'purple-leaved cherry plum'.

Most cherry plums are multi-stemmed hedgerow trees, although most purple varieties are grown in small front gardens (the poor man's copper beech). Before the cherry plums are finished, the first of the ornamental cherries begin to flower. 'Accolade' is one of the first, with pink, semi-double flowers (there being more petals per flower, between ten and twelve) of about 4cm diameter covering the branches, each petal with a notch (4 and 5). As the blossoms fade, the green leaves emerge. 'Accolade' looks different from the cherry plums in that it is a single-stemmed, wide-crowned tree that is planted in parks or gardens.

Almond, *Prunus dulcis*, has larger, pink, single flowers that show at this time, too. Almonds tend to be short-lived trees, so they aren't found in many old gardens. 'Pandora' (6 and 7) is a cherry variety with white, single flowers and notched petals that also appears now, and the early *Prunus pendula* varieties have clear, shell-pink, single flowers.

1. Cherry flowers may be white or pink and have varying numbers of petals. A 'single' flower has 5 petals, a 'semi-double' flower has 2 rows of 5 petals and a 'double' has 3 or more rows. 'Semi-double or double' flowers arise when some of the rows of anthers become petals. **www.treeguideuk.co.uk/cherry-blossom-in-spring/** 'Semi-double or double' flowers arise when some of the rows of anthers become petals. **www.treeguideuk.co.uk/cherry-blossom-in-spring/**

Opposite and above: 1–3. Cherry plum (*Prunus cerasifera*) flowers, in February 2021, Ham Preston. Pink flowers = purple-leaved variety.

4 and 5. *Prunus* 'Accolade', Kingston Lacy, 20 March 2021.

6. *Prunus* 'Pandora', Kingston Lacy, 20 March 2021.

7. 'Pandora'. Note the single notch on each petal.

8 and 9. Blackthorn blossom, Corfe, 17 March 2021.

As the cherry plum flowers fade in the hedgerows, other scrubbier trees there burst into blossom. These are blackthorns, *Prunus spinosa* (8 and 9). The small, white, single flowers are very similar to those of the cherry plums, but there is a hint of brown in their look, from the bud scales and on the flower stalk, and don't forget those sharp thorns on the twigs. Blackthorns can get to the same ultimate size as cherry plums, but they are more often met as trimmed hedgerows or shrubs, whereas the green-leaved cherry plums show most clearly in unmanaged corners of fields or roadsides. Also at this time, it is as though the cherry plums have called to their domestic cousins in our gardens, the plums and damsons, because they now get in on the act and their buds burst into small, white, single flowers, very similar to those already described.

Meanwhile, as spring gets rolling, other early cherries blossom. These might be white or pink, but are usually single. The reference variety to look for is the 'Great White Cherry' – the Japanese *Prunus* 'Taihaku' (10 and 11). This tree, with single, pure white flowers (five petals), gets to around 6m tall and blossoms just before the leaves come out. Its large flowers (5–6cm diameter) keep opening out until they are wide and flat. The leaves add a bronzy tinge to the blossom whiteness.

Left: 10. *Prunus* 'Taihaku', Kingston Lacy, 13 April 2021. Right: 11. *P.* 'Taihaku', Bursledon, 7 April 2021. Note the bronze leaves to the right.

12. *Prunus* x ***yedoensis***, Kingston Lacy, 13 April 2021.

Varieties with white flowers that appear at a similar time as 'Taihaku' include the Yoshino cherry, *Prunus* × *yedoensis* (12), and *Prunus* 'Mount Fuji' ('Shirotae') (13 and 14). The Yoshino cherry flowers spectacularly on bare branches, each single blossom (five petals) opening from a pink bud and fading to white over a couple of weeks. Yoshino cherries get to more than 10m in height.

'Mount Fuji' ('Shirotae') has semi-double flowers of intense whiteness. The edges of the petals are also characteristically ruffled or feathered. Some references say it flowers as the leaves open, but I saw one at Kingston Lacy that was flowering before the leaves appeared, and some internet references say it blossoms before the leaves. Mature 'Mount Fuji' trees are also distinctive because of their flat-topped crowns.

Above and below: 13 and 14. *Prunus* 'Mount Fuji', ('Shirotae'), Kingston Lacy, 13 April 2021.

At the same time as these white flowers, there are more Japanese varieties bursting into pink, and more double flowers are noticeable. One pink variety that blossoms around the same time as 'Taihaku' is 'Beni-yutaka', which has large double flowers that deepen in the centre during the flowering period (15). Another one you are likely to meet is *Prunus pendula*, which has a number of varieties (16).

A little later, coming out with the leaves, are the wild cherries or gean, *Prunus avium* (17 and 18). These can be quite large trees, found in large parks or at woodland edges. The white, single flowers are relatively small, but can smother the whole crown making quite an impact. In parks and cemeteries the variety 'Plena', with double flowers, is more common.

15. *Prunus* 'Beni-yutaka', Kingston Lacy, 13 April 2021.

16. *Prunus pendula* 'Ascendens Rosea', Sir Harold Hillier Garden, 16 March 2021.

17 and 18. *Prunus avium*, small, white, single flowers, Sir Harold Hillier Garden, 20 April 2021.

Above and right: 19 and 20. *Prunus* 'Ichiyo', Sir Harold Hillier Garden, 20 April 2021. A mature tree. Note the larger green pistil in each flower's centre.

21. *Prunus* 'Ukon', Kingston Lacy, 13 April, 2021. There is a distinctive yellow cast to the flowers.

About this time the small tree *Prunus* 'Ichiyo', blossoms too, with profuse pink double flowers (16–22 petals) in drooping clusters of three or four, up to 5cm in diameter (19 and 20). The flowers fade to white before they fall. The flower petals give the impression of a frilly petticoat. The centre of the flower is open where there is a pistil that looks a bit like a leaf (which is the meaning of 'Ichiyo'). Although 'Ichiyo' is normally a small tree, it can get to 10m tall when it is mature.

Once leaves are more prominent, the pink flowers of *Prunus* 'Kanzan', 'Ukon' and 'Shogetsu' appear. 'Ukon' has large, semi-double flowers of an unusual creamy sulphur-yellow colour, sometimes with a pinkish tinge, later white, with a red centre (21). New foliage is a reddish-bronze developing to mid-green.

Prunus 'Kanzan' has pink, almost double (20–30 petals), pendent flowers of about 5cm diameter that emerge just before and at the same time as the green leaves (22). It can get to 9m tall, but is quite short-lived, often not more than 25 years. This variety has been planted very frequently, especially on roadsides in UK.

22. *Prunus* 'Kanzan', Pallington Lakes, 30 April 2021.

23. *Prunus* 'Shogetsu', Kingston Lacy, 27 April 2021.

'Shogetsu' means 'moonlight on the pines', but the variety is also known as 'the blushing bride' (23). It has pink buds from which pure white double flowers about 5cm diameter, with 22–25 frilly petals emerge. The flowers have an open heart at the centre of the petals and hang down in clusters of between three and six on stalks up to 15cm long. The leaves are green.

Once bright leaves are a normal part of our lives again, and spring is well underway, you may see other cherry-like trees beginning to flower with long, thin spikes that have short stalks bearing white flowers. These are likely to be bird cherry (*Prunus padus*) (24). Those long flower heads are easy to distinguish from other cherries. Once you've noticed these flower spikes you will also spot them on laurel bushes. This is because cherry laurel (*Prunus laurocerasus*) and Portuguese laurel (*P. lusitanica*) are in the same genus as cherries. If you're in doubt about whether a flower is a cherry, look closely and you'll see that each one has many stamens (male parts) but only one pistil or style (female parts) at the centre of the ring of petals. The single pistil indicates that each flower will produce one seed at the end of the season – cherries, with a single stone inside the fleshy outer covering. Other rose tribe trees have flowers with more pistils per flower (usually five) and these produce not cherries but apples, pears, June berry or rowan/whitebeam fruits that all contain multiple seeds in the fruit. Hawthorn is the only other common rose-tribe, spring-blossom tree that also has fruit containing a single seed.

At the end of all this, what pointers can we use to guide us through the blossom time each spring? There are too many cherry varieties to learn all of them without putting immense time and effort into it. My advice is: simplify. Divide the blossoming trees into:

- before or with/after leaf emergence
- colour – are the flowers white or pink?
- and are the flowers single, double or something between?

Every locality will have its unique variations of climate but will also have its own spread of population of cherries that may include those described above or others. There are scores of varieties of Japanese cherries that are commonly sold or have been planted in the past, so concentrate on the most obvious ones and get to know the others as they fit around this general outline.

Why so much variation and conflicting detail?

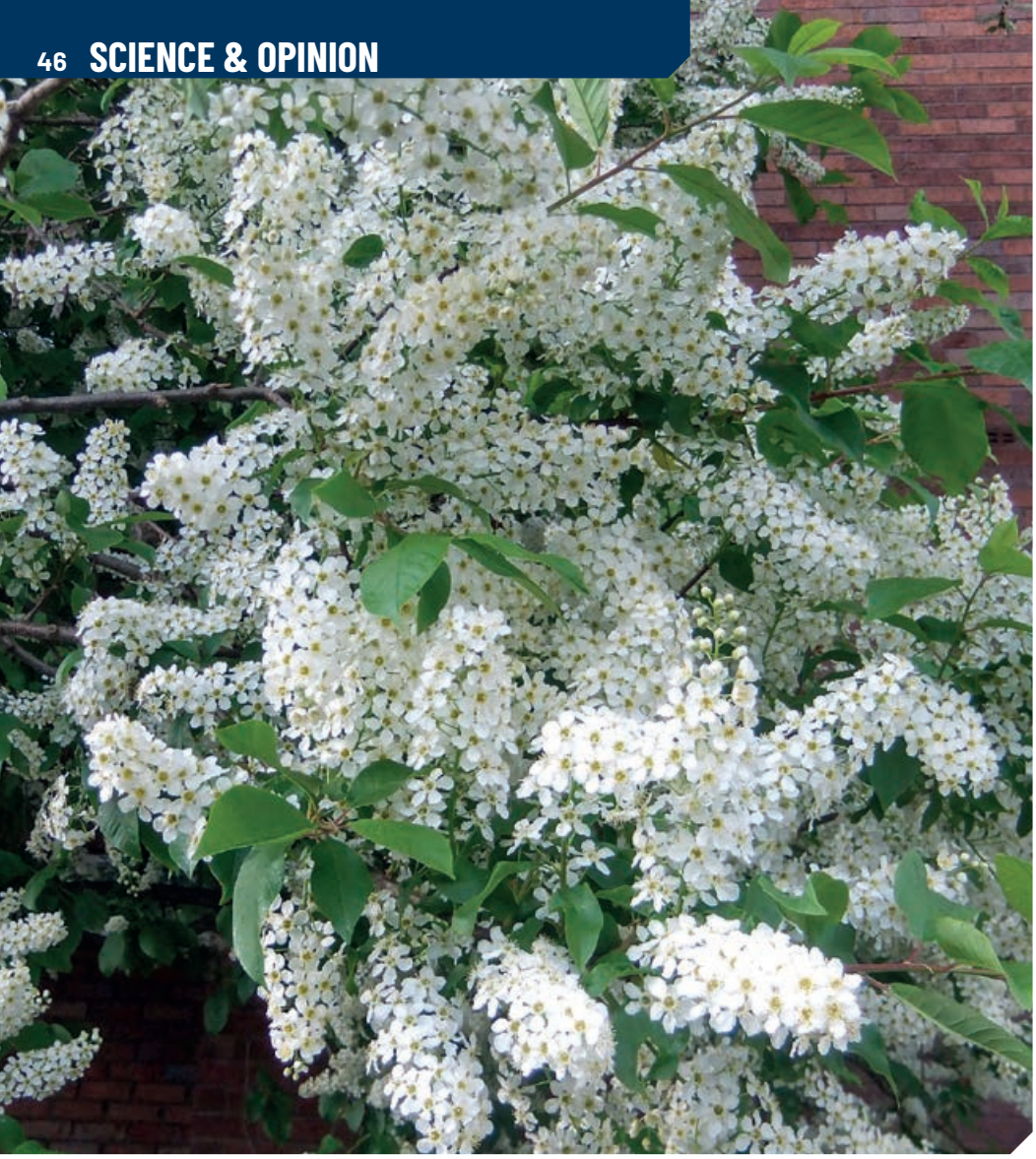
I have found conflicting details in the references I consulted in looking at cherry identification during blossom time. Part of this is due to the long history of cultivation of cherries in the homeland of many of them, Japan. This, allied to the tendency of many of the species to mutate and enable nurserymen throughout the world to create new varieties, makes identification tricky. Varieties that are nearly indistinguishable may be developed at the same time, or in different parts of the world. Some varieties have been confused when they were introduced to new markets, and it is difficult to untangle these issues once the trees are in cultivation and in the landscape. Plus, there are a lot of fine details about which I am still unsure. How reliable are the references claiming the number of petals for each cultivar? I am not absolutely sure.

The flowering order should be fairly stable, despite variations in spring onset. However, this can be affected by topography and microclimate, so use this information as a guide, not as a rigid set of rules. The details included in this article merely provide a start-point for you to find out what is happening in your locality.

Also, with regard to flowering, the history of cultivation in Japan, reaching back hundreds of years, means that there is a long time series of records which show that blossom time has been getting earlier since the mid 1800s. This is currently attributed to the urban heat island effect and part of the global changes to our climate that we are all experiencing.

Alan Mitchell's order of flowering of common *Prunus* with additional observations based on visits to the Sir Harold Hillier Garden and Arboretum (Hampshire) and Kingston Lacy (Dorset), 2021. The boxes with a pink tint indicate species or varieties with pink flowers.

		White or pink flowers	
Timing	**Species**	**Single**	**Double**
First	*Prunus cerasifera*	Small white flowers. Green leaves.	
	P. cerasifera 'Atropurpurea'	Small pink then white flowers. Dark red-purple leaves.	
Early	*P. cerasifera* 'Nigra'	Small bright pink flowers. Dark red-purple leaves.	
	P. spinosa	Small white flowers. Spiney shoot tips. Brownish flower stalks.	
	P. simonii	White single flowers.	
	P. dulcis	Large pink flowers borne singly or in pairs. Later green leaves.	
	P. 'Accolade'		Light-pink, bell-shaped, 4cm, semi-double flowers. Later green leaves.
	P. 'Pandora'	White-pinkish flowers, petal notch. Red autumn colour. 5 petals.	
	P. pendula 'Ascendens Rosea'		Clear shell-pink flowers.
Early Mid	*P. sargentii*		Small, massed, pink to deep pink flowers. Leaf bronze-red. 4cm diameter.
	P. 'Snow Goose'	Pure white single flowers. Ascending bars. Long tassel anthers. Stamens pinken as the flowers mature, developing reds and purples like blots of ink spreading out from the flower centre.	
	P. 'Spire'		Soft pink flowers. Excellent street tree.
	P. x *yedoensis*	Medium blush-pink fading to white flowers wreathed on shoots, slightly almond scented. Before green leaves. 5 petals. 3–3.5cm.	
	P. serrulata 'Shirotae' Synonym 'Mount Fuji'		Large (5cm) white, semi-double flowers, hanging below pale green leaves. 5–11 petals.
	P. serrulata 'Hokusai'		Very weeping. Double pink flowers. Green leaves.
	P. serrulata 'Taihaku'	Huge white single flowers in cluster. Deep red leaves. 5–6cm. 5 petals.	
	P. serrulata 'Cheals Weeping'		Very weeping. Double pink flowers. Green leaves.
	P. 'Pink Shell'	Slender branches with cup-shaped delicate shell-pink flowers with emerging leaves	
Late Mid	*P. serrulata* 'Amanogawa'		Very upright. Pink flowers, opening whiter.
	P. avium	Masses of single white flowers. Green leaves.	
	P. serrulata 'Ukon'		Large yellow-tinged flowers, later white with red centre. Pale brown leaves. Semi-double flowers. 10–20 petals.
	P. serrulata 'Kanzan'		Massed bunches of uniformly purplish-pink nearly double flowers. Dark red leaves. 20–30 petals. 6cm diameter.
	P. serrula	Prolific, pendulous flower clusters on 4cm green stalks. Rounded petals.	
	P. 'Ichiyo'		Double, shell-pink flowers fade to almost white. Circular flowers and frilled petals on long-stalked corymbs. 16–22 petals.
	P. 'Shogetsu' Synonyms: 'moonlight on the pines', 'the blushing bride'		3–6 blooms on stalks up to 15cm long. Light pink buds open to white flowers. 22–25 petals.
Late	*P. avium* 'Plena'		Small, globular, very double white flowers in dense drooping clusters. Green leaves.
	P. serrulata 'Pink Perfection'		Bright pink buds. Big globular pink flowers which pale over time. Brownish, soon green leaves.
	P. serrulata 'Shirofugen'		Pink buds. Hanging, white, large double flowers (5cm) with tinge of pink on reverse of outer petals. Petals become deep pink before shedding. Purple-red leaves. 25–30 petals. Fragrant. Pendulous clusters.
	P. serrulata 'Shimidsu' Synonym: 'Longipes'		Pink buds. Hanging, white, large double flowers. Green leaves.
	P. cerasus 'Rhexii'	Small white button-like flowers. Green leaves.	
	P. serrulata 'Fugenzo'		Deep rose-pink, large flowers borne in drooping clusters. Leaves still red at flowering.
	P. padus	I think bird cherry fits here in the flowering chronology.	



24. *Prunus padus*, long flower spikes.

Where to start if you want to see cherry blossom in UK

Keele University holds the National Collection of flowering cherries. They have been planted there since the late 1940s. Since then, springtime on the campus has become synonymous with cherry blossom, so this is one of the best places to visit to learn about them.

Other places worth checking out:

London
Kew Gardens
Greenwich Park Hill

South England
RHS Wisley, Surrey
Sir Harold Hillier Gardens and Arboretum, Romsey
Dunster Castle, Somerset
RHS Rosemoor, North Devon
Batsford Arboretum, Gloucestershire

Midlands:
Birmingham Botanic Garden

North England
Sizergh Castle, Cumbria
The Stray, Harrogate

Scotland
Pittencrieff Park, Dunfermline
The Meadows, Edinburgh
Princes St Gardens,Edinburgh

Northern Ireland
Ward Park, Bangor

Wales
Dyffryn Gardens, Cardiff

Summary

Hedgerow blossoms at the end of winter are likely to be white. They are cherry plums. Pink blossoms at this time are likely to be seen in gardens; they are purple-leaved cherry plums. (There are also white-flowered cherry plums grown in gardens, don't forget.)

If, a little later, a whole hedgerow has blazed into a white froth it could well be blackthorn (check for the thorns). At this time *Prunus* 'Accolade' should be flowering pink, the first double flower. It will be in a garden or park, not in a field edge. The white *Prunus* 'Pandora' will be flowering around this time too. Check for the single-notched petals.

The Yoshino cherry (white) should blossom before its leaves, around the same time as *Prunus* 'Taihaku', the 'Great White Cherry', which has large, single, white flowers opening to a flat plane and with bronzy leaves jutting into the floral view. If you find a tree covered in white, semi-double flowers without the bronziness, it could be *Prunus* 'Mount Fuji' ('Shirotae'). Pink flowers at this time could well be Prunus pendula or *Prunus* 'Beni-yutaka'.

After this, there will be many garden and park cherries flowering, the most obvious of these is likely to be 'Kanzan' – pink, double flowers pendent on not-very-old trees, likely on a roadside. 'Kanzan' flowers remain pink, but the trees don't last long enough to get to large size. If the pink flowers fade to white it could be *Prunus* 'Ichiyo'. The clinching feature is the thick, green pistil.

However, there are many varieties flowering at this time, so get to know those that are typical in your area and learn their particular attributes so you can pick them out easily. White, double flowers, frilly petals – it could be *Prunus* 'Shogetsu', 'the blushing bride'. Yellow-tinged, almost double flowers – it is likely to be *Prunus* 'Ukon'. Pink, double flowers – there are a lot of options.

In the fields and woods any cherries are likely to be wild cherries (gean) or bird cherry. At this stage of the season, cherries are not the only blossoms on offer. There will be the neat flower heads of Amelanchier, with small, rounded-base leaves already out; apples, with five pistils in each flower; pears, with distinctive black stamens and white petals (rounded-base leaves, too); then *Sorbus* (rowan and whitebeam) that have frothy white multiple flowerheads. Hawthorn is another blossom tree that has cherry-like blossoms. This is usually easily distinguished because the leaves are already out and their shape is quite distinctive. Remember, hawthorn is called 'May' because that's when it flowers. It is also most often noticed as a hedgerow, which makes its identification easier.

Reading this article is step one in flowering cherry identification. Step two is testing it to check if it works where you are, and step three is adding your own observations and insights.

Steve Cox is an AA Registered Consultant who has been working with trees for over 40 years. He began his career in arboriculture at Merrist Wood College, then gained degrees in forestry from Aberdeen and Oxford universities. Steve has worked in Europe, Africa and the Pacific and was a senior tree officer in a local authority before setting up Treecall Consulting Ltd in Dorset in 2003.

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Issue 197: Summer 2022

IMPROVING THE PROSPECTS FOR TWO TREE-DWELLING BAT SPECIES

Jim Mullholland

This article is the first in a pair which details the progress of a five-year research project, part funded by the Arboricultural Association.

'Of the 17 species of bat resident in the UK, 15 are known to roost in trees. The strict legal protection afforded to bats means that their presence is an important consideration for arborists.

Noctule roost.

One of the camera set-ups.

Barbastelle bat.

However, the ecology of bat species makes detecting their presence challenging: bats are small creatures (smallest 3–5cm and largest 6–8cm long), they hide themselves away from view (inside cavities, splits, etc.) and exhibit frequent roost-switching behaviour (as often as every 2–3 days). This creates challenges for those who are tasked with surveying for them.

How do we overcome the odds which are overwhelmingly stacked against us? Essentially, we need to increase the chances of finding bats by looking more frequently. One study showed that the encounter rate for a single visit can be as low 5%. Bizarrely, adding a second non-sequential visit (i.e. a second visit not on the following day) does not increase these odds. The only way of increasing the odds is to visit the tree sequentially: two sequential visits increase the odds to 9.8%. Fourteen visits are required to increase the odds to above 50% (i.e. more likely than not). However, the cost and delay associated with undertaking these surveys are likely to be prohibitive for most situations.

In 2018/19 we undertook a pilot project to investigate whether technology can be used to reduce/replace surveyor effort. This pilot demonstrated that trail cameras, typically used to film wildlife in gardens or locate deer for management purposes, have the potential to replace manual surveyor effort. In 2020, funding was secured from the People's Trust for Endangered Species and the Arboricultural Association, with support from STIHL, to fully test this approach.

Project aims and methods

The project involves identifying existing bat roosts in trees; we achieved this by catching bats and attaching a small radio-tag, which emits a radio signal that can then be followed. We are aiming to monitor 10 tree roosts for each of the two target species: Bechstein's bat (*Myotis bechsteinii*) and barbastelle (*Barbastella barbastellus*). These species were chosen due to their preference for tree roosting. Once the roosts are identified, trail cameras are deployed to capture the bats' movements.

To be successful, there are various challenges we need to overcome. The most significant is trigger time. The cameras have a passive infra-red sensor which triggers them to record. They are manufactured to record large, slow-moving mammals, but we are using them to monitor roosts of small, fast-moving mammals. With this limitation acknowledged, we are testing various factors such as: the position of the camera relative to the roost entrance, distance from the roost entrance, whether photo or video is more effective (the trigger time to take a photo is shorter than for a video), and, if videos are used, what length of video is most effective (the longer the video, the longer the trigger time, the larger the memory card needed and the longer needed to review footage).

Preliminary results

Over the next three years we will evaluate the effectiveness of the trail cameras as a replacement for human effort. However, we do have some preliminary results which I will share here. The most significant is that all cameras which were successfully deployed recorded bats, although there have been a few technical difficulties resulting in unsuccessful deployment, including cameras not pointing at the roost entrance (oops!). This 100% success rate is a significant advantage over that for human surveyors, which, as mentioned above, is woefully low.

Reviewing the footage is a pleasure as it provides an insight into little-studied bat behaviour. We have recorded several instances of different bat species using the same roost at different times – a bit like a time-share. For example, we have recorded noctule bats (*Nyctalus noctula*) and Daubenton's bat (*Myotis daubentonii*) in known Bechstein's roosts and Brandt's bats (*Myotis brandtii*) in a known barbastelle roost.

The overall highlight is a video which shows a weary Bechstein's bat returning to the roost (a woodpecker hole) around 2am, only to

A Bechstein's mother with a juvenile under her wing captured by one of the cameras.

Bechstein's emerging.

be seen off by a great spotted woodpecker (*Dendrocopos major*) who was already in the cavity. I am sorry that I can't share them with you via this medium; however, if you visit my YouTube channel (**www.youtube.com/c/batsintrees**) or social media pages (**@BatsRTS**) you will be able to view these videos and keep up to date with our findings.

I can, however, share photos with you. My favourite shows a Bechstein's bat landing outside the roost with a juvenile bat under its wing – mum providing support whilst the young bat undertakes one its first flights (see above).

The future

As I write this, we have just deployed the trail cameras for 2022. We will revisit them every two months to change batteries, download footage and undertake any maintenance required to ensure they function well.

So far we have demonstrated that these cameras are more effective than humans in answering the first research question – 'Are bats present?' Further refinement and analysis are required to ascertain whether we can answer additional research questions such as: 'What bat species are present?', 'How many bats are present?', 'When are bats present?' It is unlikely that an off-the-shelf trail camera will be able to answer all of these questions. Just how effective these cameras are will be evaluated as the project progresses.

In the next edition of the ARB Magazine, I will provide an update on the second strand of the research project – creating bat roosts in living trees.

Barbastelle roost shared with Brandt's bats.

Jim Mullholland is the Director of BATS Research and Training Services, an organisation dedicated to conservation of bat species through research and education. Among other training, Jim delivers a Bat Licence Training Programme designed to help ecologists and arboriculturists obtain their bat survey licence.

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Figure 1: Ancient *Q. petraea* at Moccas Park. (© Rich Wright)

Issue 197: Summer 2022

OAKS AND FUNGI IN THE UK

Rich Wright, Jasen Finch and **Nathan Brown**

HELP US RESOLVE KEY SCIENTIFIC QUESTIONS ABOUT OUR MAJESTIC OAK TREES AND THEIR FUTURES

The oaks must be amongst the UK's most loved trees. Their tangled branches and grand stature have inspired countless poems, folk tales and artworks, making them an iconic part of the British landscape.

Oaks are the second most common broadleaved tree in UK woodlands (with only birch more common) and the most common in openly grown settings, totalling more than 120 million individuals. They can live to over 1000 years, with some of the oldest, such as King Offa's Oak in Windsor, estimated to be 1300 years old.

Two species of oak are considered native to the UK, *Quercus robur* (pedunculate oak) and *Q. petraea* (sessile oak). *Q. robur* is the more common and widespread of the two species, being especially dominant in the south and east of the British Isles. *Q. petraea* is mainly found in the west and north. Wherever the two species populations overlap it is also common to find hybrid oaks (*Q.* × *rosacea*), which can be more locally common than the parent species in some areas.

The UK has more than 49,000 ancient, veteran and notable oak trees, more than all other European countries combined. These older trees support an incredible diversity of organisms living and/or feeding on or within the trunks, branches, twigs, roots, leaves, flowers and fruits. This makes the UK a hotspot for rare species that thrive within the habitat that these important ancient trees provide.

The UK also hosts the largest concentration of Atlantic oak woodland in Europe, a biodiverse and beautiful habitat found only in small patches of coastal and upland areas. This and other types of temperate rainforests around the world are of global conservation concern.

The history of the medieval British landscape has created conditions that have supported the retention of many ancient oaks, recognised as the most biodiverse microhabitat in the UK, with land management practices such as lowland pasture woodland, deer parks, chases and royal forests all considered to be important contributors. However, land management practices over the last 400 years have lacked the replanting of saplings into these sites to create continuity, and intensified grazing has greatly reduced natural seeding, which has caused substantial gaps in age succession on many of the UK's important oak sites. As well as having potentially unbridgeable generation gaps, these important habitats are threatened by greatly reduced geographical connectivity and pollution. Oak habitat is in decline globally and, in Europe as well as elsewhere, this is considered to be due to a broad range of anthropogenic and environmental factors that in combination have greatly reduced the area of woodland and the quality of that which remains.

British native oaks are also threatened by a growing number of recently discovered syndromes, discussed later. These include acute oak decline, chronic oak decline and sudden oak death, which have likely been brought into the UK through the global transport of plant material. Oaks are also constantly challenged by the native root pathogens in the genera *Armillaria* and *Gymnopus*, and functional leaf loss caused by mildews in the Erysiphales. All of these problems are exacerbated by changes in land use, decreasing habitat and nitrogen deposition.

Despite all of the problems outlined above, we still have an incredible presence of oaks in the UK, and with care and protection we will

Figure 2: Atlantic oak woodland at Wistman's Wood, Devon. (© Rich Wright)

hopefully continue to be outlived by them far into the future. To try to ensure this, Action Oak was launched in 2018. It is an initiative supported by over 30 UK tree, forest, nature and conservation focused organisations with the collective mission to lead the vital work and research needed to protect our native oak trees and safeguard their future. Action Oak supports current research to record changes in the distribution, age and health of our oak trees, including three projects detailed below, where individuals and communities can get involved and contribute important data and understanding to fill current knowledge gaps.

Oak tree biodiversity

Oak trees support over 2300 species of birds, bats, bryophytes, lichens and mammals, and over 1000 species of invertebrate. Around 320 of these species are endemic to oak and a further 229 are rarely found on any other trees. Further, numerous fungi and other microbes inhabit living and dead oak tree tissues, though these are only now starting to be revealed.

Most of the known species dependent on oak trees are invertebrates, and a majority of these interact with the fungi in the tree in some way. Many make their homes and find their food where heart-rot decay fungi have been in action, leaving partially decayed material that is physically broken down by insects, creating mounds of composting wood mulch that creates further habitat for other invertebrates. Some ambrosia and bark beetles bring symbiotic fungi into the oak tree with them in specially adapted 'pockets' on their bodies, called mycangia. Once they have burrowed under the bark, these beetles deploy the fungus where it starts to grow, creating a food source that the beetle then harvests, leaving patterns of adjoining corridors where the decayed wood has been consumed.

The biodiversity that the fungal decay of oak supports goes beyond these saproxylic invertebrates. The hollows that are created by brown- and white-rot fungi become homes to many insects such as bees and ants, but also to a host of small mammals, bats, owls, and other birds, that make their roosts and nests in these dark crevices. It is this amazing engineering partnership, between a tree and wood-decay fungi, that creates this incredibly rich habitat of hollows.

Fungi, heart-rot and oaks

As with all trees, fungi play many essential and formative roles in an oak's life. These range from mycorrhizal associations with the roots that provide critical nutrients to the tree, through to the powdery mildews that cover, feed on and reduce the productivity of living leaves. In some cases the most visible and certainly the most structurally altering of all the fungal relationships is heart-rot.

Figure 3: A cut section through the trunk of *Q. robur*, showing the visually lighter and distinctive sapwood bordering the darker brown heartwood. (© Rich Wright)

Heart-rot, simply put, is the decay of heartwood brought about by fungi and often assisted by other organisms in later stages. Heartwood is the non-functional wood that is formed from sapwood as it senesces. As a tree ages it creates a large central column of heartwood which contains few, if any, living cells.

The heartwood of oak is easily distinguished from the sapwood when looking at a transversely cut slice (Fig. 3). It is darker in colour and contains tannins and other polyphenols, chemicals that are often inhibitory to the growth of many fungi. Heartwood is found in the trunk and larger branches.

Figure 4: ***Fistulina hepatica*****, showing its typical 'liver'-like rich red and glossy appearance which it acquires at the peak of the spore-producing body's life.** (Photo by: Kean10, CC BY-SA 4.0)

Figure 5: Dense clusters of *Laetiporus sulphureus* brackets extending over 2.5m in height on a veteran oak. (© Rich Wright)

Heart-rot at the base of the tree is known as butt rot and that in higher regions is known as top rot. There are two key heart-rotting species in oak: *Fistulina hepatica* (beefsteak fungus) and *Laetiporus sulphureus* (chicken-of-the-woods), which can be commonly found growing from the trunks or larger branches (Figs 4 and 5). Both species have distinctive features, which make them relatively easy to identify. *L. sulphureus* is a bright yellow and orange, fleshy bracket, which resembles foam filler when young and expands into numerous shelves, becoming paler with age. *F. hepatica*, as the specific name suggests, resembles a liver, with deep brown-red colouring, a firm but fleshy texture, and droplets of red guttation that can form on the outside or can be squeezed as a bloody juice from a sliced fruit body.

Figure 6: The Lady in Waiting Oak on the Cowdray Estate, Midhurst, West Sussex.
The heartwood of this tree has rotted away to leave four pillars of cambium supporting the crown and a deep pile of woody mulch. (© Rich Wright)

It is important to emphasise that most fungal species that cause heart-rot are not pathogens; they are saprotrophs breaking down wood no longer functional in water conduction. This historical misconception has perhaps been brought about through the forestry focus on the loss of usable timber that heart-rotters cause. There are, however, some pathogenic heart-rot fungi, such as some *Armillaria* species, that do kill living cells as they make their way towards the heartwood. There are also non-pathogenic fungi that can sometimes cause limb loss or other structural issues, such as *Laetiporus sulphureus*.

Heart-rot fungi over time can spread into large areas of heartwood and, as the wood loses structure through the decay process, can create hollows, eventually leaving only a relatively thin layer of functional sapwood and bark and an empty cavity where the heartwood once was. In extreme cases, like the Lady in Waiting Oak pictured here (Fig. 6), the majority of the heartwood of the trunk can be consumed, and even with some loss of bark and sapwood, the tree can support itself and continue to grow for many years.

Hollowing occurs at different stages in a tree's life, depending on the species. Less than 1% of *Quercus robur* trees younger than 100 years old have hollows, 50% have hollows by 200–300 years, and all are hollowing by 400 years. In comparison, 25% of beech trees have heart-rot before they reach 100 years old, at least 50% are hollowing between 100–300 years, and all have hollows by 300 years.

Heart-rot is an important and natural part of the ageing process for the tree. The rotting heartwood, brought about by primary and secondary decay species, releases nutrients which are delivered directly to the roots of the tree, and in some cases aerial roots form on the interior of a developing hollow to gain early access to this private food source. It is as though the tree has been adding into a savings account for later life year on year and the fungi help to unlock those savings.

Threats to oak, oak decline and AOD

Oak is a resilient species; *robur* (the Latin name for English oak) is the root (and stem) of the word robust, one of the original definitions of strength. This character likely derives from the properties of its wood but also applies to the trees themselves. Nevertheless, there are a growing number of threats to oak survival, including the changing landscapes and climates in which they are growing, as well as various pests and disease threats.

Britain's native oak are affected by relatively few introduced species, especially if gall wasps such as *Andricus quercuscalicis* (cause of the knopper gall) are overlooked because they affect the acorns rather than the health

Figure 7: OPM. Late instar caterpillars moving in procession (left) and a nest (right). Nests are made on oak branches and stems and range in size. They are built in early summer from silken webbing and often contain moulted skins. (© Nathan Brown)

Figure 8: Fruiting bodies of *Gymnopus fusipes* are often found in clusters close to the root buttresses. Here the 'spindle shanks' that give rise to its common name are clearly displayed. These twisted stipes taper toward the base. (© Nathan Brown)

Figure 9: An AOD-affected oak. Black liquid runs out from between the bark plates at multiple locations on the stem. (© Nathan Brown)

of the tree. Oak powdery mildew (*Erysiphe alphitoides*) arrived in approximately 1910 and is now widespread. This fungus infects oak leaves and is distinguishable due to the presence of a white felt-like coating on affected leaves before they brown and wither (symptoms become most severe late in the summer). Oak mildew decreases the photosynthetic potential of affected trees and severe and/or repeated years of infection may have long-term impacts on tree health, with seedlings and young trees especially at risk from mildew outbreaks. The impact of mildew is also heightened when oak trees have already been defoliated by insect feeding earlier in the year.

The most notable recent arrival also acts to defoliate native oak. The caterpillars of the oak processionary moth (OPM; *Thaumetopoea processionea*) feed collectively in oak crowns (Fig. 7). OPM arrived in London between 2005 and 2006. Despite active management campaigns this species is now well established, with a range that expands annually into the surrounding counties. Further introductions have only been detected sporadically outside this area on recently planted material, although 2019 saw a significant upsurge in discoveries and 70 sites were eradicated. As well as tree health impacts, this species is a serious risk to human health, as caterpillars have hairs that cause skin irritation and allergic reactions. Any possible sightings of OPM should be reported to Forest Research using the Tree Alert web page (**https://treealert.forestresearch.gov.uk/**).

Of the existing and emerging diseases, oak declines are increasingly reported by tree managers, with their distribution, incidence and severity likely to further increase due to climate change and increasingly disturbed environments. Decline diseases are complex, resulting from the actions of multiple biotic agents acting on a host tree, and their development is influenced strongly by environmental conditions. The different agents may act sequentially or concurrently to reduce host vigour. In simple terms, the onset of decline follows a period where trees have sub-optimal growth and their condition is limited by the environment. Soil conditions, nutrient availability, between-tree competition, compaction and root damage can all play an important role in the early stage of decline, but drought is the most common 'predisposition' factor. Hosts that have been weakened by the actions of predisposing factors then become susceptible to various biotic 'contributing' factors which further reduce vigour and may ultimately cause the tree to die.

Oak decline is a broad term applied to various poor-health conditions of oak. Historically this has been used as an all-encompassing term to cover many signs of ill health on oak trees. Recently attempts have been made to focus in on specific sets of conditions within the broader topic of oak decline. The rate at which host health is reduced has been used as a first division to separate causal pathways and broadly this corresponds to agents that affect different parts of the tree. Chronic oak decline (COD) describes a slow-acting process covering decades where the trees health gradually reduces. COD is most commonly linked to the actions of fungal pathogens that degrade live root tissue; *Armillaria* species and *Gymnopus fusipes* (Fig. 8) are the species most frequently isolated from decaying oak roots in the UK. In contrast, acute oak decline (AOD) causes a fast reduction in tree health acting over years rather than decades.

In the UK, an emerging form of acute oak decline affects the main stems of oak trees (Fig. 9). On the outer bark, black, vertically arranged, weeping stem lesions and, in at least one third of cases, the D-shaped exit holes of the adult native two-spotted oak buprestid *Agrilus biguttatus* (Fig. 10) are distinguishing features. In the inner bark, larval galleries and bacterial lesions are visible close to the cambium. The degradation of live bark tissue has been attributed to a bacterial pathobiome (multiple bacterial species that act together to hasten tissue decay). Three species of bacteria play key roles in stem decay, primarily *Brenneria goodwinii*, which is supported by *Gibbsiella quercinecans* and *Rahnella victoriana*. These species become especially active in the galleries of *A. biguttatus* and a link between the beetle and the pathobiome is currently being investigated.

AOD-affected trees are found in southern England, from the East Anglian coast to the Welsh borders, and no further north than southern Yorkshire or the edge of Lancashire. AOD has strong links to environmental predisposition: it occurs in areas with low rainfall, high temperatures and where deposition of nitrogen oxides is high. It is therefore likely that these factors are crucial in the initial weakening of the trees, and this is an active area of current research, along with interactions between AOD and COD (which can both be found on the same trees). Reassuringly, trees with AOD stem lesions do not always die; in fact up to 40% of monitored trees produce callus tissue over the decay and enter remission. The number of trees that recover varies between years, which indicates that weather patterns (particularly periods of drought, which may limit recovery) affect the predisposition of oak trees. Monitoring the underlying health of the nation's oak trees is therefore a crucial step in understanding the drivers of predisposition and decline.

Figure 10: A female *Agrilus biguttatus* beetle searches for a place to lay her eggs. These shiny green jewel beetles are easily distinguished thanks to their tapered shape, large eyes and two white spots (one on each wing case).
(© Nathan Brown)

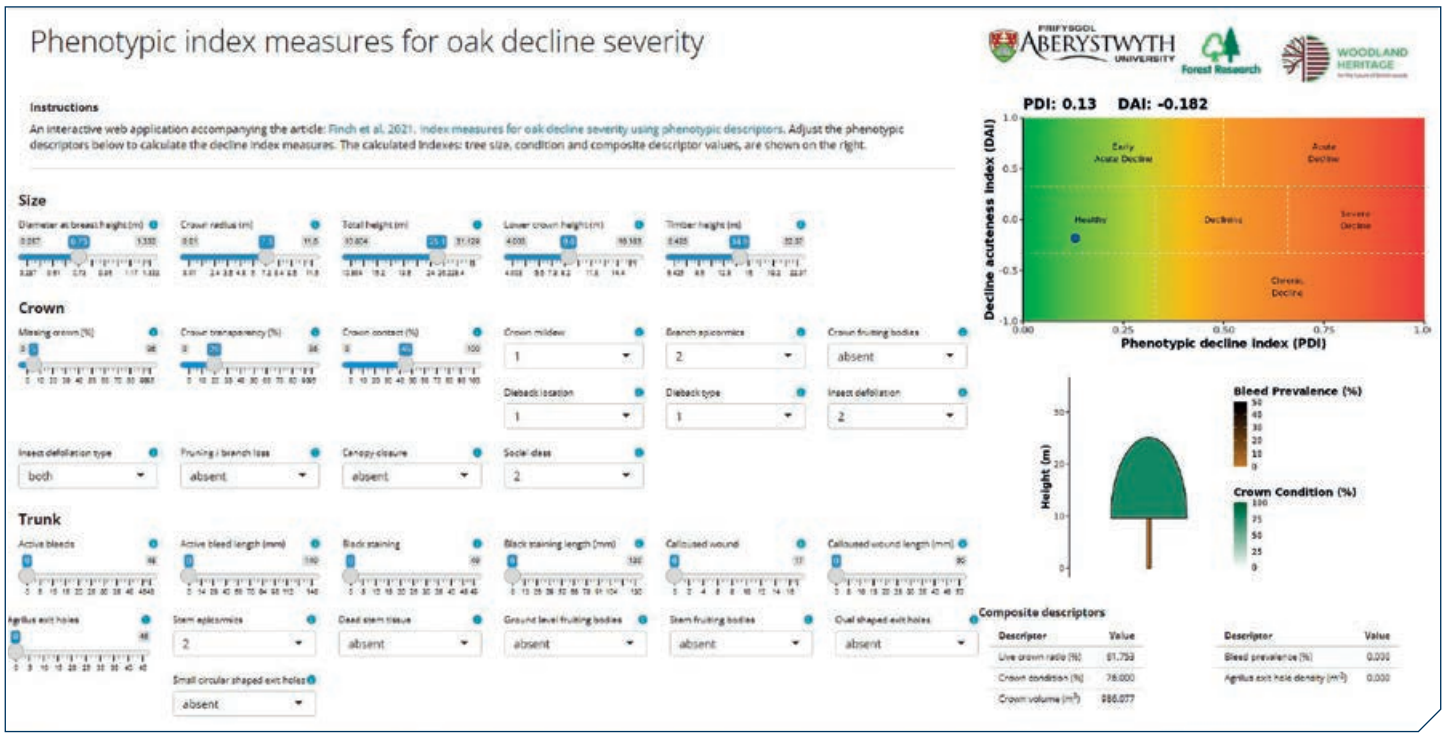


Figure 11: A screen shot of the interactive decliner dashboard.

Oak condition monitoring

The health of trees is reflected in their crowns. The number of leaves they have on their branches influences the amount of energy they can capture through photosynthesis. By monitoring crown condition, we gain an insight into the underlying health status of oak, which in turn can help reveal long-term trends and the potential impact of environmental factors that may act to predispose trees to decline. Oak crown condition is monitored by Forest Research at 85 plots across Great Britain. These plots provide vital historical context; they were established in 1989 when concerns about pollutant deposition and acid rain were prominent. However, it is unclear how representative they are of the nation's oaks more generally. All plots are in oak-dominated woodland and this means that trees outside woodland are not well represented at all. Trees in the wider treescape are likely to have several additional factors that may impact their health, for example: soil compaction from humans and animals; the impacts of agriculture through ploughing and application of fertiliser; as well as exposure to higher temperatures and wind speeds.

Collaborative work between researchers from Aberystwyth University and Forest Research, funded by Woodland Heritage and Defra, has highlighted the importance of crown condition assessment in determining the severity of decline in oak trees. Index measures have been developed to describe quantitatively the severity of oak decline and to differentiate between the acute and chronic oak decline syndromes (AOD and COD). These indexes are based on a comprehensive set of visual assessments that include aspects of tree size, crown condition and the presence of disease-causing organisms.

The first of these index measures is the Phenotypic Decline Index (PDI) which provides a measure of overall decline severity with a score between 0 and 1. Oak trees with a score closer to 1 have severe oak decline symptoms. The second index measure is the Decline Acuteness Index (DAI) which provides a quantitative measure to differentiate between AOD and COD syndromes with a score between -1 and 1. Trees with scores above zero have symptoms more typical of AOD and trees with scores below zero have symptoms more typical of COD. These index measures are showcased in a web application available at **https://jasenfinch.shinyapps.io/decliner/** (Fig. 11). This allows the user to adjust the values of the visual descriptors to determine the index values and the oak decline severity/type.

The index measures provide a standardised means to enable the monitoring and comparison of change in the visual health of oak populations across both the landscape and growing seasons. This is of growing importance with climate change and a greater need for the assessment of the health of the UK's oak population.

The BAC-STOP project is currently exploring the potential for volunteer groups to monitor their local trees and provide vital information to address existing gaps in oak condition monitoring. The first year of the project focused on method development. The initial workshops were online and relied on images of trees from Google Street View to underpin the training. However, in September 2021 we were finally able to get out into the field (Fig. 12) to hold in person training and see the trees themselves! Thank you to all the volunteers who gave their time to help our project.

We are currently in a strong position for 2022: we have a reliable method, training materials and recording systems and now we are ready to expand the scope of the project. We hope to work with groups at five sites in the coming year and we plan to use a mixture of all the methods trailed so far. We ask volunteers to attend a one-hour webinar, which will be followed by a half-day training workshop in the field. This should provide all the information and tools required for further monitoring and enable individuals to observe the trees that are most significant to them and provide data that can be integrated with an established monitoring program. One of our key aims is to instil an interest in observing change in the natural environment, as well as generating some useful data for research.

Standing Oak Tree Fungus Survey

There are many unknowns and questions that need to be answered when looking at oak heart-rot, and a vast array of species may now rely on our knowledge of this key habitat. To improve our understanding, we are currently carrying out a range of studies that will hopefully shed some light on those relationships and the structure of these fungal communities.

Alongside direct sampling, culturing and environmental DNA techniques, we are also collecting fungal observation data and surveying the condition of the oak trees that support them, to help answer questions. This part of the project has been launched as a community science project – something that anyone with access to a smartphone or desktop computer can get involved with. The survey has been developed on the ArcGIS Survey123 platform, which offers useful integration with mobile devices, including GPS location, taking photos straight into the app and other features. It operates on any Android or iOS device and is available for PC and Mac

Figure 12: Training volunteers to assess crown condition in Richmond Park. (© Nathan Brown)

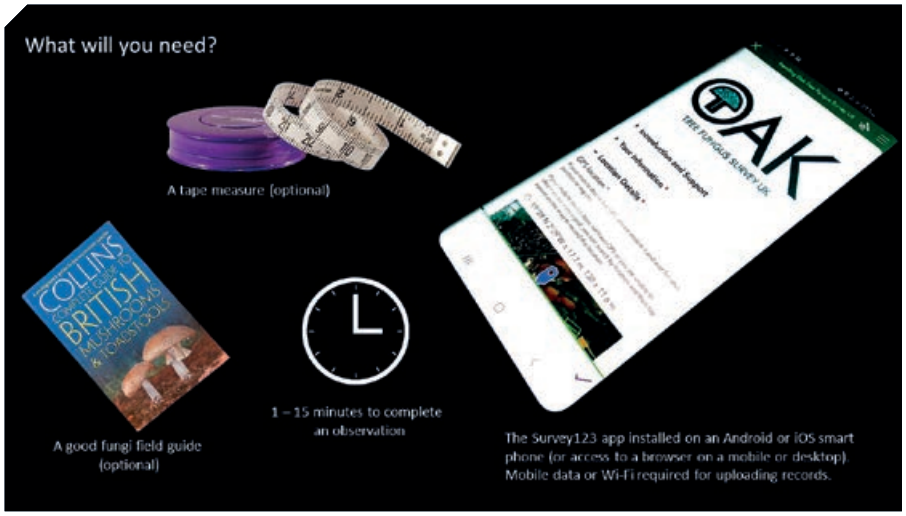


Figure 13: The Standing Oak Tree Fungus Survey app requires only a mobile phone and a few minutes to make submissions. (© Rich Wright)

as well. It can also be used in any browser, although this lacks some user functionality. We need volunteers from all over the country to record for us. Anyone who can tell a chicken-of-the-woods from a beefsteak fungus can help. All we ask is that you are very careful in your identification before submitting a record.

If you would like to give the app a try or find out more information you can visit our website for the project at **www.foreverfungi.co.uk/oakfungisurvey/**, which contains lots of detail about how to use the app and identify key fungi and tree features, further links and an introductory video that explains more about the project's aims. You can also use the QR code to visit the project website and download the app and survey.

Learning to use the app with confidence and how to submit good records will take a few survey submissions. We hope that we have made the app self-explanatory, and for those parts that require additional assistance, the guidebook, website and project Facebook group will offer the answers.

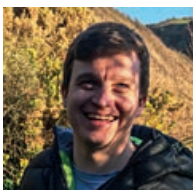
The project is intended to run until 2023, providing us with an up-to-date snapshot of the status of oak-associated fungi and the trees themselves. The large amount of potential data that we hope will be kindly provided by the community would take an impossible amount of time for a small research team to acquire. So, your contribution can really make a difference to this research and our knowledge of these fantastic trees and their fungi. We are aiming for a big push in 2022, hoping to spread the app into the hands of recorders and those who work with trees. There will be a run of training webinars and field events announced later this spring.

We need your help!

These important scientific enquiries and the resulting conservation actions are entirely reliant on volunteer contributions of data from people who share the belief that our trees and the myriad species that inhabit them are worth protecting and understanding in greater depth. As researchers, it means a great deal to have input from community recorders who are geographically spread around the country and have local knowledge of their areas and the trees there.

If you have a love of trees, a little time, and access to a smartphone or a computer, please check out our projects or pass on the details to your local groups. Huge thanks to all those involved!

Rich Wright is a PhD student at Cardiff University, researching the fungal communities that are associated with oak heart-rot. The project is funded by KESS2 and supported by the Welsh Government, the Royal Forestry Society and Action Oak. He works part time at Royal Botanic Gardens Kew as an outreach officer for the fungal tree of life projects.



Jasen Finch is a postdoctoral research plant scientist at Aberystwyth University. He uses metabolobics and machine learning to reveal the chemical changes occurring in plants during disease and disease restistance, work funded by the Future Oak and BAC-STOP projects.

Nathan Brown has a joint appointment between Woodland Heritage and Rothamsted Research and works on models of plant disease including on oak and ash trees.

The Future Oak and BAC-STOP projects are funded by the Biotechnology and Biological Sciences Research Council (BBSRC), the Department for Environment, Food and Rural Affairs (Defra), the Natural Environment Research Council (NERC) and the Scottish Government.

Issue 197: Summer 2022

DALZELL YEWS MEASURE UP TO BE THE TALLEST IN EUROPE

David Treanor with additional content by **Mark Foster**

The Scottish Branch organised a peripatetic tour of the Dalzell Estate in Motherwell, North Lanarkshire, hosted by Maxine Ross in November 2021.

Maxine introduced the group to the Covenanter's oak (*Quercus robur*) which is said to have been planted 800 years ago by King David I as part of a deer park and hunting estate, making it a contemporary of the oaks over the River Clyde at Cadzow. The conversation then turned to the historical context of the significant and numerous yew (*Taxus baccata*) trees on site.

After bowyers in Scandinavia discovered the composite benefits of yew sapwood and heartwood around 300 AD, the technology of longbows developed to give archers point-blank armour-piercing power and a range of up to 300m. Over the next 1000 years the yew longbow played a key role in the forging of a world order which eventually gave rise to the British Empire. Demand for yew staves led to the depletion of native British stock and the subsequent import of a slower-growing and therefore superior continental supply from Italy, Spain and Albania.

The extensive stand of yew trees planted at Dalzell Estate seemingly matured into obsolescence with the decree by Elizabeth I in 1595 that the army was to replace its longbows with shotguns despite the relative inferiority of firearms at the time. This is only conjecture since it is not known exactly when they were planted or for what reason.

Maxine, who has studied yew trees specifically, went on to offer an intuitively compelling theory that Irish yew is a mutation resulting from fire-damaged yew trees.

A more light-hearted discussion on the entheogenic properties of yew pollen and its potential link to religious mythology followed. Could this be the reason why in some languages the root meaning of the word for a yew tree is 'the Tree of God'?

Esau and Jacob

During the walk we encountered two especially impressive yews planted together on a riverbank at the foot of a bowl-like geological depression. The observation of these trees within this unique location gave rise to a spontaneous discussion within the group about their relatively tall appearance. This led to Mark Foster of the Arboricultural Association volunteering to return to measure their height.

Maxine explained to the group that the trees were named after the twins Jacob and Esau from the book of Genesis. Esau is the girthier and apparently taller of the two trees and received our focus when we revisited to measure its height a few months later.

Mark and I attended the location in late January with Douglas Crawford, a young apprentice arborist whom I had encouraged to come along

The apprentice Douglas Crawford arrives at the top of Jacob.

for the experience; I explained to him that time spent with trees where there are no cutting tools present is a healthy and necessary way to reconnect with your original motivating love of nature.

As we arrived on site, the nurturing sound of the river accompanied by a wee bird flying out in full song signified a hope for the forthcoming springtime beyond what had seemed like a long dark winter break. Mark climbed Esau and I passed up the measuring instruments, while Douglas suggested that he climb Jacob just for the practice.

As I tightened the tape at the base of the tree, I was surprised to find that it was going to be close to 30m. That seemed extremely tall for a yew tree. Not expecting this, we hadn't carried out any research into the tallest yew tree in Britain prior to the visit.

After consulting Google, we found that the current record for a champion yew was held by a tree in the garden of Belvoir Castle in Leicestershire which measured 28.4m in 1987. As I read this out loud to the two climbers, I discovered the Belvoir Castle yew was also thought to be the tallest in Europe.

A champion tree is the best of its kind in its area. The most common reasons why a tree may become a champion are if it is the tallest or the one with the thickest trunk, but there are other reasons too – age, most spreading, the heaviest and even for its outstanding beauty. The Champion Tree Register of Britain and Ireland (TROBI) exists to document all these trees. An excellent book is available as well as a full database online, but this needs constant updating as trees grow and new champions are found. I encourage everyone to get involved by having a look at the registered trees in your area and finding the inspiration to get involved with champion trees.

Suddenly our task took on some serious significance: Esau could be the tallest in Europe – a fitting status for the first-born twin. We checked and double-checked the result as the tape read 29.5m, over 1m taller!

As I called to Douglas to pull up his rope, the story of the apprentice pillar at Roslyn Chapel entered my thoughts where despite years of dedicated application to his craft the more experienced stonemason is overshadowed by the youthful enthusiasm of the apprentice. Could the apprentice's yew tree be taller still? Just as in the Biblical tale, Douglas's yew tree, Jacob, had grasped the heel and stolen the status of his brother Esau, measuring in at 29.8m.

It was an unexpectedly rewarding experience for all three arborists and a particularly significant boost for the young apprentice.

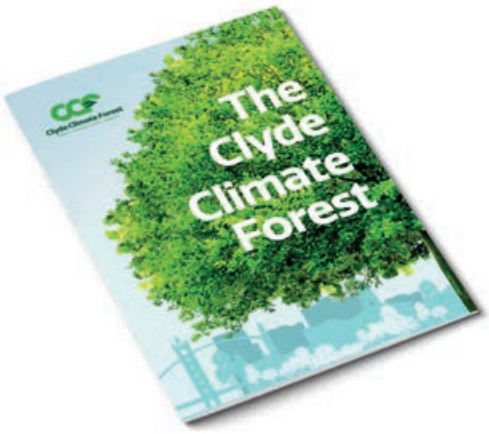
The Dalzell yews have been registered with TROBI and some more projects sit in the pipeline. Mark Foster would like to thank David Alderman with his assistance so far. It was a pleasure to tell the story of Jacob and Esau and be able to register their mighty existence. Special thanks also to Maxine for the introduction.

David Treanor holds the tape measure firm at the foot of Jacob as aloft, the young apprentice Douglas Crawford holds the sacrificial beech pole to the tips of Jacob's champion crown.

Issue 197: Summer 2022

CLYDE CLIMATE FOREST

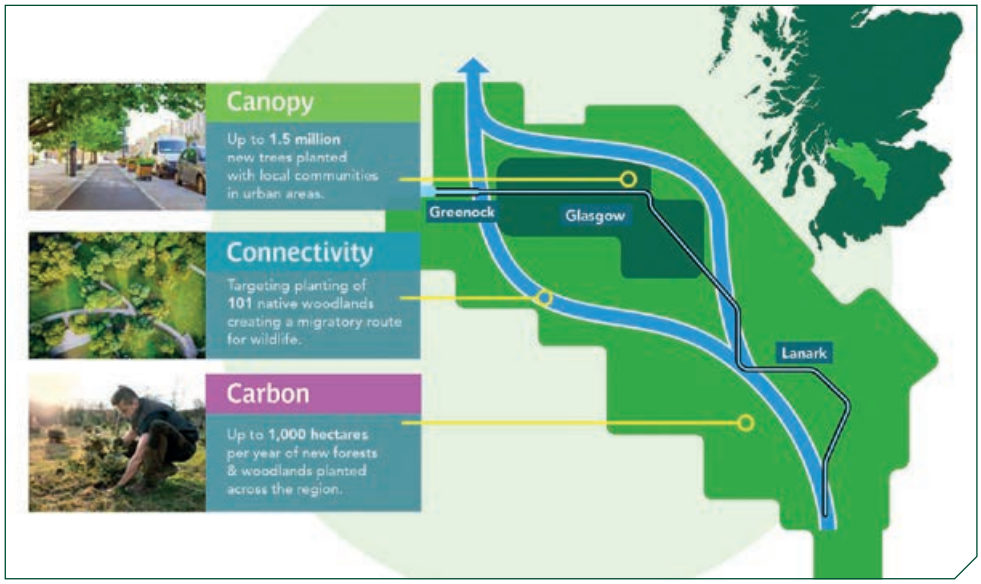
18 MILLION TREES BY 2030!



Max Hislop

The Clyde Climate Forest was launched on 1 June 2021 and enthusiastically endorsed by the eight leaders of the councils that comprise the Glasgow City Region Partnership.

Clyde Climate Forest Project, Chryston, North Lanarkshire.



Welcoming the launch of the Clyde Climate Forest, Mairi McAllan, Scottish Government's Minister for Environment, Biodiversity and Land Reform said, 'This is a significant and well-timed initiative showcasing all that is good in tree planting ... It is also a first for Scotland, with eight local authorities working together with government and other partners on a major woodland creation initiative.

'Tree planting is key to tackling the twin crises of climate change and biodiversity loss and there is tremendous support for it across Scotland. The Clyde Climate Forest taps into this and the benefits will last for generations.'

The Clyde Climate Forest (CCF) is being delivered as part of the Glasgow & Clyde Valley Green Network, with support from TCV, Green Action Trust, Glasgow City Region, Trees for Cities, Scottish Forestry and Woodland Trust Scotland.

A £400,000 grant from the Woodland Trust's Emergency Tree Fund as well as £150,000 from Scottish Forestry has kick-started the development of new tree planting schemes and supports a project team over two years.

The three Cs

The project has big ambitions for trees, woods and forests across the region with a headline target of planting 18 million trees over the next decade (equivalent to 10 trees for every person living in the region).

However, the project has more specific aims based on the three Cs:

CANOPY – Urban trees provide cooling in heatwaves and surface water management for cloudbursts, whilst also providing some carbon storage and wildlife habitat. Even a moderate increase in canopy cover can aid adaptation to the adverse effects of climate change.

Forest Research has analysed high-resolution aerial photography of the Glasgow conurbation to assess existing tree canopy cover. The current tree canopy cover for urban areas in Glasgow City Region is 17.7%. Based on this analysis, the CCF will increase canopy cover

through new tree planting in neighbourhoods with low levels of canopy cover, particularly in areas of deprivation and at risk from the impacts of climate change. Sixteen 'target neighbourhood' are being identified across the region in collaboration with local authorities. These neighbourhoods will be the focus for community engagement and preparation of tree planting proposals.

The CCF aims to work with local communities to increase the average tree canopy cover in urban Glasgow to 20% by 2032. It will take up to 1.5 million urban trees to be planted to achieve this target.

CONNECTIVITY – Native woodlands provide essential ecosystem services and wildlife habitat. Creating woodland connections helps to reverse the habitat fragmentation caused by decades of urban development, protect biodiversity and offer woodland species migratory routes as the climate changes.

Forest Research has assessed existing broadleaved woodland habitat networks on behalf of the CCF and identified where new woodland planting will make connections that provide a potential migration route for woodland species from the headwaters of the River Clyde through to the Loch Lomond and Trossachs National Park.

The CCF aims to increase the average broadleaved woodland network area by 20% by 2032 and achieve a contiguous migratory corridor by creating new native woodland connections at over 200 target locations.

CARBON – New forests are effective carbon sinks and can provide natural flood management, construction timber to substitute for high-emission steel and concrete, and wildlife habitats.

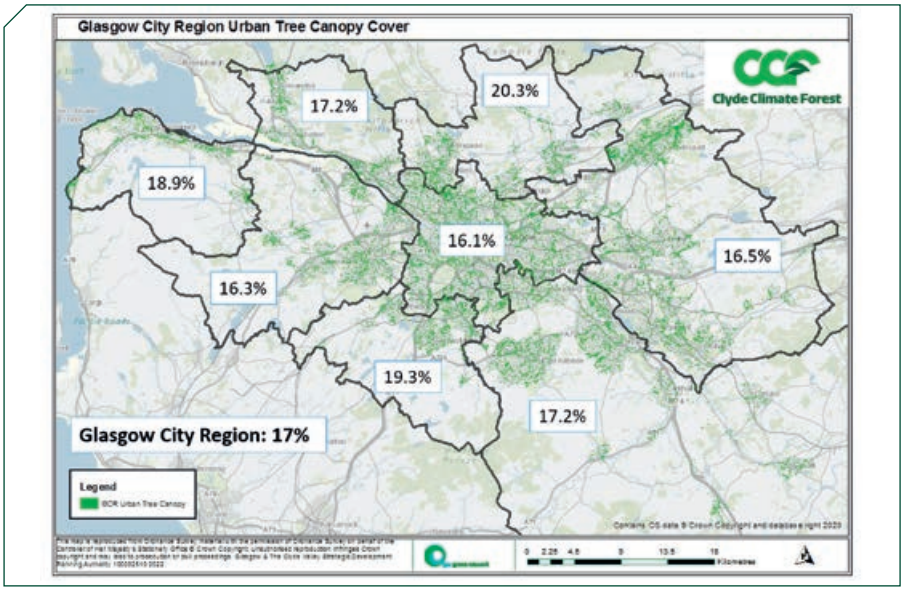
The Clydeplan Forest and Woodland Strategy identifies the potential to create 9000 hectares (approximately 18 million trees) of new forests across Glasgow City Region, amounting to an increase in forest cover of 3%. This is commensurate with the target for woodland expansion in Scotland as stated in Scottish Government's Climate Change Plan.

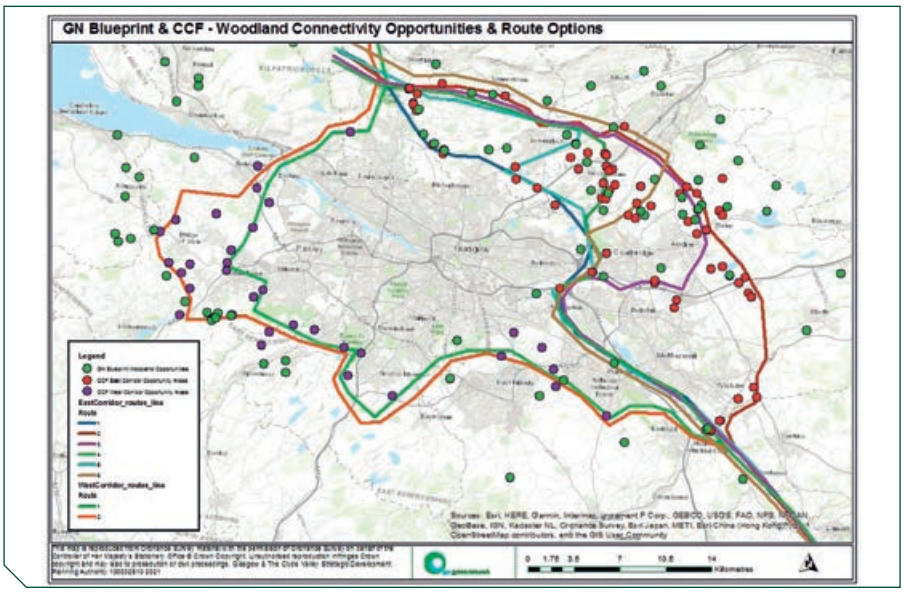
The James Hutton Institute and Forest Research have mapped the carbon storage potential for woodland expansion in the region based on a range of afforestation options. This research indicates that, depending on the species and where trees are planted (i.e. the right trees in the right places), up to 1.5 million tonnes of CO2 could be sequestered by new forests as part of the CCF by Scotland's Net Zero target date of 2045.

The CCF aims to increase forest and woodland cover in Glasgow City Region from a current 17% to 20% by 2032. It will require a doubling of the current rate of woodland creation to achieve this target.

How arborists can help

Whilst the CCF is focussed on the planting of trees, the care of our urban forest is crucial if the ambitions of the CCF to expand urban tree canopy cover are to be realised. With so many pressures on urban trees from built development, pollution and pathogens – not to mention increasingly extreme weather events such as storm Franklin – it can feel like urban tree planting is just 'topping up a leaky bucket'. Additionally, council budgets where they exist for the care or planting of urban trees are under extreme pressure, and there is often reluctance to encourage tree planting because more trees are considered an additional maintenance liability.





The CCF needs to work with arborists to ensure that urban trees are properly valued for the amazing array of benefits they provide to people who live and work in the region. We are currently working on a CCF Concordat with the eight councils that comprise the Glasgow City Region partnership. The concordat is an agreement which will expect each council to play their part in the CCF. This includes high-level commitment to:

- manage, protect and enhance the council's tree resource through robust tree canopy cover strategies and appropriate policies and practices;
- actively promote a cultural change in relation to tree provision and management and overcome perceived barriers to the planting and the retaining of appropriate trees;

and an acknowledgement that:

- additional effort must be made to manage, protect and enhance our existing trees and increase the number of trees in urban and rural areas if we are to gain the climate and ecological benefits that they can afford.

In reciprocation of the commitment from the councils, the CCF commits to work to achieve CCF targets within each council area and to seek additional resources and funding to facilitate their delivery.

If you are a tree officer, urban forester or arborist working in Glasgow City Region, I hope you will support and promote the CCF and its ambitions. If you wish to find out more about the CCF please get in touch.

Max Hislop, Director, Clyde Climate Forest: max.hislop@tcv.org.uk, 07796 937972, **www.clydeclimateforest.co.uk**

Figure 1: A huge beech glides above Gothenburg through the floodlit night sky, en route to its new location. (Photo: Linus Norden)

Issue 184: Spring 2019

A MOVING EXPERIENCE

Martin Gammie with **Hugo Loudon**

HOW GOTHENBURG CITY UTILISED A NATIONAL RAIL PROJECT TO **SECURE GREEN INFRASTRUCTURE PROVISION** IN THE CITY.

I first visited Sweden back in 2010 as part of a CABE[1] research scholarship and to attend a 'Trees and Stormwater' conference. The concept of 'Sustainable Integrated Infrastructure' (Sii) evolved as a result of the scholarship and formed the basis of the Trees and Design Action Group's best practice guidance document *Trees in Hard Landscapes*, published in 2014. What struck me at the time was the collaborative approach to delivery of the infrastructure needs of Stockholm and a general recognition and acceptance that trees and green infrastructure were an integral element of that. This, combined with a proactive 'let's get on with it' attitude from both public and private sectors, has in my opinion put Sweden ahead of the curve in terms of delivering Sii.

It was therefore with great enthusiasm and even a little excitement that I welcomed an invitation from my friend and colleague Örjan Stål asking Hugo Loudon, Managing Director of Heritage Tree Services, and me to observe one of the culminating moments of what is almost certainly one of the largest tree moving projects in Europe. The three of us agreed that this was a project that would appeal to a broad sector of the arb world, and Hugo and I have therefore combined forces to produce this article in which I hope to provide a strategic and thought-provoking overview and Hugo will address the complex technical and operational detail.

Tree planting, including the moving of large trees, forms a significant part of Hugo's work. He has imported treespades from Europe and the US, custom built the machines on which they have been mounted and utilised them to deliver multiple tree moving and planting contracts of various scales, so his experience was invaluable to me on this trip. He combines all this experience with an insatiable thirst for knowledge and a general enthusiasm for life and all things tree related, which made him the obvious compadre for such a mission.

The location and its trees

With the inevitable quips about heading for the bat cave and the wearing of underpants outside trousers, we set off for Gothenburg. A new commuter train rail link has been proposed for the city, bringing major changes and improvements to the city centre. Whilst the line will be predominantly below ground as it enters the city, a new station is proposed in the south central Landala Vasastaden area. The high profile site currently comprises the well-established linear Kungsparken (Kings Park) which borders the river to the north and which is traversed east–west by the tree-lined Nya Allen boulevard. The Parkgatan tramline runs parallel to the boulevard and, challengingly, is immediately adjacent to the largest tree identified for transplanting, but more of that later. The proposed rail station will be on the western edge of the park between Nya Allen and Parkgatan. Its location within a long-established urban green space was inevitably going to be controversial, potentially resulting in the loss of several hundred trees. The treescape of the site has a diverse age range but includes many mature trees and a range of species, predominantly lime, horse chestnut and elm.

Örjan was appointed to the project by the City Council and the Swedish Transport Administration in October 2013 as part of the team of professionals responsible for the logistical planning and pre-commencement enabling works required in advance of any construction. The project team includes public sector employees and external specialists and has been allocated space within the council offices as a way of assisting with the integrated approach to delivery of this complex project.

Transplanting 300 trees

One of Örjan's initial tasks was to establish exactly what the treescape comprised and a tree survey was commissioned that would not

1. CABE: Commission for Architecture and the Built Environment (amalgamated with the Design Council in 2011).

Figure 2: 300 city-dwelling trees on vacation in their country retreat where they will be carefully tended. The tall narrow drawn form of the early-mature limes in the background reflects their previous street scene location. They are on the limit of the size that can be effectively transplanted with the treespade, and their crowns have been heavily reduced to compensate for root loss and facilitate transportation.
(Photo: Martin Gammie)

only look at the condition and life expectancy of the tree stock involved, but also consider potential impact from the development proposals, the feasibility of retaining the trees on site, the viability of transplanting, and/or the requirement to fell. The results showed that some 500 trees would have to be removed from their current locations, many of which were early-mature to mature specimens. We understand that although no formal evaluation or cost-benefit analysis was conducted, it was agreed that new planting alone would not offer sufficient mitigation for such large-scale loss of urban tree cover and hence the selection process for trees considered suitable for transplanting. In total, 300 trees were identified for transplanting, the majority of which were in the semi-mature to early-mature age range with dbh [diameter at breast height] between 150mm and 300mm. In addition, there were two larger early-mature horse chestnuts and then the ultimate challenge, a mature beech with a dbh in excess of 900mm. It was the moving of these three larger specimens that we had been invited to witness.

The city's grounds management contractors, VEAB, are also responsible for tree management works across the city and were awarded the contract for all aspects of tree management associated with this project. Subcontractors were therefore appointed for the specialist elements such as tree surgery and tree moving but VEAB is responsible for all aftercare and future maintenance. It was proposed that the majority of the trees would be moved using a treespade. The size of the trees meant that the largest available treespade would be required and an Optimal 3000 (3m diameter) was shipped in from Germany, along with the very experienced team from Optimal-Vertrieb Opitz GmbH who design and manufacture the range of Optimal treespades as well as operating them across Europe.

Holiday home for trees

Having been collected from the airport by Örjan, Hugo and I were taken straight to site, but not the site we were expecting. Our first stop was an old plant nursery on the edge of the city which has been resurrected specifically to provide a 'holiday home' for the 300 trees that were moved with the treespade. Working at night to minimise traffic disruption, the team has transported each tree to the nursery individually, a 1.5-hour round trip for the treespade. This is five-star accommodation too, with lakeside views: the trees are set out in well-spaced rows, fitted with moisture meters and automated irrigation and individually mulched. As can be seen from figure 2, some of the larger trees (early-mature limes) have been quite severely reduced to compensate for root loss and to facilitate their transportation out of the city centre avoiding obstacles such as tram wires, traffic signs, lamp-posts and bridges. I was intrigued by the very substantial security fencing around the perimeter of the site and was advised by Örjan that this was necessary to fend off pests significantly more threatening to trees of this size than our usual enemies of deer and grey squirrel, namely moose and beavers! Despite the threat of these marauding beasts, the trees were looking good and appear to be doing well in their temporary home. The intention on completion of the rail project in 2–3 years' time is to return the trees to the city as part of the re-landscaping of the area which will include a new park on the riverbank to the west of the station.

This was an inspirational start to our visit but just the tip of the iceberg in terms of what we

Figure 3: The massive crawler crane towers over the city, dominating the buildings and treescape below. (Photo: Hugo Loudon)

were to witness over the following days, or perhaps more accurately nights: due to the massive scale of the larger tree operations, the moving work was scheduled overnight to minimise disruption in the city. However, there was plenty happening during the day too, and what impressed us time and time again during our visit were the collaboration, resolve and professional dedication from the multi-national, multi-discipline team whose prime objective was to get the job done and done well.

Moving the mature beech

As we arrived on site mid-afternoon on that first day, the scale of the operation and of the equipment needed to implement it were probably what struck us most. What looked like a lime green skeletal imitation of the Shard towered over the nearby church spire and apartment blocks. This was the 600-tonne crawler crane that would be used to lift the mature beech and transport it some 80m to its new location in the park (figs 3 and 4). Prior to that, however, we were to observe the nocturnal moving of the two early-mature horse chestnuts using a mere 250-tonne crane and a rather sophisticated self-propelled, remote-controlled flatbed trailer (fig. 5).

Having successfully completed the moving of the chestnuts, it was time to undertake the final preparations for transporting the mature beech. The facts and figures associated with moving the beech tree are summarised below to provide the reader with an insight into the long-term planning, preparation and complexity of the operations undertaken as part of this project:

- The significant lead in time meant **best practice preparatory works could be adopted over two growing seasons** in advance of lifting. These comprised trenching and careful root pruning on two sides of the 7×7×1.5m rootball in year one and the second half a year later, with membranes fitted prior to backfilling to redirect new fine root regeneration within the rootball. The size of the rootball meant that no roots >25mm were pruned as part of this preparatory work. This, along with carefully controlled watering, taking account of soil type and site conditions so as to sustain good gaseous exchange without over or under watering, was prescribed to give the tree the maximum chance of surviving the trauma. Some 5–10% canopy thinning was carried out to harmonise with root pruning.

- **The lifting methodology used an adapted version of the 'pipe and beam' method**, which is to fully support the underside of the rootball for the lift. The sides are supported by a modular system that retains some soil consolidation properties but is relatively light weight and with restricted load-bearing properties.

- **The approach to support the base** was not driven pipes as the Americans might favour but horizontal sheet piling. The advantage of this is that each sheet can snap in and locate itself along the edge

Figure 4: Preparing the reinforced trackway for a 600-tonne crane is a major operation in itself. The self-propelled flatbed trailer that would be used to move the two horse chestnuts was also used to transport the counterweights for the crane. The weights and the trailer can be seen in the foreground. (Photo: Hugo Loudon)

Figure 5: Working through the night, the first of the two horse chestnuts is lifted onto a flatbed trailer. The 50-tonne chestnut was transported to its new location on the other side of Nya Allén boulevard. (Photo: Hugo Loudon)

Figure 6: Heavy, saturated clay subsoil was just one of the challenges the project team faced in preparing the trees for lifting, but the combination of patience, skill, all the right tools and a real team effort meant that no problem was insurmountable. (Photo: Martin Gammie)

Figure 7: The proximity of regular rumbling trams took its toll on the structural integrity of the side walls of the excavated pit causing the tram platform to partially collapse and the tram stop had to be closed.
(Photo: Hugo Loudon)

of the previous one, providing some directional guidance and additional integrity to the sheets as a whole. The sheet pile specification needs to take account of the direct vertical loading that is applied by the 'dead weight' of the rootball onto the horizontal interlocked sheets as opposed to the side loading that is applied in a traditional vertical sheet piling application. Lifting the tree over the high risk target area of tramlines, highway etc. required the calculations to be spot on and also needed to take account of the potential weight increase that the hours of heavy rainfall might have caused (fig. 6).

- **The sheet piling is installed via an adapted vibration hydraulic breaker** which forces it horizontally beneath the root plate at a depth of approximately 1.5m below ground level, slowly pushing the sheet through using a custom-built template starter plate. Dense, heavy clay was encountered and this resulted in the need for additional high pressure water jetting to get the sheets to travel the 7m across to the other side in line and joined accurately. This method requires a lot of space and additional excavation is needed around the tree as the working trench on the installation side also has to be a minimum of 7m.

- To complicate matters further, **the beech tree was immediately adjacent to a tramline platform with trams stopping every 20 minutes**. The canopy was over the tram and platform, and lots of people pouring in and out presented some interesting H&S challenges!

Despite all best efforts and meticulous preparations, a project of this scale inevitably encounters unforeseen challenges. Weather conditions and the constant vibration of the trams traversing immediately south of the tree pit resulted in the tram platform starting to migrate into the tree pit, so the tram stop had to be closed (fig. 7).

Preparing for the test lift, the 600-tonne crawler crane operated by the Norwegians (cool as cucumbers, just as if they were pushing a shopping trolley along) had to be fitted with counterweights by a 250-tonne crane. This is quite time consuming, and to compound matters the 250-tonne crane was fitted with its weights by a 160-tonne crane. It was raining heavily by this time and windspeeds were increasing as the team worked into the night. City life continued around us with intense nearby traffic and an inquisitive public, including demonstrators (save our trees) who have been convinced by 'others' that large trees cannot be transplanted.

The test lift progressed but raised some issues, not least that the confirmed lift was 186 tonnes rather than the estimated 160 tonnes. The saturated clay subsoil had not only increased the weight of the rootball but also, despite the construction of a massive reinforced trackway for the crane, it was starting to sink and concerns were raised about the potential collapse of the sides of

Figures 8 and 9: The climbers traversed the canopy, making sure the massive steel cables were carefully threaded through the outer branches and structural framework of the tree before being secured to the cross beams beneath the rootball.
(Photos: main image: Martin Gammie; inset: Linus Norden)

the excavated area. As a result, the main lift was postponed and the crawler crane track had to be upgraded; this involved unloading the crane's weights and then the following day another fleet of trucks brought more materials and the kit needed to install them.

Finally, by the end of the next day we were close to the lift and the move. Swedish and English climbers were in the tree to ease the massive steel strops (as thick as Popeye's forearms) through the canopy in order to attach them to D shackles the size of a ship's anchor, whilst the crane operator had to ensure the main spreader bars were not damaging or rubbing on the top of the tree (fig. 8 and 9).

Last but not least, two purpose-made supporting beams (costing £10k) had to be carefully positioned beneath the sheet piling base of the rootball. This proved very difficult in the increasingly wet weather which was filling up the excavation around and under the tree, and the wet, slimy clay inhibited the positioning of the beams which needed to be at least 20% inside the base on each side.

Eventually everything was in place and the lift was good to go. The end result was quite spectacular as this huge tree was lifted seemingly effortlessly high above the tramlines and street lights, gliding through the floodlit sky to its new resting place (fig. 1). The new site had been carefully selected in the park to the east of the tree's original location with shelter from surrounding mature trees but enough space and sufficient light levels to give the beech all that it needs to thrive. Final positioning also reflected the tree's original orientation in order to avoid over-exposure and the potential for desiccation or scorch.

The wider project

In addition to managing the usual PR for such a project, i.e. coverage by local and national press, TV and radio, Gothenburg city council went the extra mile, joining forces with the Swedish University of Agricultural Sciences to organise and host a CPD seminar for the professionals involved in the delivery of green infrastructure in the urban realm, giving an account of the project, the principles and practices involved and the lessons learnt.

This is of course just the beginning of the overall project, provisional enabling works for the rail improvements and the start of the long-term monitoring, aftercare and future management programme for the trees. The trees stored in the nursery will eventually be brought back into the city and, along with extensive new planting, will re-establish the green infrastructure in this area of Gothenburg.

Costs and benefits

I'm sure that you are all asking what on earth did it cost and how could such costs be justified? The figures we were given suggest that the cost of moving the 300 trees, including the three larger ones, was just under £6m. It would have been interesting to have undertaken an i-Tree or similar evaluation of the existing tree stock, including those that had to be felled, and this may in many cases have been critical to convincing the bean counters of the viability of such a project.

One element that is in my opinion critical to the delivery of successful green infrastructure is its synergy and integration with other infrastructure projects such as the Gothenburg rail link. The overall cost of that project is estimated at some £2.6bn, making the £6m tree-moving budget (0.23%) seem almost insignificant. Obviously overall GI [green infrastructure] costs will be somewhat more than that, and securing the long-term revenue budgets required to ensure sustainable longevity is absolutely critical to delivery of the GI objectives. However, it would seem reasonable to suggest that a 1% or 1.5% of overall costs would not be excessive to provide the ecosystem benefits that are now proven to be so critical to our towns and cities and the well-being of their residents.

In summary, having been fortunate enough to observe this extraordinary project and to meet the people involved on many different levels, I think the message is clear: the successful delivery of sustainable and compatible green infrastructure in the modern urban realm is no mean feat. The strategic and operational complexities involved are far beyond the capabilities of any one organisation, government body or professional discipline. As arboriculturists we therefore need to not only be aware of and receptive to the requirements of those responsible for other elements of urban infrastructure, but to proactively engage with those disciplines and organisations so as to ensure arboriculture and GI are flagged up as an integral and valuable element and are therefore on the agenda from the conception stage of such projects. Recording and disseminating examples of good practice such as the Gothenburg rail project is just one way to raise our profile and ensure trees are very much on the radar.

With a view to what such aspirations might look like in reality, I offer some food for thought.

As we enter what appear to be increasingly uncertain and challenging times, I believe it will be ever more important for us to maintain good communication with our colleagues overseas and continue to explore any opportunities for collaborative research, education and working.

The arboricultural profession also needs to actively seek increased interdisciplinary working here in the UK, an area where the plethora of professional bodies and trade organisations associated with arboriculture, forestry and landscape could perhaps be more active?

As an industry we continuously criticise and demand improvements to current legislation and best practice and yet complain about the constraints and bureaucratic red tape that surround and potentially restrict our operations. Perhaps along with the ongoing call for reviews and updates, we should be considering how we can better utilise the many tools we are privileged to have at our disposal, e.g.

- improve the effectiveness of the planning system through collaborative working across public and private sector;
- take advantage of improvements where they have been achieved such as using the revised National Planning Policy Framework (NPPF) to ensure delivery of truly sustainable development, effective multi-functional green infrastructure and biosecurity net gain; *and*
- adopt well-informed yet innovative interpretation of best practice guidance such as BS5837 so that it guides rather than dictates.

I hope that our account of this project has been of interest and provides some inspiration to the reader. On that note, I would like to end with a quote from business philosopher Jim Rohn: 'Successful people do what unsuccessful people are not willing to do. Don't wish it were easier; wish you were better.'

With thanks to Gothenburg City Council, the Swedish Transport Administration and all the consultants, contractors and staff that gave us free rein on their site and in their offices and were so welcoming, helpful and forthcoming with their knowledge and in disseminating the valuable information that has enabled this project to progress so efficiently and successfully to date.

Martin Gammie
MICFor DipArb(RFS) FARborA is the Director of Consulting with Trees Ltd (**www.cwtarb.com**), a specialist consultancy providing innovative design and working practices that facilitate effective establishment and compatible longevity of trees in the urban realm. Promoting arboriculture and improving professionalism within it is at the heart of Martin's work ethic, which he actively pursues through his input to the Trees and Design Action Group (TDAG), the Fund4Trees arboricultural research and education charity and as Chairman of the Institute of Chartered Foresters' South East England Regional Group.

Hugo Loudon
has dedicated his working life to a career in arboriculture, enabling him to pursue the evolution of Heritage Trees Services Ltd (Oxon) of which he is MD (**www.heritagetreeservices.co.uk**). Now a multi-service organisation, the company employs specialist staff enabling delivery of surveying, contracting, tree landscape design, tree planting and tree relocation. Hugo passionately believes that taking time to educate their clients pays dividends for all concerned, not least the trees.

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