



Solihull Urban Forestry Strategy

2019 - 2029

Foreword

Contents



Executive Summary	4
Introduction	5



The Urban Forest	6
The Value of the Urban Forest	6
Health and Wellbeing	7
Ecosystem Services	11
Natural Capital	16



Solihull and the Urban Forest	19
--------------------------------------	-----------



Solihull Urban Forest Future	21
Challenges and Opportunities	22
Themes and Key Actions	33
Achieving Success	38



References	40
Acknowledgements	43

Executive Summary

Solihull Urban Forestry Strategy

Trees characterise and make Solihull's streetscapes and urban landscapes more joyful, liveable and resilient to extreme weather. However, trees are still immensely undervalued. The crucial role trees and the urban forest play in our increasingly urbanised lives has been eroded, mainly due to the challenge to define and quantify their value.

A new perspective on the benefits of our urban forest, expressed in a way that all can understand is required to promote a catalyst for change. In our modern society a common language is money, so there are advantages to equate the asset benefits of the urban forest and the multi-functions it performs in £s to present its natural capital. Representing in £s the tangible emotional and health benefits of the urban forest; the role it plays in our natural ecosystem; and how trees support the economy of Solihull will be a step towards ensuring trees are at the heart of planning and decision-making.

The scale and effectiveness of these benefits are directly related to the way we manage the urban forest as a resource and decision making to shape its future. Progress is being made. Internationally

the 'First World Forum on Urban Trees'¹ was held in Mantova, Italy in November 2018; and nationally, the value of the urban forest and green infrastructure is recognised through the Government's National Planning Policy Framework 2012 and Natural Environment White Paper (driven by data from the National Ecosystem Assessment). The Department of Health's plan for improved physical activity 'Be active be healthy – a plan for getting the nation moving'², the public mental health framework 'New Horizons: flourishing people, connected communities'³ and the Marmot report 'Fair society, healthy lives'⁴ all acknowledge the role of green space and trees.

Masses of evidence is available regarding the multiple benefits that green infrastructure and the urban forest can deliver when sensitively planned, designed and managed in new or retrofitted urban environments; such as providing sustainable transport links, improving recovery of hospital patients, and mitigating the effects of climate change. But in the UK (although there is environmental legislation for the protection of biodiversity and urban green spaces by regulating planning, contamination and conservation, e.g. the Wildlife and Countryside Act 1981, Environmental Protection Act 1990 and the Planning Act 2008) there is no legislation for the requirement of green spaces or the urban forest. There is momentum with a series of PostNotes produced by the Houses of Parliament⁵ and a number of NGOs including the RSPB⁶ and The

Wildlife Trust⁷ have proposed the adoption of a Nature and Wellbeing Act for the protection of green spaces as a public health strategy.

To commence the dialogue towards a better understanding of the specific values of the urban forest in Solihull, consultation has been undertaken with those who have a specific interest in trees located on local authority land; and amassed relevant information cross-referenced for further evidence basing if required by the reader. Projects and case studies have been provided to inform the framework for future policies. Statistics are generally not specific to Solihull as local analysis has not been undertaken, but the report presents value in a quantified format that can be applied to our urban forests. In brief this evidence has been collated with the aim to:

“protect, promote, sustain and enhance our urban forest and to recognise its contribution towards the character, appearance and economy” of and Solihull “for the benefit of all those who live, work and visit” the area.⁸

Introduction

Why have an Urban Forest Strategy?

The coat of arms for Solihull says all we need to know. The 'Town in the Country' or '*Urbs in Rure*' reflects Solihull's heritage as a focal point of the historical Forest of Arden. The purpose of the Strategy is to ensure our forest character is maintained and enhanced for the long term. Having a strategy will enable all concerned to guide the future of the urban forest.

The urban forest encompasses both private and public land. It includes private gardens, streets, housing estates, public parks, schools, cemeteries, small woodlands and semi natural ancient woodland. It is important to have an Urban Forest Strategy so that everyone involved can understand how the urban forest will be planned, managed and protected for future years. For the purpose of this Strategy, we are concerned with the parts of the urban forest that can be directly managed and influenced by Solihull Metropolitan Borough Council (SMBC).

The urban forest as a fundamental part of green infrastructure^{9,10} and physically stretches across administrative and operational boundaries. It is recognised that effective planning and management of the urban forest is best across

authorities like SMBC and beyond. The Habitat Biodiversity Audit undertaken by Warwickshire Wildlife Trust spans Solihull as well as six Warwickshire Local Authorities. Partner strategic planning and delivery undertaken by local authorities is seen as best practice. Solihull shares a common vision for the best use of authority land, recognising that the urban forest provides character and beauty as well as multi-functionality through the ecosystem services it supports.

The Department for Communities and the Local Government in 2008 published '*Trees in Towns II*'¹¹ which recommended local authorities produce a framework for taking a strategic view on the status and health of the urban forest by creating a tree strategy. With the priorities for local authority spending under constant pressure and review, an Urban Forestry Strategy is critical to enable the long term benefits and resource requirements to be identified alongside the priorities of the SMBC Woodland Strategy¹² and wider policy context. This includes a Priority contained within the Solihull Council Plan 2018-2020¹³ to plan and deliver Solihull's low carbon future via the Green Prospectus (with a focus on green infrastructure, transport and environment), and the Highways and Environment Directorate Service Priority within the SMBC Business Plan 2018¹⁴.

It must be recognised that the multi-functionality of the urban forest will evolve through time alongside pressures placed on its very being as

urban infrastructure expands and climate change takes its toll. As a result, the Urban Forest Strategy needs to be flexible over the long term.

An 'Urban Tree Strategy 2010-15'⁸ existed for SMBC. A vision for a shared strategy was born with the aim to raise the profile of how the urban forest breathes life into Solihull; and gain a common understanding on how our urban trees provide 1) tangible emotional and health benefits; 2) supports our natural ecosystem; and 3) energises the economy of Solihull.

Format, Structure and Content

Managing, planning and protecting the urban forest is complex. There are many people from all walks of life who are directly or indirectly concerned with and benefit from the urban forest. The Strategy has therefore been presented in an accessible format with different layers of detail to service a wide range of readers and stakeholders. The format is deliberately brief and targeted at getting large amounts of information across in accessible style. Where possible technical information has been kept to a minimum but is referenced using endnotes so that the reader can be signposted to more detailed information. The Urban Forestry Strategy has a direct relationship with the wider policy framework. Different audiences will use the strategy in various ways.

The Value of the Urban Forest

What does one Urban Tree Provide?



- 1 - Aids reduction of airborne pollution
- 2 - Mitigates urban heat island effect
- 3 - Mitigates urban flooding and wind turbulence
- 4 - Benefits biodiversity and wildlife
- 5 - Provides health and wellbeing benefits
- 6 - Adds economic value and investment
- 7 - Enhances landscape character and interest

What is the Urban Forest?

Trees give us the very air we breathe. With every breath comes life itself. Sounds obvious doesn't it?

“The urban forest is the ecosystem containing all of the trees, plants and associated animals in the urban environment, both in and around the city¹⁵.”

However, recent research and polls have shown that people have become disconnected with our relationship with trees and the natural environment. For example, in a recent poll conducted by One Poll for Trees for Cities, 18% of respondents think that WiFi is more important than trees and 24% don't know where conkers come from. The importance of trees in society should not be underestimated and the urban forest needs to flourish.

Solihull's Urban Forest



17,829ha SMBC area
 206,674 SMBC population
 600ha parks and open spaces
 23 Local Nature Reserves
 29,500 highways trees
 50,000 parks trees
 5,600 cemeteries trees
 13,060 housing trees

Demonstrating Value

The value of trees and the urban forest cannot be underestimated. But how can we demonstrate the value of our urban forests? What do urban trees provide and why are their presence in our 21st Century streets and urban centres crucial? The Urban Forestry Strategy focuses on three interrelated themes.



Trees for Health and Wellbeing: a “state of complete physical, mental and social well-being and not merely the absence of disease” (WHO, 2010).



Trees for Ecosystem Services: the “benefits provided by ecosystems that contribute to making human life both possible and worth living”¹⁶ which are broken down as products or goods such as food and water; and non-material benefits or services such as recreation.



Trees as Natural Capital: the set of “environmental assets that may provide benefits to humanity” (Defra, 2017).

The themes sit at the heart of the Strategy and are used as the basis to reinforce future actions and policies.

Health and Wellbeing

Social Value

Social exclusion is manifesting as a key problem in the 21st century, and particular groups in our society are vulnerable such as people with disabilities, ethnic minorities, our senior citizens, and those with economic disadvantage. But there is a lot of evidence¹⁷ that the urban forest and green spaces provide opportunities for many positive social interactions in the local community, encouraging people to get outdoors, meet up, talk, exercise and engage with culture and play.

“Urban green space is increasingly recognised as enabling city residents to live healthier, happier lives. - World Health Organisation, 2016”

Providing opportunities for getting people together improves social wellbeing, and develops attachment to our neighbourhoods. 83% more individuals engage in social activity in green spaces as opposed to sparsely vegetated or concreted landscapes, encouraging community cohesion¹⁸. As a consequence, this can lower crime levels¹⁹, shown particularly in areas of deprivation^{20,21} building stronger and more resilient communities. Even reported domestic violence levels have been evidenced lower in greener neighbourhoods.

Many people are passionate about trees, and volunteer a lifetime of hours to support the management and maintenance of our urban forest. Friends Groups have popped up across Solihull associated with local parks, organising a schedule of activities and community awareness events. Our “tree ambassadors”, the Solihull Tree Wardens are often seen as the “eyes” for the local authorities regarding the health of trees, their protection, campaigning and raising the profile of tree value with local residents. The Council’s Park Rangers have an active role in community engagement and articulating the value of the urban forest through every project they undertake. The ‘Love Solihull’ campaign is an environmental initiative coordinated by SMBC that supports members of the local community in making a difference in their neighbourhoods²². In Solihull, the CLAUDE (Conservation & Historic Environment - Landscape Architecture - Urban Design – Ecology) team working in Brueton Park have been sensitive to the Tree Warden’s work. Warwickshire Wildlife Trust through ‘Your Wild Life’ projects supports the Parkridge Centre Volunteers at Brueton Park. Outdoor volunteering is also related to physical activity and self-reported health and depressive symptoms, especially among mid-life volunteers²³. Without our incredible volunteers, Solihull would not be as recognisable as a “green” urban landscape that we want to live, work and play in.

Trees and Our Heritage

Our urban trees also play an important role in remembrance and heritage contributing to a sense of place and enabling reflection and reminiscence. Solihull has a large collection of Veteran Trees or VETs which many of us are fascinated with, embodying the value we place on these characters and the links to our heritage.

Many sources of information and advice exist on VETs such as collated data by The Woodland Trust’s Ancient Tree Forum through the ‘Ancient Tree Hunt’ with the aim to promote conservation and appreciation of Britain’s internationally important old trees²⁴. The Conservation Foundation and Ancient Yew Group have been promoting a ‘UK Yew Guardian Project’ which aims to record the largest yews of Britain²⁵. In Solihull, VETs are identified in the ‘Warwickshire Veteran Tree Atlas’ compiled by Steven Falk²⁶.

VETs and Ancient Woodlands warrant special protection and management and Europe-wide VETs management standards²⁷ were agreed in April 2018 which will form the basis of a full certification schemes for workers in the field, and any tree work in Solihull must be considered under Development Plan policy.

Staghorned sweet chestnut (*Castanea sativa*) VET of 6.61m girth (2007) in Elmdon Park

Trees and Public Health

As more responsibility has been placed on local authorities, through the Health and Social Care Act 2012 to improve public health and reduce health inequalities, our urban forests could be the medication required.



There is growing evidence to suggest that physical and mental health can be improved with greater access to green space and trees. Contact with trees and nature impacts positively on public health from birth to death, with a correlation between those living closest to greener areas and reduced levels of mortality and obesity (and related illnesses). In Japan, Shinrin-yoku or “spending more time with trees” has been a national health programme since 1982. This “forest bathing” has scientifically been proven to improve well-being³³. Trees emit oils called Phytoncides which boost our immune system, which are shown to lower heart disease and blood pressure plus reducing stress hormones.

In London, for the most deprived groups of our communities, the number of deaths are halved in areas with the greenest space⁴. It must though be recognised health inequalities are the result of complex interactions between physical, social and economic environments, and not just income.

The quality and scale of our urban forest, such as the density of tree canopy in an urban park affects restorative recovery³⁴. Larger spaces of urban forest such as parks may contribute more positive health impacts than small neighbourhood spaces³⁵. It has been evidenced that the larger the park or green space, the greater the observed health benefits^{36,37}, though attention to the character and quality of the space and urban forest is important³⁸.

Trees and Mental Health

Urban forests can help improve mental well-being by encouraging social activity and interaction.

In today’s high tech, urbanized societies, stress is one of the most important factors contributing to ill health³⁹. In the UK, people who live within 500 metres of accessible green space are 24% more likely to meet 30 minutes of exercise levels of physical activity^{40,41} with the added benefits of meeting others⁴². People exercising outdoors, or in “escape facilities” such as urban forests⁴³, reporting higher feelings of wellbeing, and lower feelings of stress or anxiety, than those doing the same activity indoors.

The impact of the urban forest on our mental health has been equated in capital: London’s ‘parks are estimated to avoid £370m of costs incurred each year as a result of mental health’⁴⁴. Urban trees and the landscapes in which they grow can reduce isolation, important for all but in particular new parents and their children and senior citizens. Social cohesion can in turn reduce stress and depression⁴⁵ and indirectly boost social wellbeing⁴⁶.

“Neighbourhood social ties and support networks are stronger around greener neighbourhood spaces.”⁴⁷

Trees and Ecotherapy

The urban forest plays a vital role in recovery from operations or emotional trauma.

Managing mental illness or recovering from operations, can now be prescribed through ecotherapy⁴⁸ and green prescribing⁴⁹, and the urban forest needs to be recognised as playing a huge role in this. There is evidence that some indicators of psychological stress, including blood pressure and heart rate, are reduced when people are exposed to visual and auditory stimuli associated with nature^{50,51}. Views of trees can reduce the amount of analgesics needed by patients post-surgery and the number of days in hospital⁵² which is important when planning tree planting of new hospitals, respite centres and care homes.

'90% of people who took part in MIND green exercise activities said that the combination of nature and exercise is most important in determining how they feel'⁵³. There is emerging evidence that engaging with the urban forest and green spaces benefits those living with conditions such as attention deficit disorder, depression and dementia⁵⁴, by improving cognitive functioning and reducing anxiety. Children with attention deficit disorder experienced fewer problems if they had access to green space for play and the "greener" the setting, the less severe their symptoms⁵⁵.

Trees and Active People

The urban forest is the Natural Health Service.

Physical and mental illnesses associated with sedentary urban lifestyles are an increasing economic and social burden and inactivity is the 'fourth largest risk factor for mortality globally' (WHO, 2010). If an urban space is welcoming and attractive, which our urban trees contribute to, then people are more encouraged to exercise. Campaigns such as #parkrun and #thisgirlcan, social media and fitness apps has seen the rise of our tree-lined streets and urban parks being used in this way. In Birmingham the 'Be

Active' project made a further step with voucher incentives, redeemable at high-street shops, to increase physical activity⁵⁶. The "Magic Mile" of Longford Park is promoted as 'cycle, skate, run, jog, walk, crawl however you wish' and happens every month. The 'Green Gym' run by the Trust for Conservation Volunteers helps people to take exercise outdoors while participating in activities that improve the environment such as maintaining our urban forests or allotments. 9 out of 10 participants with poor mental or physical health show an improvement within seven months⁵⁷. 'Green gyms' are now available throughout Solihull.



People playing in Elmdon Nature Park

Trees and Air Pollution

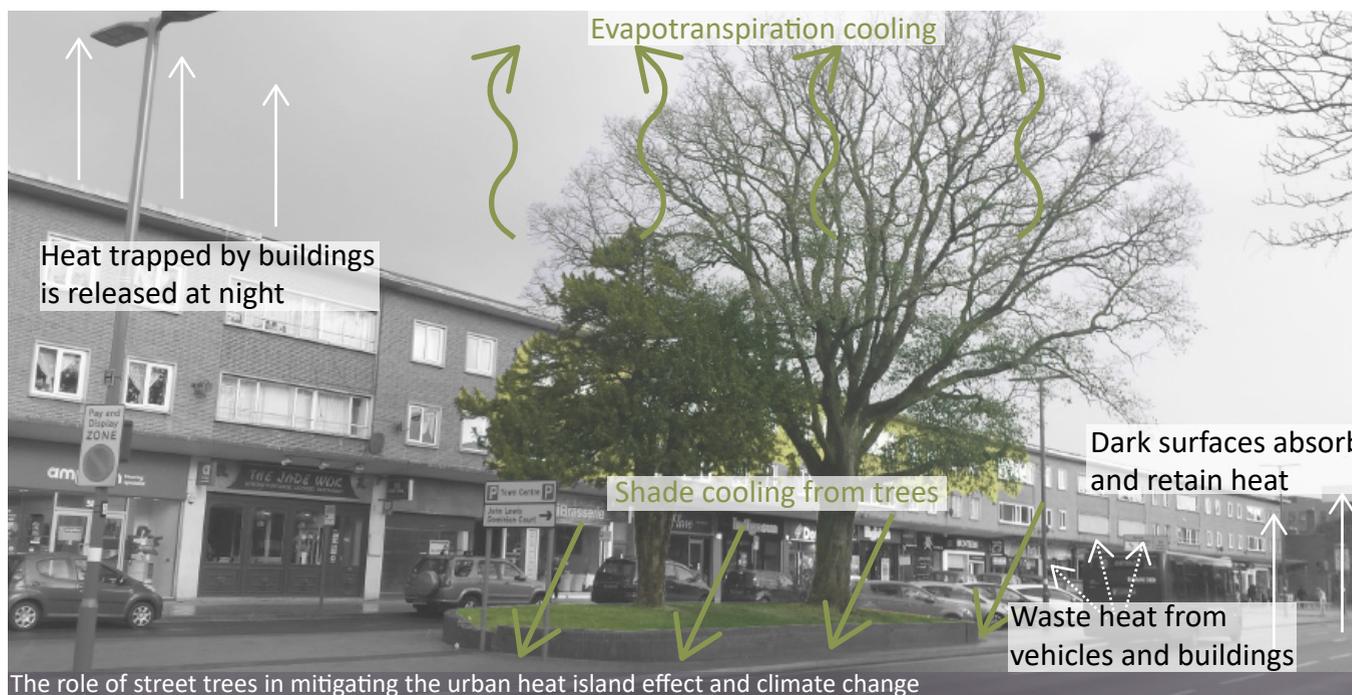
Globally, air pollution is the biggest environmental risk to health and trees can provide a solution in reducing this threat. Where you live, how you commute and where you work are all key factors in levels of exposure to pollution.

Government estimates suggest that 40,000 deaths per year are attributed to air pollution⁵⁸.

A 2007 report by Asthma UK and the Heart of Birmingham Primary Care Trust, highlighted Birmingham as having the highest hospital admissions for asthma in the UK and tackling air pollution has since become a priority issue for the city⁵⁹. Air pollution is generally highest in deprived urban areas⁶⁰ with exposure to high concentrations proven to exacerbate respiratory problems, heart disease and cancer⁶¹. Street trees have been associated with a lower prevalence of asthma in children⁶² and their contributing role in alleviating poor air quality needs to be recognised to direct the planning and design of our cities and towns⁶³.

Trees and Climate Change

The urban forest can help us adapt to the effects of climate change. Trees have a cooling effect in our town and cities; creating shade and reducing air temperatures through evaporation.



Buildings can store heat and contribute to increased temperatures in urban areas. Heat waves during the summer pose significant health risks to urban populations⁶⁴. During the 2003 heat wave, a temperature difference between urban and rural areas of up to 10°C was recorded for London⁶⁵ and estimates suggest that 40% of the 600 excess deaths in London were due to the urban heat island effect. Trees can provide a solution in regulating urban temperatures and making our streets a more comfortable place to live.

Trees and Land Contamination

Trees can combat land contamination and make our soils clean again.

In 2008, the Forestry Commission recognised the economic costs associated with hospital admissions and premature deaths due to contaminated land at £85.2 million⁶⁶. Tree planting on previously developed land to remediate contaminants, has been proven to reduce the health risk to those in contact with contaminated urban spaces.

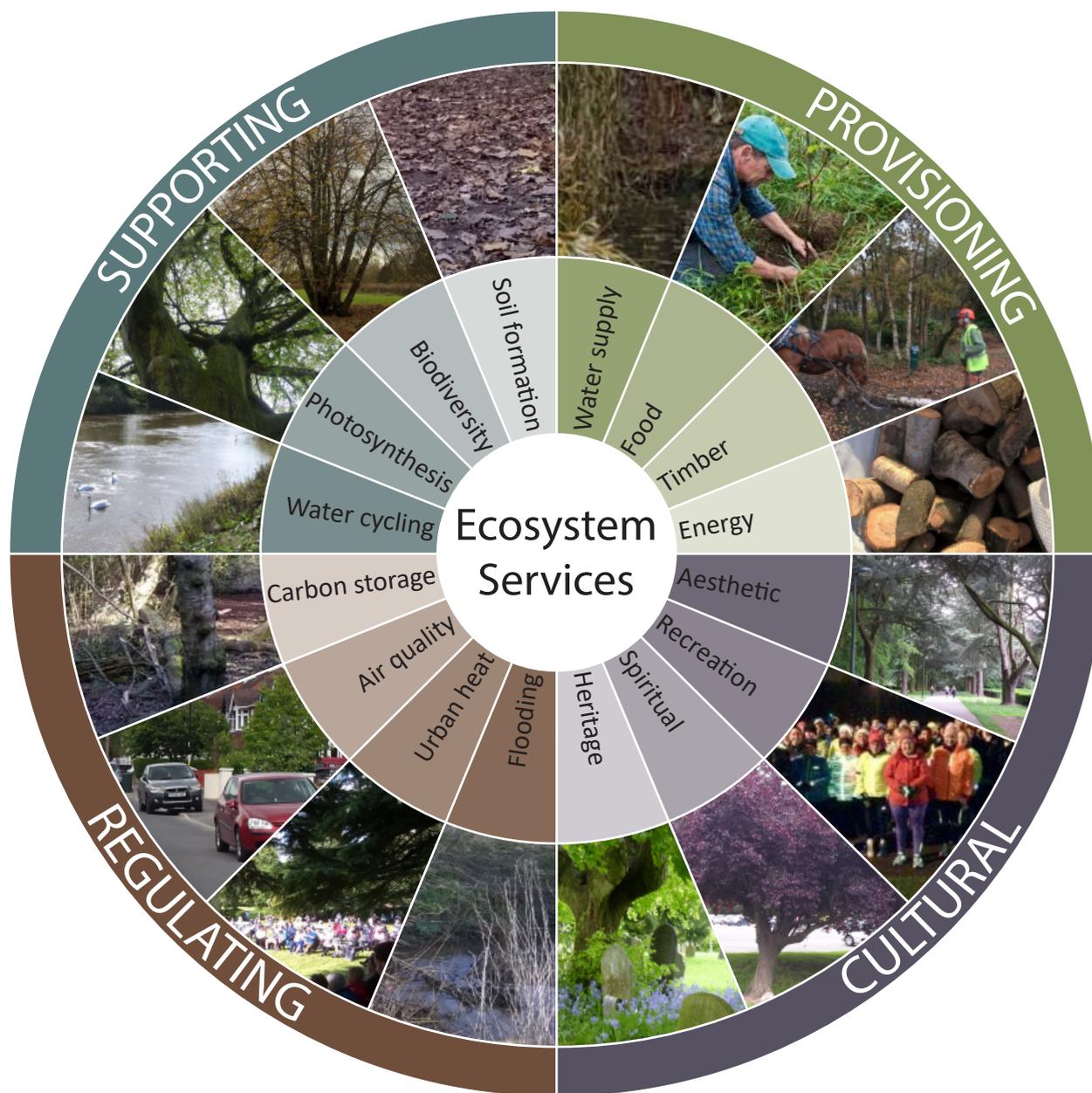
Ecosystem Services

Trees for Ecosystem Services

The urban forest provides a vast range of benefits contributing to food production, air purification, amenity value and flood management.

There is now a global understanding on the links of human well-being and nature via the Intergovernmental Platform on Biodiversity and Ecosystem Services. The UK National Ecosystem Assessment analysed the natural environment including the urban forest in terms of the benefits it provides for society and economic prosperity. It found that health, wellbeing and economic productivity of the country depended on the range of services provided by ecosystems and their constituent parts, such as water, soil, nutrients and organisms.

But for the urban forest to perform these tasks effectively the i-Tree Eco project 'Valuing London's Urban Forest'⁶⁷ revealed that 'there needs to be trees of all shapes and sizes and the right proportions to ensure that benefits can be continued to be delivered for futures Londoners'. i-Tree Eco can pick out if there is sufficient succession, a requirement for more tree planting or if there is an over reliance of over mature trees.



Trees and Storm Water Management

In recent years flooding has become prevalent in urban areas and as a society we need to be more resilient as the effects of climate change become more apparent in our everyday lives.

Flooding in urban areas is estimated to cost a minimum of £270 million per year in England and Wales, with two thirds of the homes affected in the floods of 2007 due to surface water^{68,69}.

Surface water flooding happens when rainfall runs off land and buildings at such a rate that it is unable to drain away in streams, rivers, drains or sewers. Urban trees can play a pivotal role in counteracting this. Our streets and urban spaces generally have a high coverage of impermeable surfaces which prevents surface water from soaking into the ground, increasing the risk of flooding and pollution from heavy rainfall⁷⁰. If the urban forest is designed as part of and to compliment permeable paving, with swales, rain gardens and green roofs within a Sustainable Drainage System to mimic natural drainage, rainfall can be intercepted by trees, their root systems promote infiltration and water storage in the soil and prevent “grey” drainage systems becoming overwhelmed during storm events⁷¹. Sustainable Drainage Systems is mandatory for all new developments in England and Wales (Flood

and Water Management Act 2010), although national standards remain under development by Defra. Natural England has also highlighted the use of urban forestry in wetlands and floodplains to act as buffers to protect urban areas from flooding and pollution⁷².



Trees and Water Quality

Trees are nature’s water filter.

Improving water quality is crucial to healthy life. Urban forestry can help reduce the high speed of runoff, collect pollutants and detritus from urban surfaces, and reduce infiltration of precipitation, ensuring the quality of water is as good as it can be flowing through an urban catchment.

The EU’s Water Framework Directive establishes targets for ensure water quality in our environment. In many urban areas throughout

the UK these targets are being missed. The incorporation of natural Sustainable Drainage S with existing and planned developments is one effective and environmental friendly way of improving water quality. Increasing woodland cover also has a benefit. For example in north Nottinghamshire the establishment of a new Community Forest over 24 years increased tree cover threefold and reduced annual recharge and runoff by 11%⁷³.

Trees and Noise Pollution

Trees help to mask noise.

In Solihull, sources of noise from the airport, motorway network and the industrial areas are all sources of environmental pollution that can be reduced by effective planting of trees.

The proliferation of prolonged exposure to high levels of noise can cause anxiety, stress and hearing loss. The reduction of noise pollution (sometimes called abatement) can be achieved by well planned and designed tree planting. Evidence from Forest Research suggests that planting “noise buffers” composed of trees and shrubs can reduce noise by five to ten decibels for every 30m width of woodland, especially sharp tones, and this reduces noise to the human ear by approximately 50%. To achieve this effect, the species and the planting design must be chosen carefully.

Trees, Carbon Storage and Sequestration

Trees lock up carbon from the atmosphere and help reduce the effects of global warming.

The urban forest can help mitigate climate change by sequestering, or hiding away, atmospheric carbon as part of the carbon cycle. Tree stems, branches and roots can store carbon for decades or even centuries, equating to several tons of atmospheric carbon dioxide being absorbed over the lifetime of a single tree.

“One large tree can absorb 150kg of carbon dioxide per year, as well as filtering airborne pollutants.”

In London an estimated 2,367,000 tonnes (approximately 15t/ha) of carbon is stored in London’s trees with an estimated value of £147 million⁵⁹. The number of trees present, their species and mass can affect carbon sequestration and Oak as a species stores the most carbon in the urban forest, as larger trees store more carbon in their tissues.

Trees and Food Production

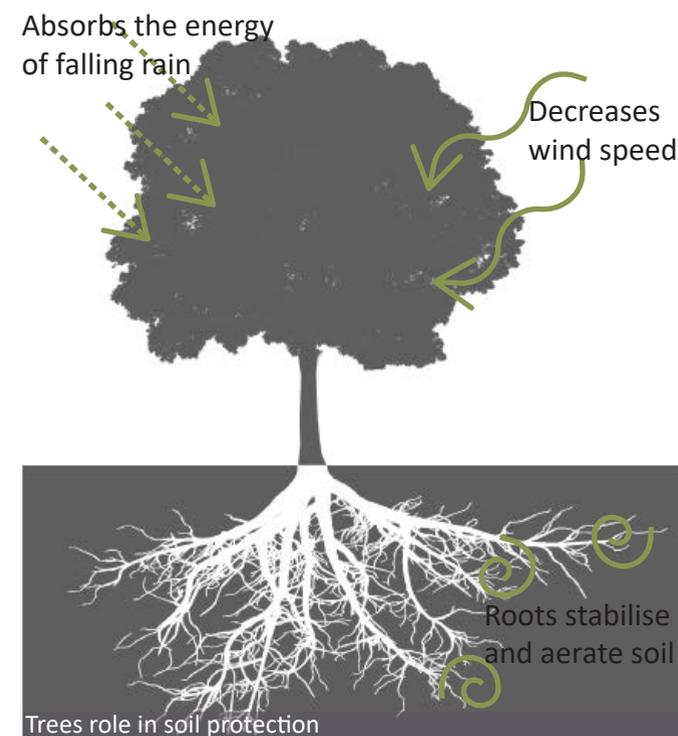
Trees play a huge part in the drive for urban gardening, Forest gardening⁷⁴ and local food production, whether this is on allotments,

community gardens or orchards. Increasing access to healthy food and providing educational and business opportunities, contributes to food security and reconnects communities with their local environment. Joining local communities with these assets presented by the urban forest, via footpaths and cycleways can encourage reconnection to the natural world further.

Trees and Soil Protection

Trees are vital for soil health. Trees and their roots aerate the soil and prevent erosion and compaction.

Wind and rain are two of the main forces that erode bare soil. Trees reduce the effect of erosive forces using their root systems and foliage. Tree roots create a network of flexible tendrils that help stabilise the soil around the tree and hold it in place. The leaves and branches of trees create a flexible screen that reduces the force of wind and rain in the surrounding area. Tree foliage intercepts falling rain water and reduces the force it exerts when it hits the ground. Rain water caught in a tree’s foliage is channelled over the stems and down the trunk until it soaks into the soil. Groups of trees planted together can act as wind breaks and prevent soil being carried away in the wind.



Trees and Air Pollution Alleviation

Air pollution from vehicles and industrial processes has an impact on our health and air temperatures.

Urban air pollution predominantly comes from traffic emissions. Urban trees can alleviate air pollution directly by trapping and removing fine particulate matter⁷⁵ and indirectly by reducing air temperatures. The strength of the effect⁷⁶ of filtering pollutants depends on many factors e.g. weather, the pollution concentration, extent of tree cover, leaf area, species and quality of vegetation⁷⁷. The structure of large trees and their rough surfaces cause interception of particulate matter (of less than 10 microns diameter) by disrupting wind flow. Therefore the uptake of SO₂, NO_x and ozone is higher in broadleaved species than conifers, but conifers capture larger amounts of PM₁₀ than broadleaved trees due to the larger total surface area of needles, giving conifers larger filtering capacity than broadleaved trees⁷⁸. Trees also provide a surface area for capture between 2 to 12 times the area of land they cover.

As a consequence, urban planning needs to consider a combination of parklands, buildings, street trees, and gardens to create a rough surface of differing heights, to create essential turbulence, increasing mixing, and pollutant dispersion⁷⁹. In the West Midlands, a study has suggested that

doubling tree cover across the region would reduce the concentration of fine PM₁₀ by 25% and could prevent 140 air pollution related deaths in the region each year^{80,81}, supporting proposals for planting new urban woodlands.

But can urban trees make pollution worse at a street level? In some circumstances this can be the case, but always the best way to improve air quality is to remove the emission sources – road traffic - rather than the tree. Natural chemicals produced by the tree called volatile organic compounds can on very hot days with strong sunlight mix with pollution to form ozone, which at street level, is a pollutant with negative health impacts⁸². For a significant health impact this would require millions of trees and take several hours. This effect is large-scale and the ozone formation occurs hundreds of miles away from the original source. Dense avenues of street trees with large interconnected canopies can trap air at street level if the pollution source is located within this zone⁸³, but most importantly if the source is located outside, the tree canopies will create locally cleaner air. Therefore green corridors need to be master planned across cities to reduce pedestrian exposure to pollution by providing alternative routes⁸⁴ and acting as a green barrier, increasing the pathway between pollution source and receptor, and speeding up the mixing and remediation of pollutant concentration⁷⁸.

Trees and the Urban Heat Island

Trees are nature's air conditioners.

Well planned and designed urban places and spaces with trees are crucial for reducing the long term effects of climate change.

Urban areas in Solihull experience elevated temperatures compared with rural areas, because the urban fabric, e.g. tarmac and concrete, absorb and retain heat⁸⁵. Climate change projections suggest a trend towards elevated temperatures, but urban forestry has an important role to play in cooling air temperatures through the evaporation of water^{86,87}, shading⁸⁸, and the conversion of solar radiation to latent heat. Through modelling it is possible to determine the cooling effect of the urban forest and associated green space e.g. in Birmingham (BUCCANEER project⁸⁹). Trees can cool cities by between 2°C and 8°C and when planted near buildings, can cut air conditioning use down by 30%, and reduce heat energy consumption by 20-50% (UN Urban Forestry Office).



Trees within new developments, Dickensheath

Trees and Traffic Calming

Traffic and trees can work together to make our streets safer and more distinctive.

Well designed streets and urban areas with carefully positioned trees can have a positive effect on slowing traffic and making spaces more pleasant for pedestrians and motorists. Carefully positioned trees can frame and segregate pedestrian areas and sub consciously inform vehicle drivers. Improving sightlines and helping to slow down cars in urban settings can be used as an alternative to bollards and speed bumps or to reinforce their presence and enhance the role of a central reservation.

Trees and Distinctive Design

Solihull's "leafy character" is synonymous with its rich and mature treescape and creates a distinctive environment.

Successful urban forestry embraced by the local community, which relates to the landscape character and heritage of the locality, can contribute to the local sense of place.

Trees shade buildings, shield from winter winds and regulate temperatures through evapo-transpiration, influencing the energy consumption to heat and cool the building. In the summer, trees reduce building energy consumption, but in the

winter months can either increase or decrease building energy use, depending on the location of trees around the building.

Street trees present aesthetic qualities to our urban spaces; provide distinctive landmarks and can evoke memories, which are particularly important for the sensory development of young children and recognition for seniors suffering from dementia. Streetscapes can be injected with vibrancy, beauty and light when trees have been planted, making them distinctive places, and as a consequence can be a catalyst for regeneration, enhance house prices (when compared with similar streets without trees and investment). The visual appearance and attractiveness of towns and cities has been found to be strongly influenced by the provision of green space⁹⁰. Distinctive trees can potentially result in a boom in tourism, stimulating job opportunities as a result. With the approach of largescale development such as HS2, the CLAUDE team of SMBC are working hard to ensure that the managed landscape around Arden Cross station hub continues to present Solihull's "leafy character".

Natural Capital

Trees as Natural Capital

Trees of course do have social and environmental benefits. However, the urban forest as an assets, also has direct financial benefits. This is often called natural capital.

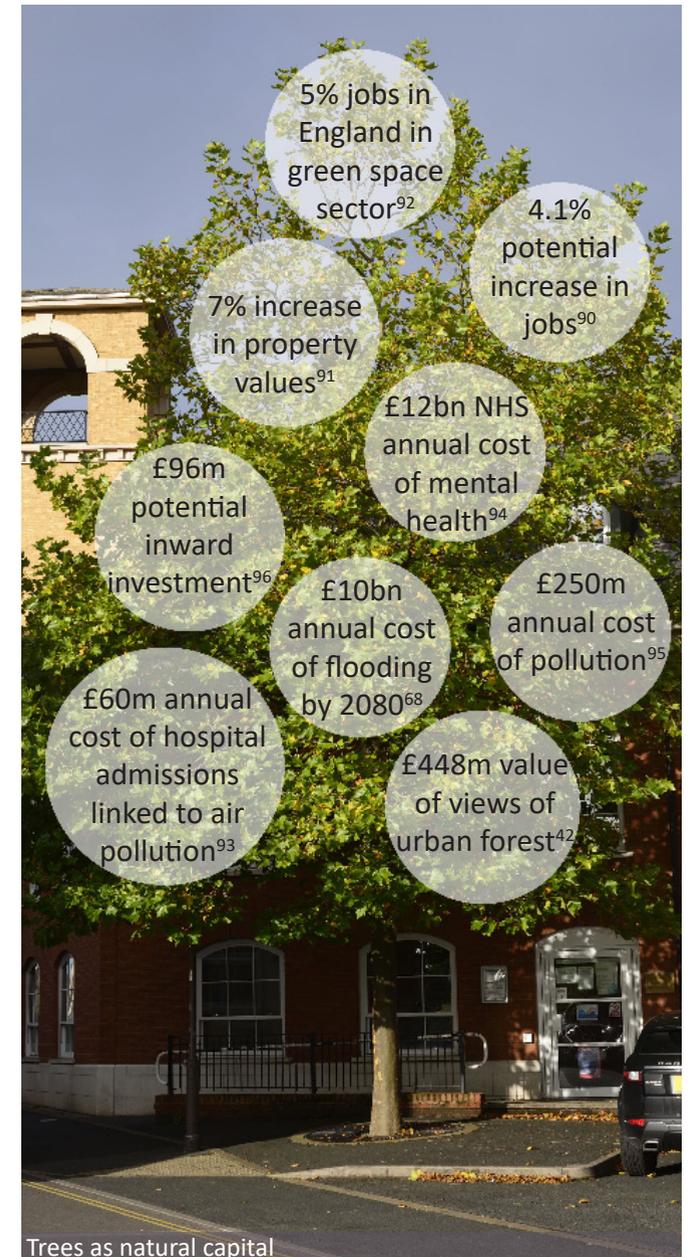
“Natural capital refers to the set of ‘environmental assets that may provide benefits to humanity’ (Defra, 2017).”

The significant contribution of green infrastructure including urban forestry to growth, jobs, health and social welfare, climate change, disaster mitigation, and agricultural and environmental policy was recognised by the European Commission in May 2013⁹⁷. Determining monetary values regarding the tree stock as a component of green infrastructure is vital to support the case for sustained investment of the urban forest.

Across the UK a lot of research has been undertaken, including the ‘Value of London’s Parks and Green Space’ by Vivid Economics who calculated for every ‘£1 spent by the Local Authority and their partners on public parks, Londoners enjoyed at least £27 in value’ and that ‘Londoner’s avoid £950m/year in health costs due to public parks’³⁵. The restorative benefits⁹⁸

of green space come at no direct cost to the user whereas other forms of relaxation e.g. medical treatment; yoga usually do. Just a 10% increase in adult physical activity which can be in the urban forest would benefit England by £500 million per annum⁹⁹.

Living with views of the urban forest or having views of broadleaved woodland on journeys were estimated to be valued at around £448 million at 2007–08 house prices, or £15.7 million per year⁸⁸. To demonstrate the value of our urban forests in Solihull, it would be beneficial to express a monetary value of the multiple benefits provided by the urban forest as a resource to help decision-makers manage the urban tree stock as a whole.



Trees and the Local Economy

Trees can have a direct influence on Solihull's economy.

The value of good quality and accessible urban forestry on local economic regeneration can be quantified through inward investment and changes in employment (FTE jobs created); land and property values; new business start ups; and land and property prices. When the National Forest was created, the number of local jobs increased by 4.1% and local regeneration attracted £96 million of investment⁹³. If for example a new urban forest was created in or near Solihull it can be argued that inward investment would follow and be beneficial. Natural England has argued that green infrastructure and urban forestry can provide a competitive advantage to urban centres at a local scale^{100,101}. So what happens?

Job creation

The labour force required for the management and maintenance of the urban forest.

Supply chains

Sales and growth through the urban forest supply chain, such as horticultural and construction companies.

Investment

High quality living and working environments attract high value industries and skilled workers to a region.

Land and property values

Forested landscapes increase land and property values, and attract further development to an area.

Tourism

Urban forests attract visitors to an area, and increase their dwell time and spending with local businesses.

Culture

Generation of creative and cultural businesses, employment and events held in the urban forest.

Environmental cost-savings

Green infrastructure is a long term cost effective alternative to grey infrastructure.

Productivity

Urban forestry has a positive effect on the physical and mental health and wellbeing of the local workforce.

Public health

The urban forest results in NHS and social care cost savings, which can be reinvested elsewhere.

Urban heat island effect

The cooling effect of urban trees result in a reduction in energy costs associated with air conditioning.

Vandalism

Good quality managed environments can reduce the incidence of vandalism and crime in an area.

Land regeneration

Trees are a cost effective tool for treating contaminated land, which can then be released for redevelopment.

Trees and the Financial Balance Sheet

Trees and the urban forest can be quantified as financial assets.

There are various digital technologies that help us assess the benefits of the urban forest or a single urban tree, which will in turn direct management choices. The Forestry Commission's 'Street Tree Valuation System'¹⁰² compares three of these digital tools: CAVAT, i-Tree and Helliwell.



Mature street trees, Brueton Avenue



CAVAT or Capital Asset Value for Amenity

Trees is a tool which can be used to express the public amenity value of urban trees in monetary terms. It is used for the calculation of compensation by SMBC when a planning decision is being made which involves the potential loss of a significant tree or if a tree has been damaged CAVAT can be used for evidencing, at levels agreed between local authorities and insurance companies. It provides a method for managing trees as public assets or Asset Value Management for Trees (AVMT) rather than liabilities, based on a depreciated replacement cost approach. 'CAVAT takes into account the contribution of location, relative contribution to amenity, social value and appropriateness, as well as an assessment of functionality and life expectancy'. AVMT can be effectively used to demonstrate benefits of the urban forest and provide an argument to safeguard the budget for planting and management. CAVAT can be used as part of an i-Tree assessment to provide the "structural" value of a tree population.



i-Tree Eco¹⁰³ is recommended for use by communities to strengthen forestry management. It standardises field data from randomly located sites across the whole of the authority area combined with local hourly pollution statistics and meteorological data to provide a picture of the ecosystem services supported by the urban forest.

It can be used through i-Tree Canopy to measure overall tree canopy or urban forest cover, which can be one way of assessing the extent of tree cover over an area. It can also be used to determine Gross Leaf Area and species dominance¹⁰⁴.



Helliwell is based on expert judgement and focuses on valuing the visual amenity of a tree, independent both of the cost of originally growing the tree and of the potential replacement cost. An historic tree of great beauty may have grown at no cost, without human intervention; while an expensive street tree could be inappropriately located. Helliwell focuses on evaluation of the relative contribution the urban tree brings to the visual quality of the landscape.

In SMBC, there is a growing momentum to undertake an i-Tree canopy cover assessment across Solihull in the future, and to set up a 'Natural Capital Group' to act as an Advisory body to the Council's 'Environment Board'. The Council has a 'Green Prospectus' with the ambition for Solihull to be a low energy area which 'Sustainability West Midlands' is monitoring¹⁰⁵.

Solihull and the Urban Forest

Case Studies

The urban forest of Solihull forms the backbone of the places where we live, work and play. As part of the preparation of the new urban forestry strategy for Solihull we have consulted with stakeholders, SMBC officers and looked in detail at the issues effecting how we current plan, manage and maintain trees and the urban forest. To help inform our thinking we have developed series of case studies that reflect just a snapshot of the current issues facing urban forest in Solihull.



Deodar Cedars, Fillongly Road

- Visually impressive and unusual Deodar Cedars on Fillongly Road.
- Threatened by soil compaction due to inappropriate car parking within root area.



Horse Chestnuts and Limes, Conker Lane

- Mature avenue of up to 60 trees along Conker Lane, subject to a Tree Preservation Order.
- Presents management conflict due to proximity of trees to surrounding houses, drain blockage, and falling conkers.



Yorks Wood

- Woodland area in Kingshurst.
- Under severe urban pressure due to open public access, which is compromising ecological value and regeneration.



New planting, Dickensheath

- New development in Dickensheath, which incorporated new tree planting.
- Inappropriate design and planning has meant that many new trees have already failed, and existing mature trees have been compromised.



Lime trees, Brueton Avenue

- 200 year old historic avenue of lime trees along Brueton Avenue.
- Ongoing maintenance and pruning challenges of existing stock to ensure sufficient spacing and clearance. Additional tree planting for infill and replacement where appropriate.

Vision

A dynamic, living and breathing urban forest that enriches and sustains our natural environment; contributing positive and tangible benefits for the health and well being of the people and the economy of Solihull.



Challenges and Opportunities

Our research and engagement with stakeholders has identified several long-term challenges that we need to address. However there are also new and emerging opportunities that we need to embrace over the coming years. These challenges and opportunities can be summarised as follows.

- 1  Funding
- 2  Planning
- 3  Maintaining
- 4  Protecting
- 5  Promoting
- 6  Sustaining

Funding the Urban Forest

Historically the majority of funding for the urban forest in the UK comes from the public sector - 70% from local authorities and 15% from Central Government and the EU¹⁰⁶.

Nationally, a reduction in central government grants to local authorities has led to a 10.5% decrease in spending on green spaces and the urban forest between 2010/11 and 2012/13¹⁰⁷.

Across Solihull, Lottery grants, WREN funding bids, ERDF and fundraising events have been successful in raising capital, but these opportunities aren't sustainable, often one-off or small short-term grants and not for securing the long-term cost of management¹⁰⁸. As a result, the lack of funding has consistently been raised as the main constraint for improving the urban forest and green infrastructure, both in its creation and maintenance. In the longer term, funding the urban forest will require longer term financial planning and securing investment in the urban forest asset from a range of sources. Now opportunities should focus on the following issues



Planning gain- Investment in the long term strategic planning of the urban forest should seek to maximise planning gain via s106 agreements and the Community Infrastructure Levy.



Regeneration and Business Improvement Districts (BIDs)- Tree planting opportunities and retrofitting existing grey infrastructure arise through BIDs or economic regeneration whereby businesses, local government and agencies work together to deliver local business-led aspirations. The 'Greening for Growth' project (2010) in London's Victoria BID identified the potential for 1.25ha of new green infrastructure, 1.7ha of enhancements to existing green infrastructure and suitable space for 25ha of green roofs¹⁰⁹. A BID is valid for five years and all BID members make an annual contribution to the running of the programme. This model could provide a sustainable option for contributing to the urban forest in the longer term.



The Arden tree scheme- Birmingham Airport partners with SMBC to fund native tree and hedgerow planting as offset mitigation. Thousands of urban trees have been planted through this scheme, and features characteristic of the wider Warwickshire landscape have been restored in line with Warwickshire Design SPG. The initiative is open to any individuals or groups wishing to create hedgerows or small woodlands on their own land, within the borough of Solihull. There are opportunities for extending the scheme and creating a wider "off setting" project that realises a new Arden Forest for Warwickshire.



Investment in the urban forest- SMBC need to be savvy in how they rethink, invest in and justify the redirection of any funding to the urban forest. If a holistic approach to the planning, design and management of the urban forest is applied within any new development, key contributions to reducing construction costs can result, with enhanced efficiencies of land use, and generating new income streams. The developer would be required to invest in the urban forest to mitigate and support the new development. In order to provide long-term maintenance costs, certain authorities are adopting SMART technologies such as Geo-Sense¹¹⁰ to capture visitor data to direct their investment or create income-generating opportunities like cafes, forest holidays, eco-resorts and events.

With a mass of evidence revealing the role of urban trees affecting the nation's health and wellbeing, the current urban forestry budgets for creation, management and maintenance is a small leaf in the Autumn fall when compared to the costs that have been identified eating up the NHS and Social Care budgets which access to the urban forest could address as health savings. Birmingham, through the 'Active Parks' initiative, has looked at redirecting money from the NHS to invest in green spaces used by patients fulfilling 'exercise prescriptions'.

Planning the Urban Forest

Planning and designing development within the context of the urban forest is vital.

To assist in planning urban forests, local authorities around the UK have adopted the principles behind 'Trees in the Townscape – A Guide for Decision Makers'¹¹¹ produced by the Trees and Design Action Group in 2012. The NPPF 2012 recommends all local authorities set out a strategic approach to the 'creation, protection, enhancement and management of Green Infrastructure' including urban forests but only a few local authorities have achieved embedding a 'GI Approach' into their local strategies⁹. Birmingham, for example has included spatial plans of additional green infrastructure sites¹¹². The 'Warwickshire, Coventry and Solihull Green Infrastructure (2016)' has been developed at a sub-regional level as an effective tool for planning and evidence base for planning policies and strategies. In 2010, an 'Urban Tree Strategy 2010-15' was produced by SMBC, which officers still utilise, which guides the authority on planning the urban forest and new tree planting.

As trees take more than a life time to mature, and the loss of mature tree stock have particular repercussions in the value of the urban forest, future planning for planting is essential to accommodate best practice and consider how

best to deliver the multiple benefits of the urban forest. The following issues will need to be considered.



Planning for tree planting- To ensure Solihull retains existing tree cover levels, planting needs to be continually assessed, opportunities scoped, designed effectively and tree planting undertaken in accordance with best practice. SMBC will need to consider revisions to supplementary planning guidance and detailed technical notes.



Working with developers- One of the most significant threats to our urban forest is new development and Solihull has a high demand on land resource. Effective partnerships and adopting innovation is key in successfully delivering environmentally sympathetic managed growth across Solihull's already pressurised urban environment. The maintenance, development and conservation of Solihull's tree stock is important in ensuring that Solihull remains a great place to work and live, supporting Solihull's future. For example, incorporating strong policy into local plans to ensure new developments contribute to enhancing local environmental quality is essential, with Sefton Borough Council taking a lead with their Policy DQ3¹¹³. Sefton Borough Council stipulate for planning permission to be granted, developments should not result in an



SBC Urban Forest management and maintenance team

unacceptable loss of or damage to existing trees; with replacement planting at a ratio of at least 2:1; with new trees planted, at a minimum of 3 per residential dwelling; or for non-residential development, 1 tree per parking space or 1 tree per 50 square metres of gross floorspace. If it is not possible to secure new or replacement tree planting within the site, developers are required to pay a sum in lieu, with 10 years of maintenance costs, for Sefton BC to plant at an alternative site.

The Planners at SMBC frequently receive inadequate plans from developers, often with trees being retained which are unsuitable for the proposal or new buildings not considering the

existing tree stock on the site. Communication is the key to convey to the developer that any planning guidance involving trees will be to the minimum standard as described in 'BS 5837:2012 Trees in relation to design, demolition and construction – Recommendations', which also describes minimum tree protection standards. A tree survey needs to be undertaken by the developer to BS5837: 2012 to understand the condition and habit of the trees on site and to be able to calculate the Root Protection Area (RPA) to ensure proper protection from indirect and direct damage.



Partnership working with private landowners- The greatest proportion of our urban forest is privately owned, and care of the tree obviously varies vastly. SMBC seeks to work with private

landowners to ensure that our urban forest is well planned and cared for. This includes supporting planners in terms of advising on the right tree planting for future investments. Policies and future actions will need to consider how SMBC continues to engage and work with private land owners for the development of the urban forest.



Enhancing biodiversity- Trees make up a significant and highly visible component of Solihull's biodiversity, with Tree Protection Orders (TPOs) and listings designated for their biodiversity value.

They include ancient semi-natural and secondary native woodland, wood pasture, parkland, scrub, and individual VETs. Many priority species of animals and insects including bats, common dormouse, barn owl and stag beetle are directly associated with certain tree species for habitats and food, such as Black poplar, which is a biodiversity priority species. Many insects specialise in their feeding preference on just a few tree species, whilst others are generalists that benefit from multiple tree species. In England native willows, oaks and birches support the most varied insect herbivore species; Beetles are better supported by Scots pine. Generally non-native

trees are associated with fewer species than native trees as they 'have had less time to form associations with native organisms'¹¹⁴. It can though be seen where tree diversity is limited in urban areas that some non-native trees such as sycamore support a large quantity of biomass, providing a valuable food source for birds. Some native tree species form few insect herbivore associations due to a high level of tree defence mechanisms eg. yew¹¹⁵. Pollinating insects hosted by trees provide essential ecosystem services in urban areas of Solihull by pollinating flowers and producing food. Trees offer an important source of pollen at particular times of year when other sources are unavailable.

The Habitat Biodiversity Audit has been undertaken by Warwickshire Wildlife Trust in partnership with the six Warwickshire local authorities including Solihull since 1995. Their remit is to survey every field and boundary to provide up-to-date biodiversity data, which is mapped in GIS. This process is continually ongoing, data is updated annually, making the Habitat Biodiversity Audit the longest continual survey of this kind, which is crucial as the data is used in decision making regarding the spatial planning and development control of the urban forest. Phase 1 Habitats Surveys provide data on urban forest change, land use pressures and feeds policy and decision making on green infrastructure, ecological connectivity and biodiversity offsetting.

The Warwickshire Wildlife Sites Project is now part of the HBA Partnership, which is responsible for Local Wildlife Site selection which covers some of our urban forest. A detailed Phase 2 Habitat Survey is undertaken against a set of national criteria called the 'Green Book'. The designation of Local Wildlife Sites is considered by a panel of experts which includes an officer from SMBC.

The biodiversity value of urban trees when seen as a collective and in association with other elements of GI is a functioning ecosystem providing habitats for many species in hostile urban environments.

The UK Biodiversity Action Plan established a native woodland habitat creation target of 134,500ha by 2015¹¹⁶. The new UK Biodiversity Action Plan habitat 'Open Mosaic Habitat on Previously Developed Land' is concentrated in urban and peri-urban areas, which is an important habitat for many rare or threatened and protected invertebrates, plants and birds on unique soil conditions. The urban forest can be planned to increase these populations. Some species harbouring within the urban forest are invasive and require careful management.

Important for planning Solihull's urban forest, it is known that species population size is also directly linked to the size of available habitat area e.g. the biodiversity benefits of massing the urban forest was demonstrated by bird species richness¹¹⁷, and most 10-35 ha parks will contain all the

birds recorded in any urban area of that region. Therefore, removal of an area of urban forest in Solihull or a line of street trees could impact on the movement of species, which use urban trees and green infrastructure as 'stepping stones' of habitat enabling including longer-distance movement for some species. Woody streets in Madrid for example contain a higher number and diversity of birds if they connect directly to an urban park; and even small patches have a potential to benefit movement of biodiversity¹¹⁸. Managed roundabouts and road verges planted with suitable trees support a wide variety of plants and insects¹¹⁹. In Solihull, the CLAUDE team have been successful in securing two European Rural Development Fund grants for 'Woodland Management' and activities supporting Solihull's 2020 'Biodiversity Strategy'. These have been profiled as priority projects with best practice management principles being adopted across 80ha of green infrastructure, enhancing green corridors, cycle routes and hedgerows, during the first phase; with the second phase called 'Wildlife Ways' (previously called 'Greening the Grey') connecting woodlands to the first phase sites, running until March 2021. In the future, policies and actions need to consider long term management plans for biodiversity within the urban forest.



Planning for climate change- Extreme and more frequent weather events are expected in the future¹²⁰, and infrastructure will need to resist these predicted changes, which is not considered extensively in current Local Development Plans. ‘Solihull’s Green Prospectus – delivering a Greener Solihull for Success 2017/18 Refresh’ supports and informs managed growth to enable transition to a low carbon economy and links to Solihull’s ‘Sustainability Vision and Plan’. It must be recognised that Solihull’s Town Centre Masterplan’s have been adopted, but we must lobby to address the outstanding need to produce a robust dataset for measuring air quality for which action plans can be shaped in the future. It is essential that joined up thinking across the sectors is used connecting the urban forest to a whole raft of policies and strategies such as the vision for the ‘Walking and Cycling Strategy’ and the designation of the ‘Strategic Cycle Network’.

The NPPF 2012, the UK Climate Change Risk Assessment 2012 and the subsequent National Adaptation Programme 2013 all recognise the role of urban green infrastructure and forest in climate change adaptation. The BiFOR: Birmingham Institute of Forest Research, is researching the evidence case for forests as part of One Planet Living, and is currently researching how forests will respond to the future prediction of CO2 increase¹²¹. This data will provide an important

argument for enhancing our urban forest in Solihull. Even modest increases in tree canopy can reduce the urban heat island effect and build resilience to climate change through evapo-transpiration and shading, as well as improving air quality. The role trees play in alleviating the effects of climate change needs to be recognised and provision made available to plan for new tree planting.

Well-informed decision making is therefore required on the design of buildings, infrastructure, open space provision and tree species selection in response to the effects of climate change. TDAG guidance needs to be integral to all decision making¹²².



Planning to alleviate air pollution-

Street trees have been associated with a lower prevalence of asthma in children. Designated Natural Health Improvement Zones is one of the initiatives endorsed in the ‘2011-15 Health Protection Agency Strategy’ to tackle this challenge. These Zones are centred on those areas most affected by air pollution (Air Quality Management Areas), and, within these areas, trees and green walls planted facilitate the trapping of pollutants by foliage.

The urban forest in Solihull has a direct role to play in alleviating air pollution and specific technical guidance will need to be developed to address this increasingly concerning issue.

Maintaining the Urban Forest

Officers from SMBC have undertaken significant work to explore new ways of working that will effectively provide better value for money. Investigating opportunities through sub-regional working scoped a potential to combine services with Coventry City Council (CCC). A market testing of the combined Forestry Services Contract was devised, driven by maximum efficiencies and financial savings, through economies of scale. Forestry Contract delivery for SMBC was awarded to Glendale Countryside in April 2010, with yearly renewals and in 2016 a joint 20 year contract in multiples of 5 years was undertaken with CCC. The contractor was selected through EU open tendering process with eight suppliers bidding for the work assessed through a 40% price: 60% technical/quality criteria. This resulted in £195,487 joint cashable savings to SMBC and CCC. This joint procurement was considered unique in the arboricultural industry and an innovative way forward.

But sadly this was not to last with a series of milestones, such as implementing combined ICT systems not being achieved. The combined authority status of this contract was concluded in 2018. It was recognised that both authorities work in different ways, providing challenges in managing a Forestry Contract; but both authorities will continue to have a shared vision

regarding their urban forest. Both councils are therefore continually looking at other ways to effectively cost save through maintenance with increasing financial constraints placed on CCC and SMBC to manage the urban forest, the public and private sector both need to seriously consider investment targets.

Local community support or 'buy-in' to their urban forest assists in moderating long-term financial and managerial costs. But is maintenance of the urban forest essential to maximise its benefits? While well-maintained green spaces can improve mental health, overgrown vegetation can have a negative impact by increasing the fear of crime although these overgrown spaces may be better for biodiversity. Some infrastructure such as green roofs, walls and rain gardens require minimal maintenance once installed. For other types of infrastructure, such as green spaces, the cost of maintenance can be higher – through mowing, weeding and watering. These costs often fall to local authorities and have been the focus of budget cuts in recent years. Green infrastructure includes a wide range of infrastructure types, so generalisations regarding the cost of implementation and maintenance are difficult to make. Maintenance may increase long-term jobs in the local community, but alternative sources of funding are required to cover these costs. Design that is sensitive to maintenance costs can improve the sustainability of a project by minimising this budget. The following issues and challenges for

long term management and maintenance of the urban forest need to be considered.



Tree inspections and risk assessments- Inspections based on Visual Tree Assessment form the basis of pro-active maintenance regimes for all SMBC owned trees. A recent court case has set

a precedent for tree inspection regimes. In January 2012, Mr Cavanagh (The Claimant) was driving public bus along the A283 Petworth Road in Witley, Surrey, when a mature lime tree fell across the road hitting the vehicle and causing him severe injuries. The responsibility for the tree rested with Witley Parish Council (The First Defendant) who operated a three-yearly inspection regime leading up to the incident. The Second Defendant was a tree and forestry contractor, Mr Shepherd, who inspected the tree about three years before the failure. The experts agreed that the tree failed due to severe and extensive decay in the root system, with high winds being a contributory factor. At the time of failure, the tree had a significant fungal bracket at its base, but on the side furthest from the road. The case was heard in the High Court in December 2016 and the judgment handed down in February 2017 (Case No: HQ14 P05328) in favour of the Claimant. The judge found that a three-year inspection regime was inadequate and that a reasonable inspection frequency should have been every two years.

In 1996 SMBC undertook a detailed survey of all its street trees, cataloguing all the details on ARBORtrack. SMBC continue to develop ARBORtrack and have now incorporated other areas of the urban forest, including housing, strategic land, parks, woodlands and cemeteries. In light of recent precedents, SMBC will need to consider specific policy and resource implications for cyclical visual tree inspections.



Tree pruning- Inappropriate or poor pruning of trees can have long term financial and safety impacts. For example, re-growth via topping (from 50 years ago in Solihull) has been stimulated in thousands of street trees which have now regrown with full crowns. They might appear no different to a naturally grown tree but their branches do not have the same strength of attachment to the main stem, and this accelerated growth results in inferior structural stability. Current maintenance to resolve this involves thinning the tree's crowns responding to resident's requests for more light or lifting crowns to meet highways regulations. SMBC will not top trees, which in the past have been 'lopped' and 'topped' due to a lack of knowledge regarding a tree's future health, aesthetics, the way it grows and safety. These policies and procedures need to be clearly articulated.



Street trees- SMBC takes responsibility of all the street trees on Solihull’s highways. Specific policies and procedures for inspections and proactive maintenance need to be adopted as part

of the Urban Forestry Strategy.



Parks and public open space- In Solihull, all trees in the principal parks have been surveyed and recorded in ARBORtrack, with the resulting health and safety actions undertaken.



New planting- It is recognised that new trees require specific maintenance during the initial establishment phase to ensure that they thrive, and to avoid costly maintenance issues and health

and safety concerns in the future. For street trees this is becoming more of a challenge and it is important in these environments where trees have been removed due to highway operation that replacement planting is undertaken the following season to ensure continuity of tree heritage of that street. Clear policies and procedures need to be adopted to ensure the correct establishment of trees within the urban forest.

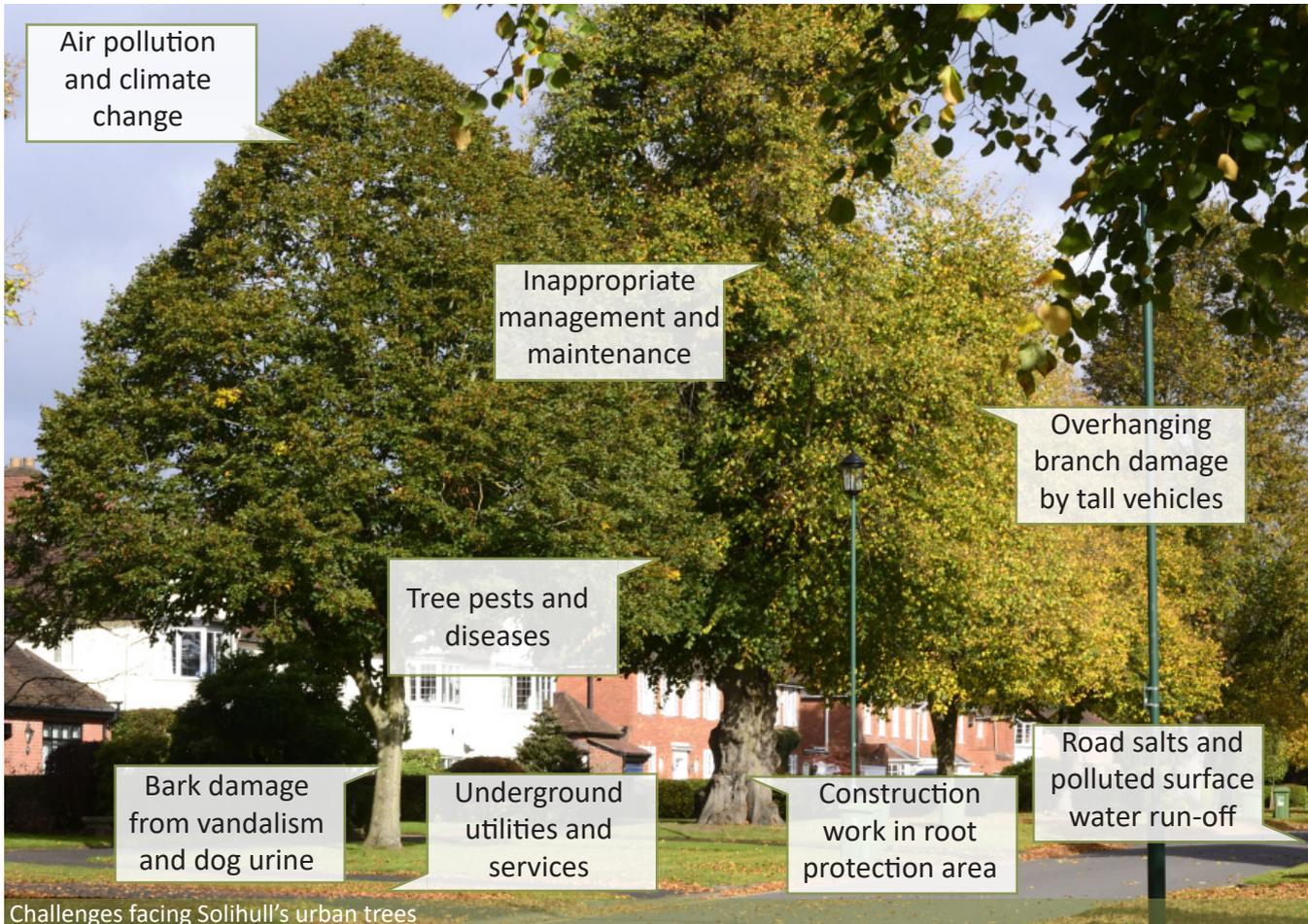


Woodland trees- Solihull’s Woodland Strategy (2010) aims to ‘protect, manage and enhance council owned woodlands for recreation, nature conservation and visual amenity’. In Solihull, there are 23

Forestry Commission approved Native Woodland Plans and these form part of the Woodland Strategy. Ongoing policies to update and revise the Woodland Strategy should form part of the long term aspirations for incorporation with the Urban Forestry Strategy.



Community housing- In Solihull a large proportion of the public housing sector was built in line with the new town concept with extensive planting of a wide range of tree species in garden areas and public open space. Housing officers feed



Challenges facing Solihull’s urban trees

Air pollution and climate change

Inappropriate management and maintenance

Overhanging branch damage by tall vehicles

Tree pests and diseases

Bark damage from vandalism and dog urine

Underground utilities and services

Construction work in root protection area

Road salts and polluted surface water run-off

the urban forestry team with resident complaints regarding trees being previously planted in these restricted areas, adjacent to their properties. A long term and proactive solution needs to be established to resolve ongoing issues with inappropriate planting.

Protecting the Urban Forest

Our urban trees have to be tough to survive, in particular our street trees which have to fight for survival.

Solihull already has a range of protection measures for trees but we need to communicate the benefits of trees as well enforcing legal protection. Challenges for future consideration will include the following issues.



Legal protection- Trees are important hosts to a variety of animals and insects and holes in trees and dislodged bark may provide roosts or breeding sites for bats protected under the Wildlife and Countryside Act 1981 (as amended).

SMBC and its partners will need to consider the requirements of the Wildlife and Countryside Act in future policies and actions for the urban forest.



Current policies- Policies for tree protection should embrace the lifecycle that an individual tree endures to thrive and survive, and the value it contributes to the urban forest as a whole. Our urban forest now shapes our local landscape character and is a legacy left to us by Victorian, Edwardian and pre-war designers. Current and future policies will need to be reviewed and adopted to meet future challenges.



Loss of trees- Sometimes for the right reasons, a tree does need to be felled. But when is loss unavoidable and who makes this decision? Many members of the public have raised this question after tree felling within the distinctive streetscapes of Sheffield. Planning Services at SMBC are responsible for enforcing and monitoring statutory protection of trees on private land, but rely on the technical and design support from Urban Forestry Officers and Landscape Architects. With increasing pressures on our resources in Solihull, with house building, new infrastructure and attracting new business, strong policy is required on enforcing protection and compensation, and an increase in awareness amongst professionals, residents and developers.

There are opportunities to provide suitable compensation measures when a tree is lost. Either replacement trees, or a financial

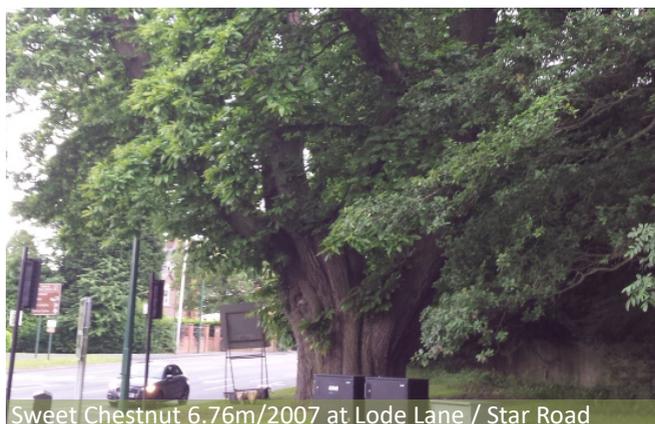
contribution equivalent to the value of the removed tree(s). How this is calculated is using appropriate assessment provided by the 'Tree Protection Supplementary Planning Document' and agreed between the Developer and SMBC using methods such as CAVAT calculating the value of a single tree. In replacement of older forest-type tree species smaller short-lived ornamental tree species that do not grow to the same scale or habit, thus reducing maintenance costs and potential liabilities can be seen to be favourable when planning new infrastructure, as seen in Sheffield¹²³, or within new streetscape developments. Policy must therefore ensure that this is not the case and assessment will take place to identify the most suitable species.



Tree protection orders (TPOs)- SMBC has a responsibility to protect the urban forest by administering TPOs and designating Conservation Areas. This proactive use of TPOs as a tool to sustain the urban forest and protect from the urban pressures it faces, places a responsibility on the land owner to request permission from the Council prior to any tree works. Future policies and actions will need to communicate the importance of TPOs.



Sweet Chestnut staghorned 6.61m/2007 at Elmdon Park



Sweet Chestnut 6.76m/2007 at Lode Lane / Star Road



Veteran Trees (VETs) and Ancient Woodlands

Although ash is one of the most common tree species within Solihull, few really old ashes exist; many by 150 years are hollow due to a decline

in tree health and prone to wind-blow of their crowns²³. A significant number of VETs exist across Solihull. English Oak (*Quercus robur*) dominate the VET listings, with 382 specimens (currently known) with girths of 5 metres-plus, judged to be at least 250 years old with many in the former historic Arden parkland or within ancient hedgerows.

Future policies and actions will need to address the long term custodianship of VETs and the ancient woodlands of Solihull.

Promoting the Urban Forest

How do you get the public and potential developers to become more aware about the importance of the urban forest in Solihull? Positive news stories are a challenge to gain the interest of the press, but aiming high in a strategic vision is something that Solihull needs to do. For example SMBC undertake social media campaigns regarding parks eg #loveparks but not specifically the urban forest, and deal with twitter threads, humour and engagement in different ways. Solihull's stories are amassed in a generic @LoveSolihull twitter feed. Social Media is not everything as SMBC appear effective with their face to face engagement and relationships with residents and groups, and only certain sectors use social media, but an increasing number do so across a range of ages.

The challenge we need to embrace is how SMBC

translate the community's increasing awareness of the urban forest into a long-term, meaningful engagement at a local level, particularly with people's time being even more pressurised. Solihull Tree Wardens are proactive crucial groups of volunteers who are trained, act as the "eyes" for the Council, provide advice and undertake certain routine maintenance and look after SMBC's old tree nursery site. It is though important that they do not undertake work which is beyond their duties and liabilities. Tree Wardens work in partnership with the Council, the Tree Council and Conservation Volunteers to research and empower their local communities to take on practical projects relating to the urban forest. Several also sit on their respective Parish Councils or other organisations and can therefore be seen as the connection between the local authority and the Council, and a key voice for the urban forest.

As we have discussed, there are a wide range of bodies including universities, government agencies, the third sector, companies and other organisations with a focus on trees in urban landscapes working in Solihull, such as Solihull Tree Wardens, WWT, The Woodland Trust, TDAG and Trees for Cities, who have knowledge, experience and expertise about urban trees which could be beneficial to SMBC. There is also a wealth of evidence from research emerging all the time about the wider benefits of trees and GI, as referred to in this Strategy, which could be used to

benefit and inform the way that SMBC maintains, manages and develops Solihull's urban forest.

SMBC should utilise this knowledge and expertise in conjunction with that already in-house from directorates across the Council and delivery bodies, including Amey, to bring together a joint independent-led group which can be called on for advice and knowledge, which could be called the Solihull Urban Forest Group. This has been suggested by the Birmingham Tree People (an urban tree warden initiative) for Birmingham creating the 'Birmingham Forest Group'. Promoting and raising the profile of the urban forest will be key to the successful implementation of the strategy.

Sustaining the Urban Forest

A resilient and sustainable urban forest is based on various factors, such as a wide ranging tree size and species distribution, directed by rigorous management strategies and policy and planting more than felling. This is important to enable the urban forest to deliver the benefits described in the values sections outlined above. One of the prime objectives Solihull's urban forestry management should be to facilitate sustainability and resilience through population diversity. A healthy tree population, for example, can ensure more carbon is stored than released, as long as the amount sequestered by healthy trees is

greater than the emission of carbon from the decomposition of dead trees.

For example, large mature trees offer unique ecological roles not offered by smaller and younger trees, therefore the optimum level of trees of this stature needs to be maintained, and thus protected. It is important to calculate the number of trees required to restock their mature neighbours to ensure the urban forest is inherently resilient. New planting must be in excess to take into account tree mortality of new stock.

For Solihull's more mature tree stock, Biodiversity Management Action Plans for 'Wood-pasture', 'Old Parkland' & 'Veteran Trees' have been written¹²⁴; and 'Veteran Trees: A guide to good management'¹²⁵ is also full of information. Future policies and plans will need to consider the following challenges and opportunities.



Optimising the urban forest- "Ideal" tree populations have been adopted in certain cities such as Toronto to inform management of the urban forest with the aim of creating a resilient urban forest. Optimising and mapping the tree population structure can be compared with the existing to identify gaps and indicate how the urban environment can benefit more and with what type of tree stock. This provides powerful data for policy and demonstrates the funding and

resources required to achieve this optimum urban forest. But numbers of trees are not only the crunch data as:

“leaf area and tree canopy cover is the driving force behind tree benefits.”

When leaf area and tree canopy cover is calculated through an i-Tree type assessment and combined with abundance of a certain tree species a "dominance value" can be determined regarding the benefits they can bring. In London, for example, apple trees are the "third most populous tree" but "ranked 8th for species importance".



Diversity of tree species- Diversity in the urban forest has two main components: the number of species present plus the genetic diversity of the individual species present.

Diversity of both native and non-native trees is crucial in reducing the potential impact from threats such as pests and diseases and climate change; and enhances the capacity of the tree population to deliver ecosystem services. The selection of tree species will be crucial for long term diversity and this should form part of detailed technical advice promoted by SMBC.



Planting more, felling less- As well as species diversity, the principle of planting more than felling or removal of trees needs to be endorsed. Systems will need to be adopted to determine metrics and targets for planting.



Pest and pathogens- Pest and diseases are a serious threat to the bio-security of our urban forests. With an Ash dominant urban forest there are concerns about Chalara Dieback of Ash (*Hymenoscyphus fraxineus*) which has been identified in Solihull. The University of Birmingham through BiFOR is currently researching the resilience of trees to pests and diseases including resilience of imported diseases/pests and has found that climate change is altering the range of pests and diseases likely to affect the UK¹²⁶. The outbreak of pests and diseases is supported by the importation of trees, particularly large landscape trees, and the increasing volume of packaging materials used in international trade. Tree populations dominated by a few species are more vulnerable to the threat with 'Dutch Elm Disease' for example, causing the death of approximately 30 million Elm trees in the UK.

SMBC have recognised that action must be taken to limit pests and diseases as incidence, spread and severity of an outbreak varies according to tree health, management and young tree procurement policies, as well as the weather

and tree species. Pests and diseases cannot be controlled but action plans leading to largescale outbreaks such as Ash dieback will meet with Government advice.

The Landscape Institute's Technical Note 4 (2017)¹²⁷, identifies the following main pests and diseases affecting the UK's trees: Chalara (ash); Sweet chesnut blight; Bleeding canker (horse chestnut); Massaria (London plane); Phytophthora; Asian longhorn beetle; Oak processionary moth; Acute oak decline. There are other pests and diseases which have not yet arrived in the UK, but have the potential to do so, including Emerald ash borer; *Xylella fastidiosa*; Japanese beetle; and Citrus longhorn beetle.

Future policies and procedures will need to consider how pest and diseases are addressed and controlled in the future.



Managing different interests- Across Solihull we have significant swathes of mature urban forest. However these very same trees we have been demonstrating the value of can for some residents and businesses be a source of frustration. This generally happens when the particular tree significantly contributes to the local public realm and landscape character, but provides challenges to those nearby.

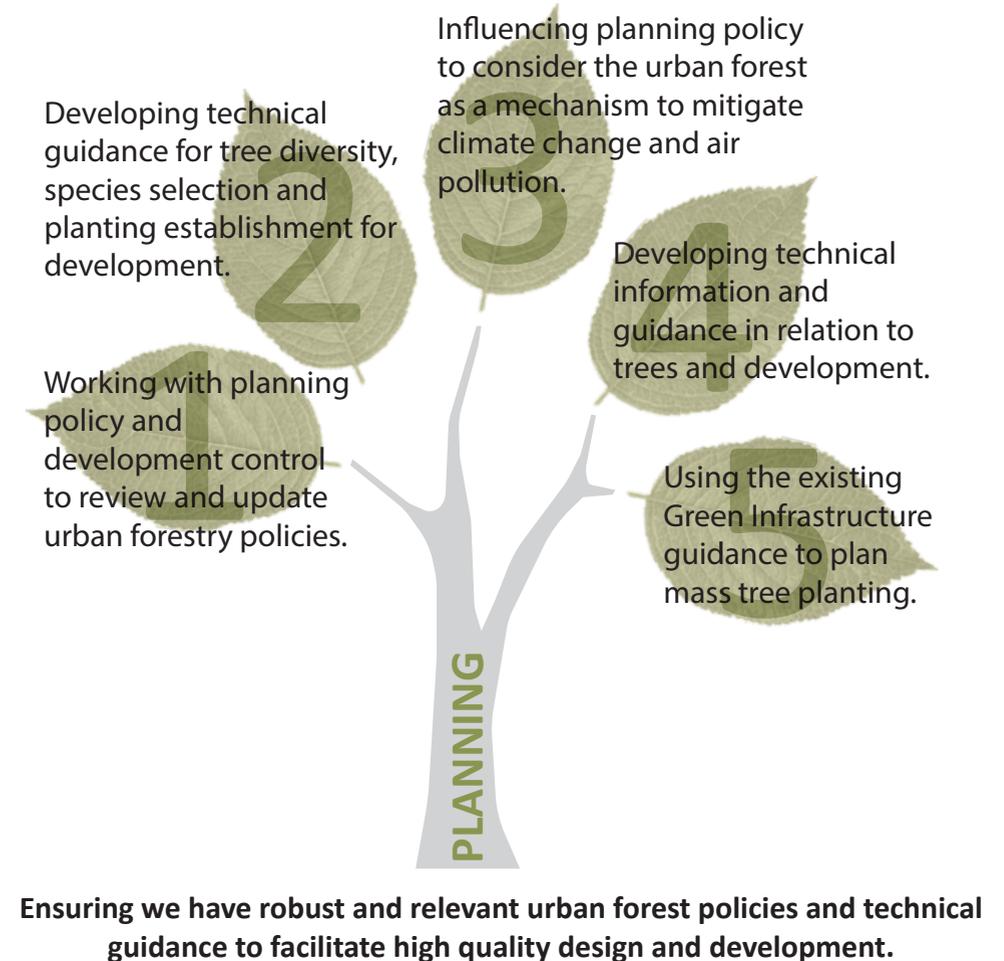
Managing potential conflicts can be resolved through effective communication and proactive maintenance. In the future, promoting good management and the need for trees should be a priority.

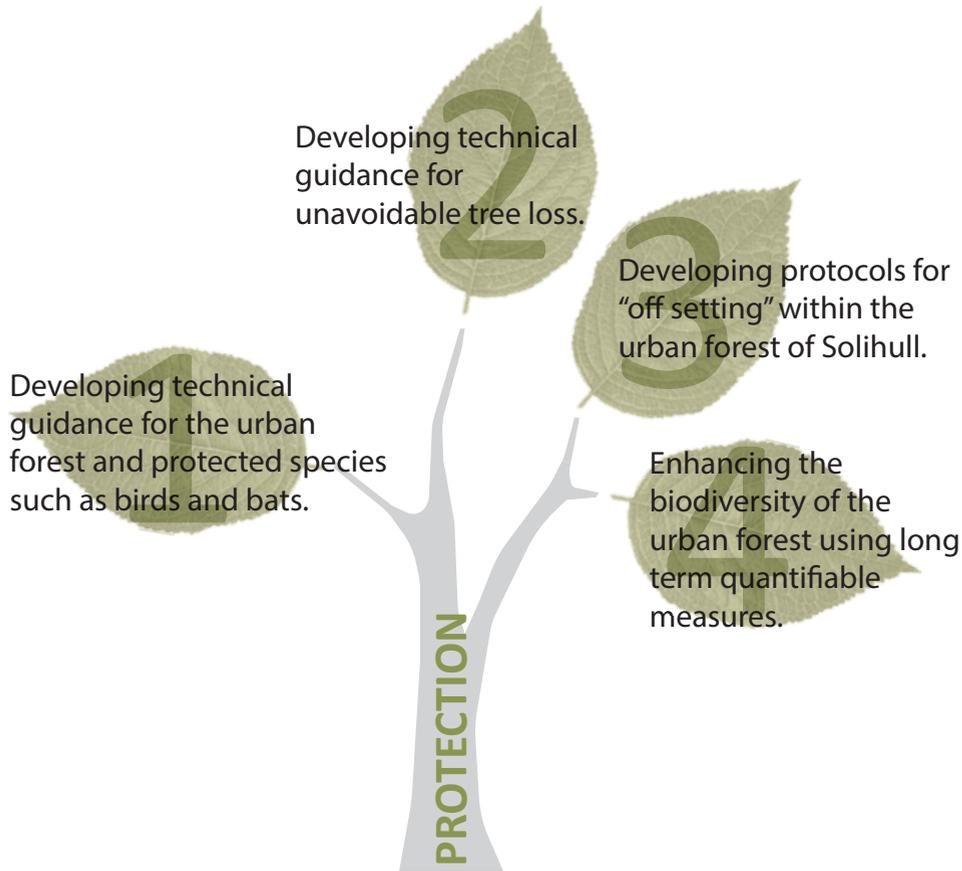


Anti-motocycle gate in Yorks Wood

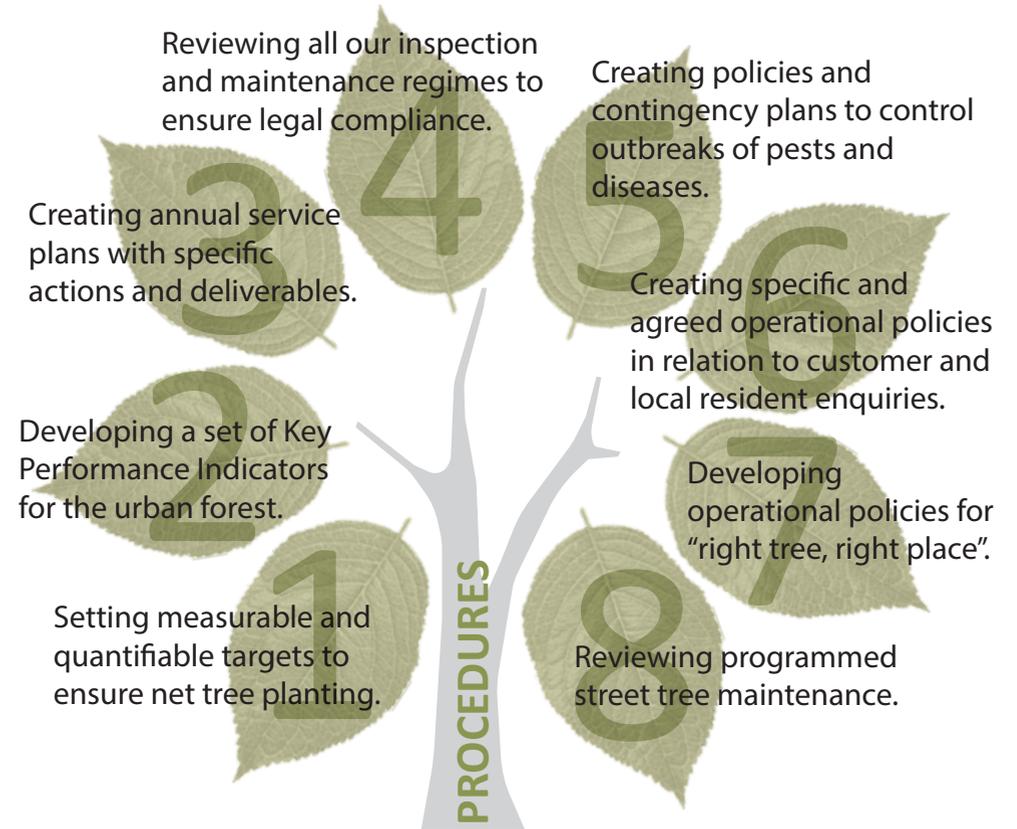
Themes and Key Actions

To achieve the vision of the urban forestry strategy we plan to develop and implement a detailed service plan each year. Specific tasks for the service plan will be informed by the following themes and key actions.





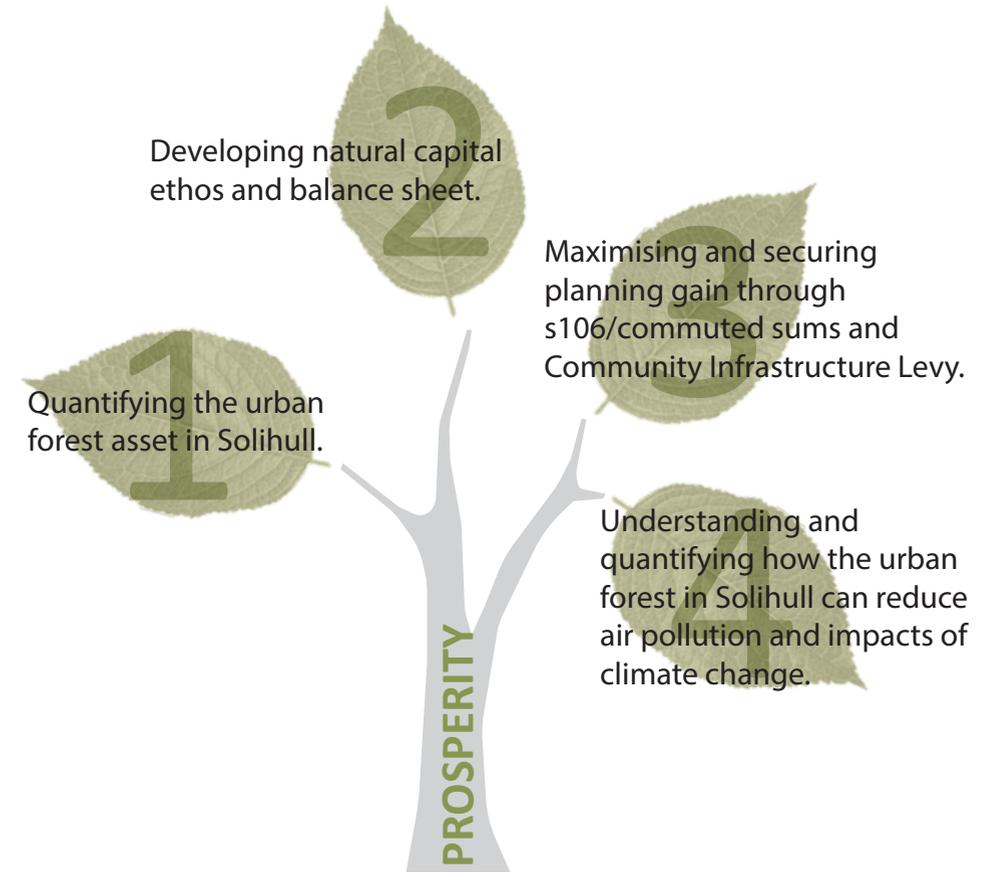
Putting biodiversity and the health of trees at the heart of all our work.



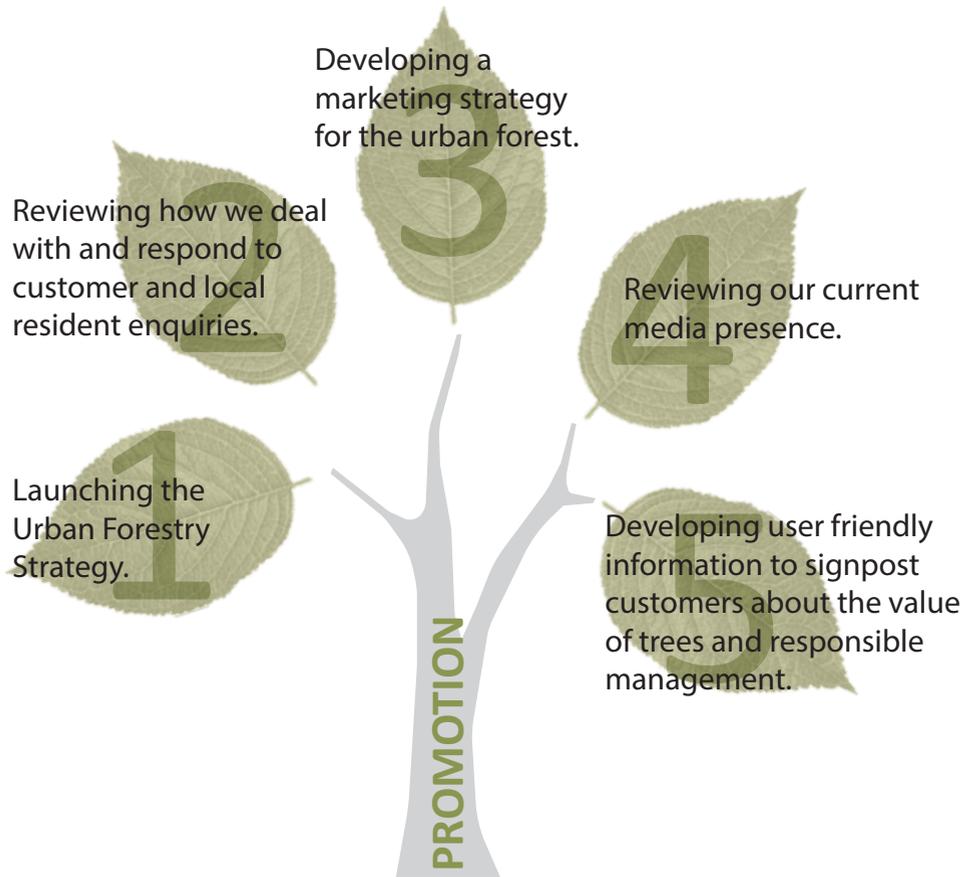
Ensuring we have appropriate operational plans and processes that are regularly monitored and reviewed.



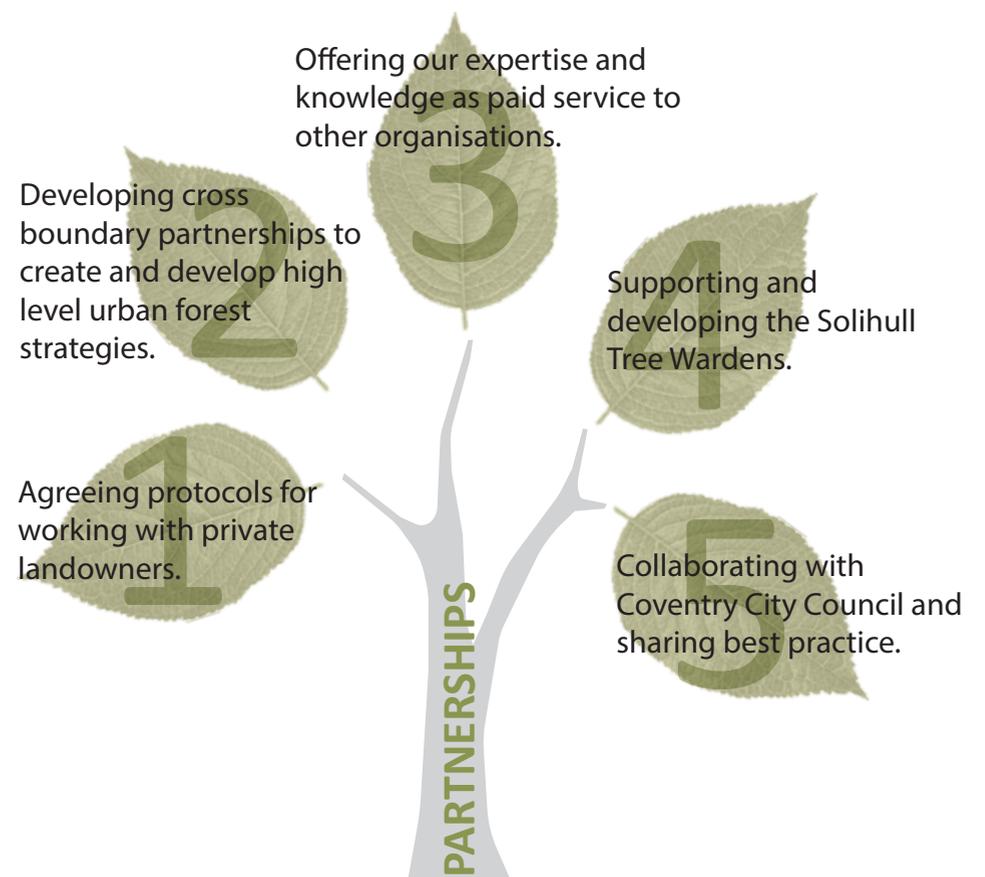
Developing and creating long term projects for the management and enhancement of the urban forest in Solihull.



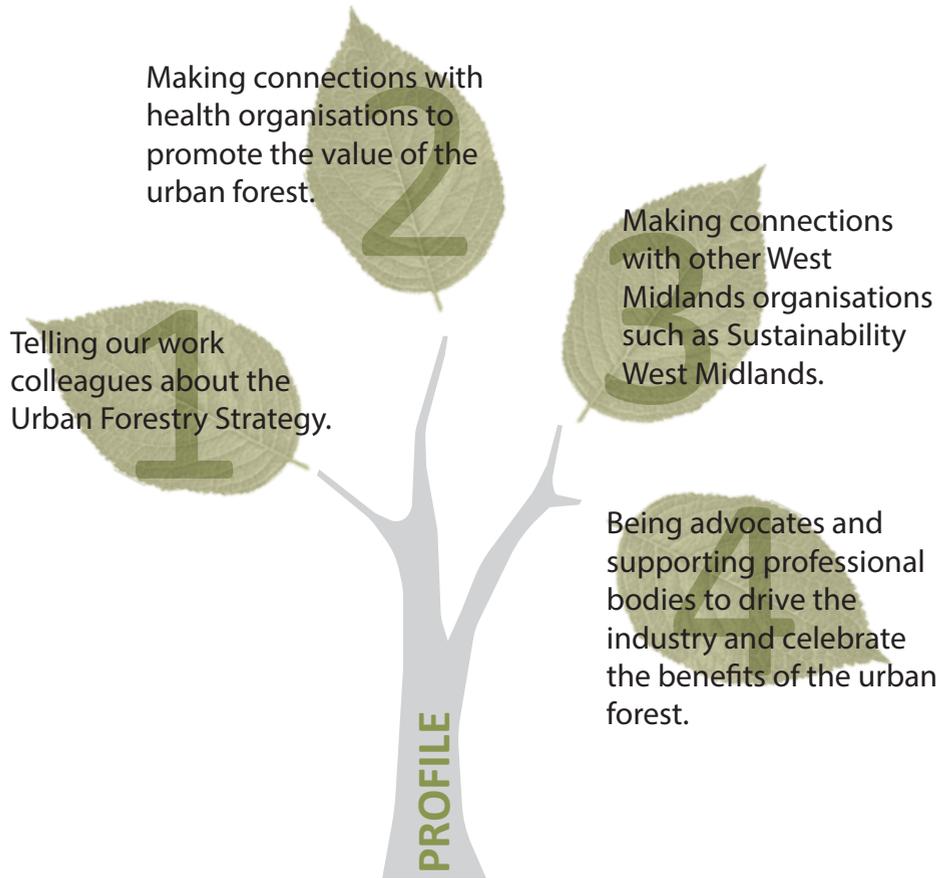
Making the link with the urban forest and natural capital for sustainable economic regeneration.



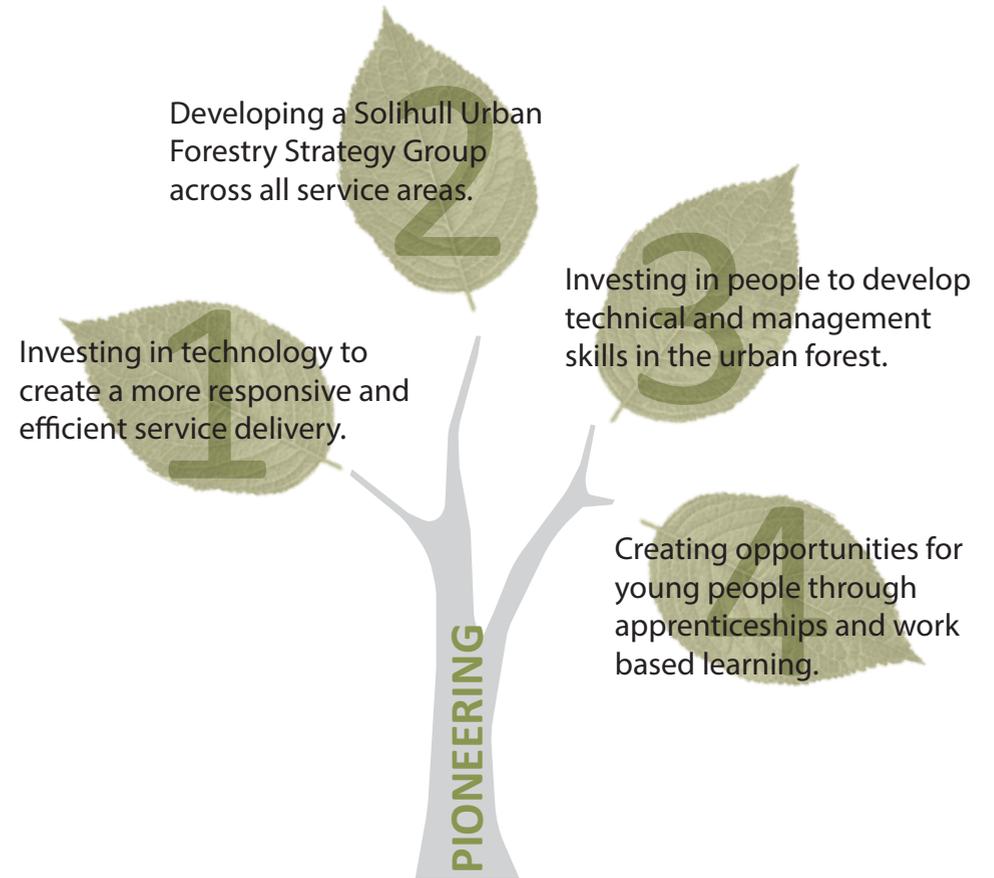
Having a presence and getting the message across to all our stakeholders and customers.



Building on existing and facilitating new working relationships for the benefit of the urban forest in Solihull.



Having a presence and influencing colleagues, stakeholders and professional networks in decision making.



Using technology and new ways of working to create innovation and efficient working.

Realising Success

This Urban Forestry Strategy will be continually reviewed and updated during the next 10 years. To achieve success we need to build on the foundations and principles set out in the document.

“The provision of high quality, well-maintained green space can have a positive effect on local activities and business, and improve an area’s image and the confidence of both local inhabitants and potential investors’. (Land Use Consultants, 2004).”

The role of the urban forest in addressing the challenges faced by Solihull in the 21st century cannot be underestimated. Alongside GI, the requirement of urban forestry, articulated in this document, should be an adopted vision that permeates every level of the planning and design process, whatever the scale. This can be achieved over a period time through SMBC core policies, their approach to development, and embedded in strategies and local plans to drive future funding opportunities. This Urban Forestry Strategy and green infrastructure need to be recognised and work hand in hand. We must not hesitate on communicating the value of trees and lobbying for change to those in the position to change policies at time of reconsideration.

Although the urban forestry contract ended in April 2018, the relationship between CCC and SMBC Forestry Services is stronger and from this the foundations have been laid to create a cross-sector cross-authority expert group who are passionate about urban trees. Both authorities still share the strategic aim of effectively managing the urban forest and have an urge to continually share best practice. Having a greater understanding of the services and benefits our urban forests provide to inform future management and investment priorities, requires collaboration between the local community, CCC, SMBC, scientific and environmental experts, NGOs and developers. CCC and SMBC need to take on a proactive approach to championing the urban forest, presenting its role as an integral part of a vibrant future for Solihull and Warwickshire. The urban forest must be planned, delivered and managed effectively; supported through innovation and a creative appetite to secure funding to sustain it through capital and revenue generation. Working with the complexity of the many interactions of the urban forest as a resource, whilst maximising its natural capital, the Urban Forestry Strategy must be placed at the heart of an integrated approach to green infrastructure, and this way will unlock the potential of the urban forest vision for Solihull for a sustainable lifestyle, alongside thriving landscapes, habitats and effective ecosystem services.

There is growing evidence that returns on urban forestry investment are high, with investing in green space proven to improve a region’s image; helping to attract and retain high value industries, new business start-ups, entrepreneurs and workers, all of which are crucial to support a thriving economy in Solihull. The role of investing in green infrastructure and urban forests to reduce unemployment and increase ‘Gross Value Added’ needs to be succinctly conveyed as the UK leaves the deepest recession since 1930s, particularly in competing in international markets post Brexit to attract overseas companies to bring high quality investment to the UK. In addition, investment in our urban tree stock helps to meet the requirements of the UK Sustainable Development Strategy. CCC and SMBC policy makers need to explore new sustainable models for funding and financing the urban forest.

With a multi-age urban tree stock, which is responding to changing urban and climatic conditions, we need to be equipped with the expertise and methods of best practice to better understand how to implement appropriate management, monitoring and planting regimes in these fast changing environments. i-Tree software is one such way to establish changes in our tree canopy cover over time in comparison with the current situation.

We face multiple urban challenges, both today and in the future. As a major component of

green infrastructure, trees are widely recognised as making a significant contribution towards ameliorating some of these issues. However, trees can only deliver their many long term benefits if appropriate species are selected for a given location.

Enhancing and effectively maintaining Solihull's urban forest has considerable public and policy support, but unless we express a monetary value of the multiple benefits provided by the urban forest, it will not receive the recognition it deserves. Generally people are unaware of the vast array of benefits urban trees provide expressed as ecosystem services and these need to be at the forefront of any decision making process on service delivery. We are aware that low income areas generally have fewer urban trees and poorer quality green spaces compared with more affluent areas across Solihull and this needs to be rectified. The community need to fully engage with the creation and decision making of the management of the existing urban forest to ensure its success and healthy future. Empowering local communities to take responsibility of Solihull's urban forest, and directing how we use and play in this resource can result in local benefits such as community cohesion and inclusion, and reduce incidence of vandalism and crime, minimising management costs. This Strategy therefore sets out the rationale and framework for nurturing the urban forest for future generations.



Lime trees, Brueton Avenue

References

- 1 World Forum on Urban Trees, 2018: <https://www.wfuf2018.com/>
- 2 Department of Health, 2009. Be active be healthy – a plan for getting the nation moving. HM Government.
- 3 Department of Health, 2009. New Horizons: flourishing people, connected communities. HM Government.
- 4 Marmot, M., et al., 2010. Fair Society Healthy Lives (The Marmot Review). Institute of Health Equity.
- 5 Houses of Parliament, 2016. Green Space and Health, PostNote 538. Parliamentary Office of Science & Technology.
- 6 Benwell, R., Burfield, P., Hardiman, A., McCarthy, D., Marsh, S., Middleton, J., Morling, P., Wilkinson, P., Wynde, R. 2013. A Nature and Wellbeing Act. The RSPB and The Wildlife Trusts.
- 7 The Wildlife Trusts, 2018. Homes for People and Wildlife: How to build housing in a nature-friendly way.
- 8 Solihull Metropolitan Borough Council, 2010. Urban Tree Strategy 2010-15.
- 9 Landscape Institute, 2013. Green Infrastructure: An integrated approach to landuse. Landscape Institute Position Statement.
- 10 Houses of Parliament, 2013. Urban Green Infrastructure. PostNote 448, Parliamentary Office of Science & Technology
- 11 Britt, C. and Johnston, M., 2008. Trees in Towns II: A new survey of urban trees in England and their condition and management. DCLG.
- 12 SMBC, 2010. Solihull Woodland Strategy.
- 13 SMBC, 2018. Solihull Council Plan 2018-2020.
- 14 SMBC, 2018. 'Shaping Places with People': Managed Growth and Communities. Business Plan, April 2018
- 15 Treeconomics London, 2015. 'Valuing London's Urban Forest'.
- 16 UK National Ecosystem Assessment, 2018. <http://uknea.unep-wcmc.org/EcosystemAssessmentConcepts/EcosystemServices/tabid/103/Default.aspx>
- 17 Wolf, K.L., Krueger, S. and Rozance, M.A., 2014. Stress, Wellness & Physiology - A Literature Review. College of the Environment, University of Washington
- 18 Kuo, F.E., 2001. Coping with Poverty: Impacts of Environment and Attention in the Inner City. *Environment and Behaviour*, 33(1): 5-34
- 19 Davies, P. and Deaville, J., 2008. Natural heritage: A pathway to health. Countryside Council for Wales, Bangor
- 20 Weldon, S. and Bailey, C. in collaboration with O'Brien, L., 2007. New pathways to health and wellbeing: Summary of research to understand and overcome barriers to accessing woodland. Forestry Commission, Scotland
- 21 Bell, S., Hamilton, V., Montarzino, A., Rothnie, H., Travlou, P. and Alves, S., 2008. Greenspace and quality of life: A critical literature review. Greenspace Scotland, Stirling.
- 22 SMBC, 2018. 'Love Solihull': <https://www.lovesolihull.org/>
- 23 Pillemer, K., Fuller-Rowell, T.E., Reid, M.C., and Wells, N.M., 2010. Environmental Volunteering and Health Outcomes Over a 20-Year Period. *The Gerontologist* 50(5): 594-602.
- 24 The Woodland Trust, 2018. www.woodland-trust.org.uk/ancient-treeforum and www.ancient-tree-hunt.org.uk
- 25 Ancient Yew, 2018. www.ancient-yew.org
- 26 Falk, S. 2011. The veteran trees of Warwickshire. Warwickshire County Council.
- 27 VetCert, 2018: <https://www.vetcert.eu/home>
- 28 Donovan, G.H., Michael, Y.L., Butry, D.T., Sullivan, A.D. and Chase, J.M., 2011. Urban trees and the risk of poor birth outcomes. *Health & Place*, 17(1): 390-393
- 29 Li, D. and Sullivan, W., 2016. Impact of views to school landscapes on recovery from stress and mental fatigue. *Landscape and Urban Planning* 148: 149-158
- 30 Aspinall, P., Mavros, P., Coyne, R. and Roe, J., 2015. The urban brain: Analysing outdoor physical activity with mobile EEG. *Br J Sports Med*, 49(4): 272-276
- 31 Ulrich, R.S., 1984. View through a window may influence recovery from surgery. *Science*, 224(4647): 420-421
- 32 Detweiler, M.B., Murphy, P.F., Kim, K.Y., Myers, L.C., and Ashai, A., 2009. Scheduled medications and falls in dementia patients utilizing a wander garden. *Am J Alzheimers Dis Other Dement* 24(4): 322-332.
- 33 Morita, E., Fukuda, S., Nagano, J. et al. 2007. Psychological Effects of Forest Environments on Healthy Adults: Shinrin-Yoku (Forest-Air Bathing, Walking) As a Possible Method of Stress Reduction. *Public Health* 121(1): 54-63.
- 34 Hauru, K., Lehvavirta, S., Korpela, K. and Kotze, D.J., 2012. Closure of View to the Urban Matrix Has Positive Effects on Perceived Restorativeness in Urban Forests in Helsinki, Finland. *Landscape and Urban Planning* 107: 361-69.
- 35 Fan, Y., Das, K.V. and Chen, Q., 2011. Neighborhood Green, Social Support, Physical Activity, and Stress: Assessing the Cumulative Impact. *Health & Place* 17(6): 1202-1211.
- 36 Paquet, C., et al., 2013. Are Accessibility and Characteristics of Public Open Spaces Associated with a Better Cardiometabolic Health? *Landscape and Urban Planning* 118: 70-78.
- 37 Mitchell, R., Astell-Burt, T. and Richardson, E.A., 2011. A Comparison of Green Space Indicators for Epidemiological Research. *Journal of Epidemiology & Community Health* 65(10): 853-58
- 38 Talbot, J.F., and Kaplan, R., 1986. Judging the Sizes of Urban Open Areas: Is Bigger Always Better? *Landscape Journal* 5(2): 83-92.
- 39 Grahn, P., and Stigsdotter, U.A., 2003. Landscape Planning and Stress. *Urban Forestry & Urban Greening* 2(1): 1-18.
- 40 Natural England, 2011, Green space access, green space use, physical activity and overweight. Natural England Commissioned Report NECR067
- 41 Hillsdon, M., Panter, J., Foster, C., & Jones, C., 2006. The relationship between access and quality of urban green space with population physical activity. *Public Health*, 120(12): 1127-1132
- 42 Foster, C., et al., 2009. Objective measures of the environment and physical activity - Results of the Environment and Physical Activity Study in English Adults. *Journal of Physical Activity and Health*, 6(1): 70-80
- 43 Guite, H.F., Clark, C. and Ackrill, G., 2006. The impact of the physical and urban environment on mental well-being. *Physical Health*, 120(12): 117-26

- 44 Vivid Economics, 2017. Natural Capital Accounts for Public Green Space in London. Report prepared for Greater London Authority, National Trust and Heritage Lottery Fund
- 45 Forest Research, 2010. Benefits of Green Infrastructure Evidence Note: Social interaction, inclusion and community cohesion. Forest Research.
- 46 Public Health England, 2014. Local Action on Health Inequalities: Improving Access to Green Spaces. Health equity briefing 8
- 47 Kuo, F., Sullivan, W.C., Coley, R.L., and Brunson, L., 1998. Fertile Ground for Community: Inner-City Neighbourhood Common Spaces. *American Journal of Community Psychology*, 26(6)
- 48 Brag, R., Wood, C., and Barton, J., 2013. Ecominds effects on mental wellbeing: A evaluation for Mind. University of Essex
- 49 NICE, 2014. Physical Activity: Exercise Referral Schemes. NICE Guideline PH54
- 50 Lee, J., Park, B.J., Tsunetsugu, Y., Ohira, T., Kagawa, T., and Miyazaki, Y., 2011. Effects of forest bathing on physiological and psychological responses in young Japanese male subjects. *Public Health*, 125(2): 93-100
- 51 Beil, K., and Hanes, D., 2013. The influence of urban natural and built environments on physiological and psychological measures of stress - a pilot study. *Int J Environ Res Public Health*, 10(4): 1250-1267
- 52 Ulrich, R., et al., 1991. Stress recovery during exposure to natural and urban environments. *Journal of Environmental Psychology*, 11(3): 201-230
- 53 Mind, 2007. Ecotherapy: The green agenda for mental health.
- 54 Cannock Chase District Council, 2016. 'Creating dementia friendly communities in Cannock Chase District'.
- 55 Taylor, A.F., Kuo, F., Sullivan, W., 2001. Coping with ADD: The surprising connection to green play settings. *Environment and Behaviour*, 33(1): 54-77
- 56 The Active Wellbeing Society, 2018. <https://theaws.co.uk/>
- 57 Yerrell, P., 2008. National Evaluation of TCV's Green Gym. School of Health and Social Care, Oxford Brookes University
- 58 Royal College of Physicians. Every breath we take: the lifelong impact of air pollution. Report of a working party. London: RCP, 2016.
- 59 Dayani, A., 2007. 'Asthma care a failure in Brum, figures show.' Birmingham Live.
- 60 Netcen, 2006. Air Quality and Social Deprivation in the UK: An environmental inequalities analysis
- 61 Houses of Parliament, 2014. Ambient Air Quality. PostNote 458. Parliamentary Office of Science & Technology
- 62 Lovasi, G.S., Quinn, J.W., Neckerman, K.M., Perzanowski, M.S., Rundle, A., 2008. Children living in areas with more street trees have lower prevalence of asthma. *J Epidemiol Community Health*, 62(7): 647-649
- 63 Ferranti, E.J.S., MacKenzie, A.R., Ashworth, K. and Hewitt, C.N., 2018. First Steps in Air Quality for Built Environment Practitioners. Technical Report. University of Birmingham & TDAG
- 64 Hillsdon, M., et al., 2006, *Public Health*, 120, 1127-1132
- 65 Greater London Authority, 2006. London urban heat island: A summary for decision makers. Greater London Authority, UK
- 66 Forest Research, 2008. A valuation of the economic and social contribution of forestry for people in Scotland. Forest Research, Farnham.
- 67 Hand, K. and Doick, K., 2018. London i-Tree Eco Project - impact summary. Forest Research
- 68 Sunderland, T., 2012. Microeconomic Benefits of Investment in the Environment. Natural England
- 69 Tunstall, S., Tapsell, S., Green, C., Floyd, P., and George, C., 2006. The health effects of flooding: Social research results from England and Wales. *Journal of Water Health*, 4(3): 365-380
- 70 Houses of Parliament, 2007. Urban Flooding, PostNote 289. Parliamentary Office of Science and Technology
- 71 Pitt, M., 2008. Learning lessons from the 2007 floods. Cabinet Office, London
- 72 Chesterton, C., 2009. Environmental impacts of land management. Natural England
- 73 Willis, K.G., 2002. Benefits and Costs of Forests to Water Supply and Water Quality. Centre for Research in Environmental Appraisal and Management.
- 74 Remiarz, T., 2017. An Illustrated Practical Guide for Homes, Communities and Enterprises – Forest Gardening in Practice.
- 75 Nowak, D.J., Crane, D.E., Stevens, J.C., 2006. Air pollution removal by urban trees and shrubs in the United States. *Urban Forestry & Urban Greening*, 4: 115-123
- 76 Broadmeadow, M.S.J and Freer-Smith, P.H., 1996. Urban woodland and the benefits for local air quality. Department of Environment, HMSO, London.
- 77 Tiwary, A. et al., 2009. An integrated tool to assess the role of new planting in PM10 capture and the human health benefits: a case study in London. *Environ Pollut*, 157(10): 2645-2653
- 78 Stolt, E., 1982. The ability of vegetation in decreasing exposure to car fumes.
- 79 Barnes, J., Hayes, E.T, and Longhurst, J. 2015. Has UK local government action improved local air quality? A Bristol case study. University of the West England.
- 80 Stewart, H. et al, 2003. Trees and sustainable urban air quality: Using trees to improve air quality in cities. Centre of Ecology and Hydrology and Lancaster University
- 81 Pugh, T.A., MacKenzie, A.R., Whyatt, J.D. and Hewitt, C.N., 2012. Effectiveness of green infrastructure for improvement of air quality in urban street canyons. *Environmental science & technology*, 46(14): 7692-7699.
- 83 Jeanjean, A.P., Hinchliffe, G., McMullan, W.A., Monks, P.S. and Leigh, R.J., 2015. A CFD study on the effectiveness of trees to disperse road traffic emissions at a city scale. *Atmospheric Environment*, 120: 1-14
- 84 Tallis, M., Taylor, G., Sinnett, D. and Freer-Smith, P.H., 2011. Estimating the removal of atmospheric particulate pollution by the urban tree canopy of London, under current and future environments. *Landscape and Urban Planning*, 103(2): 129-138
- 85 Arnfield, A. J., 2003. Two decades of urban climate research: A review of turbulence, exchanges of energy and water, and the urban heat island effect. *Intl Jour of Climatology*, 23(1): 1-26

- 86 Bowler, D., Buyung-Ali, L., Knight, T., and Pullin, A., 2010. Urban greening to cool towns and cities: A systematic review of the empirical evidence. *Landscape & Urban Planning*, 97: 147-155
- 87 Forest Research, 2012. Green infrastructure and the urban heat island.
- 88 Doick, K.H., 2013. Air temperature regulation by urban trees and green infrastructure. *Forest Research*
- 89 Birmingham City Council and University of Birmingham BUCCANEER project: <http://www.birminghamclimate.com/>
- 90 Tibbatts, D., 2002. Your parks: The benefits of parks and greenspace. *Urban Parks Forum*
- 91 CABE, 2005. Does money grow on trees? Commission for Architecture and the Built Environment.
- 92 CABE, 2009. Green Space Skills 2009: National Employer Survey Findings. Commission for Architecture and the Built Environment
- 93 Sustainable Development Commission, 2008. The NHS and Climate Change. *Healthy Futures* 7(2).
- 94 The Mental Health Task Force, 2016. The Five Year Forward View for Mental Health.
- 95 Environment Agency, 2007. Government strategy for flood risk management in England and Wales.
- 96 CESR, 2004. Much more than trees 2: Measuring the social and economic impact of the National Forest. Staffordshire University Centre for Economic and Social Regeneration
- 97 European Commission, 2013, COM/2013/0249. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and Committee Enhancing Europe's Natural Capital
- 98 Croucher, K., Myers, L., and Bretherton, J., 2007. The links between greenspace and health: A critical literature review. *Greenspace Scotland Research Report*.
- 99 Natural Economy Northwest, 2008. The economic benefits of green infrastructure: the public and business case for investing in green infrastructure and a review of the underpinning evidence
- 100 Natural England, 2013. To what extent does green infrastructure improvement act as a catalyst for economic growth? An assessment of the intentional and UK evidence.
- 101 Smith, D., 2010. Working Paper 42, Valuing housing and green spaces: understanding local amenities, the built environment and house prices in London. GLA Economics.
- 102 Sarajevs, V., 2011. Street Tree Valuation System. *Forest Research*
- 103 About i-Tree Eco UK' -Treeconomics & Forest Research: <https://www.forestresearch.gov.uk/research/i-tree-eco/>.
- 104 Trees for Cities, 2018. Valuing Ealing's Urban Trees: Ealing i-Tree Eco Technical Report.
- 105 SMBC, 2018. Solihull Green Prospectus: Delivering a Greener Solihull for Success. 2018/19 Refresh.
- 106 Heritage Lottery Fund, 2016. State of Public Parks: Research Report. Peter Neal Consulting and Community First Partnership
- 107 Drayson, K. 2014. Green Society: Policies to improve the UK's Urban Green Space. *Policy Exchange*
- 108 Neal, P., 2013. Rethinking Parks: Exploring new business models for parks in the 21st Century. *Nesta*
- 109 Natural England, 2013. Greening for Growth in Victoria: Green Infrastructure Case Study. *Natural England*.
- 110 Geo-Sense SMART technologies – Red Kite Network Ltd. And Elephant WiFi
- 111 TDAG, 2012. Trees in the Townscape: A Guide for Decision Makers
- 112 Birmingham City Council, Green Living Spaces, <http://www.birmingham.gov.uk/greenlivingspaces>
- 109 Birmingham City Council, Green Living Spaces.
- 113 Sefton Borough Council, 2008. Green Space, Trees and Development Supplementary Planning Document.
- 114 Kennedy, C. and Southwood, T., 1984. The number of species of insects associated with British Trees: A re-analysis. *British Ecological Society*.
- 115 Daniewski, W., Gumulka, M., Anczewski, W. and Masnyk, M., 1998. Why the Yew Tree (*Taxus baccata*) is not attacked by insects. *Phytochemistry*, 49(5): 1279-1282
- 116 UK Bio-Reporting: Focusing on Biodiversity Research. <http://www.ukbap-reporting.org.uk/>
- 117 Fernández-Juricic, E. and Jokimäki, J., 2001. A habitat island approach to conserving birds in urban landscapes: Case studies from southern and northern Europe. *Biodiversity & Conservation*, 10(12): 2023-2043
- 118 Fernandez-Juricic, E., 2000. Avifaunal Use of Wooded Streets in an Urban Landscape. *Conservation Biology*, 14(2)
- 119 Helden, A.J. and Leather, S.R., 2004. Biodiversity on urban roundabouts: Hemiptera, management and the species-area relationship. *Basic and Applied Ecology* 5(4): 367-377
- 120 IPCC, 2007, Summary for Policymakers. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*
- 121 BIFOR, 2018. 'Impact of Climate and environmental change on woodlands': <https://www.birmingham.ac.uk/research/activity/bifor/index.aspx>
- 122 TDAG Guides and Resources, 2018. <http://www.tdag.org.uk/guides--resources.html>
- 123 Sheffield Tree Action Group, 2018. <https://savesheffieldtrees.org.uk/>
- 124 Warwickshire County Council, 2018. Heritage & Culture Warwickshire: Natural History. <http://heritage.warwickshire.gov.uk/museum-service/natural-history-of-warwickshire/>
- 125 Natural England, 2000. Veteran Trees: A guide to good management.
- 126 The resilience of trees to pests and diseases' BiFOR <https://www.birmingham.ac.uk/research/activity/bifor/index.aspx>
- 127 Landscape Institute, 2017. *LI Biosecurity News - Winter 2017*.

Acknowledgements

Report Title: Solihull Urban Forest Strategy

Project Ref: 246.16

Client: Solihull Metropolitan Borough Council

Report Status: Draft, rev.1

Date of Issue: 19/12/2018

Report Author: Red Kite Network Limited

Copyright © Red Kite Network Limited 2018

red kite 

Landscape Architecture | Ecology | Greenspace



RED KITE NETWORK LIMITED

The John Rose Building, High Street, Coalport, Shropshire TF8 7HT
t 01952 582111 e info@redkitenetwork.co.uk www.redkitenetwork.co.uk

Registered in England & Wales No: 8169295