Appendix C – The Benefits of Trees

Trees have long held a valued place in our environment, though as greater pressure is being exerted on land use, particularly in and around urban areas the value of trees and woods has been brought into question. The more traditional and intuitive arguments for there continued presence are still persuasive, growing and retaining them for their:

- natural beauty
- historical connections
- creating local distinctiveness
- forming a key feature in the landscape
- connections to wildlife

Our forebears instinctively knew of trees had wider benefits and 19th Century philanthropists planted trees for their restorative value and contribution to peoples general wellbeing. In our towns and villages this has been a guiding principle in the past for making space for trees in our street, open spaces and parks.

Research through the decades has been able to confirm the observations of these early visionaries and the importance of trees and woods in our environment, in our countryside and within the communities in which we live and work.

Today the importance of the presence of trees and woods and planting of more is recognised for a much broader range of benefits. Their continued presence is important to our adjustments and adaption to the changes we are experiencing in the climate and environment. Fundamentally the larger and closer trees are to sources of pollutants the greater the benefits they can have.Climate change and Carbon capture

Human activities have resulted in many changes to this natural environment resulting in changes to our climate, especially during the past 200 years as urbanisation and industrial activity have accelerated. Climate change is now recognised as one of the most serious challenges facing us today.

Climate change could alter the growth and health of trees in a number of ways:

- Elevated CO_2 concentrations in the atmosphere act as a fertiliser for plants, allowing more photosynthesis to take place and resulting in faster growing trees. Experiments on young trees have shown growth increases of 35%. However, it is uncertain whether this 'CO_2 fertilisation effect' will occur to the same extent in mature woodland.
- Leaves will lose less water at higher CO_2 concentrations. However, this advantage may be offset by the increase in total leaf area.
- In the UK, warmer weather, particularly in winter, is likely to lead to longer growing seasons and increased tree growth.
- Cold and snow-related damage are likely to become less common.

- There will be opportunities to plant species which are currently not planted because they are sensitive to winter cold.
- Trees may become more susceptible to damage from late spring frosts as a result of earlier leafing.
- In the south of England, less summer rainfall may reduce tree growth and, as climate change progresses, severe summer droughts may kill increasing numbers of trees, particularly species such as birch and beech.
- Violent storms may occur more often, and more trees are likely to be blown down or suffer wind-snap.

The benefits trees deliver in our efforts to counter the impacts of climate change though far out way the negative ones. The changes are affecting which trees will grow in a local environment, so some native species may no longer be able to grow and thrive locally, similarly introduced species could be the best alternatives. This is considered more fully in the Right Tree for the Right Place appendix.

The Council is working to reduce carbon emissions across our service functions, as well as with partners and businesses to drive wider reductions across West Northamptonshire. Where emissions are unavoidable, trees and soil play a crucial role in locking up carbon dioxide and absorbing other damaging pollutants. Trees absorb carbon dioxide as they grow, around half of this carbon is stored (sequestered) in the trunks, branches, roots and other biomass of the tree, accumulating over time to provide a long-term carbon store.

Once an area of woodland has matured, it has reached its full potential for carbon sequestration; further carbon can only be locked up if the trees are felled, the wood used, and the land replanted for continuing carbon sequestration. Short-lived products such as paper contribute little, but the use of timber in buildings fencing and furniture could be important, particularly if replacing materials such as steel and concrete.

A wealth of reports, such as the England Trees Action Plan, emphasise the importance of trees for carbon capture[1]. The Committee for Climate Change (CCC) have advised government that in order to help achieve net zero greenhouse gas emissions, the UK should plant at least 30,000 hectares per year up to 2050[2].

Increasing canopy cover across West Northamptonshire through better management of existing trees and through additional tree planting will be a key driver in our approach to carbon sequestration owing to the capacity of trees to capture and store carbon. A wide diversity of site-appropriate tree species is required to remove and store greenhouse gases across our towns, villages, and surrounding areas. The Council's Estates Climate Strategy and Construction and Maintenance Climate Strategy reference the role of tree planting for carbon offsetting. The Council will

[1] The England Trees Action Plan (publishing.service.gov.uk)

[2] Major shift in UK land use needed to deliver Net Zero emissions - Climate Change Committee (theccc.org.uk)

start to measure some of these benefits [3]using itree, a tool designed to measure carbon capture, pollution removal and storm water runoff avoided[4].

Evidence shows that trees and open space within towns is more effective in helping adaptation. The urban trees and woods help urban areas adapt to the impact of climatic change regardless of whether they are in parks, private gardens or street trees, but the space, size, quality and vegetation type and proportion of coverage all influence the level of impact – bigger is better.

A different climate will have implications for the costs of, and approaches to, maintaining our trees and woods, such as increased watering during droughts, greater pressure on spaces as they are used more intensively and an effect on the health of some species. The urban trees and woods will need to be well maintained to be at its most effective.

Atmospheric pollution

Trees and woods have important roles in ameliorating air pollution and greenhouse gases; as well as the capture of carbon dioxide by photosynthesis trees also absorb nitrous oxides, sulphur dioxide, carbon monoxide and ozone from the atmosphere. However, trees are affected by atmospheric pollutants, whether wet (acid rain) or dry (particulates). Whilst acid rain is a natural occurrence, man-made acidity (burning fossil fuels) increases the concentrations, in England up to 90% of the acidity arises from mans' activities, and whilst this is no longer the serious problem it was in the mid twentieth century it can still have a detrimental effect on trees, affecting their ability to photosynthesise.

Atmospheric particulates (emissions from industry and vehicles have been linked to increased incidences of illness in people (eg asthma and allergies). Trees have an important role in combating (mitigating) these effects. Some particulates are absorbed and used as part of the trees growth processes, other, larger particulates are filtered from the atmosphere by attaching themselves to leaves. The closer trees (and greater their canopy) are, to the sources of pollution the greater their contribution and benefits.

Urban cooling

Climate scientists forecast major environmental, health and economic problems in coming years due to the overheating of urban buildings and urban areas. Trees in gardens, streets, schools, parks and other publicly accessible places provide shade from the sun for people and buildings and reduce the intensity of the urban heat island. The effective temperature of people can be reduced by 7-15 °C by tree shade. Tree shade can also reduce air conditioning costs of buildings by 20-50% providing suitable tree placement[13].

[3] Government response to the making space for nature review - GOV.UK (www.gov.uk)

[4] i-Tree Tools - Calculate the benefits of trees! (itreetools.org)

Modelling work based on Manchester suggested that adding 10 per cent green cover kept maximum surface temperatures in high density residential areas and town centres on the hottest summer days at or below the 1961-1990 level (the baseline projections are based on). However, removing 10 per cent canopy cover from these areas may increase the maximum surface temperatures by up to 8.2^{o}C by the 2080s, assuming the highest emissions scenario. This scenario mirrors the increase in canopy cover the Vision is aiming to achieve.

The physical size of trees and in particular the canopy formed, has indirect human health benefits, as their shade during hot summer days helps reduce localised day time temperatures by up to 2 degrees Celsius so contributing to a reduction in heat related illnesses. Shade from the canopy of trees can reduce overall exposure to ultra-violet (UV) radiation by up to 75 per cent, reducing sun exposure illnesses, such as skin cancer.

Evidence shows that grassed surfaces in tree shade can be 15-20°C cooler than tarmac and the air temperature in tree shade can be 4-7°C lower than in the sun[5].

Flood and storm water alleviation

Urban expansion and new developments change many attributes of the land that is developed and built upon. Amongst these is the reduction in the permeability of surfaces leading to changes in patterns of water runoff and increased loads of pollutants entering water courses.

Tree canopies and root systems reduce and slow storm water flows and nutrient loads that might otherwise end up in our waterways. Broad canopies intercept and mitigate the impact of heavy rainfalls and healthy, fibrous tree roots help reduce the nitrogen, phosphorus and heavy metal content in storm water.

Rainfall interception in canopy

The volume of runoff is reduced by the evaporation of rainfall from leaf surfaces within the tree canopy. Rainfall interception by trees in the parks and streets of a Californian city equated to 1.6% of total precipitation. Rainfall interception is maximized with large, evergreen tree species as these affect storm water runoff all year round.

Increased infiltration of rainfall and soil water storage

Trees can increase the rate, or amount, of soil water infiltration and subsequently increase soil and groundwater recharge. A proportion of the rainfall temporarily held on the canopy will flow down the stem and trunk. In hard impervious surface areas this trunk flow increases the likelihood that rainfall is directed into soil at the base of the tree rather than onto surrounding impervious surfaces

Tree pits can be designed to maximize water storage, and the use of structural soil under pavement areas such as car parks and footpaths can be used to retain

[5] https://cdn.forestresearch.gov.uk/2013/03/fcrn012.pdf

storm water. By providing increased rooting volumes through the use of structural soils, these systems should support larger-sized trees and will further mitigate storm water by rainfall interception and retention within the soil.

Pollutant removal

In addition to reducing the quantity of urban runoff, vegetation and its associated soil can play an important role in removing nutrients and heavy metals from storm water.

Natural flood management involves the slowing of floodwater and storage of water in the catchment area of rivers to reduce flows and flooding downstream. Trees and woods play a vital role in reducing flooding by slowing down the flow of rainwater, absorbing rainwater and reducing erosion[6]. Planting trees has demonstrable benefits in reducing flooding risk through water infiltration, reducing and slowing runoff on farmland.

Local regeneration

Most infrastructure and design decisions are based on a simple Cost Benefit Analysis and so an understanding of urban forest's financial value is critical and can give those decision makers sympathetic to the urban forest a very powerful tool.

The economic benefits of an urban forest include the following:

Reducing energy costs

Trees help improve the environmental performance of buildings – increasing tree cover in a well planned development can lower heating and cooling costs by 20%

Avoiding costs of infrastructure damage

Tree canopies and root systems play a key role in mitigating flood levels during extreme events and have the ability to lower storm water flows into the existing drainage infrastructure and so reduce the risk of damage.

Marketing West Northamptonshire

Tourism and local marketing can be boosted by a good quality trees and woods as recognised by "Green Flag" awards. Green Flag urban parks can be marketed as attractions and will provide attractive settings for various events and activities which will boost the local economy.

Trees play an important role in place-making in urban settings and adding value to investment and development in recreating quality urban spaces as a setting and attractor to investment. Research shows that employees who can see a natural environment from their workspace are more productive and experience greater job

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[6] https://www.woodlandtrust.org.uk/trees-woods-and-wildlife/british-trees/flooding/

[13] https://www.tdag.org.uk/uploads/4/2/8/0/4280686/what_is_known_and_not_know_cooling_benefits_of_urban_trees.pdf

satisfaction[7]. Woodland can also increase the value of property. Natural England found that a property close to a large public open space is on average has about 3.5% greater value than a similar property far from any publicly accessible green space. Having a view over a green or a blue (water) space further increases property price by 2.0%[89]. Increasing the value of property makes an area more attractive, and attracts inward investment.

People are also attracted to live, work and invest in green surroundings. Research shows that average house prices are 5-18% higher when properties are close to mature trees[17]. Companies benefit from a healthier, happier workforce if there are parks and trees nearby.

Trees and Noise

Noise, or unwanted sound, can be quite invasive and one of the most problematic issues in the urban environment. Optimally the most effective solution is to reduce the noise, but often this is not possible, nor is it possible to increase the distance between the source of the noise and the hearer.

Trees' canopies can help to reduce noise pollution, absorbing and deflecting sound. However, on their own they require dense and wide planting (15 to 30m wide tree belt can provide 6 to 10dB reduction). Greater benefits can be gained by their use in combination with other barriers such as soil mounds.

Often it is not possible to provide effective barriers, in these instances trees may be able to provide a visual screen between the source of noise and hearer. Whilst the sound reduction is negligible, the lack of direct view creates the impression of greater noise reduction.

[7] https://assets.publishing.service.gov.uk/media/5b2a43e3ed915d2cdb024daa/eng-casefortrees.pdf

[8] https://publications.naturalengland.org.uk/publication/6692039286587392

[9] https://greenblue.com/gb/how-trees-increase-property-values/