

Practical Guidance

Residential Developments and Trees

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WOODLAND
TRUST

Incorporating trees into residential developments

With over 80 per cent of the population living in towns and cities, it is critical that Local Planning Authorities and developers step forward to ensure they are healthy, happy and productive places to be. These communities need to be multi-faceted and resilient to the challenges posed by climate change, an ageing population, the obesity crisis and increasing budgetary constraints. The importance of trees and green space in delivering high quality places to live, work and spend leisure time is now widely recognised. These vital spaces can be taken for granted but add significant value to developments in terms of social, economic and environmental benefits. Integrating trees and green spaces into developments early on in the design process minimises costs and maximises the benefits they can provide.

Environmental benefits

Reducing flooding

An increase in hard surfaces increases the speed and volume of water runoff which can quickly overwhelm drains. This results in urban flooding, which is currently estimated to cost £270 million a year, a figure that is only going to rise¹. Poor quality water is also a significant problem in urban areas, which has a detrimental impact on wildlife and water-based leisure and recreation activities. This in turn leads to increased water treatment costs.

Woods and trees should form an integral part of all Sustainable Urban Drainage Systems (SUDS).

- Planting trees can slow the flow of water and reduce surface water runoff by up to 62 per cent compared to asphalt^{2,3}. Trees also increase the interception of water as it falls, increasing the infiltration of water into the soil and lowering the risk of surface water flooding.
- Isolated single trees (e.g. urban street trees) have a much higher water use on account of their larger canopy and greater exposure; maximum transpiration rates range from 500-2000 litres per day for individual trees of varying species, compared to 18 litres per day for a tree in a stand of Sitka spruce⁴.
- Individual tree canopies in full leaf can intercept as much as 79 per cent of a 20mm, 24 hour rainfall event under optimum conditions².

- A single young tree planted in a small pit over an impermeable asphalt surface can reduce runoff by around 60 per cent, even during the winter when it is not in leaf⁵.
- Tree roots can increase infiltration rates in compacted soils by 63 per cent, and in severely compacted soils by 153 per cent⁵.
- Trees can help mitigate diffuse pollution and by reducing the amount of water running into drains, this in turn helps reduce the quantity of water that needs treating^{6,7}.

Improved air quality

Poor air quality can have an adverse impact on health, especially heart and lung conditions, including asthma. Estimates show the cost of the adverse health impacts of air pollution is between £8.6 and £20.2 billion a year⁸. High particulate matter concentrations from air pollution have been linked to lower test scores and achievement in school children⁹. Trees can modify air quality through trapping particulate matter on leaf surfaces and via the direct absorption of gases^{10,11}. Trees can remove the pollutants which cause greatest concern: particulate matter (PM), oxides of nitrogen, and ground-level ozone. Planting in areas of high pollutant concentration, such as traffic junctions, will have the greatest benefit¹². A single tree has been estimated to reduce PM concentration by 15-20 per cent¹³. Tree species do however differ in their ability to remove pollutants. The Woodland Trust report on Urban Air Quality has more details on which species to choose¹⁴.

Mitigating the urban heat island effect

The hard surfaces of structures such as buildings and roads absorb heat during the day and release it at night. This causes the urban heat island effect, which can result in as much as a 10°C temperature difference between residential centres and the surrounding area. Increasing tree cover in urban areas can help mitigate the urban heat island through direct shading and by reducing ambient air temperature through the cooling effect of water evaporation from the soil via plant leaves. The shading provided by trees can also reduce energy use for heating and cooling buildings.

Trees can therefore play an important role in urban climate change strategies¹⁵.



Reducing noise

In an urban environment noise can be amplified as it reflects off hard surfaces. Using a barrier can increase the distance between the noise and the receiver¹⁶. Natural barriers provide a more pleasing aesthetic alternative to artificial ones constructed of concrete or wood. Trees can reduce surrounding noise through a combination of reflection and absorption of sound. Larger leaved trees in particular, such as beech, are more effective than smaller leaved ones, with low shrubs and hedges also providing good sound barriers¹⁷. The denser a natural barrier and the closer it is to the source of the noise, the more effective it will be at lessening the impact¹⁸.

Biodiversity

Natural spaces such as parks, gardens and woodland within urban areas can support a range of wildlife. They can also ensure that a wider range of people are able to experience and appreciate nature.

Social Value

Health and wellbeing

The provision of green spaces can benefit both physical and mental health, reduce health inequalities and reduce the wider costs of health care. The role that green space can play in helping to tackle public health issues and

deliver wide-ranging benefits to people's health and wellbeing is widely acknowledged and should not be underestimated^{10,19,20}. For individuals to lead healthy, active lifestyles, the surrounding environment should provide opportunities for healthy living and be one in which people want to spend time²¹.

Reducing health care costs

The cost to the NHS of treating overweight and obese patients together with related health problems were estimated to have reached £4.2 billion in direct costs by 2007, and £15.8 billion in indirect costs, such as to the wider economy²². The cost of mental health in terms of health and social care are increasing; estimated as reaching £12 billion a year in England, with a wider economic impact of £63 billion per year²³.

A number of studies have emphasised the savings to the NHS from increasing activity and exercise among individuals. Research by the Department for Culture, Media and Sport has suggested that an increase in adult physical activity by 10 per cent would benefit England by £500 million per year²⁴. A report to the Forestry Commission suggested a saving of £1.44 billion in health care costs could be achieved with a one percent reduction in sedentary behaviour,²⁵ while Natural England has estimated that access to quality green space could save around £2.1 billion in health care costs²⁶. Studies have also highlighted specific benefits to physical and mental health.





Image credit: Victoria Bankes Price

Benefits to physical health

Irrespective of income or social group, the closer people live to green space the more likely they are to be physically active, and have a lower tendency to be overweight or obese²⁷.

- Improving the quality of outdoor space with trees can increase physical activity such as walking and cycling. Physical activity in green spaces has a greater positive impact compared to activities in alternative environments²⁸.
- Green space can have a positive effect on physical health conditions such as obesity, heart disease, circulatory and respiratory diseases and asthma through encouraging activity and reduced air pollution²⁹. Spending time within sight of trees and walking in a natural environment have been associated with lowered blood pressure and lower stress levels³⁰. Increased exercise also has mental health benefits.
- A high amount of green space within walking distance, has correlated with lower BMI scores in children³¹.

Benefits to mental health and wellbeing

- Increased physical activity has been linked to an improvement in mental wellbeing³² with increased exercise linked to delaying the effects of dementia³³.

- Access to green space improves people's mental health as does the view of a natural environment. Contact with nature was also found to have had a relaxing effect on Alzheimer's patients³⁴.
- Recovery from stress was enhanced when patients were exposed to images of a natural environment³⁵.
- Children with a more natural space nearby have higher levels of psychological wellbeing³⁶.
- The symptoms of ADHD in children improved in those that had taken part in outdoor activities³⁷.
- A review of the benefits of access to nature for people living with dementia found evidence that it helped patients and carers remain connected to the wider community and retained their quality of life³⁰.
- Access to the natural environment benefited people living with dementia through increasing awareness and attention, as well as reducing stress and improving social interaction²⁹. Further evidence showed the potential of woodland visits to improve verbal expression and stimulate memory as well as enhancing wellbeing³⁸.
- As individual visits to urban green space increased, significantly fewer individuals reported stress-related illnesses³⁹.

Reducing health inequalities

Health inequalities between communities with differing economic conditions, are influenced by the wider environment⁴⁰. Access to green space is not equally distributed across the population⁴¹. More affluent areas and people in higher socio-economic groups have larger amounts and greater access to green space compared to more deprived areas⁴². Promotion of existing spaces and the creation of new green space can help reduce these inequalities. In those areas where there is a greater proportion of green spaces, income-related health inequalities are lower.

Community benefits, recreation and amenity value

Studies show:

- Around 83 per cent more individuals use green spaces for activity compared to bare sites⁴³.
- Over 1.36 billion visits were made to urban green spaces in 2014⁴⁴.
- Encouraging the use of outside space and maintaining its quality can be used to deter crime and anti-social behaviour. Open green space and widely spaced trees are preferred to dense vegetation⁴⁵.
- The presence of trees is perceived as indicating a more cared for neighbourhood and the presence of street trees was associated with a decreased incidence of crime⁴⁶.
- A greater amount of surrounding vegetation reduced crime by 50 percent in residential areas⁴⁵.
- Trees can play a significant aesthetic role, helping to integrate new developments into existing ones and creating a local identity¹⁰.
- A poor quality local environment can have a negative impact on the quality of life of those communities⁴⁷.
- Children prefer to play in natural areas but these are increasingly being lost. Green areas are proven to increase activity levels, enhance creativity and help physical development, as well as increase social skills¹⁹.

Road safety

Trees can create an environment in which road and hazard awareness of road users is improved. Trees along roads help motorists judge their speed more effectively and can be used as part of traffic calming measures⁴⁸.

They can also be used as a means of making local access and residential roads visually distinct from main roads (below). In this example, the result was to significantly reduce speeds on the local roads. There was a 36 per cent reduction in crashes in the area as well as an 86 per cent reduction in crash costs⁴⁹.



One of the local streets transformed by the Glen Innes SER project. Trees were used to limit forward visibility as well as make the local access or residential roads visually distinct from the collector roads.

Image credit Samuel G Charlton.

Education

Learning outdoors has many developmental benefits including increasing confidence, self esteem and team building. Connection with nature as a child can influence attitudes to the environment as an adult. Those that visited green spaces frequently as a child had a more positive attitude towards the environment¹⁹. Views of a natural environment are also important and have been found to increase children's concentration, improve results and decrease time off due to illness¹⁹.



Image credit WTPPL

Economic value to development

Provision of green space has both direct and indirect economic benefits⁵⁰. Good quality green space can enhance the appearance of developments and improve people's perceptions of an area¹⁷. Several studies have also shown investing in green space and tree planting increases property and land values and encourages further investment⁵¹. Others indicate buyers are willing to pay more for views of trees and the natural environment^{10,52,53}. The additional benefits of, for example, trees in mitigating air pollution and storing carbon should also be included in an economic consideration of green spaces⁵⁰.

Direct economic benefits

- The Commission for Architecture and the Built Environment (CABE) review showed that properties in environments landscaped with trees or close to green space had a range of price increases of up to 30 per cent⁵⁴.
- The economic value of the benefits of urban woodland has been estimated at £39 billion or £130,000 per hectare⁵⁰.
- In a study in the north west of England, a natural view added 18 per cent to a property's value²³.
- In a London case study, a one per cent increase in green space was associated with a 0.5 per cent increase in the average house price⁵⁵.
- Well managed local green space has been estimated to increase property values between 2.6-11.3 per cent⁵¹.

Indirect economic benefits

- Trees can reduce the maintenance costs of green space.
- Urban trees can enhance the prospect of securing planning permission¹⁷.
- Green infrastructure can make an area more attractive to visitors and through this, add value to the local economy by increasing inward investment and increasing land and property values¹⁰.
- An economic valuation of green infrastructure can support the case for its inclusion into developments¹⁷.

Measuring benefits

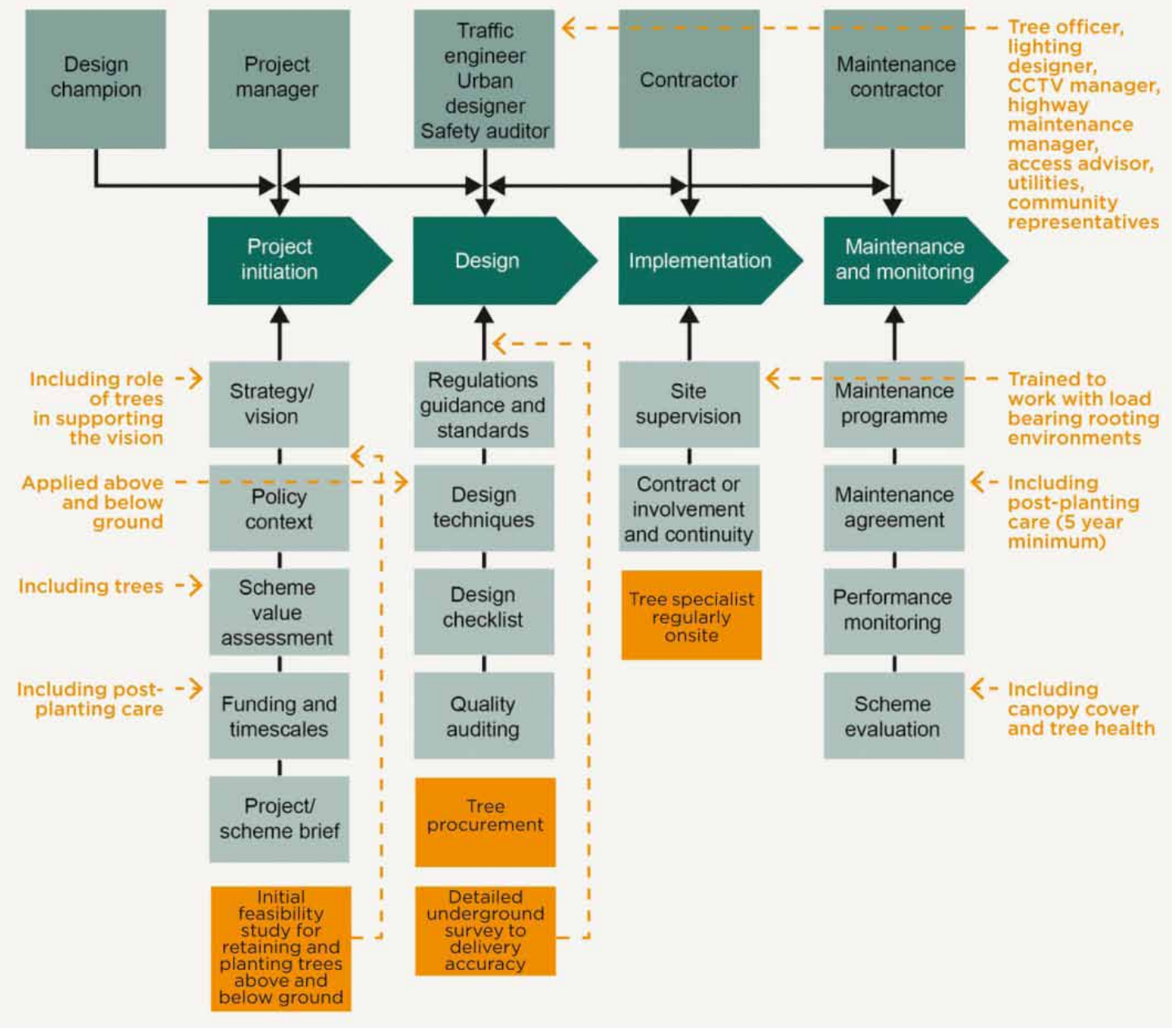
A number of methods also exist for placing an economic value on trees^{17,56}:

- The Helliwell method is used to calculate the amenity value of trees and woods.
- The Council of Tree and Landscape Appraisers (CLTA) economic model can also be used to create a value of trees.
- The Capital Asset Value for Amenity Trees (CAVAT) method is designed to incorporate the value of a tree alongside its social importance.

| Regime | Average annual costs (£/ha) | |
|--|-----------------------------|-------------|
| | Years 1-9 | Years 10-50 |
| Amenity grassland 50 per cent mown by hand | £2,280 | £2,280 |
| Amenity grassland 10 per cent mown by hand | £1,750 | £1,750 |
| Amenity grassland 100 per cent gang mown | £1,620 | £1,620 |
| Complex mixed woodland planting | £1,425 | £2,750 |
| Woodland in managed green space | £1,065 | £1,050 |
| Meadow grassland | £710 | £710 |
| Rough grassland | £580 | £580 |
| Pioneer style woodland | £250 | £400 |
| Naturally colonising woodland | £200 | £350 |

Summary of the average annual maintenance costs for each landscape type from the Woodland Trust *Trees or Turf? Report* (2011)

Integrating trees into the LTN1/08 design process, flow, inputs and outputs



Courtesy of Trees and Design Action Group

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This four-step approach of initiation, design, implementation and maintenance and monitoring can be applied to new developments. The titles refer to roles rather than to professional backgrounds; one person may fill several roles.

Image credit TDAG

Factors to consider when incorporating trees

The Trees and Design Action Group (TDAG) publication 'Trees in Hard Landscapes: A Guide for Delivery Checklist' has a checklist of headline considerations when incorporating trees and green space into development⁴⁸. Adapted from the Department for Transport's Local Transport Note 1/08 Traffic Management and Streetscape, the orange annotations (see adjacent) demonstrate how to integrate trees into the design and implementation process.

Design^{48,57,58}

- Check for existing habitat value and preserve and incorporate existing habitats such as wetlands, waterways and water bodies, heathlands, flower-rich grasslands and biodiverse brownfield sites.
- Incorporating new and existing trees at the early stages of development plans is essential.
- Promote the use of shared service trenches.

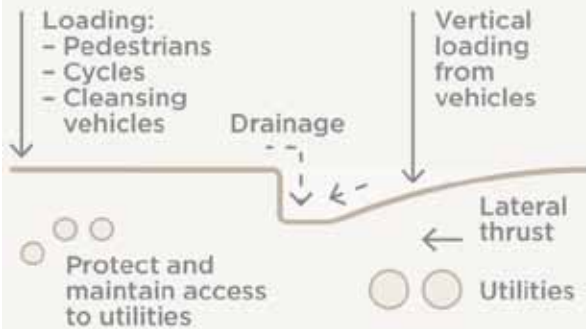
- Refer to any relevant local strategies applying to trees and green space. If there is a history in the area for the use of a particular species, that could be reflected in the planned planting.
- Using existing mature trees when planning and designing developments can save money and add immediate impact. Where the setting allows, take opportunities to plant large species of trees with a long lifespan.
- Studies have shown that people generally prefer a mix of open areas and trees rather than dense tree cover.
- In high density housing, space along boundaries, paths and areas of public space can be used to accommodate roots and canopy growth.
- Community involvement in the creation of green infrastructure can help ensure its success and increase its value to communities through a sense of ownership.
- New trees and woodland are most needed where they can provide people with access to nature and natural landscapes in areas presently lacking such an opportunity.



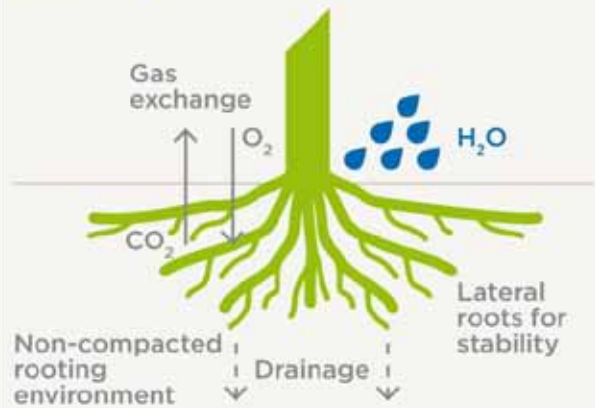
Image and scheme credit LDA Design

Key points for success with trees in hard landscapes

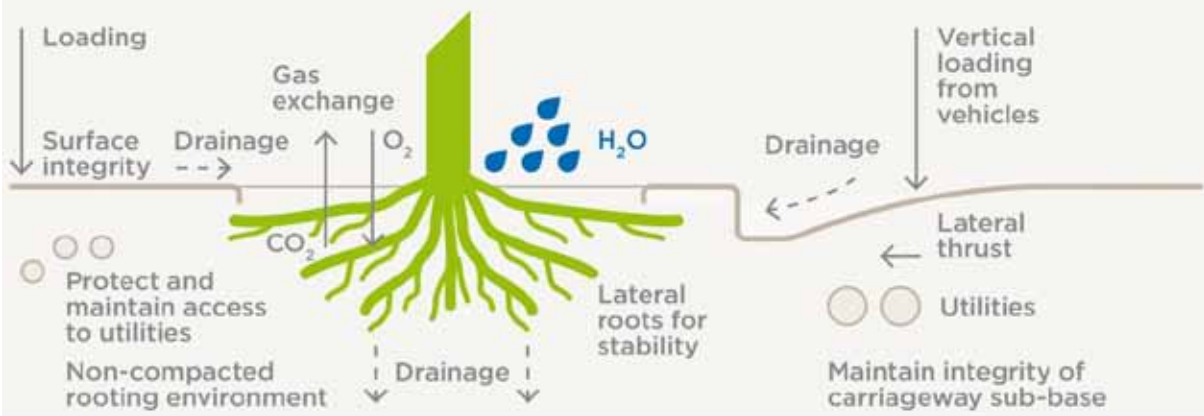
Highway needs



Tree needs



Setting the brief



Courtesy of Trees and Design Action Group

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Key points for success with trees in hard landscapes.

Image credit TDAG

Maintenance^{57,58,59}

- Promote the design/management continuum to make management the tool by which design never ends
- Making provision for maintenance and incorporating it into management plans can highlight any issues that can be dealt with at the design stage.
- The benefits of open space can decline if they are poorly maintained – plan for long-term existence of trees.
- Choose the right tree for the right place:
 - Different species will provide different environmental, social or economic benefits in a particular location⁵⁹.
 - Some species can generate problems in the wrong location.
 - Where there are several options to choose from, native trees may support more biodiversity.
- Consider existing and future infrastructure requirements and position trees appropriately to allow sufficient space for them to grow and prevent conflicts with underground utilities.
- Providing appropriate surfacing around the root can prevent future issues.
- Allow adequate spacing between the tree and the path to avoid obstruction.

- Knowing the final canopy height of a tree species and finding a suitable location can prevent the problem of shading and the obstruction of lighting, and meet the statutory requirement to maintain a clear route along roads.

Ancient woodland

The guidance within this paper should always be considered after the existing ecological conditions have been assessed on site. The Woodland Trust is primarily concerned with the protection and enhancement of ancient woodland. Ancient woodland is land that has been continuously wooded since 1600. It is recorded on the Ancient Woodland Inventory⁶⁰. The inventory generally only records woodlands over two hectares in size but smaller woodlands can be added. The inventory is provisional so even if the woodland is not recorded as ancient woodland, map evidence and site surveys may prove that it is and should be added.

Ancient woodland is impossible to replicate because many of the species that make it up are long-lived and slow growing and do not respond positively to any disturbance. Furthermore, it is often wrongly assumed that development only impacts ancient woodland if there is direct damage to the wood. Development adjacent to woodland can cause indirect effects such as changes to drainage, increase in pollution risk, impacts on tree roots and changes to noise and lighting, all of which can have a harmful effect on the woodland ecosystem. Development near ancient woodland should be treated in accordance with Natural England's Standing Advice⁶¹. Bespoke buffering schemes should be considered on a case by case basis. The Woodland Trust has produced two useful guides on development adjacent to ancient woodland to assist in considering the impacts of different schemes^{62,63}.

Ancient and veteran trees are special because of their great size, age or condition. Retaining these trees can enhance the value of any development. They will add a unique quality, giving it a sense of place and an air of respectable antiquity, creating character and distinction which will be appreciated by future residents and their families. The impact upon ancient and notable trees must also be considered as part of the development process. The Woodland Trust has produced a useful guide⁶⁴. The Ancient Tree Hunt website is also a useful resource for both developers and communities⁶⁵.

Standards and benchmarks

Measurable standards for green infrastructure exist to inform planning and provide a point of reference for accessible green space⁶⁶.

- The Accessible Natural Green Space Standard⁶⁷ developed by Natural England, provides local authorities with a guide as to what constitutes accessible green space. It recommends the distance people should live from certain types of green spaces and the size of the green spaces in conjunction with distance to homes.

Everyone should have accessible natural green space:

- Of at least two hectares in size, no more than 300m (five minutes' walk) from home.
- At least one accessible 20 hectare site within 2km of home.
- One accessible 100 hectare site within 5km of home.
- One accessible 500 hectare site within 10km of home.
- A minimum of one hectare of statutory local nature reserves per thousand people.
- The Woodland Access Standard developed to complement the Accessible Natural Green Space Standard recommends⁶⁸:
 - That no person should live more than 500m from at least one area of accessible woodland of no less than hectare in size.
 - That there should also be at least one area of accessible woodland of no less than 20ha within 4km (8km round trip) of people's homes.

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Free advice and support

If you have any questions or would like to find out more about how to incorporate trees into residential developments please email **governmentaffairs@woodlandtrust.org.uk**.



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