TREE CANOPY COVER ASSESSMENT

Huntingdonshire District Council

Treeco$_2$nomics

Huntingdonshire DISTRICT COUNCIL

bluesky

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This assessment was carried out by Treeconomics

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Headline Figures

Huntingdonshire's Urban Forest Highlights		
Average Canopy Cover	10%	
Carbon Storage	637,470 tonnes	£163,618,700
Carbon Sequestration (annual)	25,380 tonnes	£6,514,900
Pollution Removal (annual)	3,142 tonnes	£25,783,871
Avoided Runoff (annual)	6,347,590 m^3	£4,058,682
Total Annual Benefits	**£36,357,453**	

Table 1: Headline Figures for Huntingdonshire District

Contents

Executive Summary

- The overall canopy cover of the district of Huntingdonshire is estimated at 10%. Canopy cover varies across the wards from 24% to 3%.
- The average canopy cover for England currently stands at 16%.
- Forest Research suggests 20% canopy cover is an appropriate target for localities outside of coastal areas. Current canopy cover would need to be doubled in order to attain the target recommended by Forest Research.
- Huntingdonshire's forests and trees currently store approximately 637,000 metric tonnes of carbon.
- A further 25,000 metric tonnes of carbon are sequestered every year by Huntingdonshire's trees.
- The trees and green infrastructure of Huntingdonshire prevent flooding through reducing surface runoff with an associated value of £4 million each year.
- More than 3,100 tonnes of air pollutants are removed by Huntingdonshire's trees with a value of more than £25 million every year!

1. Introduction

Canopy cover (also referred to as tree canopy cover and urban canopy cover) can be defined as the area of leaves, branches, and stems of trees covering the ground when viewed from above. It is a two-dimensional metric indicating the spread of tree canopy across an area.

Quantifying the spatial extent of canopy cover in this way is one of the first steps in 'measuring to manage' urban forests, recognised by many authors[1]. It is a cost-effective method and answers the fundamental questions: 'How much urban forest do we have?', 'Where is it?' and 'How has it changed over time?'. These concepts are easy to understand and useful in beginning to communicate messages about the distribution of urban forests with both the public and policy makers. Further evaluation and appreciation can be given to canopy cover in considering its relationship with other environmental and social indicators. The benefits it provides are known as ecosystem services, which contribute to natural capital when assigned monetary values. Adding this perspective allows the urban forest to be viewed and quantified as an asset, encouraging city planners, urban foresters, and residents to consider trees as key components of community planning, sustainability, and resilience.

Urban trees and forests also contribute to green infrastructure, as networks of new and well-established natural spaces within urban areas. This can encompass river and coastal systems, sometimes referred to as 'blue infrastructure'. Green spaces should thread through and surround the built environment, connecting urban areas to its wider rural hinterland:

'Green Infrastructure is a strategically planned and delivered network comprising the broadest range of high quality green spaces and other environmental features. It should be designed and managed as a multifunctional resource capable of delivering those ecological services and quality of life benefits required by the communities it serves and needed to underpin sustainability. Its design and management should also respect and enhance the character and distinctiveness of an area with regard to habitats and landscape types'[2]*.*

The importance of green infrastructure in urban areas has long been recognised (e.g., Oke, 1982; Huang *et al.,* 1987; Nowak *et al.,* 2010). Among a plethora of beneficial ecosystem services, vegetation provides shading, evaporative cooling, and rainwater interception (Gill et al., 2007). Tree canopy cover also has a strong influence on several social factors including reducing energy demand, improving air quality and noise pollution, promoting biodiversity, mitigating high urban summer temperatures, and enhancing human health and wellbeing.

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[1] Britt and Johnston, 2008; Escobedo and Nowak, 2009; Schwab, 2009

[2] Natural England Green Infrastructure Guidance, 2009

There is a growing body of international research and literature which supports the theory that increasing tree cover in our towns and cities provides multiple benefits at little cost. For example, a study in Torbay found that for every £1 spent on an Oak tree, £4.96 was returned in benefits, accounting for all the costs of management and maintenance, whilst only being able to value just 2 of the associated benefits (pollution removal and carbon sequestration - Sunderland *et al*., 2012). A similar study in New York found that for every $1 spent on its street trees, $5 were returned in benefits (Wells, 2012).

Trees and urban tree cover are also implicitly linked to other key concepts that are emphasised and highlighted within The National Planning Policy Framework (NPPF). Sustainability, ecosystem services and green infrastructure are all dependent on the significant contribution that trees in the urban forest make. Of the 16 sections in the NPPF, trees can contribute to meeting the objectives of 11. For example, increased tree cover can increase economic growth[3] and prosperity as leafier environments improve consumer spending[4]. Additionally, businesses are prepared to pay greater ground rents associated with higher paid earners who are also more productive[5], house prices increase, and crime is reduced; thereby 'building a strong, competitive economy'. This is also directly linked to 'ensuring the vitality of town centres'. A full summary of how trees benefit local communities within the context of the NPPF is provided in Appendix II. In addition to the above, these include:

•Supporting a prosperous rural economy

•Improving journey quality and encouraging use of alternative transport corridors

•Increasing property prices and reducing crime

•Improving the 'liveability' of urban areas, increasing happiness and reducing stress

•Providing habitat, increasing biodiversity and therefore recreational value

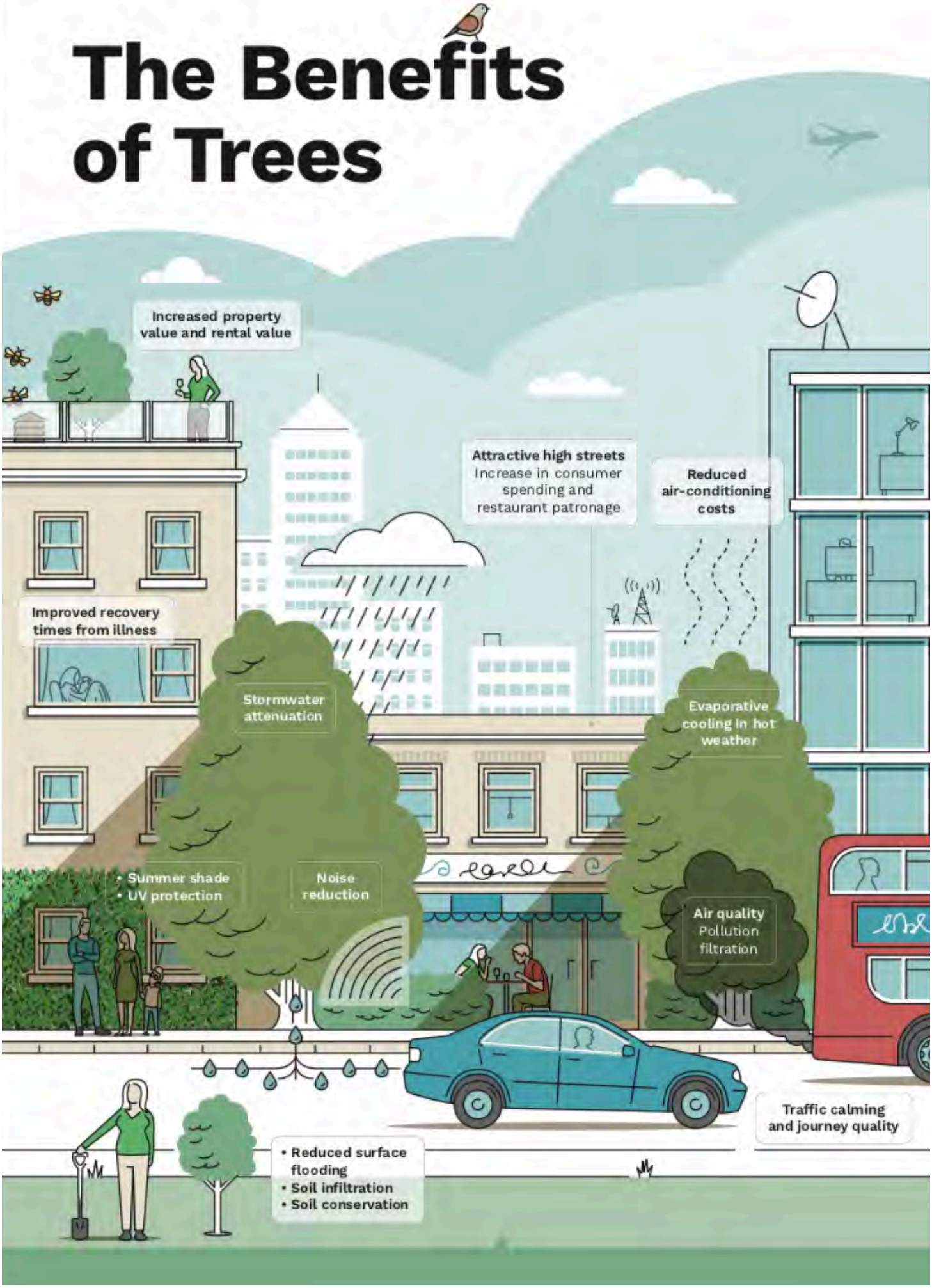
Therefore, investigating the extent and understanding the benefits of canopy cover in Huntingdonshire will allow the area's urban forest to be improved and maintained. Data from this study can be used to target resources to the areas that need it most, therefore advocating sustainability and resilience.

[3] Rolls and Sunderland, 2014

[4] Wolf, 2005

[5] Kaplan, 1993, Wolf. 1998; Laverne and Winson-Geideman, 2003

The Benefits of Trees




Treeconomics
Improved concentration and productivity
Winter windbreak
Reduced heating costs
• Social cohesion
• Sense of place
• Cultural links to the past
Bio-diversity and habitat
Oxygen production
Food
• Reduced stress
• Health and wellbeing benefits
Carbon storage
Encourages outdoor recreation
Timber
Fuel and building materials
© Treeconomics 2018. You're free to use this image with attribution.

2. Huntingdonshire District

Huntingdonshire District has a total area of 91,255 ha with an estimated population of 178,985[6]. Agricultural land covers approximately 68% of the district, based on the i-Tree Canopy assessment of ground cover. Currently 10% of the district is covered by tree canopy, according to our analysis of BlueSky National Tree Map data.

The landscape of Huntingdonshire '*embraces a diversity of landscapes from the flat, expansive Fenlands in the north-east to the rolling uplands in the west*'. The district has 5 market towns and over 80 villages. The agricultural landscape incorporates both arable and pastoral farming and agriculture, as seen in the ground cover estimate of 68%, this land-use dominates the district. The landscape character assessment for Huntingdonshire acknowledges the significant loss of hedgerows after the Second World War which helped to improve farming efficiency[7].

As part of this study, we have analysed canopy cover, ecosystem services and population-level statistics in each of the 26 wards of Huntingdonshire district.

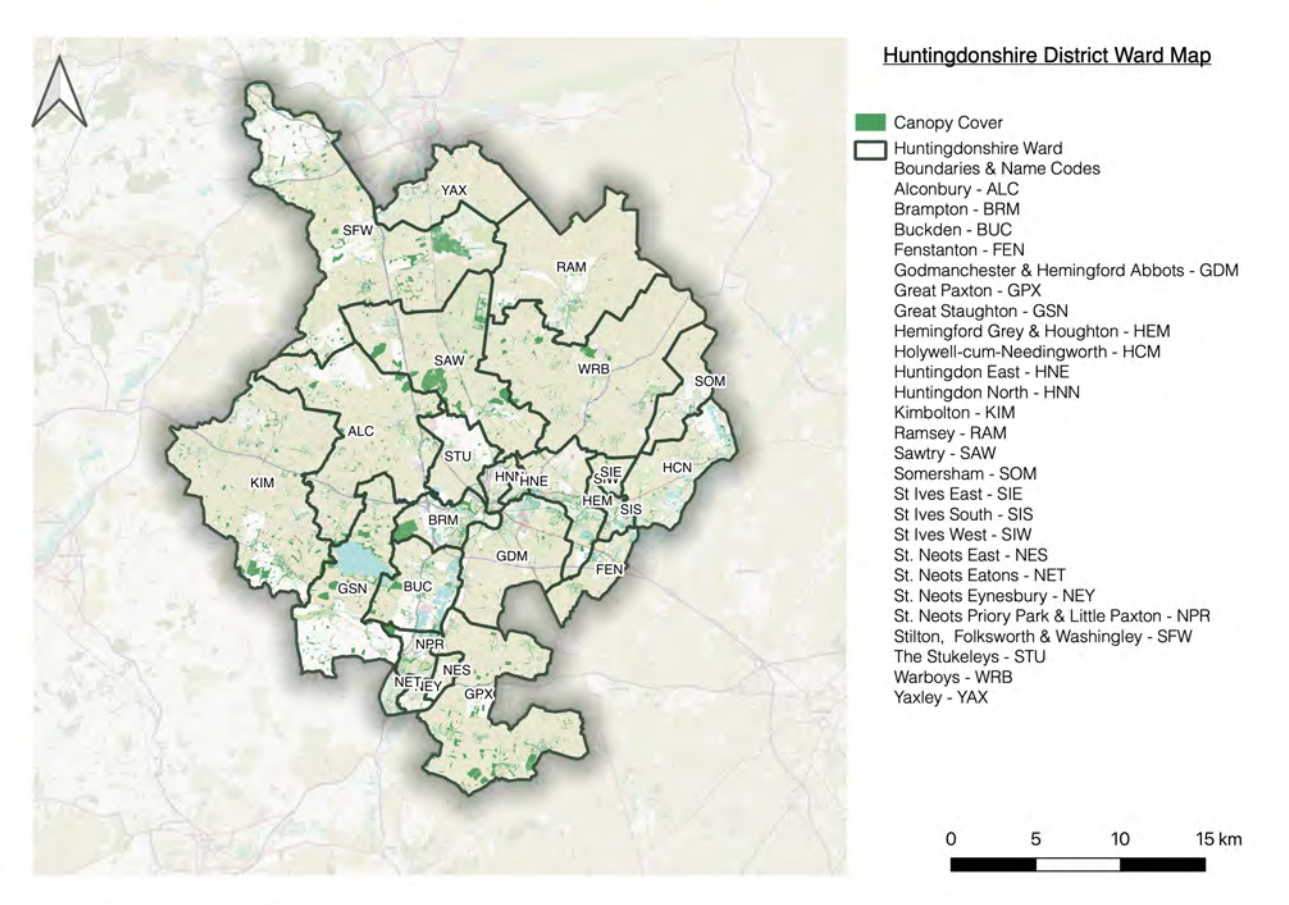


Figure 1: Huntingdonshire District Ward Map

[6] ONS, 2020

[7] Huntingdonshire District Council, 2007

Figure 2: Godmanchester Mill Steps; Godmanchester Community Nursery[8]

[8] Source: Huntingdonshire.gov.uk (2021)

3. Results

3.1 Canopy Cover

3.1.1 Average Canopy Cover

The average canopy cover across the district of Huntingdonshire was calculated at **10%** using BlueSky's National Tree Map data (NTM). It varies significantly from 3% in Ramsey Ward, to 24% in St. Neots Priory Park & Little Paxton.

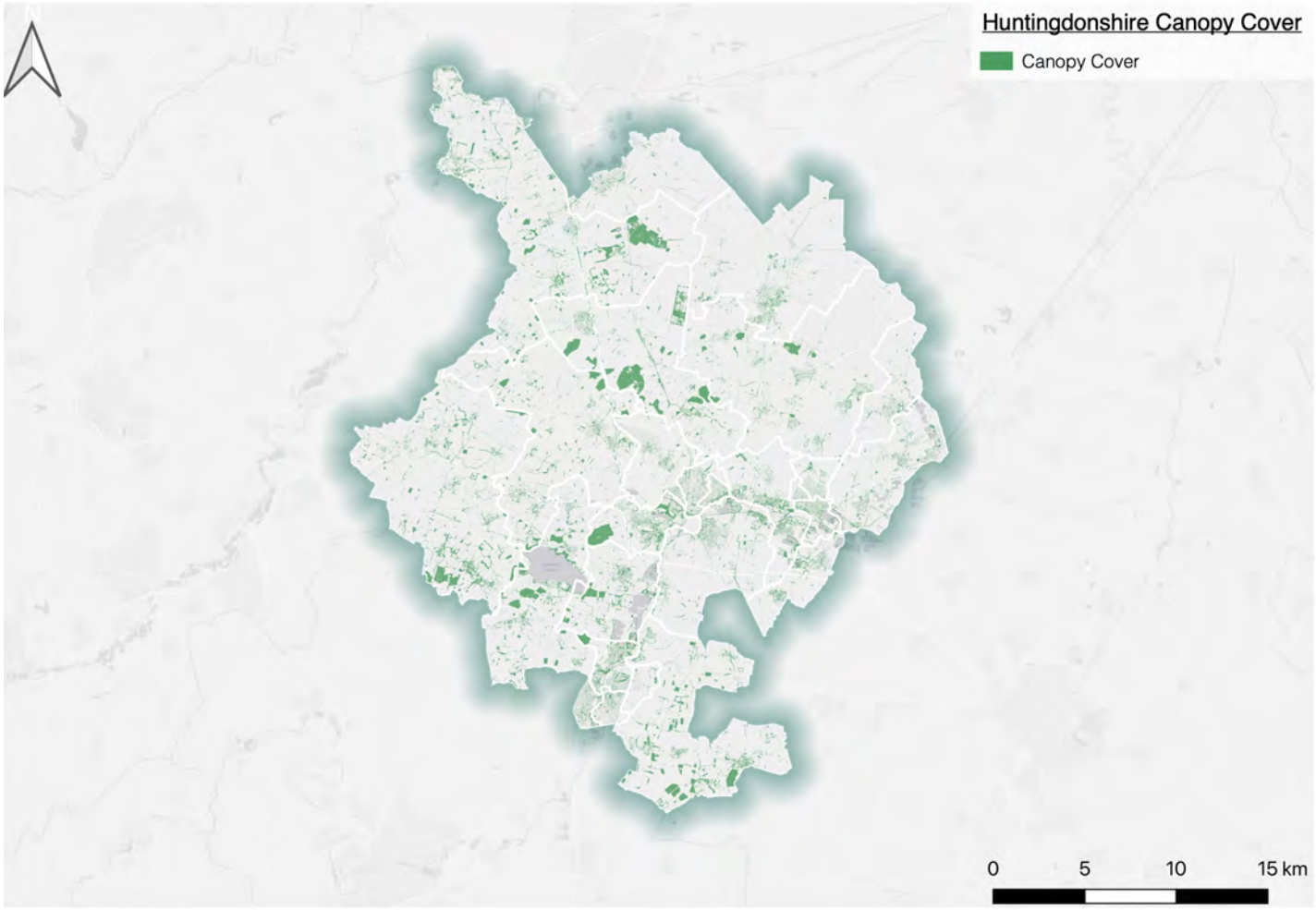


Figure 3: Canopy Cover Across Huntingdonshire

In a study of 283 UK towns and cities, Doick *et al.* (2017) reported that the average canopy cover value for England stands at 16%. Currently Huntingdonshire's canopy cover is below this average at 10%, and it would be recommended that a target to increase canopy cover across the district is included within strategic plans and policies for the development of the district. Doick *et al.* recommend a canopy cover target of 20% for non-coastal towns and cities.

City/District	% Tree cover	Source
Mid Suffolk	15.1	Forest Research; Canopy Cover Map UK 2021[1]
Cambridgeshire	13.9	Forest Research; Canopy Cover Map UK 2021
Fenland	12.5	Forest Research; Canopy Cover Map UK 2021
Torbay	12.0	i-Tree Survey 2011
Cambridge	11.6	Forest Research; Canopy Cover Map UK 2021
Peterborough	10.3	Forest Research; Canopy Cover Map UK 2021
Huntingdonshire	10.2	i-Tree Canopy+ Blue Sky NTM Survey 2021
Aberdeen	10.0	i-Tree Canopy 2016[2]
York	9.8	i-Tree Canopy 2016
Sunderland	9.2	i-Tree Canopy 2016

Table 2: A selection of UK districts, cities and towns and their estimated canopy cover.

[9] Treeconomics (2016)

3.1.2 Canopy Cover by Ward

Canopy cover by ward is depicted in Figure 4 (overleaf).

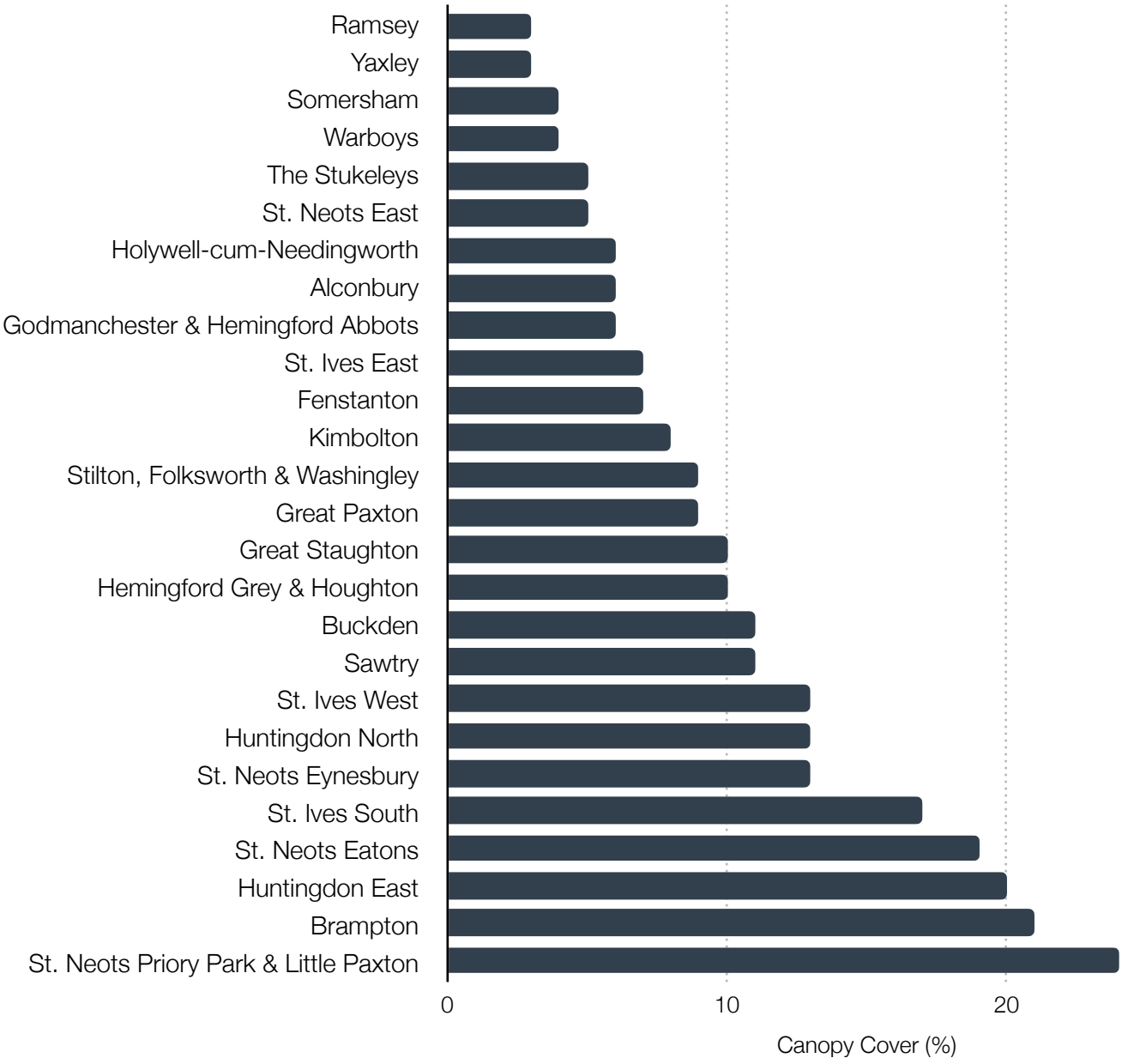


Figure 4: Canopy Cover ranked by % area per ward for Huntingdonshire

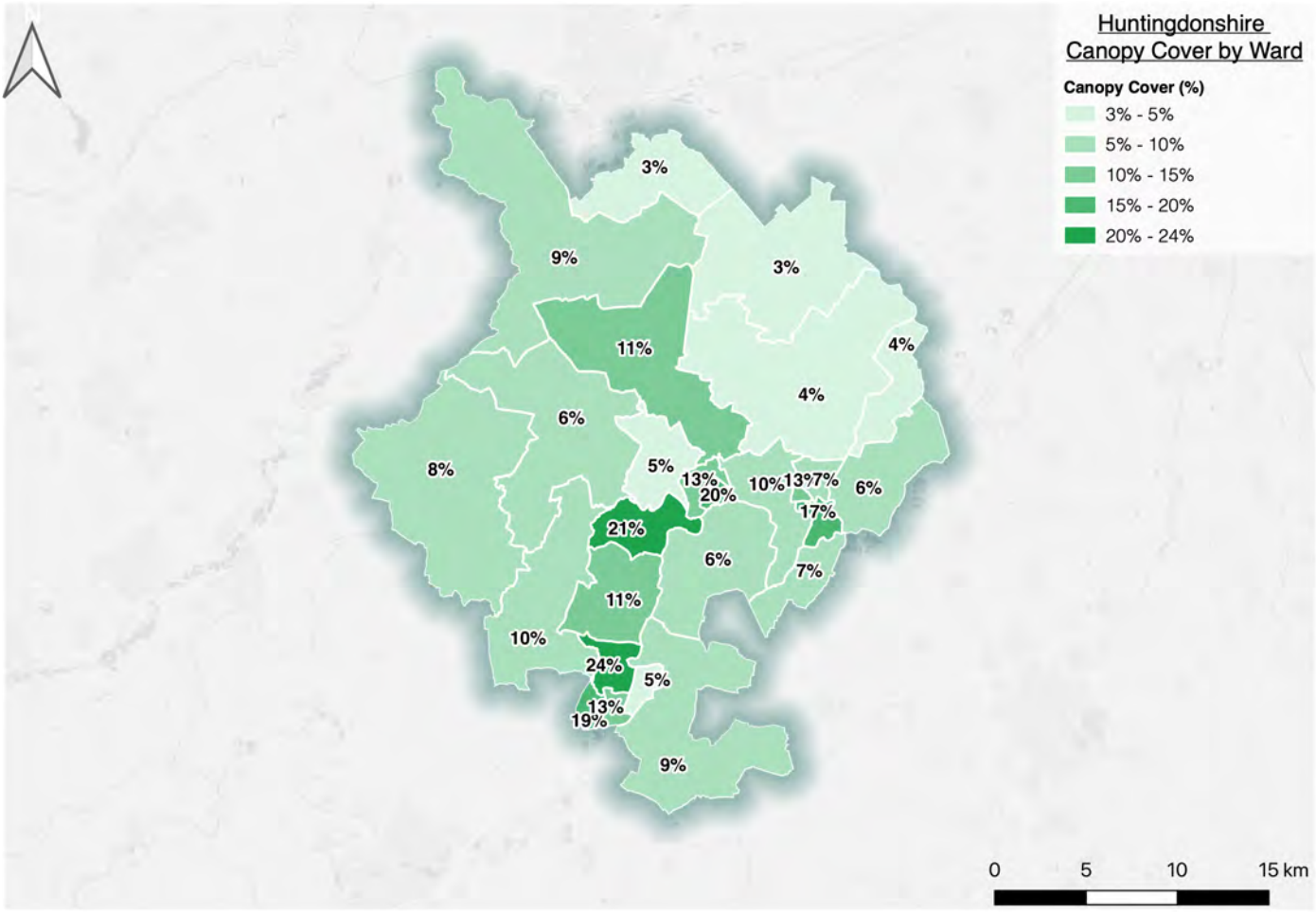


Figure 5: Canopy Cover by % area across Huntingdonshire

3.1.3 Individual Ward Canopy Cover Maps

Alconbury Ward: **6%** Canopy Cover

Brampton Ward: **21%** Canopy Cover

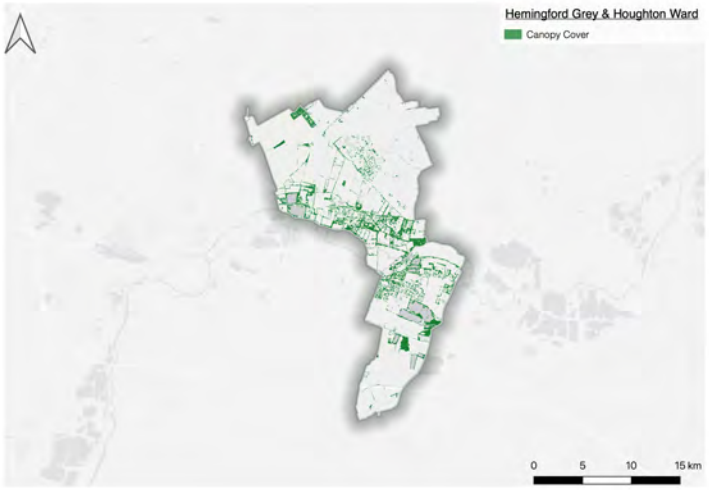
Buckden Ward: **11%** Canopy Cover

Fenstanton Ward: **7%** Canopy Cover

Godmanchester & Hemingford Abbots Ward: **6%** Canopy Cover

Great Paxton Ward: **9%** Canopy Cover

Great Staughton Ward: **10%** Canopy Cover

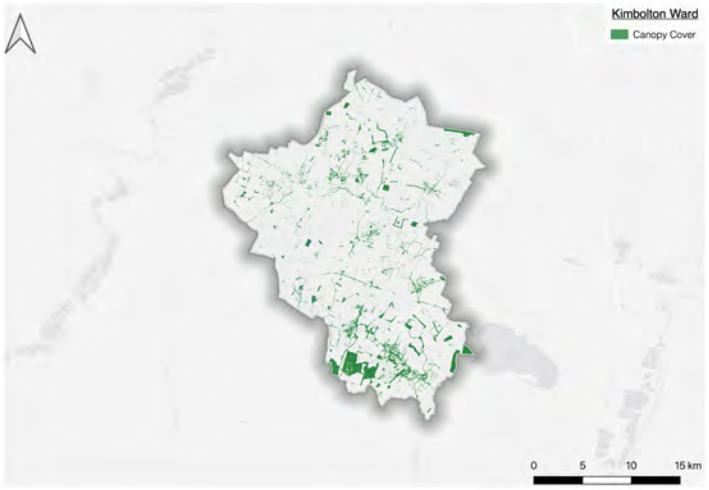


Hemingford Grey & Houghton Ward: **10%** Canopy Cover

Holywell-cum-Needingworth Ward: **6%** Canopy Cover

Huntingdon East Ward: **20%** Canopy Cover

Huntingdon North Ward: **13%** Canopy Cover



Kimbolton Ward: **8%** Canopy Cover

Ramsey Ward: **3%** Canopy Cover

Sawtry Ward: **11%** Canopy Cover

Somersham Ward: **4%** Canopy Cover

St Ives East Ward: **7%** Canopy Cover

St Ives South Ward: **17%** Canopy Cover

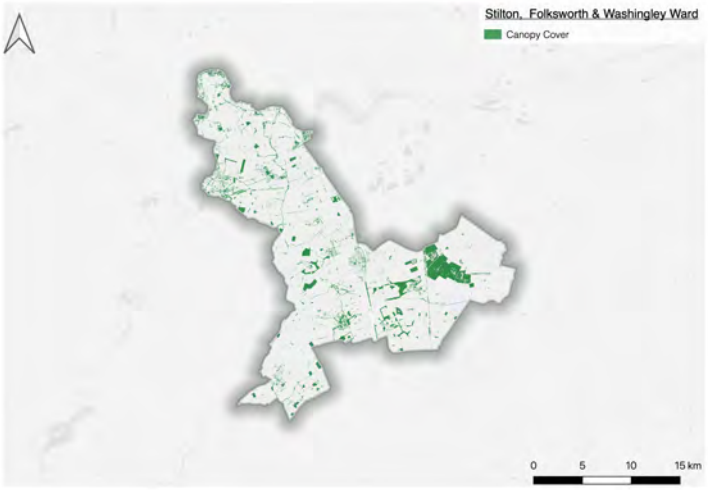
St Ives West Ward: **13%** Canopy Cover

St. Neots East Ward: **5%** Canopy Cover

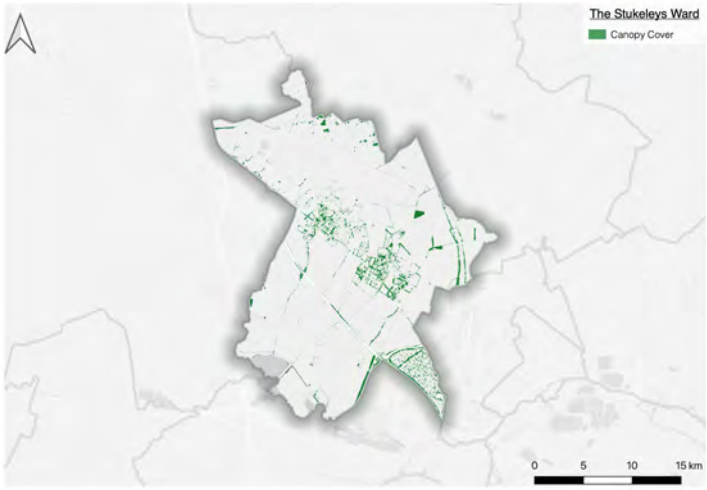
St. Neots Eatons Ward: **19%** Canopy Cover

St. Neots Eynesbury Ward: **13%** Canopy Cover

St. Neots Priory Park & Little Paxton Ward: **24%** Canopy Cover



Stilton, Folksoworth & Washingley Ward: **9%** Canopy Cover



The Stukeleys Ward: **5%** Canopy Cover

Yaxley Ward: **3%** Canopy Cover

Warboys Ward: **4%** Canopy Cover

Figure 6: Canopy Cover by Ward Across Huntingdonshire

Figure 7: Hinchingbrooke Country Park[10]

[10] Source: Huntingdonshire.gov.uk (2021)

4. Canopy Cover and Communities

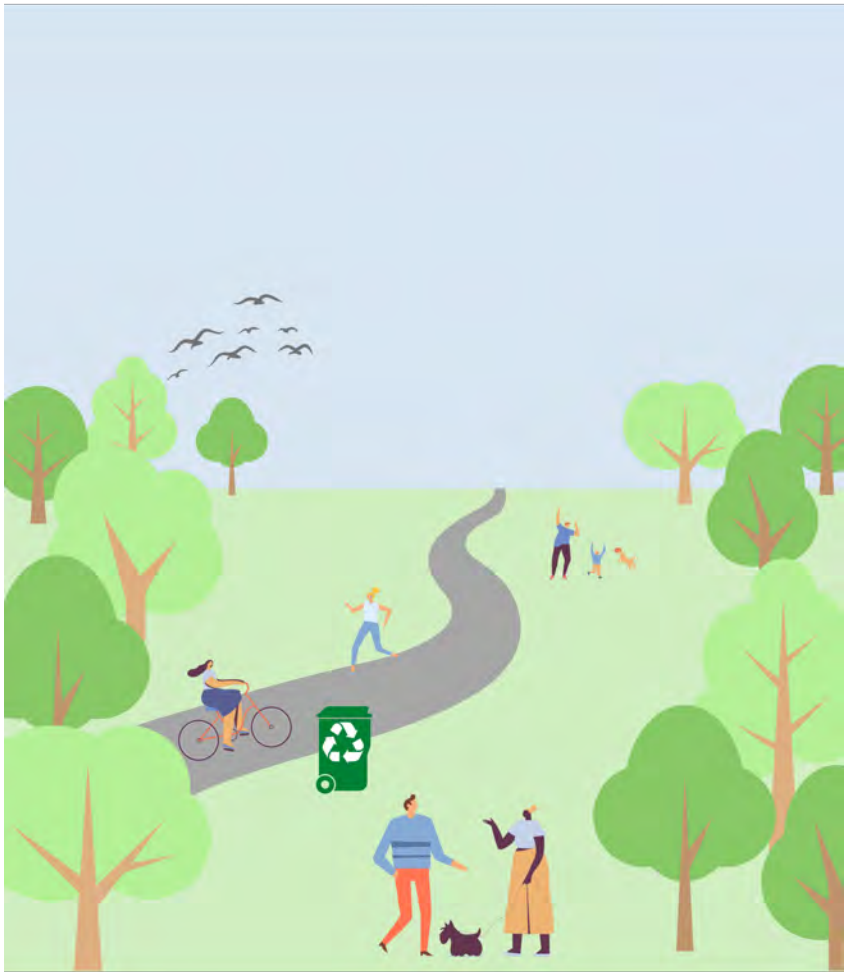
This section compares canopy cover with various quality of life indicators for Huntingdonshire. These are shown for the ward level, for appropriate comparison to the canopy cover assessment. Where data was obtained at Lower Super Output Area (LSOA) level it has been overlaid with current ward boundaries.

The information presented in the charts below does not necessarily show causations or even clear correlations. This is important to consider when analysing. However, it draws attention to the fact that areas with higher tree canopy generally perform well on other indicators (e.g. greater tree cover = less "*deprived*").

The insert on each map shows the corresponding canopy cover replicated from Figure 3 (page 17).

Figure 6: St. Ives Bridge over the River Great Ouse[11]

[11] Source: Huntingdonshire.gov.uk (2021)



Green spaces see less littering than urban areas and help connect people to the environment and green issues.

Trees provide a habitat for wildlife including birds, insects and small mammals.

Green open spaces promote a healthy mind by reducing stress and providing a peaceful environment.

Areas deprived of trees can be dull, and discourage people from spending time outside. This can affect peoples mental wellbeing.

Urban areas with fewer trees see an increase in crime such as graffiti and antisocial behaviour.

People feel more inclined to exercise around green infrastructure and air quality is generally much better, therefore people living in greener areas are typically healthier than those from less green areas.

4.1 Index of Multiple Deprivation

Data concerning deprivation is collected at the Lower Layer Super Output Area (LSOA) scale and the ward averages are displayed in the following charts and figures.

'*The Index of Multiple Deprivation (IMD) ranks every small area in England from 1 (most deprived area) to 32,844 (least deprived area)*.'

IMD combines information from seven domains to produce an overall relative measure of deprivation.

The domains are combined using the following weightings:

- Income Deprivation (22.5%)
- Employment Deprivation (22.5%)
- Education, Skills and Training Deprivation (13.5%)
- Health Deprivation and Disability (13.5%)
- Crime (9.3%)
- Barriers to Housing and Services (9.3%)
- Living Environment Deprivation (9.3%)

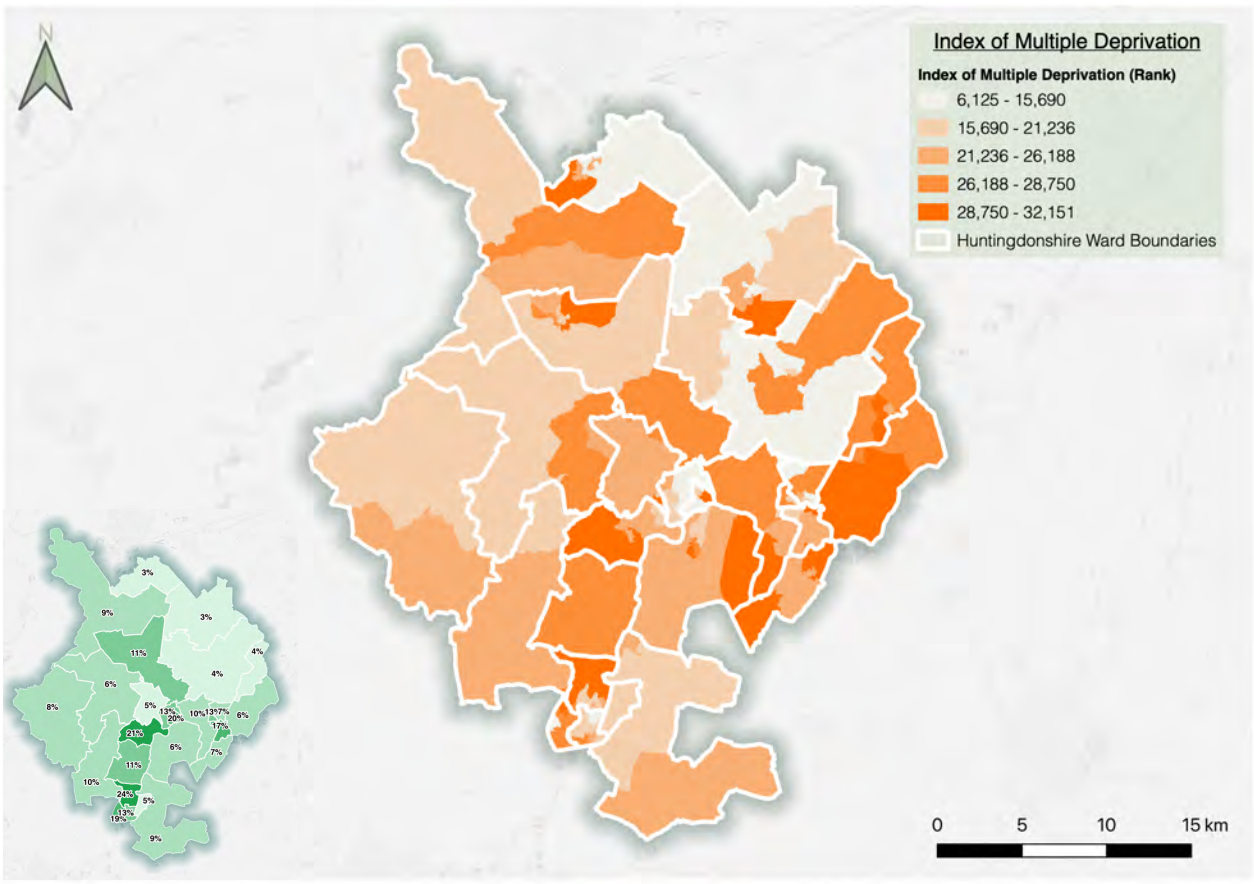
'*Deprivation 'deciles' are published alongside ranks. Deciles are calculated by ranking the 32,844 neighbourhoods in England from most deprived to least deprived and dividing them into 10 equal groups*[12].'

The average IMD rank for Huntingdonshire District is 23,048 and this falls within the 8th decile (with the 10th decile being the least deprived category.) The relationship between canopy cover and IMD is illustrated in figure 7 (above)[13].

The data shows that for IMD, on average, wards with canopy cover below the average for England of 16%, had an average decile of 7, compared with wards with more than 16% canopy cover which had a decile of 8, and this trend can be seen when comparing the IMD rank also. Although this echoes the findings of most other canopy studies, the difference is very small.

[12] gov.uk, 2019

[13] Public Health England, 2020



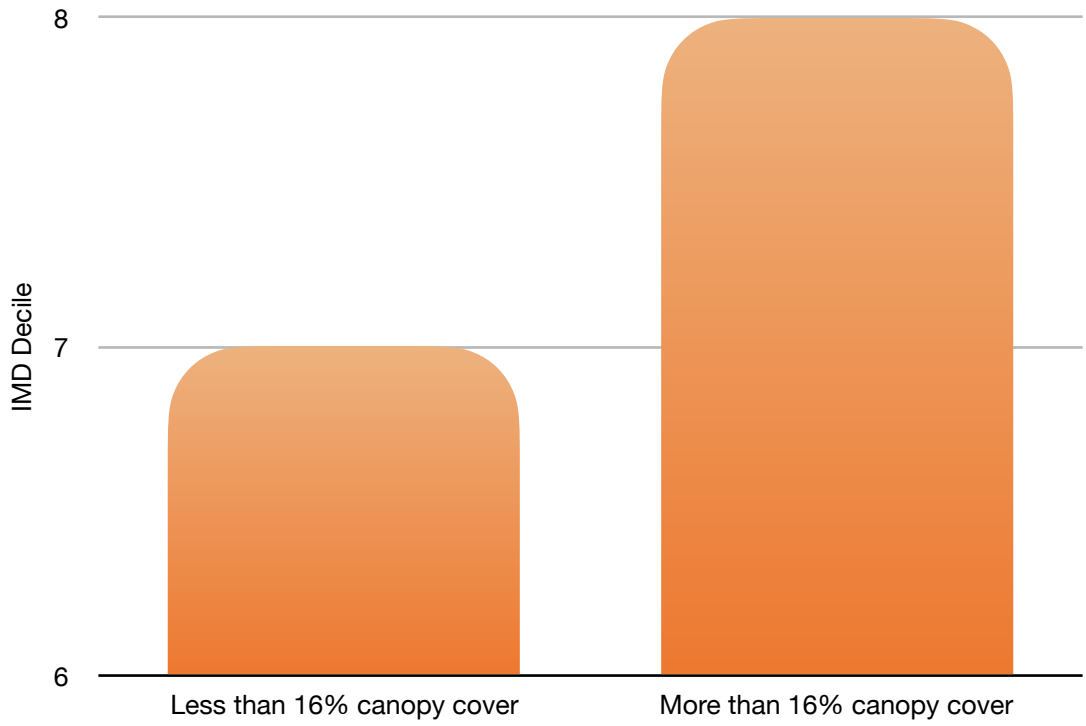


Figure 7: IMD by Ward and Canopy Cover

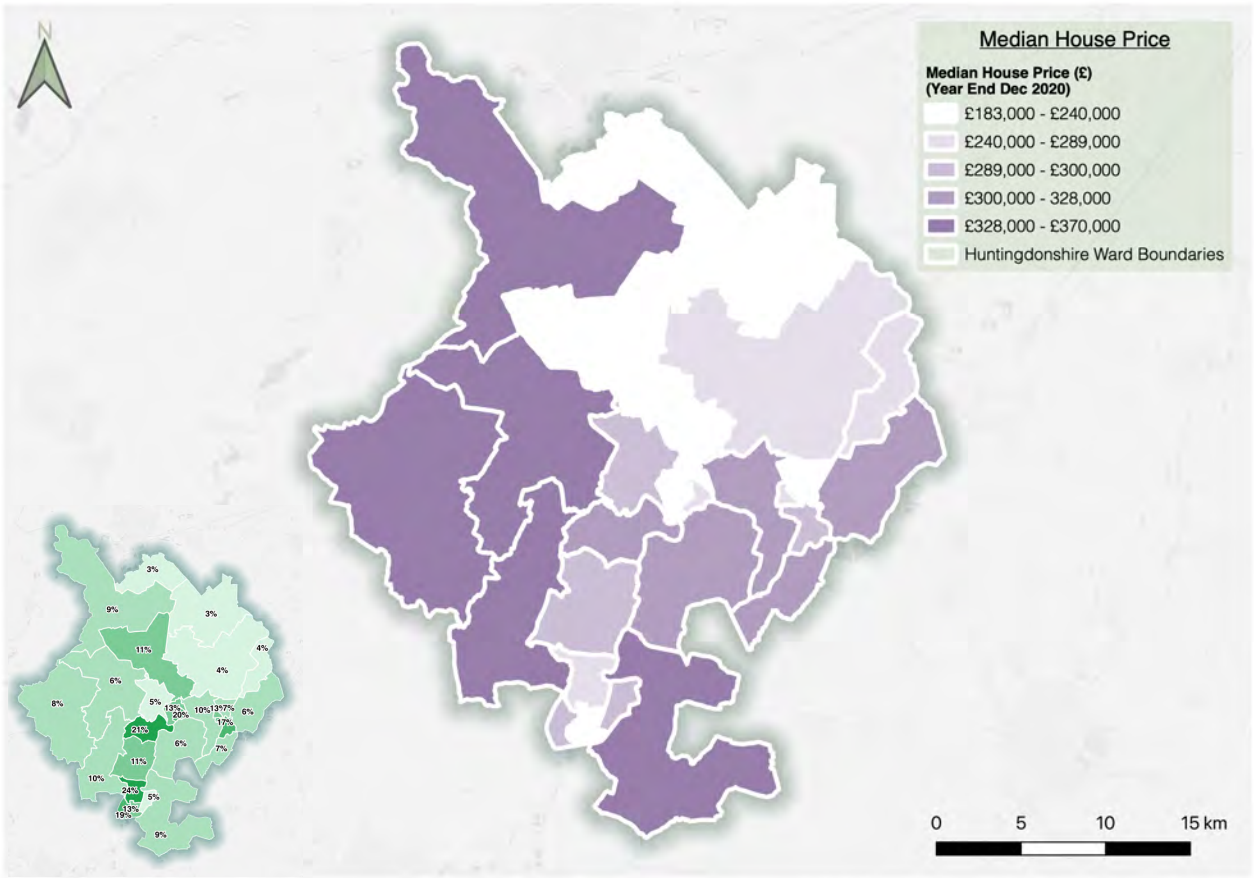
4.2 Median House Price

ONS holds data on the 'Median price paid for residential property in England and Wales by property type and electoral ward' and this annual data is updated on a quarterly basis[14].

Huntingdon North, Ramsey and Yaxley Wards have the lowest house prices at £183,000, £216,250 and £218,000 respectively. Ramsey and Yaxley Wards have large expanses of agricultural land and correspondingly, the lowest canopy cover percentages within Huntingdonshire at 3%.

There is a difference of approximately £8,300 in house prices between areas with below the average 16% canopy cover for England, and wards above 16% canopy cover, with these wards above 16% being slightly higher.

St. Neots Priory Park & Little Paxton Ward (the ward with the most canopy cover at 24%) average house price is £289,000. Comparatively, in Ramsey ward (with 3% canopy cover), average house price is £216,000.



[14] ONS, 2021

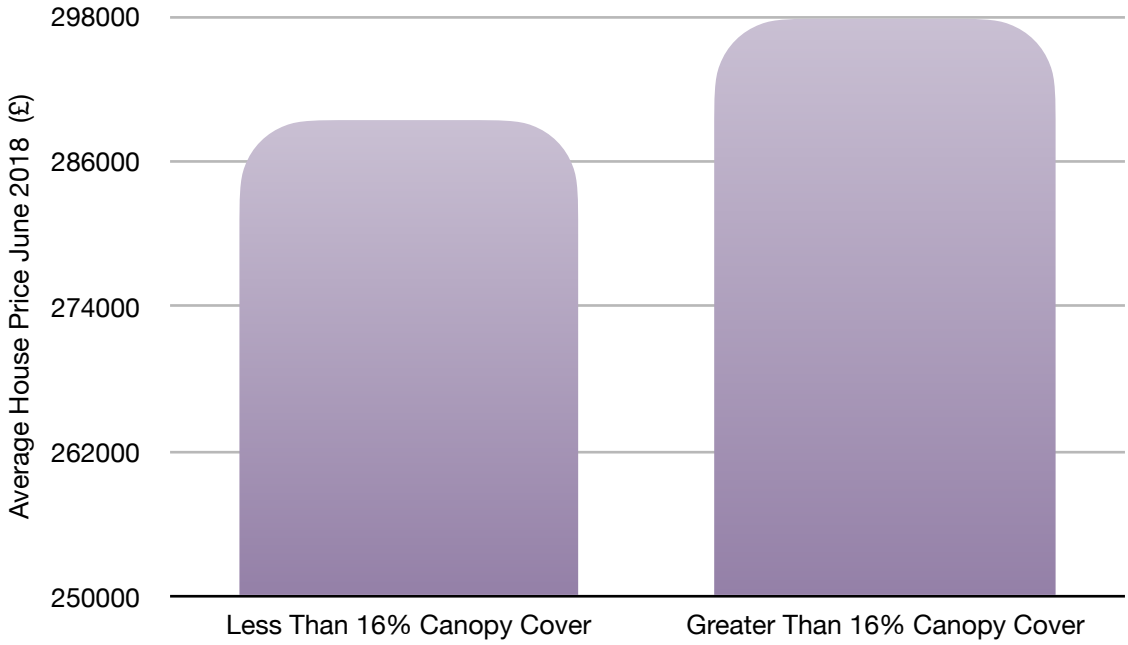


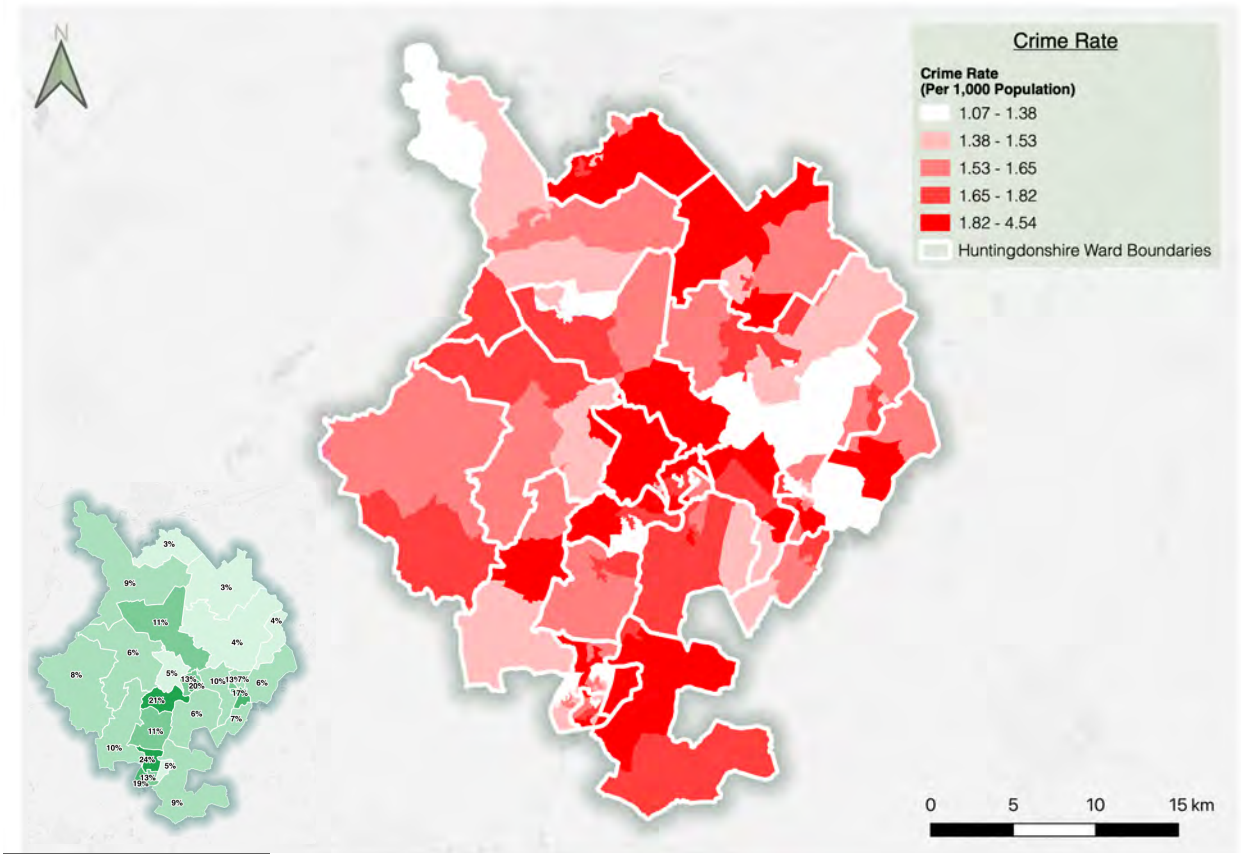
Figure 8: House Prices by Ward and Canopy Cover 4.2 Hospital Admissions

4.3 Crime

The crime domain measures the risk of personal and material victimisation at local level. For the purpose of this study we have taken the definition of Crime Rate to be "*Crimes per 1,000 resident people as per the latest official Census over a selected time period*" according to the UK Crime Statistics guidance[15].

Increasing tree cover can be one way to create safe and accessible environments, which are also visually attractive. However, poorly maintained areas can increase the perception of crime. Studies in the US have demonstrated that a 10% increase in tree cover correlated to a 12% reduction in crime[16]. Furthermore, among minor crimes, there is less graffiti, vandalism, and littering in outdoor spaces with natural landscapes than in comparable spaces with little green open space[17]. There is a positive correlation between high canopy cover and low crime rate, as shown in Figure 9 (below).

Across Huntingdonshire crime rates generally increase in areas with lower tree canopy, with a rate of 1.79 crimes per 1,000 people against 1.63 crimes per 1,000 people in areas with more than 16% canopy cover.



[15] UK Crime Stats, 2011

[16] Troy, 2012

[17] Brunson, 1999

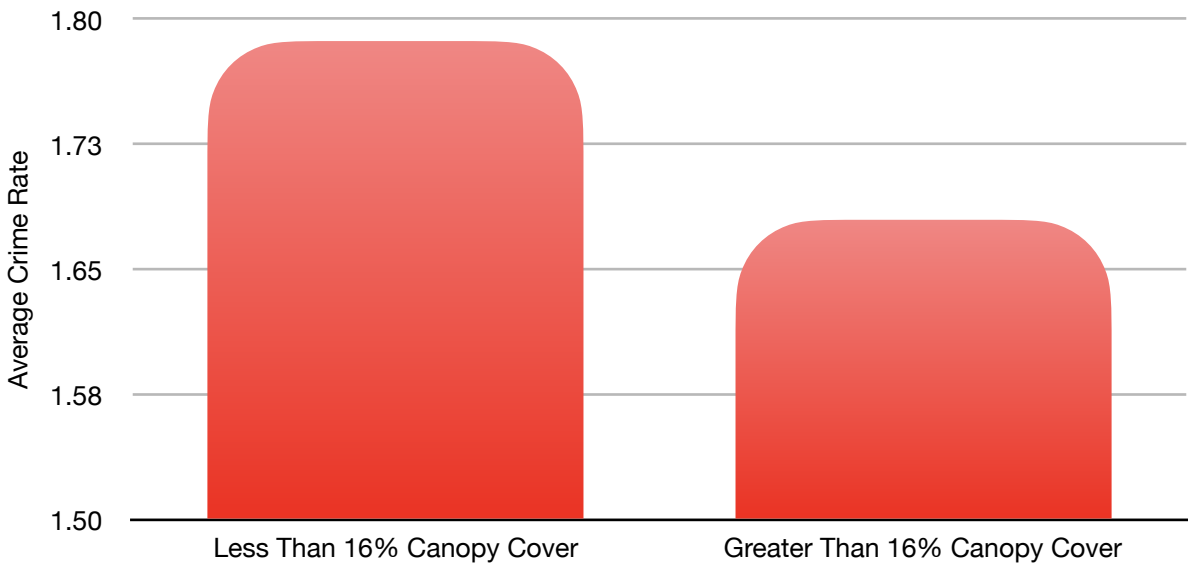
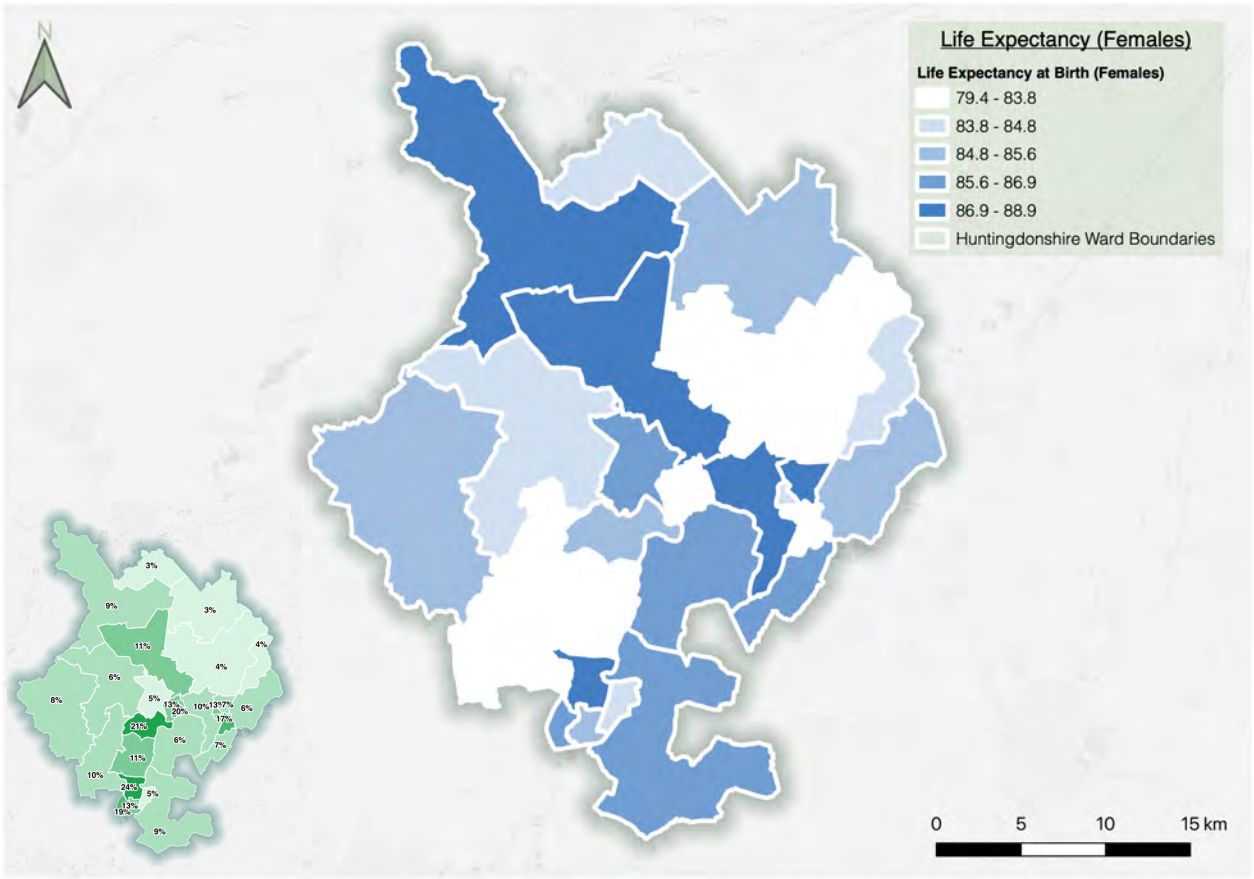


Figure 9: Crime Rate by Ward and Canopy Cover

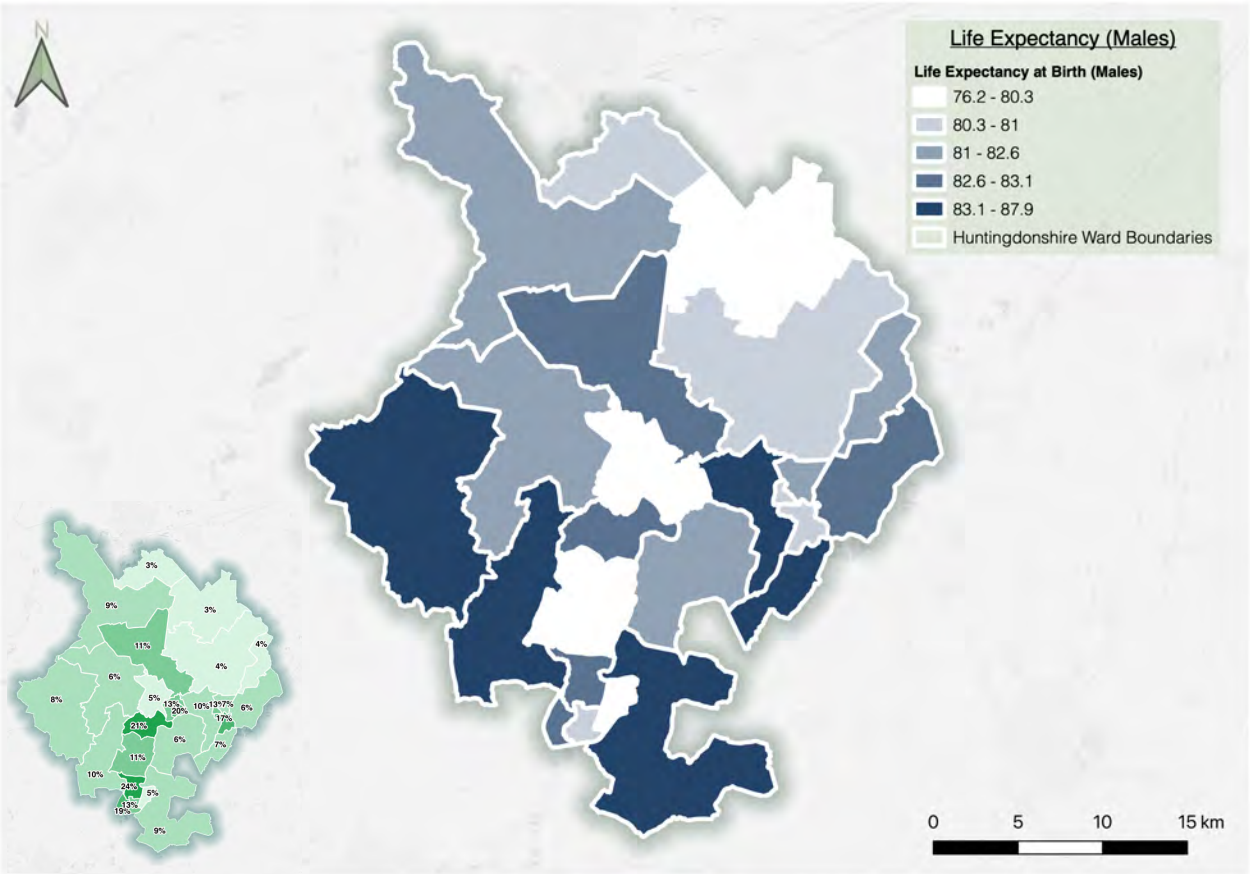
4.4 Life Expectancy

Life expectancy for women is on average 85 years for both wards with above, and wards with below 16% canopy cover. For males, life expectancy was higher at 82 years in wards with below 16% canopy cover compared with wards with more than 16% with 81 years.

The degree of these small differences suggest that the average life expectancy across the whole district does not show distinct differences between wards with regards to canopy cover18.



[18] Public Health England, 2020



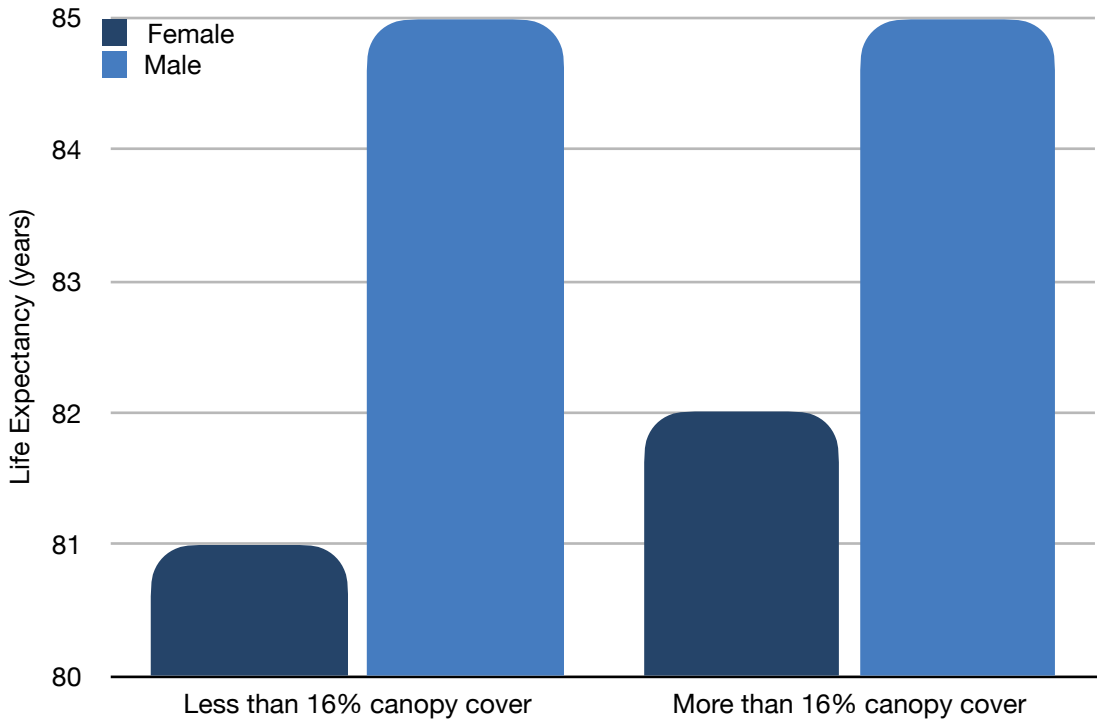


Figure 10: Life Expectancy by Ward and Canopy Cover

4.5 Hospital Admissions

Trees help to promote healthy environments and there is a growing body of research that shows people are happier in leafier environments, with reduced levels of stress and blood pressure[19].

Stress is one of the key contributing factors to mental health issues, which access to good quality green spaces can alleviate[20]. Depressive disorders are now the foremost cause of disability in middle-high income countries and can be precursors to chronic health problems.

Increased tree cover can help to promote good health (and therefore reduced numbers of hospital admissions) passively, by filtering air pollution and lowering peak summer temperatures, for example, and by promoting physical activity. Where green space is available it can be used for physical activity and may even help to reduce social health inequalities[21]. This is important because 1 in every 15 deaths in Europe is associated with a lack of physical activity.

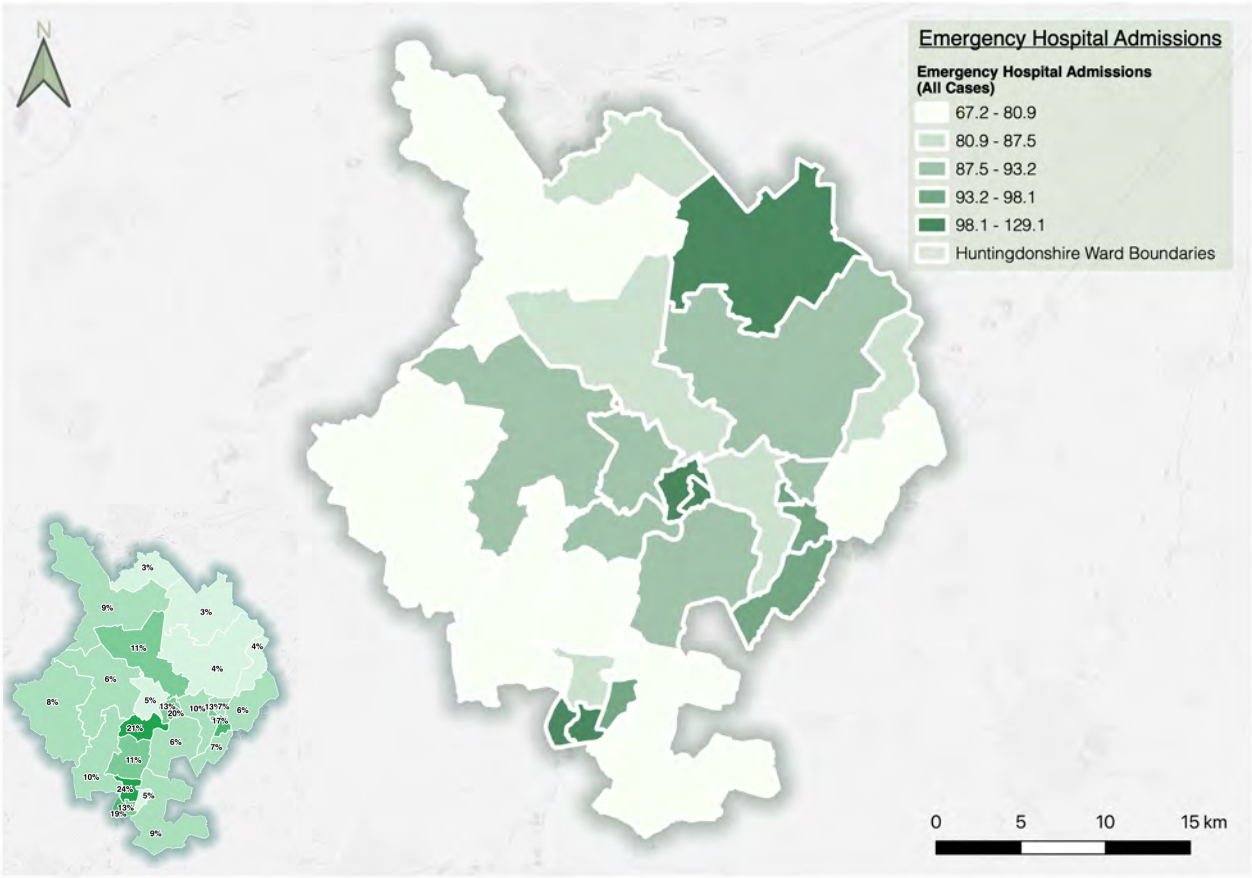
The average number of hospital admissions in relation to canopy cover does not appear to show any major differences. Interestingly, in areas with more than 16% canopy cover, the hospital admissions appear to be slightly higher with 97 cases in comparison with wards with less than 16% canopy cover which had 89 cases[22].

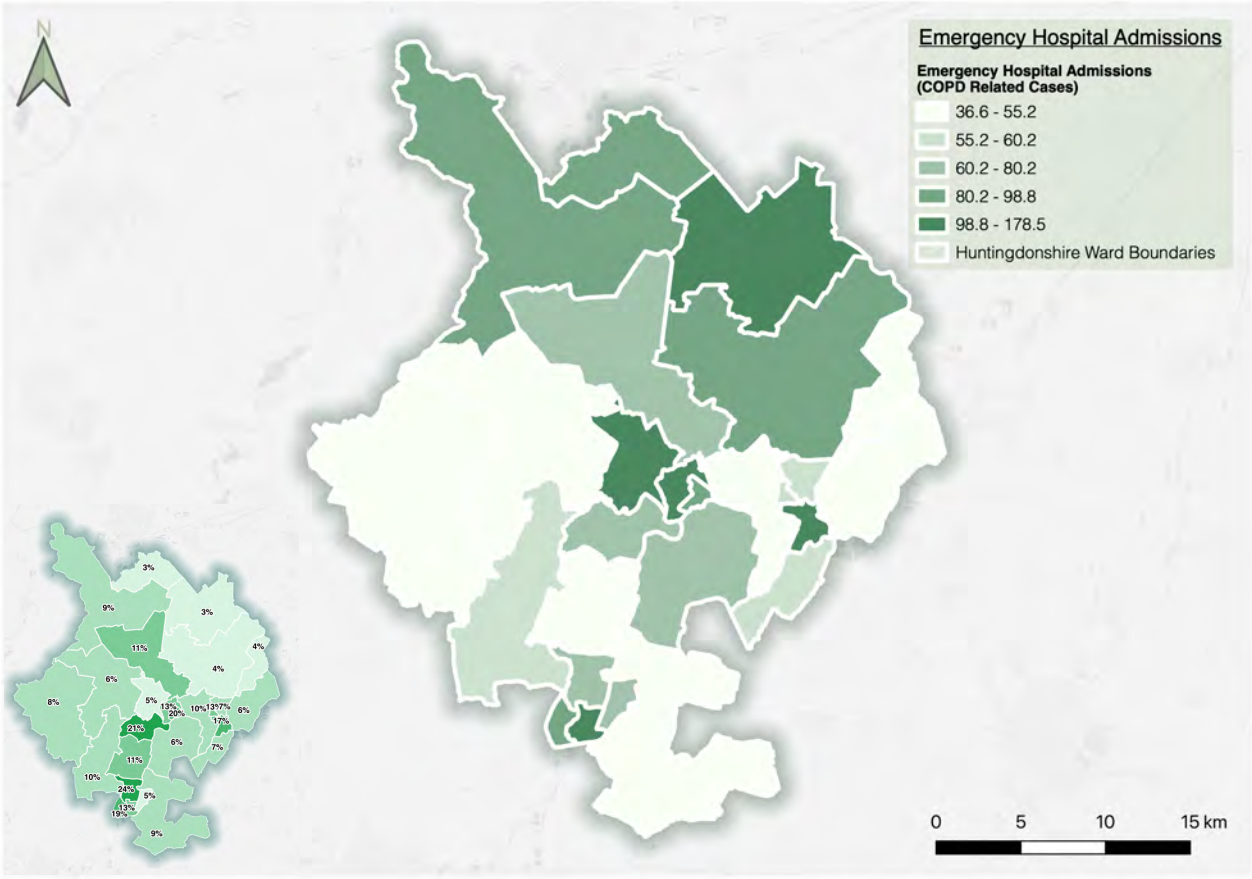
[19] Hartig, 2003

[20] White, 2013

[21] Mitchell & Popham, 2008

[22] Public Health England, 2020


Emergency Hospital Admissions
Emergency Hospital Admissions (All Cases)
67.2 - 80.9
80.9 - 87.5
87.5 - 93.2
93.2 - 98.1
98.1 - 129.1
Huntingdonshire Ward Boundaries
0
5
10
15 km


Emergency Hospital Admissions
Emergency Hospital Admissions (COPD Related Cases)
36.6 - 55.2
55.2 - 60.2
60.2 - 80.2
80.2 - 98.8
98.8 - 178.5
Huntingdonshire Ward Boundaries
0
5
10
15 km

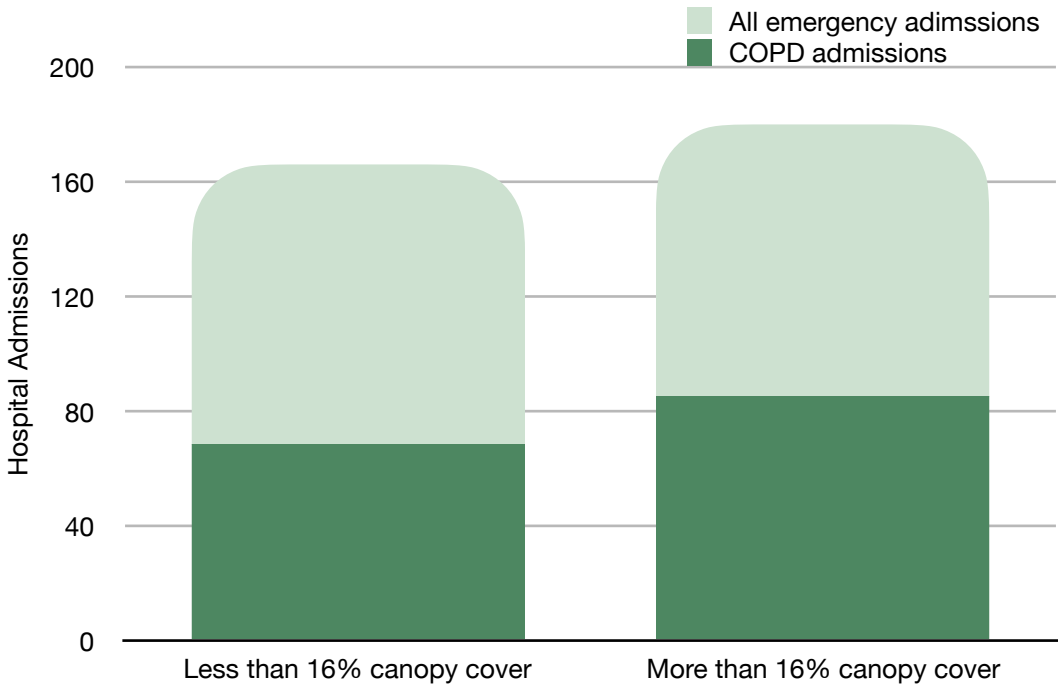


Figure 11: Hospital Admissions by Ward and Canopy Cover

Figure 12: Warner's Park & Pathfinder House

4.6 Educational Attainment

Educational Achievement is reported at the ward level by Office for National Statistics. The variable used in this report is the percentage of pupils achieving five A*-C at GCSE Level. Whilst the grading system has now changed, only the historical data collected using the A*-F grading system is currently available and these are based on 2016 ward boundaries which differ slightly from the current electoral boundaries.

In St. Neots Priory Park & Little Paxton Ward (the ward with the most canopy cover at 24%) average GCSE attainment is 55% A*-C. Comparatively, in Ramsey ward (with 3% canopy cover), average GCSE attainment is 50% A*-C[24].

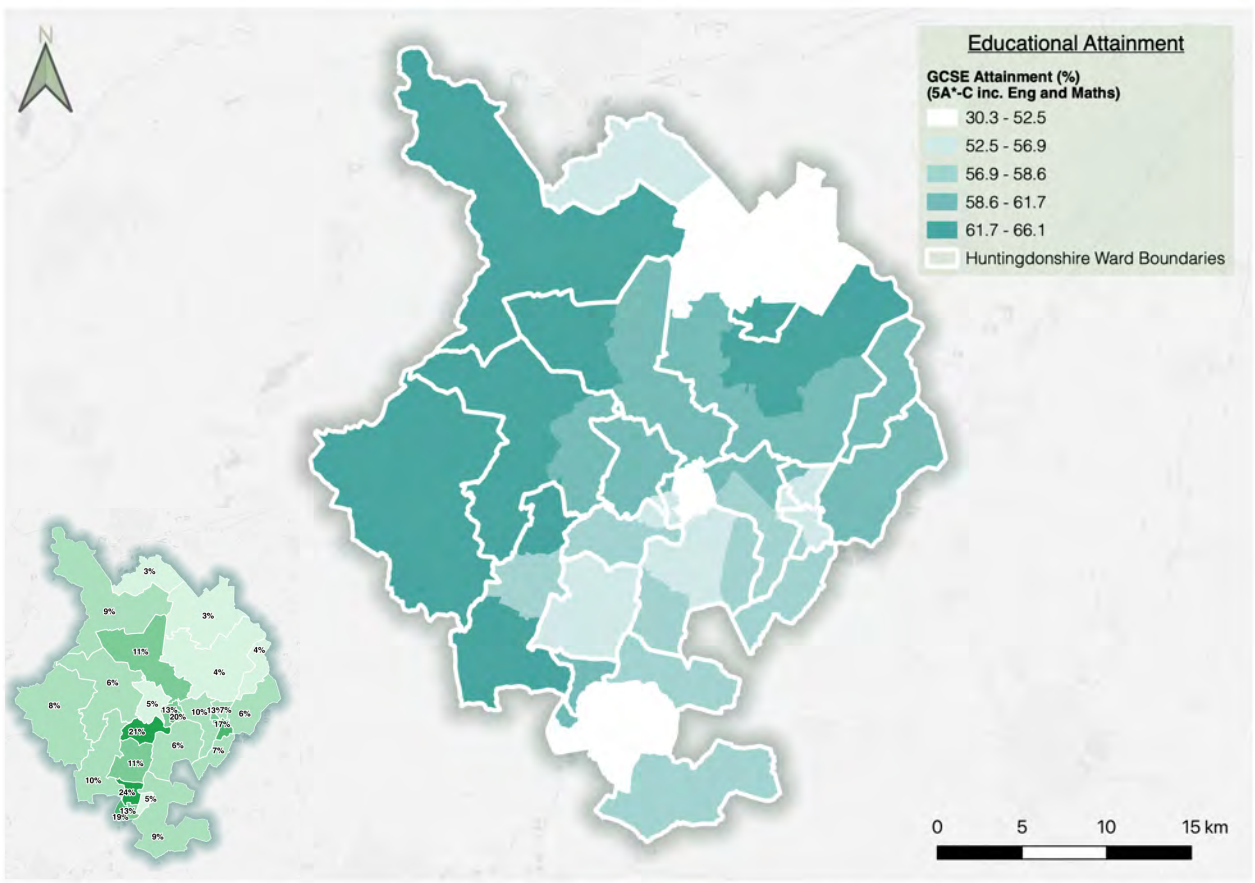


Figure 12: Educational Attainment by Ward and Canopy Cover

[23] For this dataset we have chosen to highlight the wards with the highest and lowest canopy cover and their educational attainment due to the differing ward boundaries.

[24]Department for Education, 2014

Figure 12: Green Leys, St Ives

5. Ecosystem Service Provision

Trees in cities bring with them both benefits and costs. Whilst many of the costs are well known, the benefits can be difficult to quantify or justify. Nevertheless, a considerable and expanding body of research exists on the benefits that urban trees provide to those who live and work in our cities, to green infrastructure and to the wider urban ecosystem. Trees provide a 'sense of place', moderate extremes of high temperature in urban areas, improve air quality and act as a carbon sink. Yet, trees are often overlooked and undervalued. Understanding and valuing these services allows us to make more informed planting and management decisions for the benefit of current and future generations.

The ecosystem services provided by Huntingdonshire's urban forest are estimated using the i-Tree Canopy tool. This is a conservative estimate as some services cannot yet be

measured accurately.

In total, the trees of Huntingdonshire provide an estimated £28,112,481 worth of ecosystem services each year.

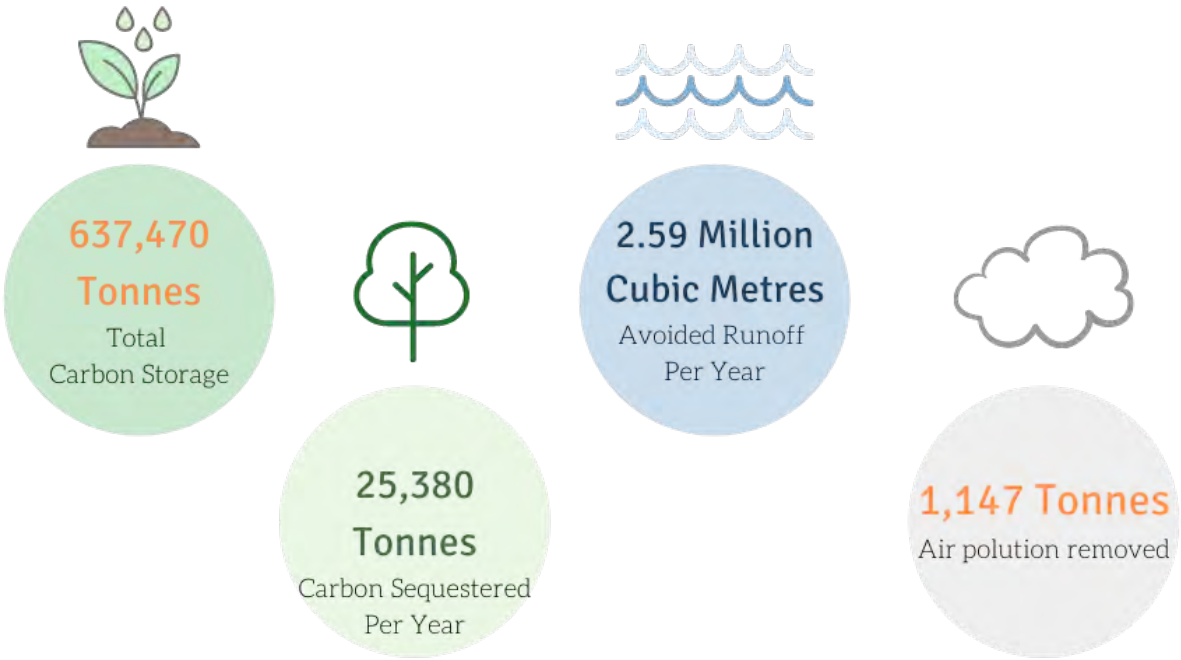


Figure 13: The Benefits of Huntingdonshire's Trees

5.1 Carbon Storage and Sequestration

The main driving force behind climate change is the concentration of carbon dioxide (CO_2) in the atmosphere. Trees can help mitigate climate change by storing and sequestering atmospheric carbon as part of the carbon cycle. Since about 50% of wood by dry weight is comprised of carbon, tree stems and roots can store up to several tonnes of carbon for decades or even centuries.[25] As trees die and decompose they release the stored carbon. The carbon storage of trees and woodland is an indication of the amount of carbon that could be released if all the trees died. The current value for carbon in the UK is £70/tonne of CO2e. Overall, the trees in Huntingdonshire **store 637,470 tonnes of carbon** with a value of over **£163.6 million**.

Carbon sequestration is calculated from the predicted growth of trees. It refers to the amount of carbon a tree removes from the surrounding atmosphere and earth as it grows in one year. In total, the trees in Huntingdonshire **sequester 25,380 tonnes of carbon ever year**. This service is valued at **£6.5 million**. The average newly registered car in the UK produces 34.3g carbon per mile, therefore carbon sequestration across the district corresponds to around 73 million 'new' vehicle miles per year. This is equivalent to the annual mileage of 14,100 cars registered in the UK.[26]

5.2 Avoided Runoff

Surface runoff can be a cause for concern in many areas as it can contribute to flooding and is a source of pollution in streams, wetlands, waterways, lakes and oceans. During precipitation events, a proportion is intercepted by vegetation (trees and shrubs) while the remainder reaches the ground. Precipitation that reaches the ground and does not infiltrate into the soil becomes surface runoff.[27] In urban areas, the large extent of impervious surfaces increases the amount of runoff. Trees are very effective at reducing runoff[28] as tree canopies intercept precipitation, while root systems promote water infiltration and storage in soil. Avoided surface runoff is calculated based on interception by vegetation, specifically the difference between annual runoff with and without vegetation. The current volumetric charge for surface water treatment by Anglian Water is £1.5655/m^3. In the district of Huntingdonshire, trees **intercept a total of 2.5 million m^3 of surface runoff**; this is valued at **£4 million** in avoided sewerage charges.

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[25] Kuhns 2008, Mcpherson 2007

[26] https://www.gov.uk/government/statistical-data-sets/nts09-vehicle-mileage-and-occupancy#table-nts0901

[27] Hirabayashi 2012

[28] Trees in Hard Landscapes (TDAG) 2014

4.4 Air Pollution Removal

Poor air quality is a common problem in many urban areas, in particular along transport corridors. Air pollution caused by human activity has caused issues since the beginning of the industrial revolution. With increasing populations and industrialisation, large quantities of pollutants are produced and released into the urban environment. The problems caused by poor air quality are well documented, ranging from severe health problems in humans to damage to buildings. Urban trees can help to improve air quality by reducing air temperature and directly removing pollutants.[29] Trees intercept and absorb airborne pollutants on to the leaf surface.[30] Through removing pollution from the atmosphere, trees can reduce the risks of respiratory disease and asthma, thereby contributing to reduced healthcare costs.[31]

In terms of the urban forest structure, and considerations with regards to tree planting, greater tree cover, pollution concentrations and leaf area are the main factors influencing pollution filtration. Therefore increasing areas of tree planting have been shown to make further improvements to air quality. Furthermore, because filtering capacity is closely linked to leaf area, it is generally the trees with larger canopy potential that provide the most benefits.

The trees in Huntingdonshire filter out a total of **1,147 tonnes of pollutants** from the surrounding atmosphere each year - a service worth over **£25 million each year**! Figure 14 (below) shows the total amount and value of each of the pollutants removed by the trees.

[29] Tiwary *et al.*, 2009

[30] Nowak *et al.*, 2000

[31] Peachey *et al.*, 2009. Lovasi *et al.*, 2008

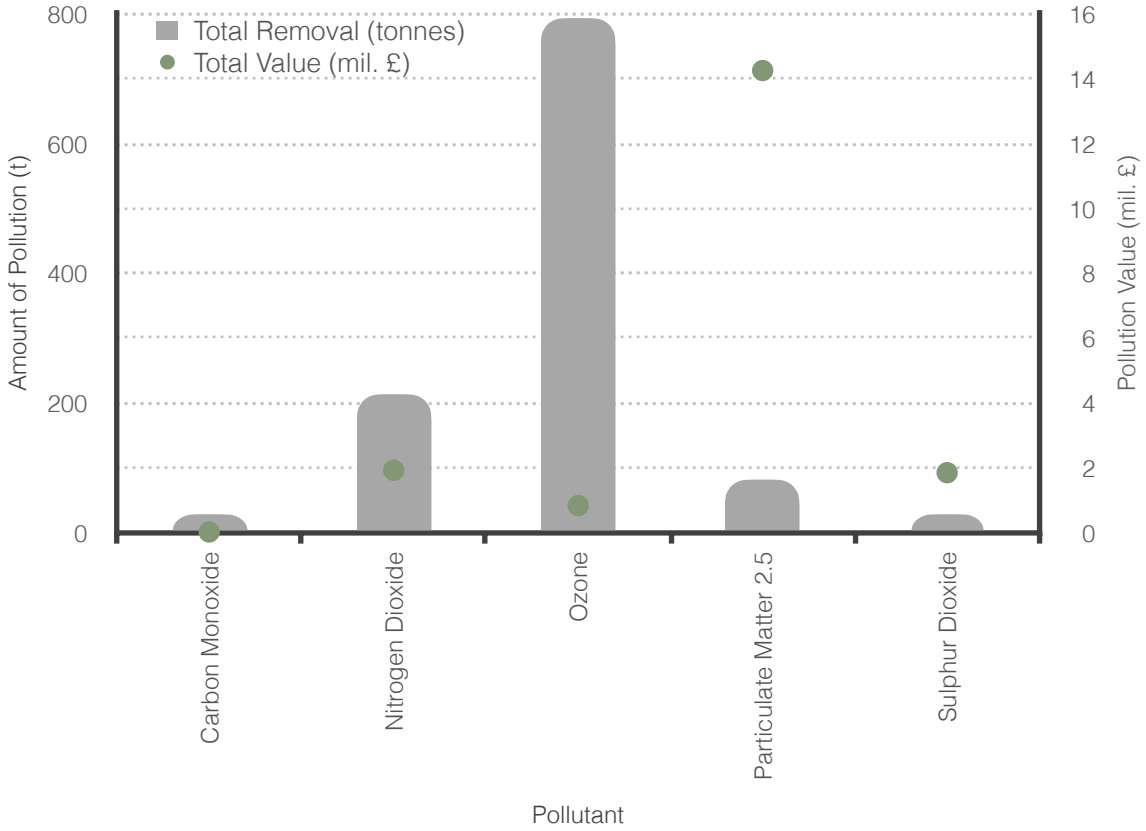


Figure 14: Annual pollutant removal and associated value, by pollutant type

The valuation method uses UK social damage costs (UKSDC) where available. Where there are no UK figures, the US externality cost (USEC) is used as a substitution. These US costs were used for Ozone and Carbon Monoxide only. Huntingdonshire District has been classified within the 'Road Transport Urban Large Category' for the purposes of valuation in this study.

5. Conclusions

This preliminary study presents data on the canopy cover found in Huntingdonshire. It also establishes a baseline which can be used to monitor future progress, or used in further research.

Primarily however, the data collected can inform where there are opportunities to increase tree cover by highlighting areas of low tree canopy cover and the available plantable space within them. Furthermore, planting could also be targeted to the areas which also are the most deprived as discussed within Chapter 4.

This report highlights much scientific research that supports the assertion that trees provide a wide range of valuable ecosystem services. Huntingdonshire as a whole has 10% tree canopy cover, which is below average for England. The ward with the highest canopy cover is St. Neots Priory Park & Little Paxton with 24% and the wards with the lowest cover are Ramsey and Yaxley with just 3% canopy cover each.

Increasing tree cover in Huntingdonshire will provide multiple benefits to the community and should be part of the solution in creating resilient places for people to live and work.

Figure 12: Brampton Green

Appendix I. Methodology

GIS Analysis

GIS Project boundaries of Huntingdonshire and the individual wards were provided by Huntingdonshire District Council. Additional background mapping data were obtained from various open source web portals, referenced on the maps.

Tree canopy cover within Huntingdonshire was assessed using the Blue Sky National Tree Map. This data provides polygons of the canopy across Huntingdonshire and idealised crown polygons, along with point data representing each tree. This information can be used to estimate the canopy cover percentage for the area.

Health and socio-economic data have been obtained from the Office of National Statistics (ONS) and Public Health England (PHE) official published data.

Where the data obtained were presented at Lower Super Output Area (LSOA) level, it has been aggregated up to ward level geography, or overlaid by current ward boundaries for visual representation. This was carried out using the 'Lower Layer Super Output Area (2011) to Ward (2019) Lookup in England and Wales' table provided by ONS.

These three datasets were combined using Geographical Information System (GIS) software to provide the maps used in this report.

Note: Life Expectancy data was not available for St.Ives South Ward - An assumption to apply the same LE as St.Ives West Ward of 80.6 was made.

i-Tree Canopy

i-Tree Canopy is a quick and simple tool which uses 'on-the-fly' technology to obtain statistically valid estimates for canopy cover and ecosystem services based on the point method. Its simplicity, and ease of use means that it has certain limitations over other methods. For example i-Tree Canopy is not spatially explicit and so there is no 'geo-referenced' layer for use in GIS applications. Further technical information on i-Tree canopy is included in Appendix 1.

Using the i-Tree Canopy tool, a minimum of 1,000 random points were surveyed in each ward across Huntingdonshire to assess the land cover and in particular, note the presence of trees and shrubs.

The number of points surveyed enables us to achieve a satisfactory standard error for canopy cover. i-Tree Canopy Methodology

For each of the 1,000 random points a cover class is assigned and Table 1 (below) provides further details.

Cover Class	Description	Including but not limited to…
Tree/Shrub	Tree and shrub canopy cover	Trees, shrubs, hedges,
Grass/Herbaceous	Grassland and herbaceous plant cover	Grass, herbaceous borders, scrubland,
Soil/Bare Ground	Exposed soil and bare ground	Soil, bare ground, sand,
Agricultural	Agriculture land	Planted and unplanted cropland
Impervious Road	Roads, pavements and paths	Roads, pavements, pedestrian paths, private driveways, public car parks,
Impervious Buildings	All buildings	Any and all buildings
Impervious /Other	Other impervious cover	Industrial land, railway/ transportation networks not listed as ‘road’ garden impervious surfaces, exposed rock, and any other surfaces classed as impervious.
Water	Bodies of water	Sea, river, lakes, ponds,
Potentially Plantable Space	Areas not covered by impervious cover types or under existing canopy where a tree could be planted	Summation of plantable areas (grass/herbaceous, soil/bare ground and agricultural)

Table 3: i-Tree Canopy Cover Classes

Appendix II. Trees in the National Planning Policy Framework

NPPF Section		The Role of Urban Forests
	**NPPF 2 Achieving sustainable development**	Sustainable development is defined as meeting the needs of today without compromising the needs of future generations[1]. Economic, social, and environmental objectives must be actively integrated. The NPPF states that plans should 'meet development needs' while they also 'improve the environment' and 'mitigate climate change (including by making use of land in urban areas) and adapt to its effects'. Urban forests therefore have a vital role to play through the multiple social and environmental benefits of green infrastructure[2]. These benefits are well known, and include improvement of the natural environment, climate change mitigation, economic growth, and improvement of local community health and wellbeing[3 4]. This echoes a key driver for the 'England Trees Action Plan 2021-2024'; 'to leave the environment in a better state than we found it'[2].
	**NPPF 6 Building a strong, competitive economy**	Planning should 'support economic growth and productivity' in urban and rural areas to 'capitalise on their performance and potential'. Increased urban tree cover can contribute to this through increased prosperity[5], revitalised high streets with improved customer spending and greater investments[6], and the provision of forest products such as fuel and timber[7]. There is also the opportunity for the development of a larger, innovative, and skilled forestry workforce[2]. The contributions of urban forests outlined in NPPF 7's section (below) could also be linked to a growing economy.
	**NPPF 7 Ensuring the vitality of town centres**	As the 'heart of local communities', planning should allow for the 'growth, management and adaptation' of urban centres. As detailed in NPPF 6's section (above), urban forests contribute to economic prosperity in commercial areas[5]. Furthermore, where tree cover is greater, property values increase[2] and businesses are prepared to pay greater ground rents[8]. This is also associated with higher paid earners who are also more productive[9]. Revenue from tourism and recreation can be added[7]. Additionally, town centres can be safer, with greater tree cover associated with reduced crime levels[10 19].
	**NPPF 8 Promoting healthy and safe communities**	Community plans 'should aim to achieve healthy, inclusive and safe places'. Urban forests provide multiple benefits to physical health[1]. These include cleaner air, reduced stress, quicker patient recovery times, and green spaces can encourage exercise activity. They can also contribute to improved mental wellbeing, improve self-esteem, and alleviate symptoms of anxiety and depression[20]. Social values can be improved, providing a sense of pride in place, community cohesion, and more harmonious environments[6]. These social aspects contribute to enhanced safety, alongside evidence that higher tree coverage reduces crime rates[7 19].
	**NPPF 9 Promoting sustainable transport**	Transport network plans should be based on and account for the 'environmental impacts of traffic and transport infrastructure', thereby 'avoiding and mitigating any adverse effects' and including opportunities for 'environmental gains'. The NPPF also promotes walking, cycling and public transport. The urban forest supports sustainable transport, improves journey quality[11], and can encourage use of alternative travel corridors such as pavements and cycleways[12]. Additionally, trees near road networks absorb pollution and airborne particulates, therefore helping to fulfil obligations under local air quality action plans[13]. Trees also buffer noise[14], lower traffic speeds[15], and increase pedestrian safety[7].

1. United Nations General Assembly, 2021, 2. Rolls and Sunderland, 2014, 3. Turner-Skoff et al, 2019, 4.Gov.uk, 2021, 5. Wolf, 2005, 6. Gov.uk, 2012, 7. Forestry Commission, 2010, 8. Laverne and Geideman, 2003, 9. Kaplan, 1993; Wolf, 1998 , 10. Wolf, 2007; Kuo and Sullivan, 2001a & 2001b, 11. Davies et al., 2014, 12. Trees and Design Action Group, 2014, 13. Escobedo and Nowak, 2009, 14. Van Renterghem, 2014, 15. Mok et al., 2003, 16. Doick et al., 2012, 17. Thomas and Nisbet, 2007, 18. gov.uk, 2021, 19. Troy, 2012, 20. Wolf, 2020

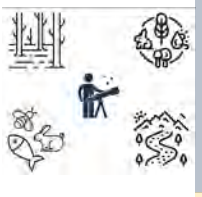
NPPF Section		The Role of Urban Forests
	**NPPF 11** Making effective use of land	The NPPF emphasizes that planning should encourage multiple benefits; 'meeting the need for homes and other land uses, safeguarding, and improving the environment, and ensuring healthy living conditions'. Suggestions are made for net environmental gains through habitat creation and improved access to green space, as well as realizing the value of undeveloped land for 'wildlife, recreation, flood risk mitigation, cooling/shading, carbon storage, or food production'. Land development which includes protection for existing, and plans for new planting of trees will promote this plethora of ecosystem services. Trees are therefore a priority in development requirements and can be enabled directly and indirectly through policy[7].
	**NPPF 12** Achieving well designed places	High quality design is a 'key aspect of sustainable development'. The NPPF explicitly emphasises that trees have an 'important contribution to the character and quality of urban environments'. It also states that 'planning policies and decisions should ensure that new streets are tree-lined [where appropriate], that opportunities are taken to incorporate trees elsewhere in developments (such as parks and community orchards), that appropriate measures are in place to secure the long-term maintenance of newly planted trees, and that existing trees are retained where possible'. The role of local planning authorities in working with highways and tree officers is also emphasised to ensure right trees are planted in the right place. The incorporation of trees into new development, when done in the right way with minimal conflict, will provide a positive contribution to good design. The Trees and Design Action Group[12] also point out that trees are critical infrastructure that improve development viability through financial, environmental, and social values.
	**NPPF 13** Protecting green belt land	The importance of Green Belts in maintaining open land is well recognised by the NPPF. The NPPF makes recommendations and highlights the opportunities provided the National Forest and Community Forests for 'improving the environment around towns and cities'. Trees are key to enhancing the beneficial use of the Green Belt, including recreation, landscape enhancement, visual amenity, biodiversity, and improvement of damaged land; as stipulated by the NPPF.
	**NPPF 14** Meeting the challenge of climate change, flooding and coastal change	Mitigating and adapting to the impacts of environmental changes has become central to long-term planning implications. The NPPF states that planning should 'minimise vulnerability and improve resilience' through a low carbon transition and accounting for flood and coastal risks. Trees are fundamental to such strategies. Trees sequester and store carbon, and decrease peak summer temperatures in both the urban and wider environment by several degrees[16]. Trees also reduce stormwater runoff by attenuating precipitation in their canopies[17].
	**NPPF 15** Conserving and enhancing the natural environment	The ability of trees to improve the landscape is well understood. The NPPF recognizes that planning should 'enhance the natural and local environment' through habitat networks, green infrastructure, natural capital, ecosystem services, biodiversity protection, conservation and land / pollution remediation; to all of which trees are integral. Specifically, it is stated that 'the intrinsic character and beauty of the countryside' must be recognised, 'including the economic and other benefits of the best and most versatile agricultural land, and of trees and the woodland'.
	**NPPF 16** Conserving and enhancing the historic environment	Historical and cultural assets are irreplaceable resource and planning should conserve their significance and 'contribution to the quality of life of existing and future generations'. The England Trees Action Plan 2021-2024[3] highlights that trees form a significant part of our cultural heritage and sense of place. It states the importance of increasing people's engagement with the planning, planting and management of nation's forests for 'health, wellbeing and learning' and reconnecting ourselves with nature. It also states that ancient woodlands and veteran trees will be more resilient through recognition of their cultural and ecological values that have accumulated over centuries.

Table 4: Trees in the National Planning Policy Framework Review (July 2021)

Appendix III. Blue Sky National Tree Map Technical Notes

The National Tree Map (NTM) by Bluesky International Ltd is a commercial product which seeks to identify all trees and shrubs in England and Wales over 3m in height.

Classification of trees is achieved using stereo aerial photography (RGB/CIR), Digital elevation models (DTM/DSM) and hydrological models. The process produces three datasets: crown polygons, idealised crowns and height points. The map operates a 5 year rolling update program (NTM, 2015).

Aerial photography

Crown polygons

Idealised crowns

Height points

The National Tree Map consists of three GIS datasets:

1. Crown Polygons (Vector - Polygon) - Representing individual trees or closely grouped tree crowns
2. Idealised Crowns (Vector - Polygon) – Crown polygons visualised as circles for ease of use. Area measurement remains true to original crown feature
3. Height points (Vector - Point) - Detailing the centre point and height of each crown.

The point locations of each tree in the NTM dataset allowed each individual tree to be assigned a ward, a lower layer super output area (LSOA) and a middle layer super output area (MSOA), allowing for comparing canopy cover with other statistics from ONS.

Bluesky claims that the product captures more than 90% of all canopy coverage and within 50m of buildings greater than 95% all canopy coverage (NTM, 2015).

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