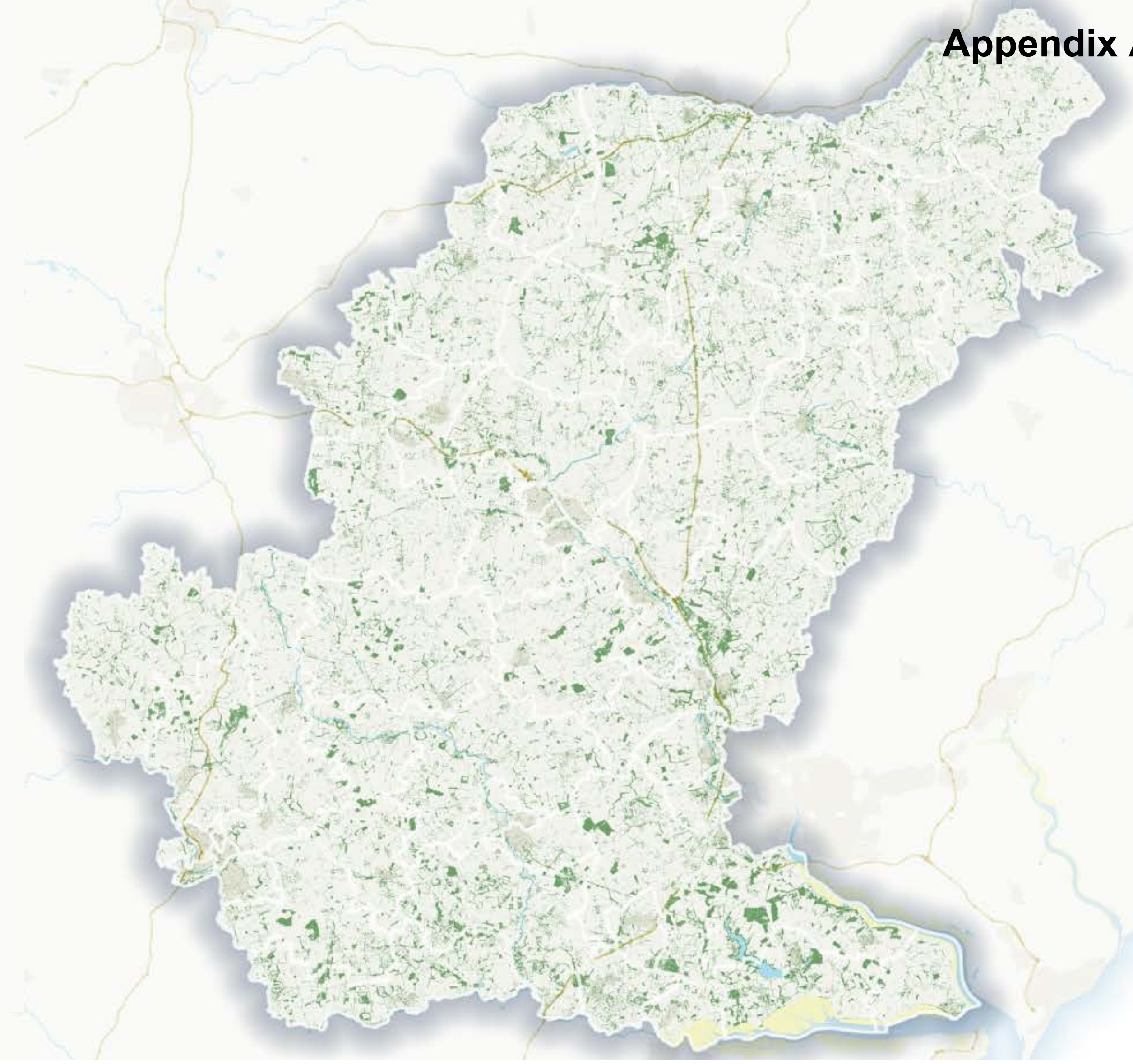
Appendix A



Babergh & Mid Suffolk

Canopy Cover Assessment Report

Of Babergh & Mid Suffolk District Councils' Tree Cover

September 2021

The Authors

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This assessment was carried out by Treeconomics

September 2021

Contents

Executive Summary

Babergh

Across the wards of Babergh, tree canopy cover varies significantly, ranging from 5.5-19.0%. On average, canopy cover sits at 10.3%, which is below the average for England of 16%. Forest Research suggest that 15% tree canopy cover is an appropriate target for coastal areas, and 20% is appropriate for localities outside of coastal areas. This being said, it is also well documented that rural areas in the UK often have lower canopy cover than urban areas as historically, land has been cleared for farming leaving tree cover mostly confined to hedgerows. Given Babergh's location and rural setting, and the existing canopy cover, it would be suggested that 15% is a sensible and attainable target for the area, though a reasonable time frame for achieving this should be set. The 20% target should be a longer term aspiration for the area.

The trees in Babergh contribute significantly to the health and wellbeing of the local people, the local environment, and the wider global environment by providing a range of ecosystem services; the trees store 612,000 tonnes of carbon and sequester an additional 24,000 tonnes annually. They also remove over 1,100 tonnes of pollution from the atmosphere, worth over £20.5 million in associated service costs, and saves local public sector service providers around £3.7 million in avoided sewerage charges by intercepting rainfall.

Mid Suffolk

Across the wards of Mid Suffolk, tree canopy cover varies significantly, ranging from 5.5-19.0%. On average, canopy cover sits at 8.5%, which is below the average for England of 16%. Similarly to Babergh, the rural setting of Mid Suffolk may be one of the main reasons for this low canopy cover. Though it may be a challenge, it would be suggested that 15% canopy cover is an attainable target for the area, and a reasonable time frame for achieving this should be set. The 20% target should still be a longer term aspiration to work towards in the future.

The trees in Mid Suffolk contribute significantly to the health and wellbeing of the local people, the local environment, and the wider global environment by providing a range of ecosystem services. Though percentage canopy cover is lower than in Babergh, the trees in Mid Suffolk provide more ecosystem services; the trees store 723,000 tonnes of carbon and sequester an additional 29,000 tonnes annually. They also remove over 1,300 tonnes of pollution from the atmosphere, worth over £21.8 million in associated service costs, and saves local public sector service providers around £4 million in avoided sewerage charges by intercepting rainfall.

Headline Figures

Babergh's Tree Canopy Headline Figures		
Average Tree Canopy Cover	10.4%	
Carbon Storage (t)	612,000	£157,000,000
Annual Carbon Sequestration (t)	24,000	£6,260,000
Annual Pollution Removal (t)	1,100	£20,523,000
Annual Avoided Runoff (m³)	2,337,000	£3,658,000
Total Annual Benefits	**£30,441,000**	

Table 1: Headline figures for Babergh's tree canopy cover

Mid Suffolk's Tree Canopy Headline Figures		
Average Tree Canopy Cover	8.5%	
Carbon Storage (t)	723,000	£186,000,000
Annual Carbon Sequestration (t)	29,000	£7,417,000
Annual Pollution Removal (t)	1,310	£21,831,000
Annual Avoided Runoff (m³)	2,513,000	£3,934,000
Total Annual Benefits	**£33,182,000**	

Table 2: Headline figures for Mid Suffolk's tree canopy cover

Babergh & Mid Suffolk's Combined Tree Canopy Headline Figures		
Average Tree Canopy Cover	9.4%	
Carbon Storage (t)	1,335,000	£343,000,000
Annual Carbon Sequestration (t)	53,000	£13,677,000
Annual Pollution Removal (t)	2,410	£42,354,000
Annual Avoided Runoff (m³)	4,850,000	£7,592,000
Total Annual Benefits	**£63,623,000**	

Table 3: Headline figures for Babergh and Mid Suffolk's combined tree canopy cover

*The monetary benefits shown above are the estimated savings to local public sector services thanks to the tree canopy ecosystems. Pollution values have been calculated using UKSDC values (NO_2-£11.74/kg, SO_2-£6.79/kg, PM2.5-£220.12/kg), and USEC values (CO-£0.96/kg, and O_3-£1.06/kg). Carbon values calculated using the UK's central non-traded value for CO_2 (£70/tonne). Avoided runoff is calculated from the household measured sewerage treatment volumetric charge by Anglian Water (£1.57/m³).

1. Introduction

Tree 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.

In the production of this report two data collection methods were used. National Tree Map (NTM) data was used to collect information on canopy cover of trees above three meters in height. This figure is used when stating percentages of tree canopy cover across Babergh and Mid Suffolk. i-Tree Canopy was used to collect information more widely covering both tree canopy cover and shrub cover. This gives a picture of the entirety of the urban forests benefits when considering its ecosystem service provisions. In order to report on the benefits of trees only, the values for ecosystem services have been scaled to the canopy cover percentages established by the NTM data. This scaled data is resultantly used when considering carbon storage, carbon sequestration, pollution removal and avoided runoff.

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 answers the fundamental questions: 'How much urban forest does our area have?', 'Where is it?' and 'How has it changed over time?'. These concepts are useful in communicating messages about the urban forests to 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 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

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

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. Among a plethora of beneficial ecosystem services, vegetation provides shading, evaporative cooling, and rainwater interception. 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.

There is a growing body of international research and literature which supports the theory that 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:

- Improving journey quality and encouraging use of alternative transport corridors
- 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 Babergh and Mid Suffolk 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.

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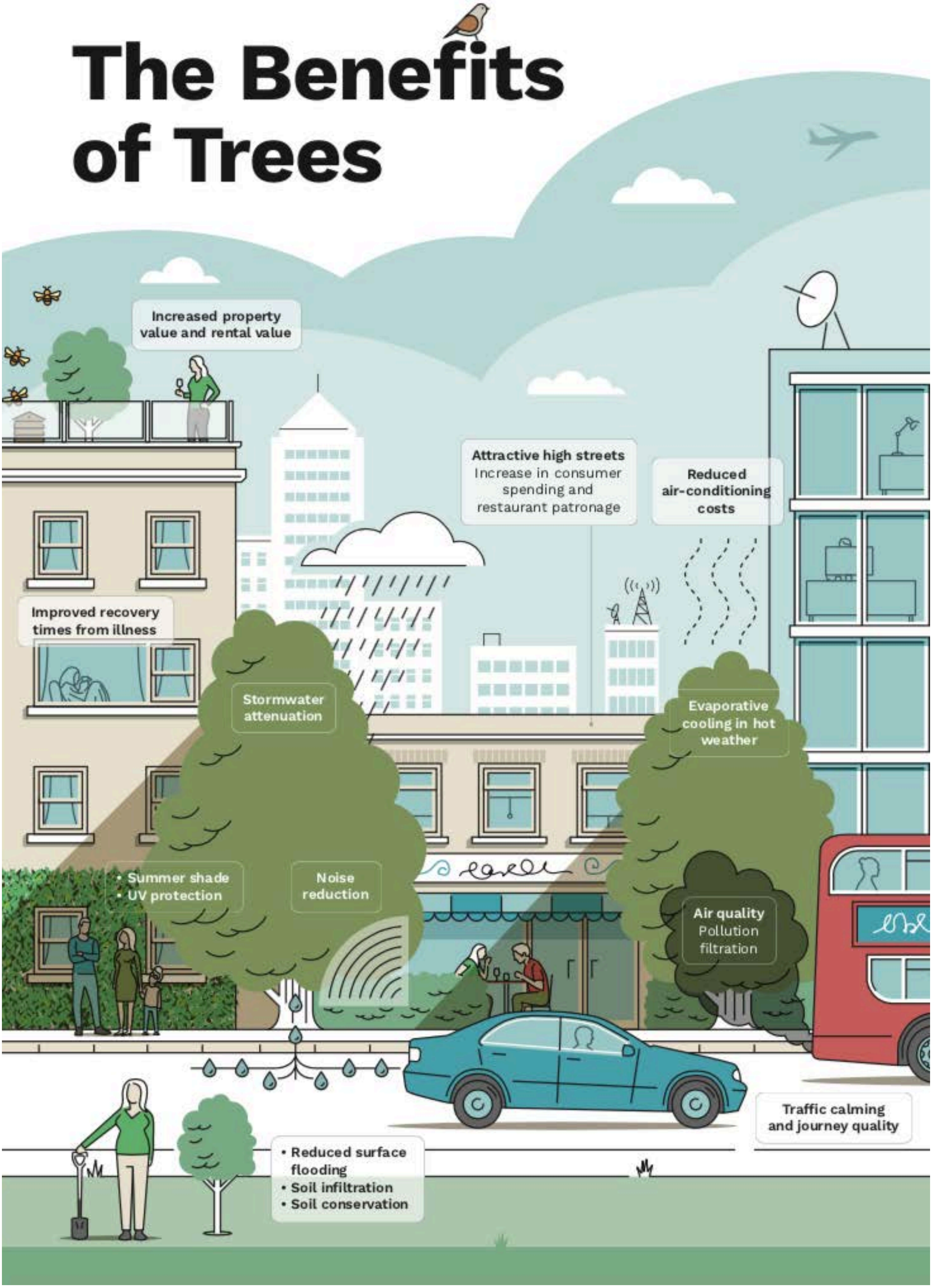
[2] Natural England Green Infrastructure Guidance, 2009

[3] Rolls and Sunderland, 2014

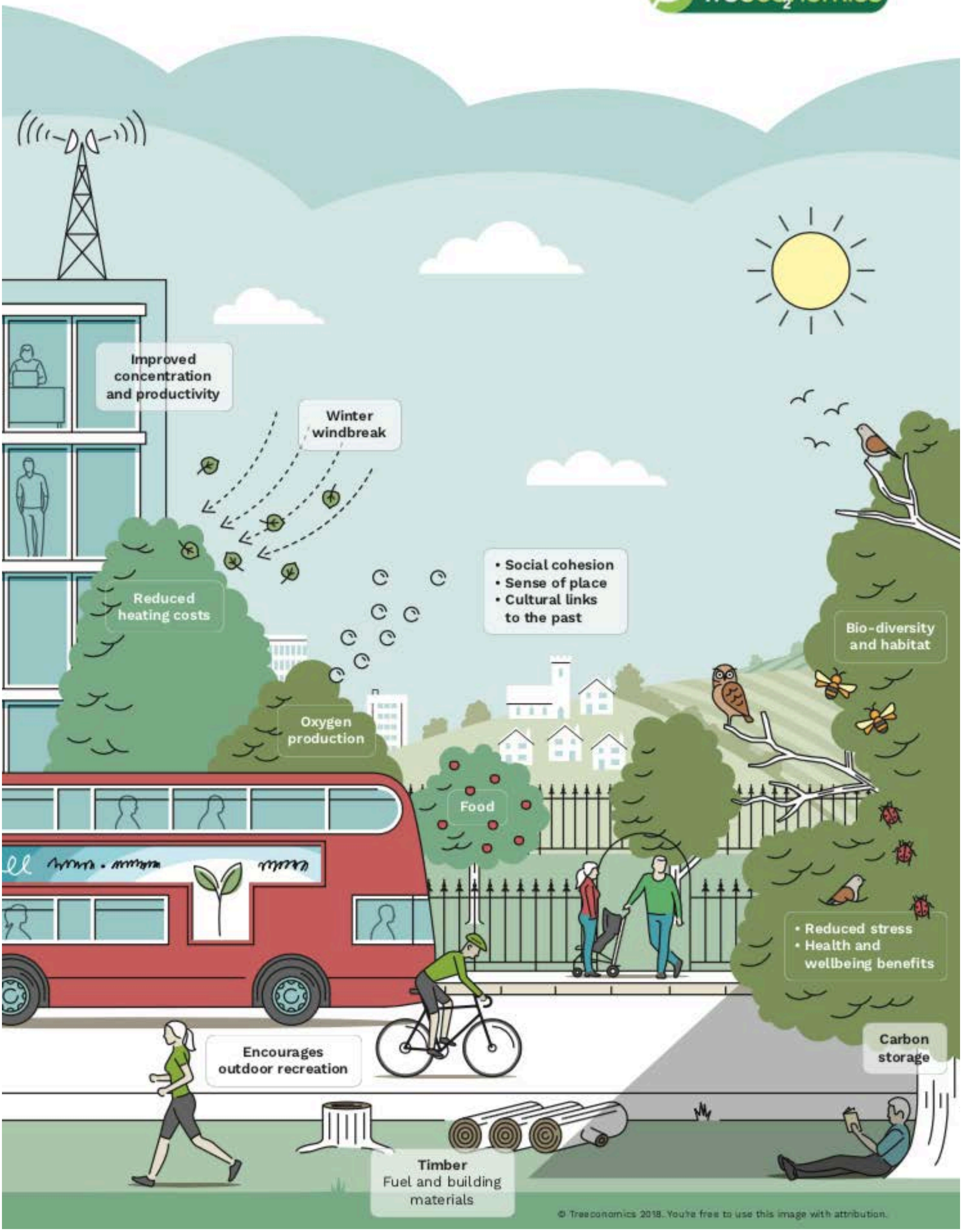
[4] Wolf, 2005

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

The Benefits of Trees



Treeconomics



2. Babergh and Mid Suffolk District Councils

Babergh and Mid Suffolk District Councils provide services for total area of 146,300 ha with an estimated combined population of over 184,000,[6] and across Babergh and Mid Suffolk, more than half the population live in villages and rural areas. Though the countryside is on the doorstep of most residents of Babergh and Mid Suffolk, this study indicates that in reality, tree cover is unfortunately low in many areas. Trees and green infrastructure should be an integral part of any landscape, in particular in towns and cities where buildings and grey infrastructure can quickly dominate and overwhelm residents and visitors alike.

Though separate and sovereign councils in their own rights, Babergh and Mid Suffolk District Councils have established a partnership to tackle the difficulties facing local governments. The ‘Working Together’ co-oprative has facilitated the development of a shared vision and allowed both the councils to benefit whilst retaining their autonomy.

Mid Suffolk District Council covers and area made up of 26 wards with a total area of around 871,100 ha. The landscape of Mid Suffolk is rural for the most part, with a patchwork of productive farmland and hedgerows, and its largest town is Stowmarket.

Babergh District Council is situated south of Mid Suffolk and consists of 24 wards. It is bordered by the River Stour to the south, and the River Orwell to the Northeast. Its eastern-most ward, Ganges is coastal, which presents a number of difficulties for the tree population; tree canopy cover is frequently lower in coastal areas due to the environmental factors. Whilst most of Babergh is rural, the two largest towns are Sudbury and Hadleigh.

This project has been commissioned on behalf of both Babergh District Council and Mid Suffolk District Council to allow both councils to better understand their tree stock and therefore provide a baseline for future environmental policy and management strategies. As part of this study, we have analysed canopy cover, ecosystem services and population-level statistics in each of the 50 wards which Babergh and Mid Suffolk District Councils provide services for.

[6] Census (2011)

Figure 1: Babergh and Mid Suffolk Map of Tree Canopy Cover by Ward

3. Results

3.1 Average Canopy Cover

National Tree Map (NTM) data from Bluesky has been used to produce canopy cover estimates for the areas of Babergh and Mid Suffolk. The average canopy cover across both districts was calculated at **9.4%** using BlueSky's National Tree Map data (NTM). Canopy cover stands at **10.4% in Babergh** and **8.5% in Mid Suffolk**. Canopy cover across Babergh varies significantly, from 5.5% in Lavenham, to 19% in Orwell, whilst in in Mid Suffolk it ranges from 6% in Stow Thorney to 12.8% in Claydon & Barham.

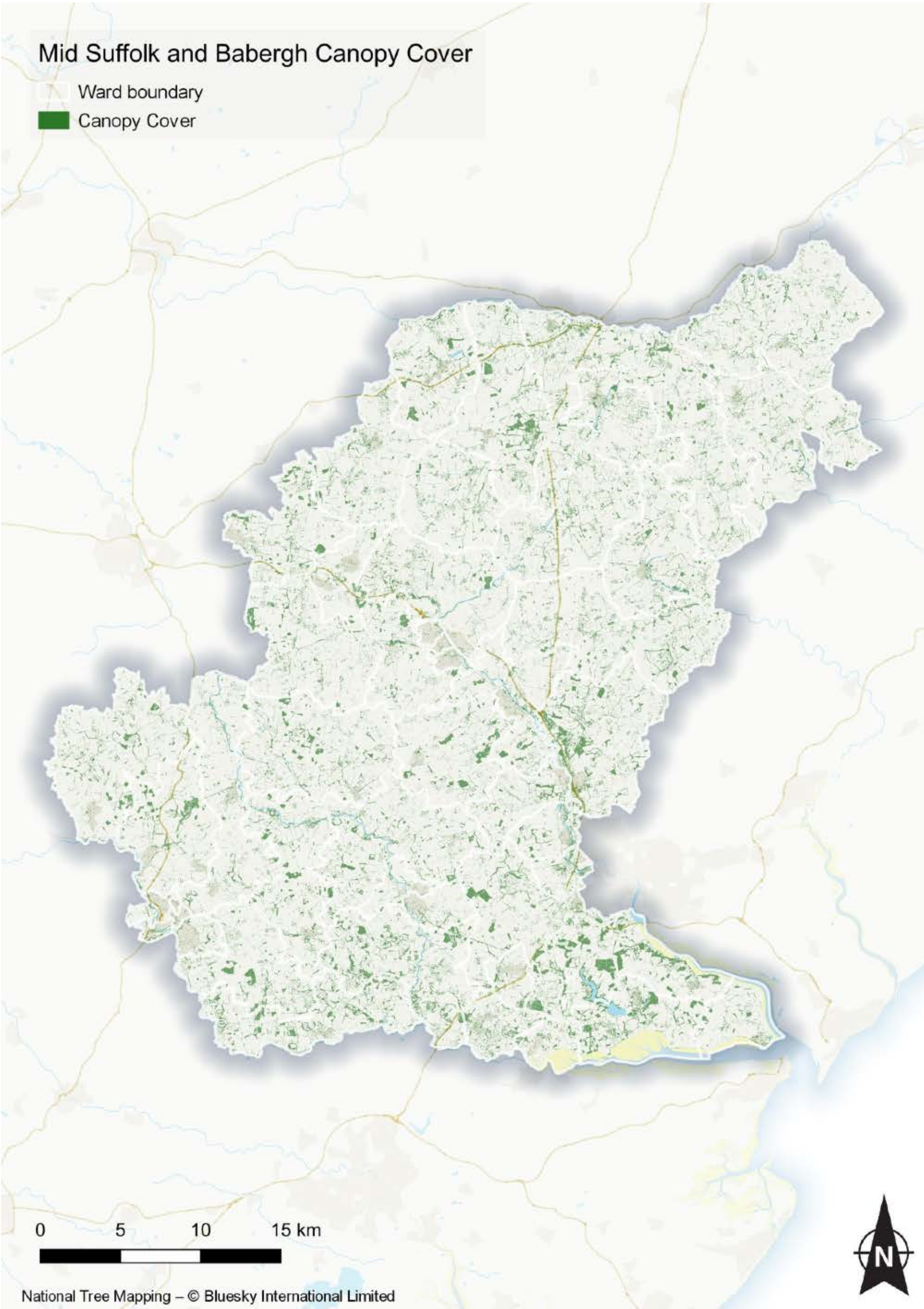


Figure 2: Canopy Cover Across Babergh and Mid Suffolk

3.2 Canopy Cover by Ward

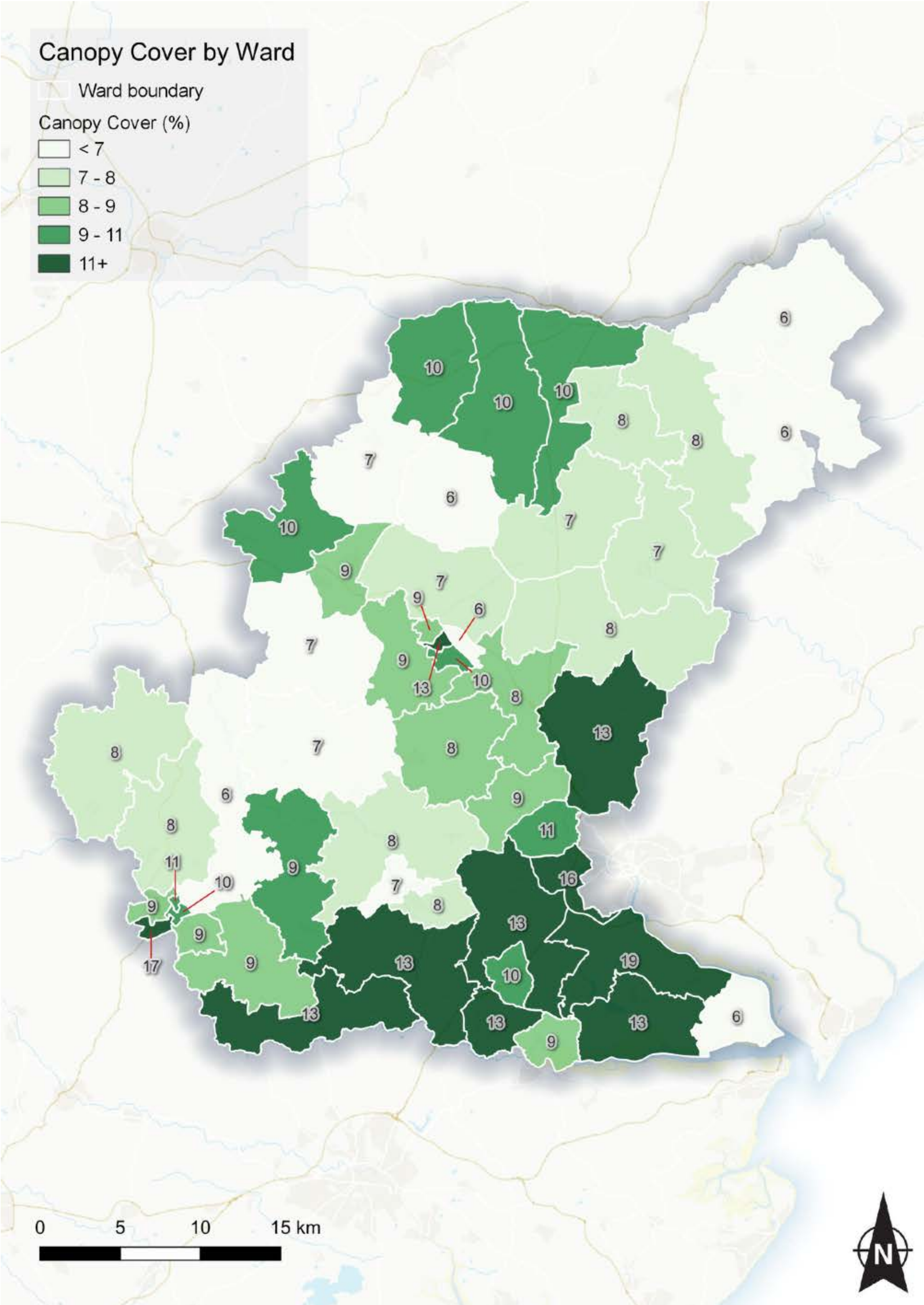


Figure 3: Canopy Cover ranked by % area per ward for Babergh and Mid Suffolk

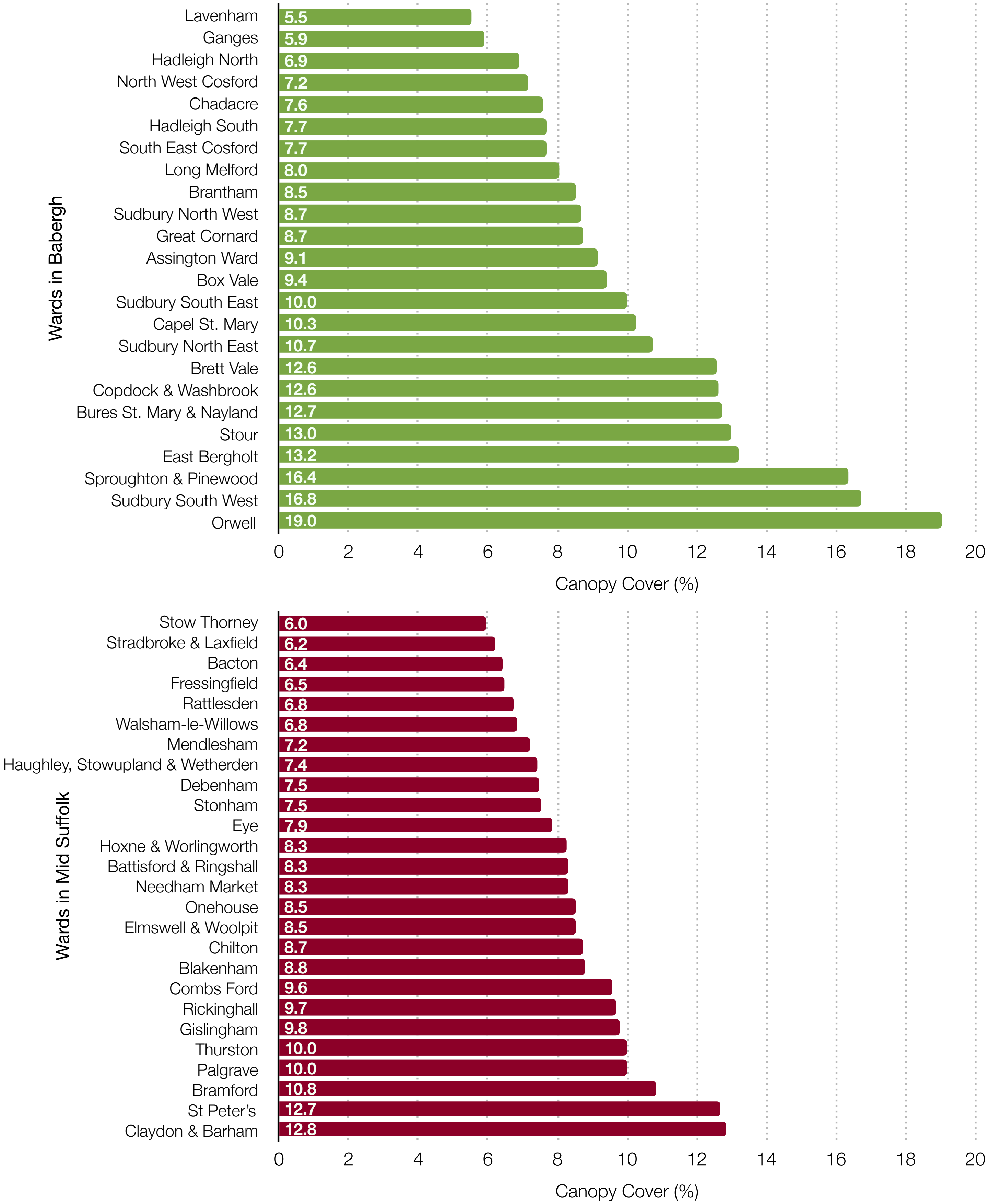


Figure 4: Canopy Cover by % area across Babergh and Mid Suffolk

A study of 283 UK towns and cities[7] reported that the average canopy cover value for England stands at 16%. Currently Babergh and Mid Suffolk's canopy cover is below this average at 9.4%, and it would be recommended that a target to increase canopy cover across the districts is included within strategic plans and policies for the development. The study recommend a canopy cover target of 20% for non-coastal towns and cities. This being said, Mid Suffolk and Babergh have a significant area of rural land, and these areas typically do struggle for tree canopy cover as trees are frequently confined to hedgerows, highways, and small corners of woodland. A more realistic target would be the average for England of 16% canopy cover.

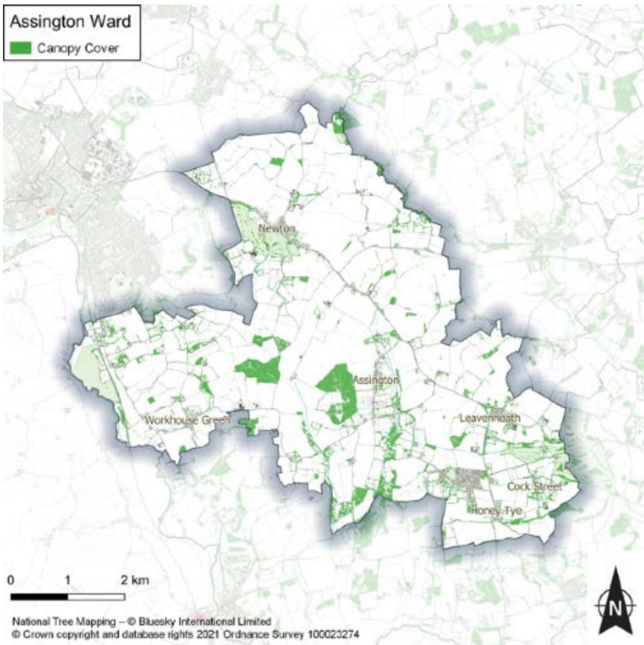
City/District	% Tree cover	Source
Cambridgeshire	13.9	Forest Research; Canopy Cover Map UK 2021
Fenland	12.5	Forest Research; Canopy Cover Map UK 2021
Torbay	12.0	i-Tree Canopy 2011
Cambridge	11.6	Forest Research; Canopy Cover Map UK 2021
Peterborough	10.3	Forest Research; Canopy Cover Map UK 2021
Babergh	**10.3**	**Blue Sky NTM Survey 2021**
Huntingdonshire	10.2	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
Mid Suffolk	**8.5**	**Blue Sky NTM Survey 2021**

Table 4: A selection of UK districts, cities and towns and their estimated canopy cover.

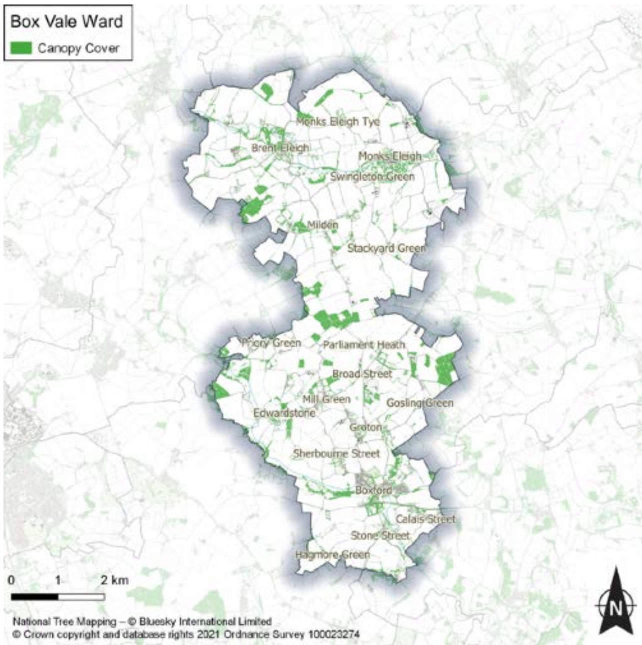
[7] Doick et al. (2017)

[8] Treeconomics (2016)

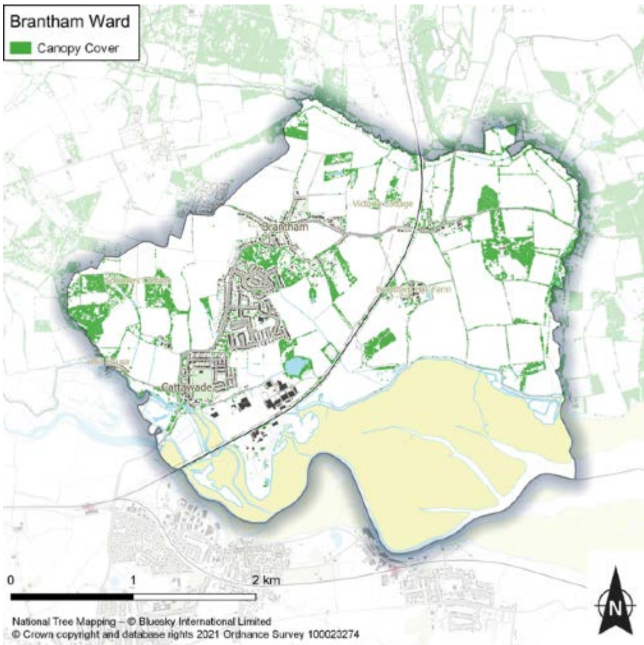
3.3 Babergh's Individual Ward Canopy Cover Maps



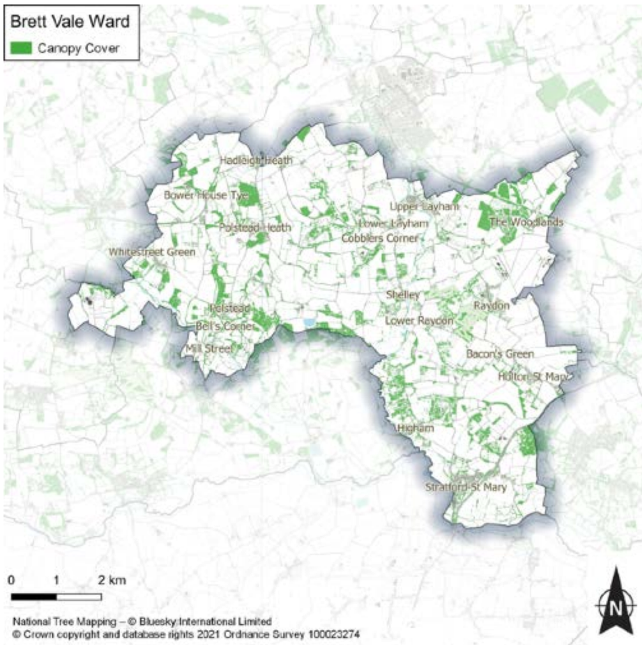
Assington Ward: **9.1%** canopy cover



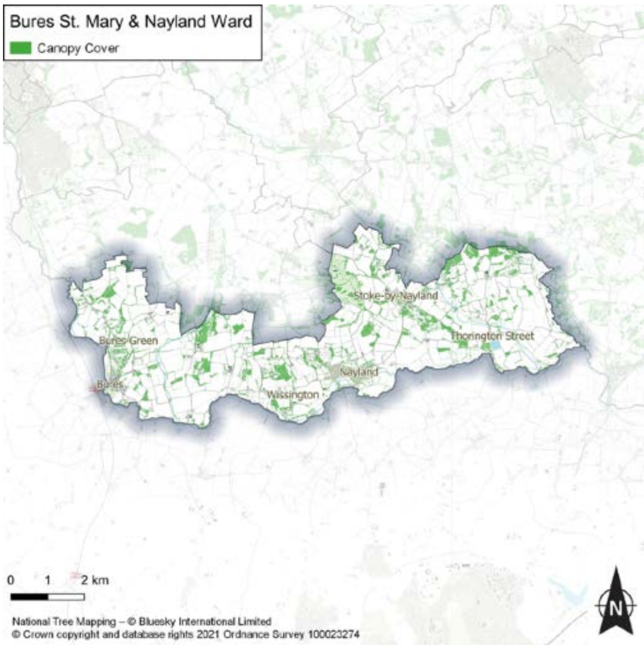
Box Vale Ward: **9.4%** canopy cover



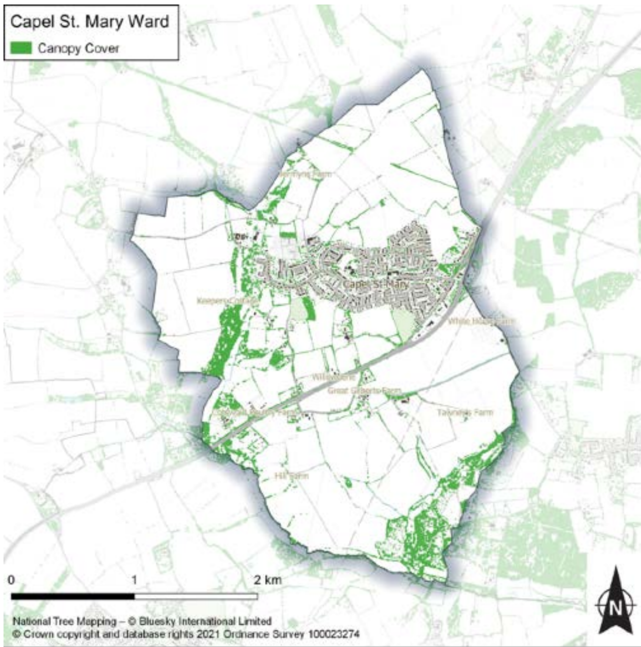
Brantham Ward: **8.5%** canopy cover



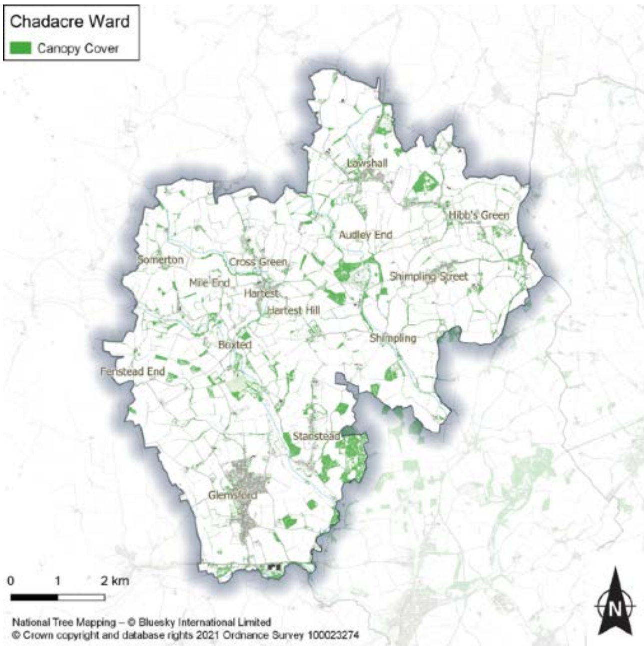
Brett Vale Ward: **12.6%** canopy cover



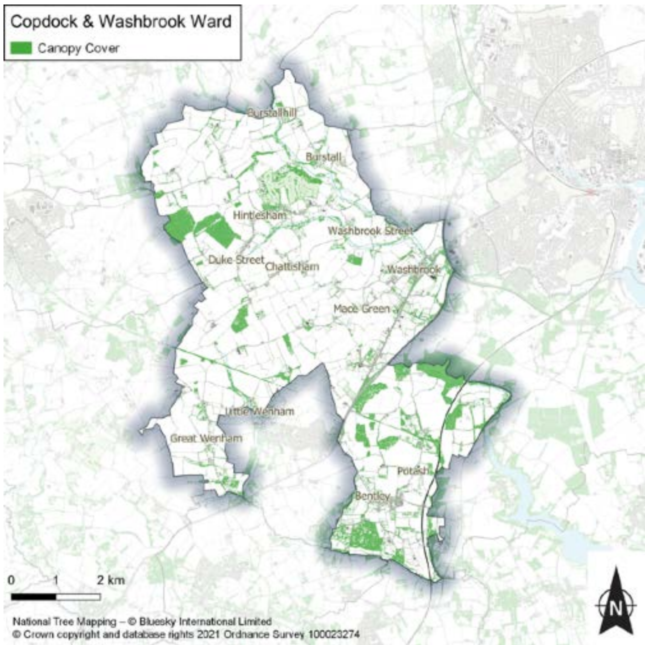
Bures St. Mary & Nayland Ward: **12.7%** canopy cover



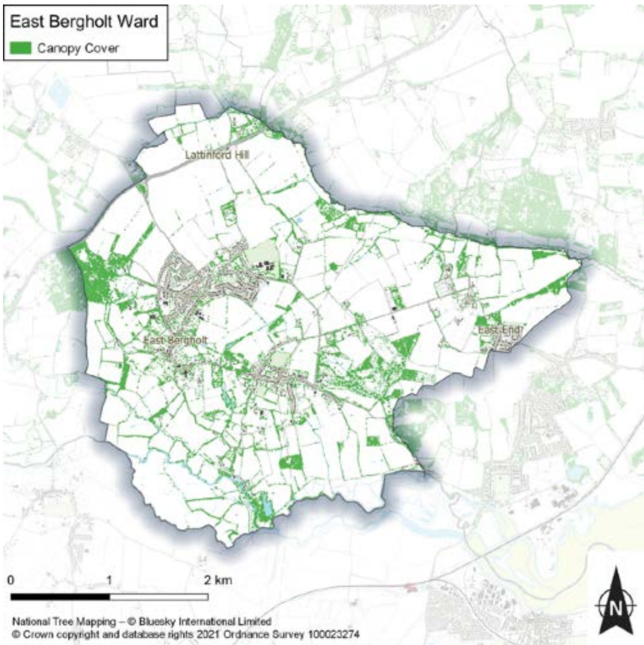
Capel St. Mary Ward: **10.2%** canopy cover



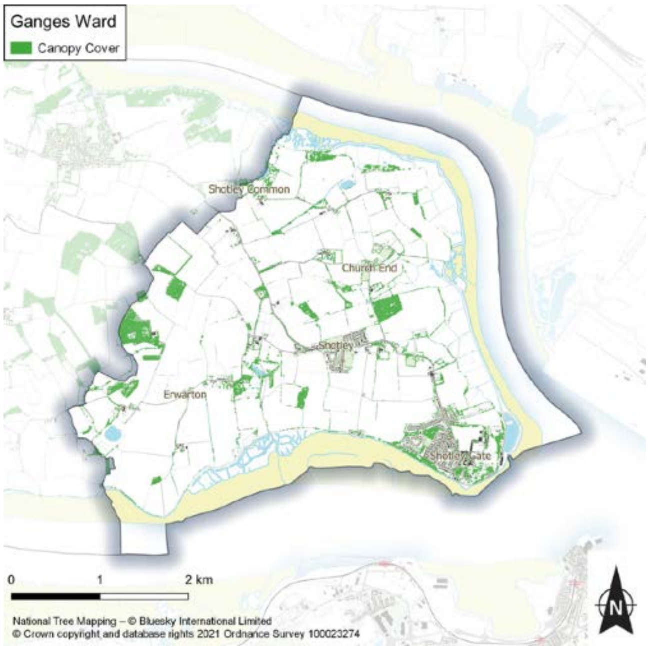
Chadacre Ward: **7.6%** canopy cover



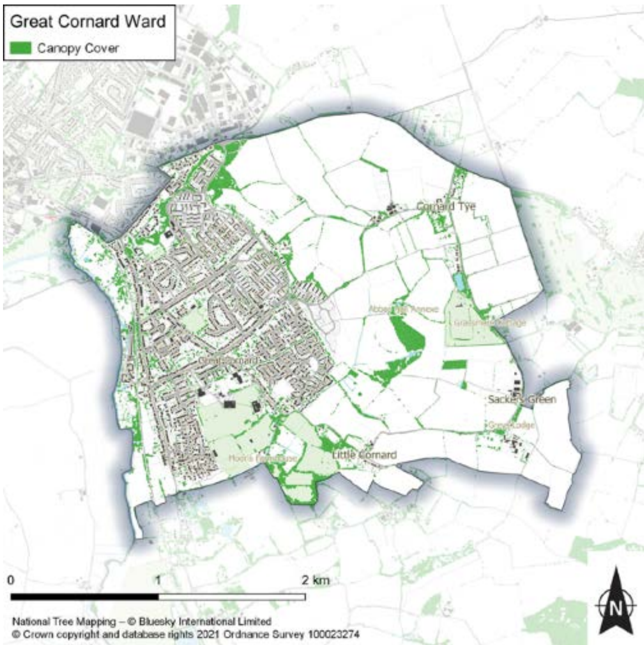
Copdock & Washbrook Ward: **12.7%** canopy cover



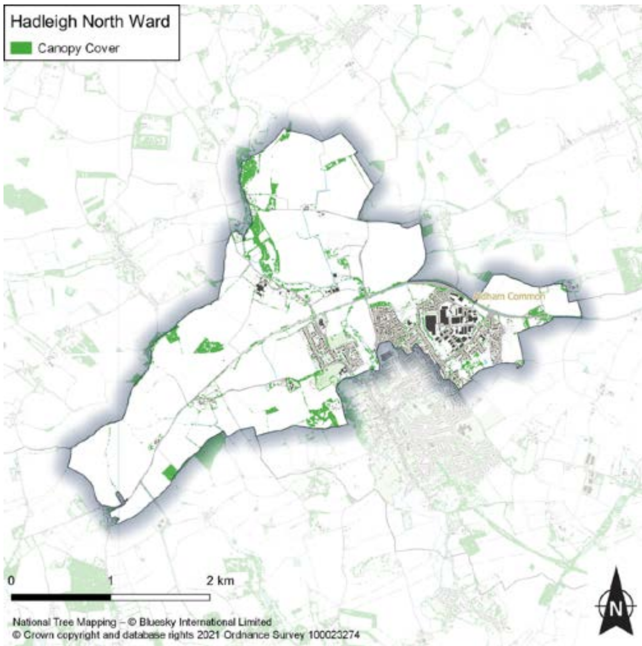
East Bergholt Ward: **13.2%** canopy cover



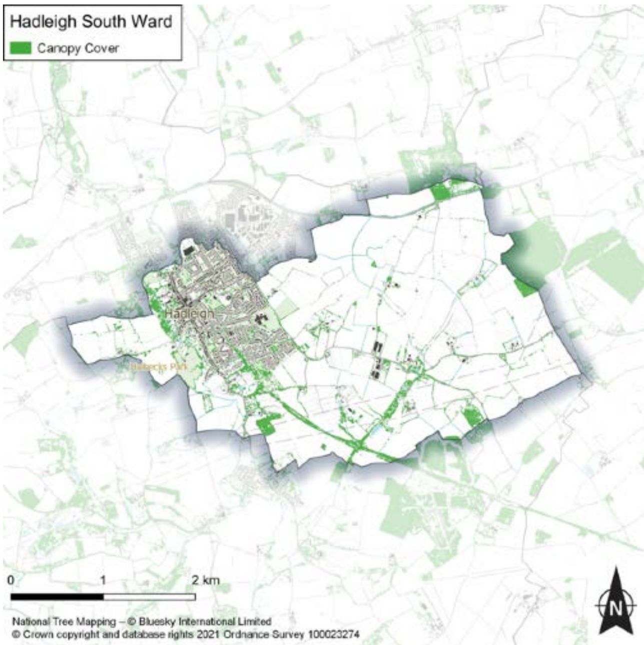
Ganges Ward: **5.9%** canopy cover



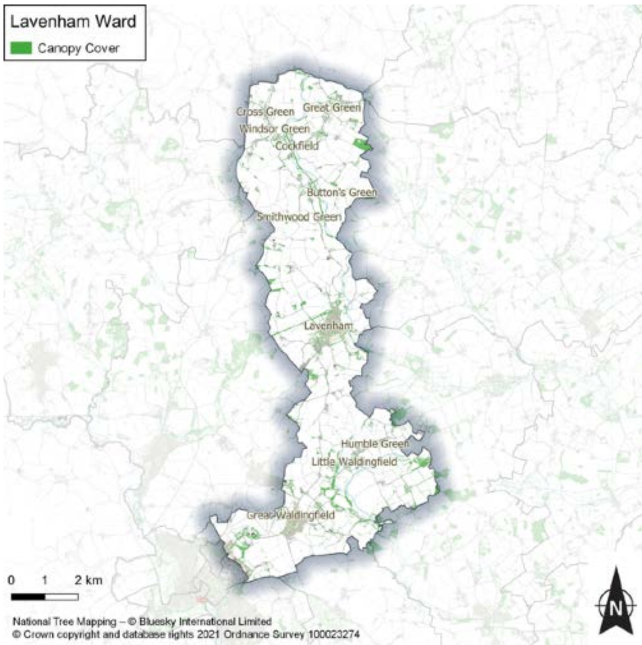
Great Cornard Ward: **8.7%** canopy cover



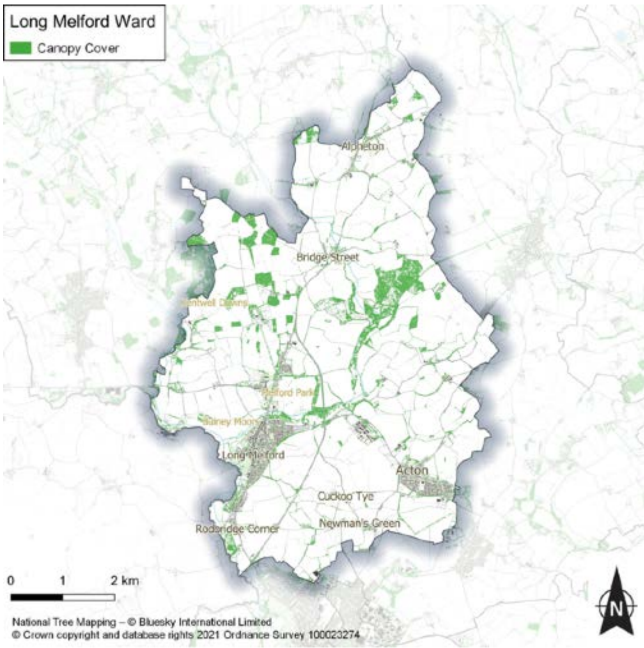
Hadleigh North Ward: **6.9%** canopy cover



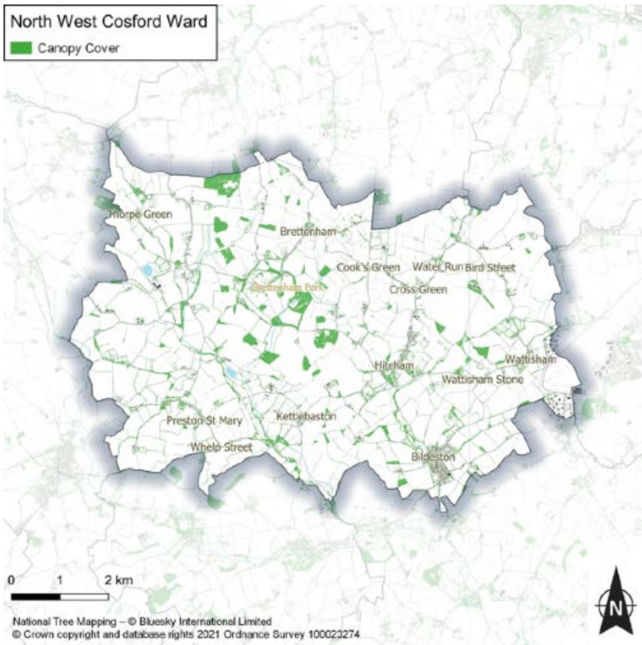
Hadleigh South Ward: **7.7%** canopy cover



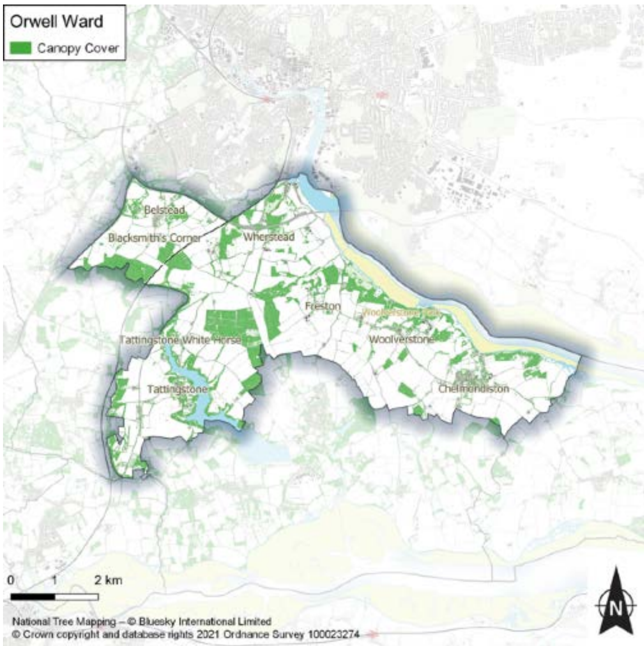
Lavenham Ward: **5.5%** canopy cover



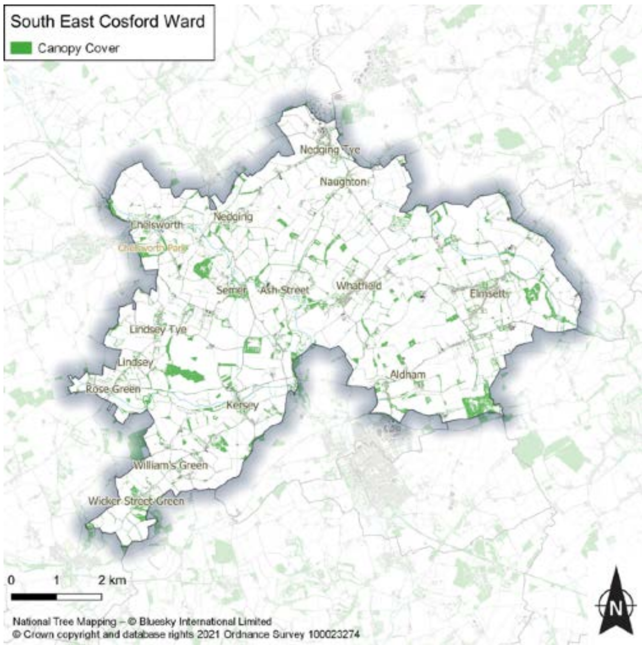
Long Melford Ward: **8.0%** canopy cover



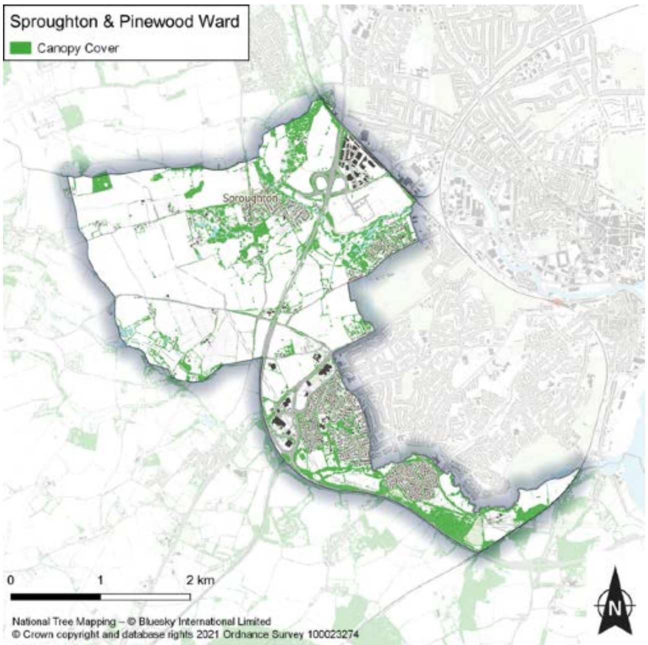
North West Cosford Ward: **17.2%** canopy cover



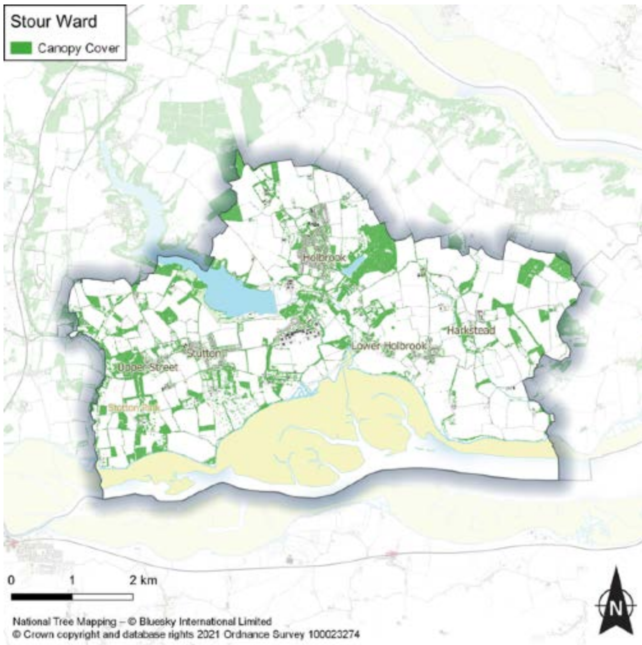
Orwell Ward: **19.0%** canopy cover



South East Cosford Ward: **7.7%** canopy cover

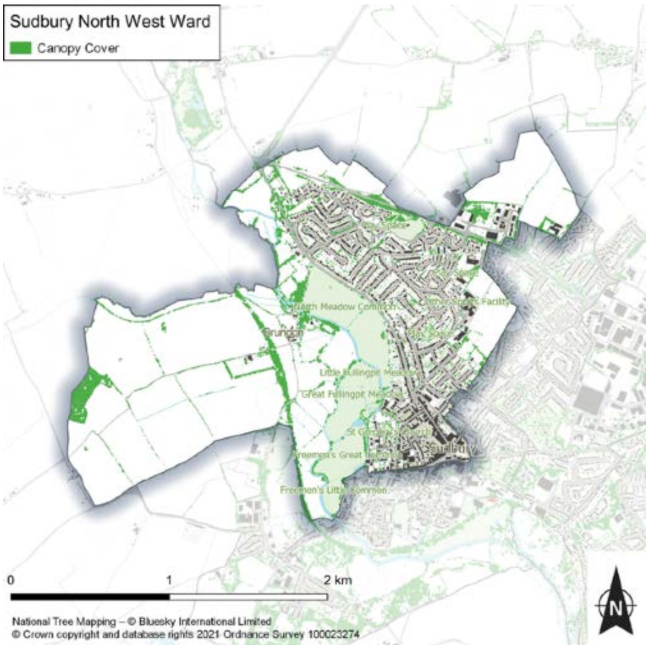


Sproughton & Pinewood Ward: **16.4%** canopy cover

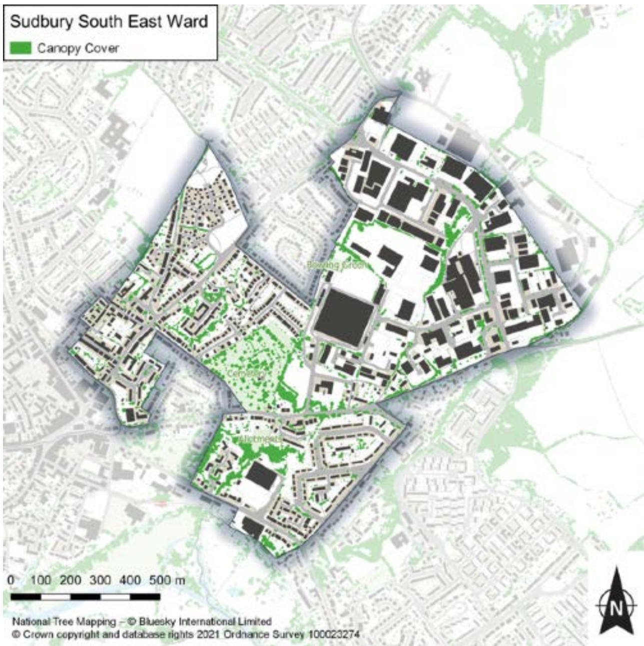


Stour Ward: **13.0%** canopy cover

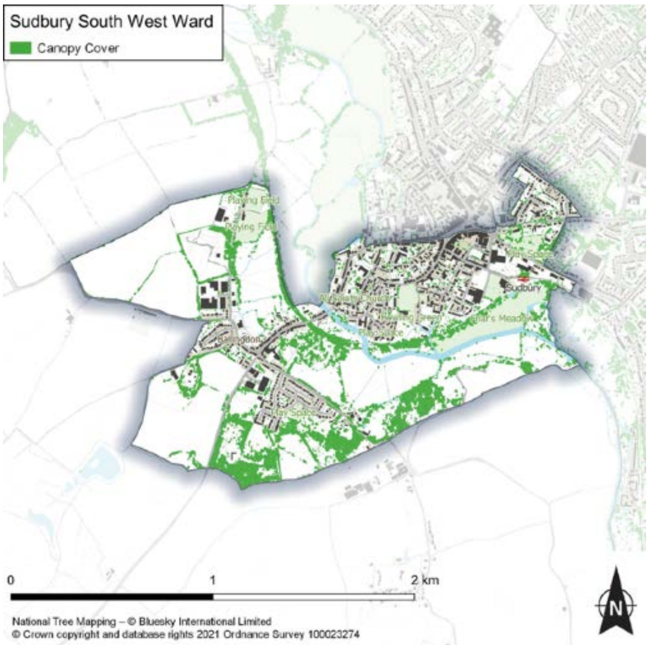
Sudbury North East Ward: **10.7%** canopy cover



Sudbury North West Ward: **8.7%** canopy cover

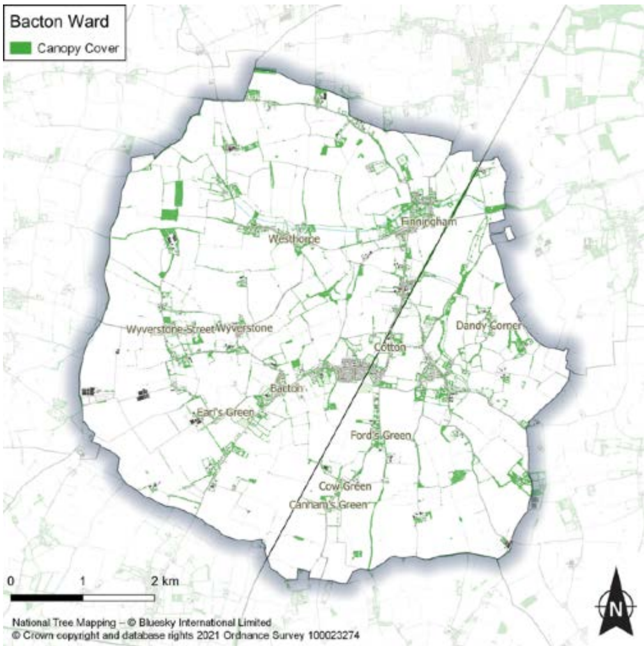


Sudbury South East Ward: **10.0%** canopy cover

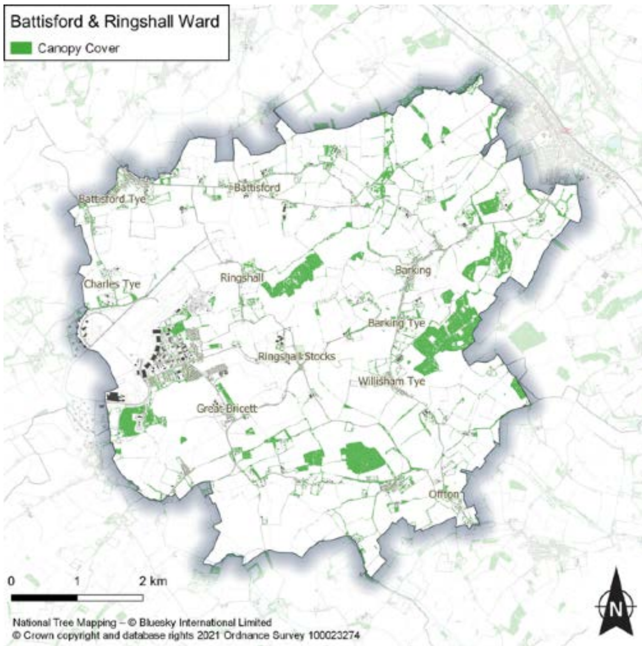


Sudbury South West Ward: **16.8%** canopy cover

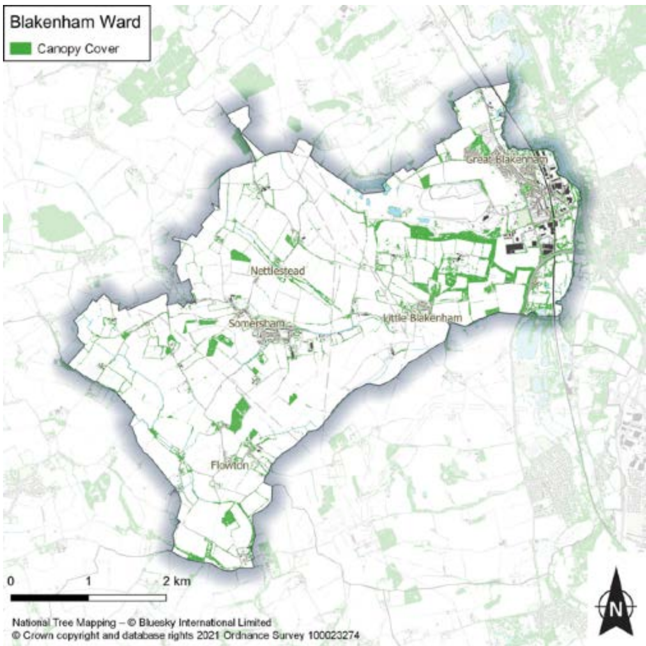
3.4 Mid Suffolk District Council’s Individual Ward



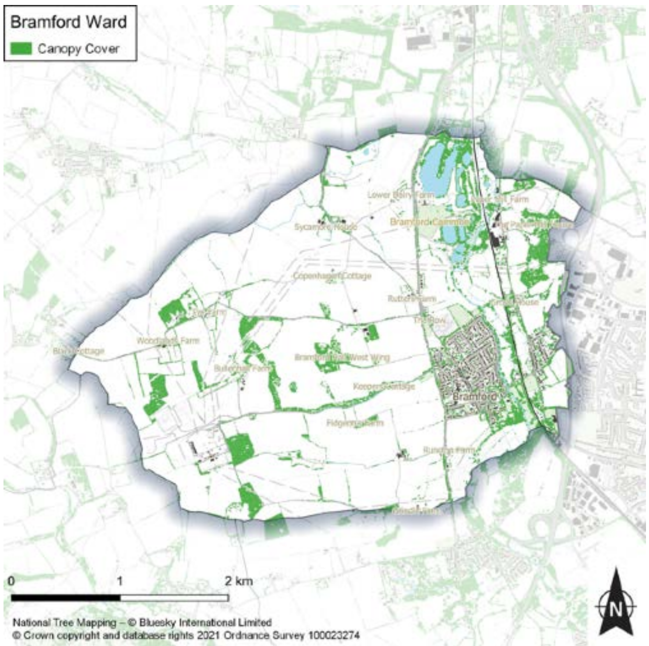
Bacton Ward: **6.4%** canopy cover



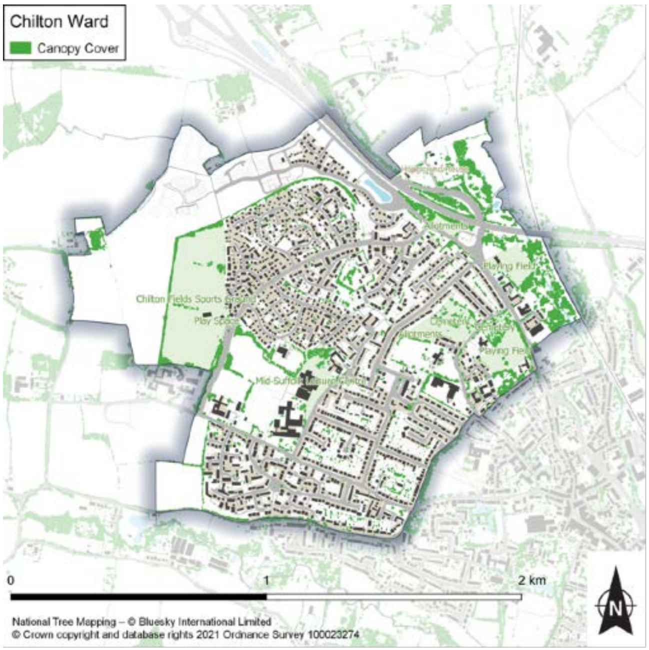
Battisford & Ringshall Ward: **8.3%** canopy cover



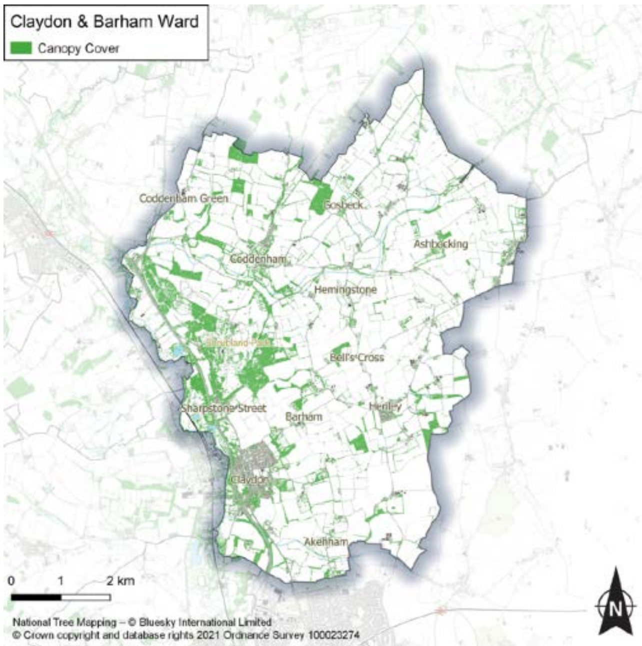
Blakenham Ward: **8.8%** canopy cover



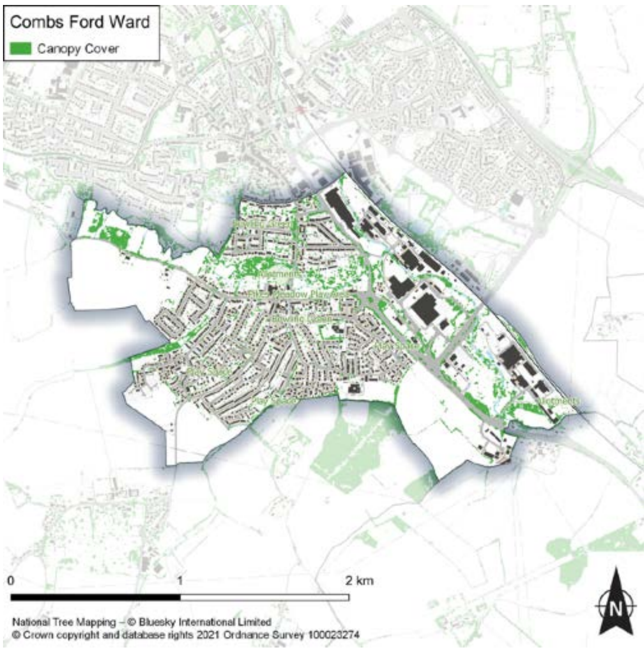
Bramford Ward: **10.8%** canopy cover



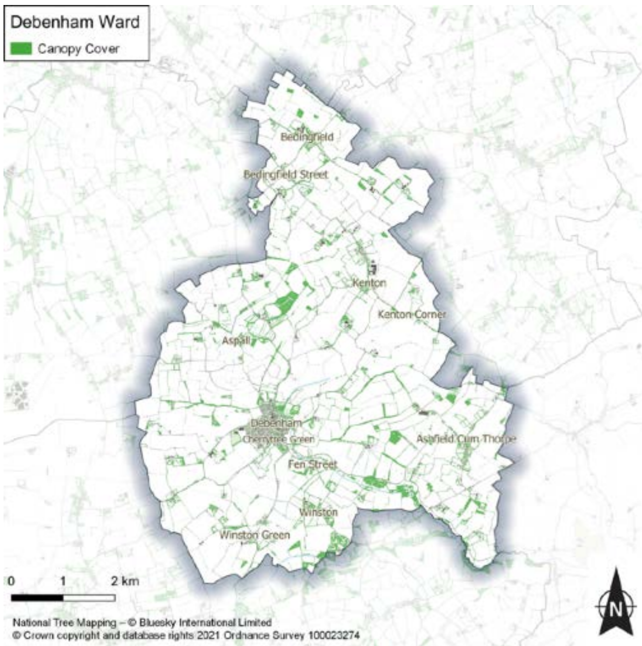
Chilton Ward: **8.7%** canopy cover



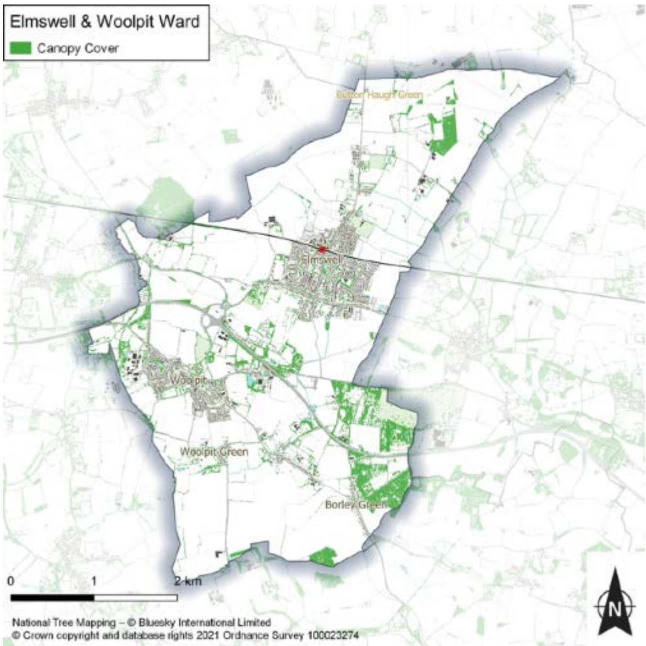
Claydon & Barham Ward: **12.8%** canopy cover



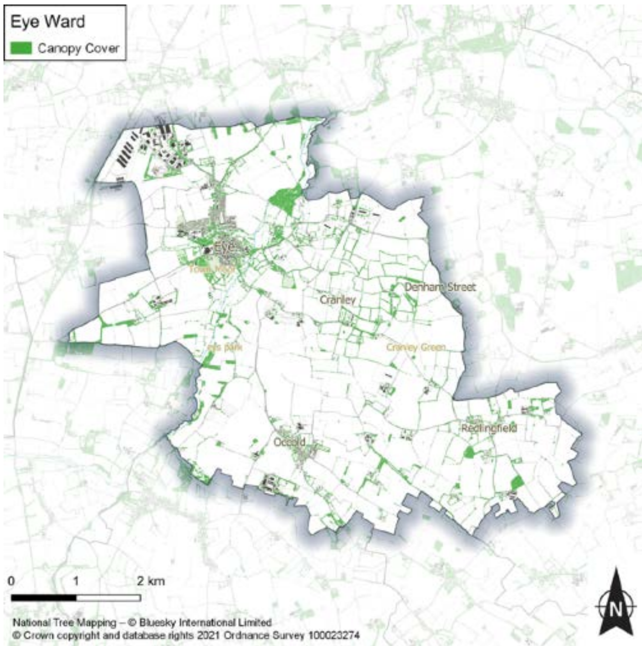
Combs Ford Ward: **9.6%** canopy cover



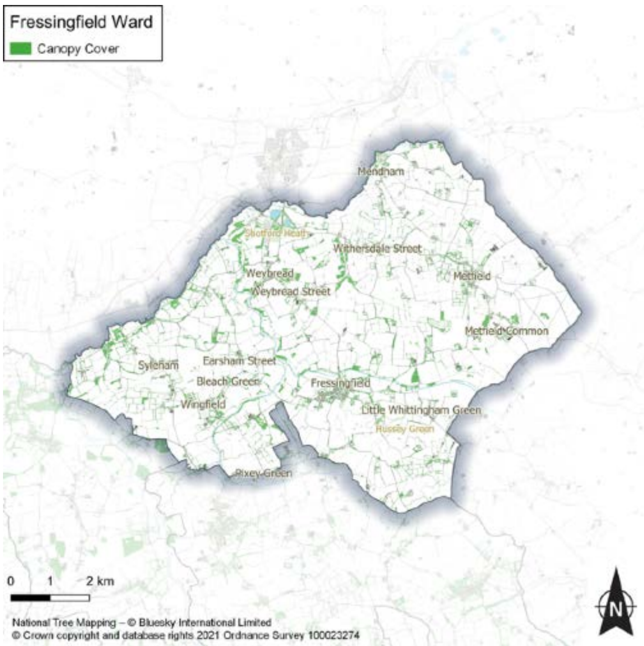
Debenham Ward: **7.5%** canopy cover



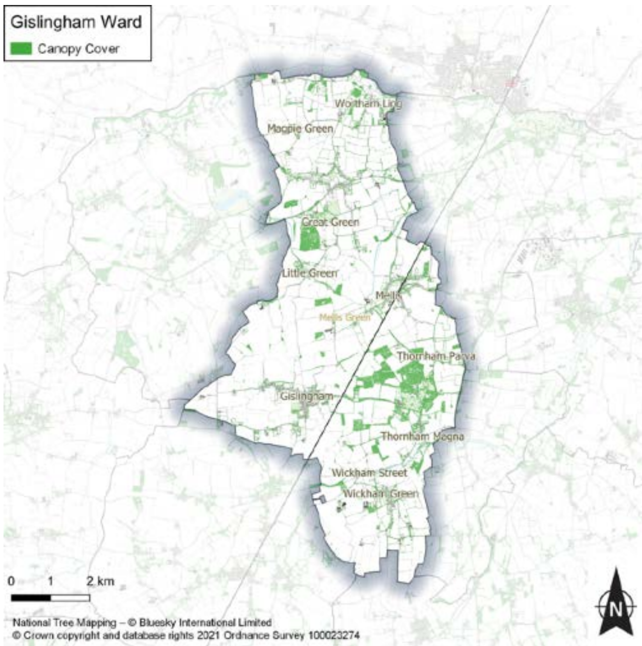
Elmswell & Woolpit Ward: **8.5%** canopy cover



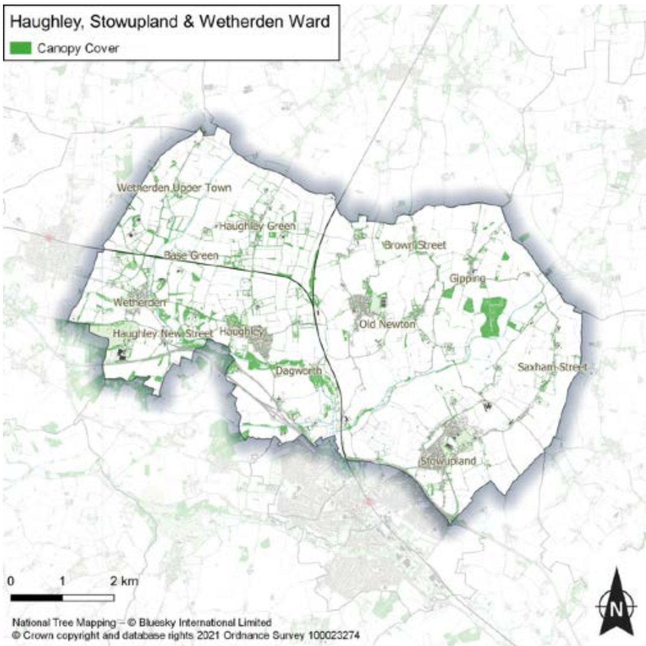
Eye Ward: **7.9%** canopy cover



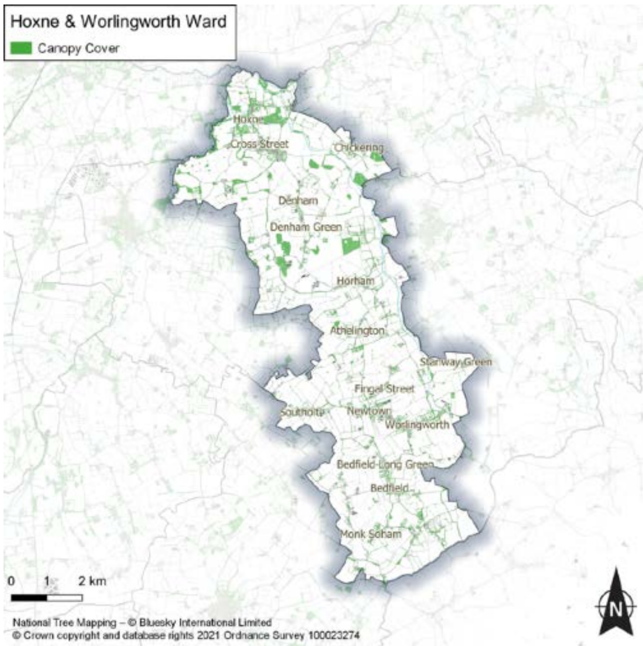
Fressingfield Ward: **6.5%** canopy cover



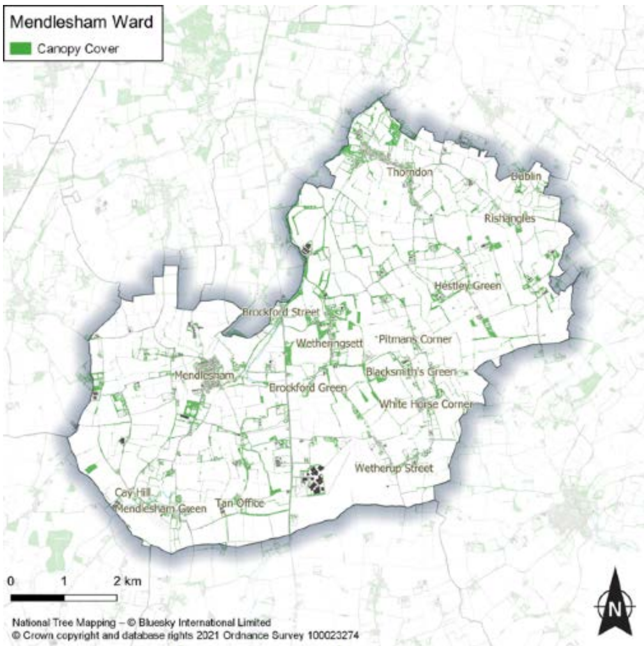
Gislingham Ward: **9.8%** canopy cover



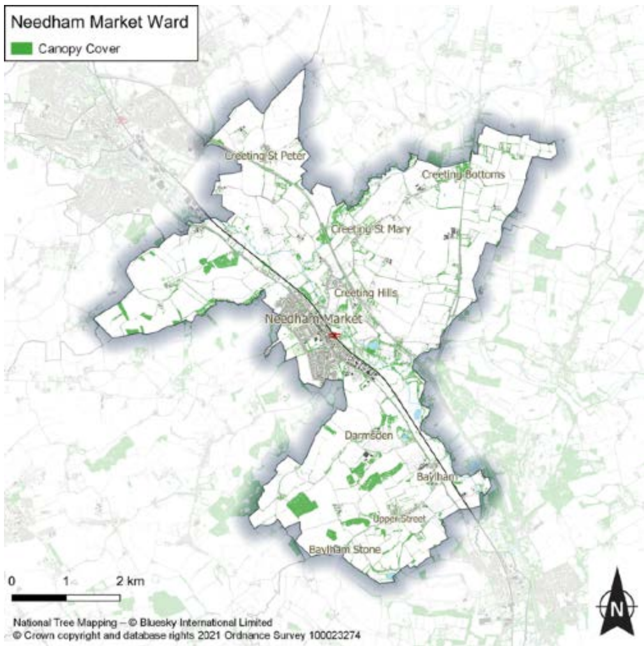
Haughley, Stowupland & Wetherden Ward: **7.4%** canopy cover



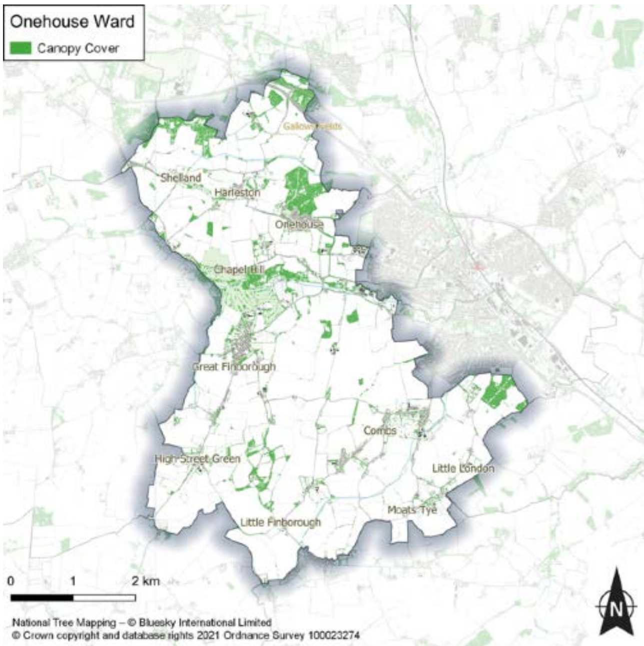
Hoxne & Worlingworth Ward: **8.3%** canopy cover



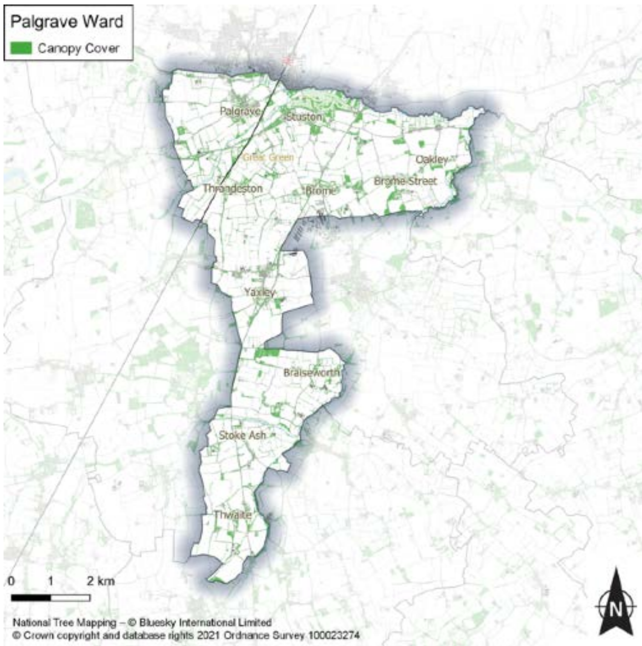
Mendlesham Ward: **7.1%** canopy cover



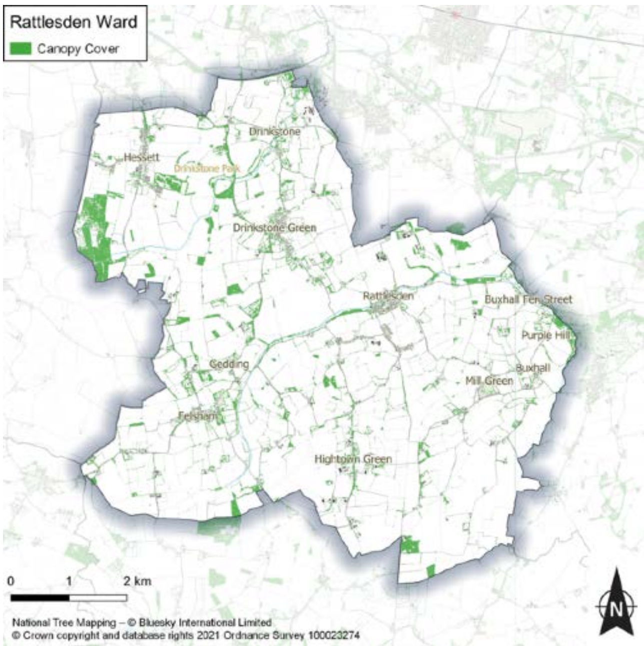
Needham Market Ward: **8.3%** canopy cover



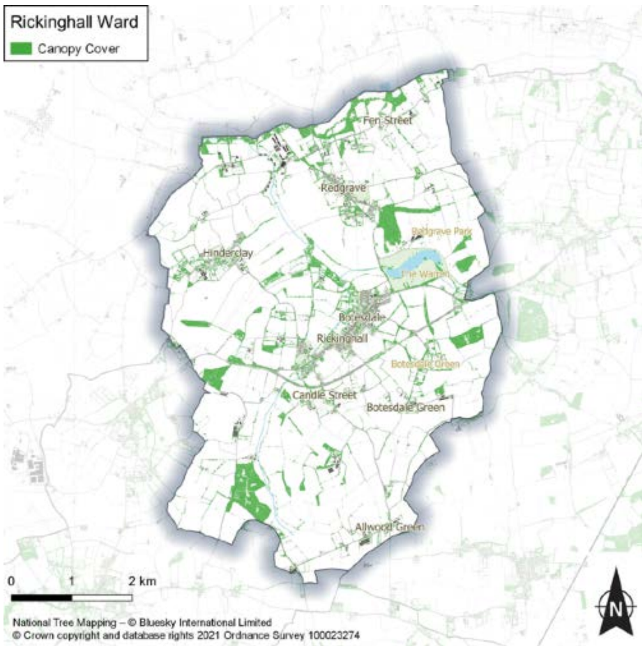
Onehouse Ward: **8.5%** canopy cover



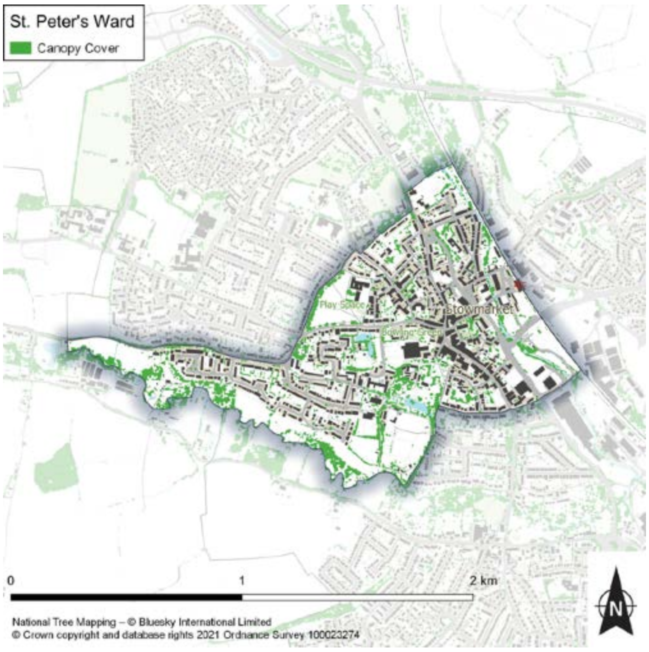
Pelgrave Ward: **10.0%** canopy cover



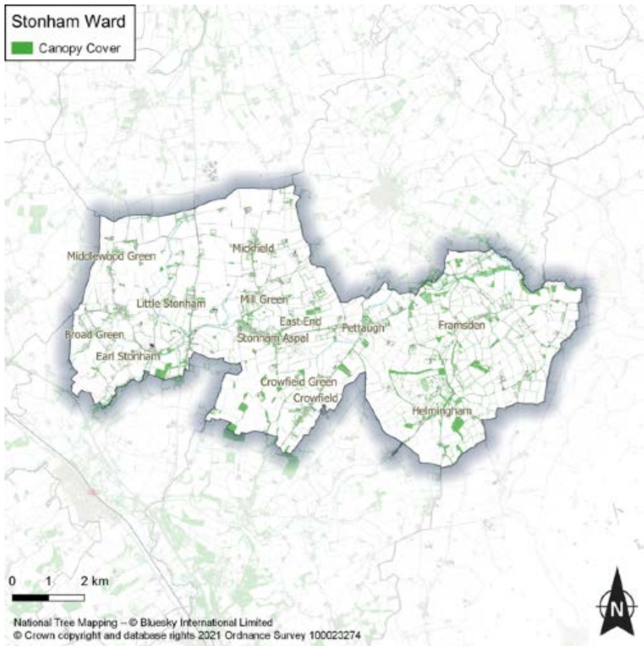
Rattlesden Ward: **6.8%** canopy cover



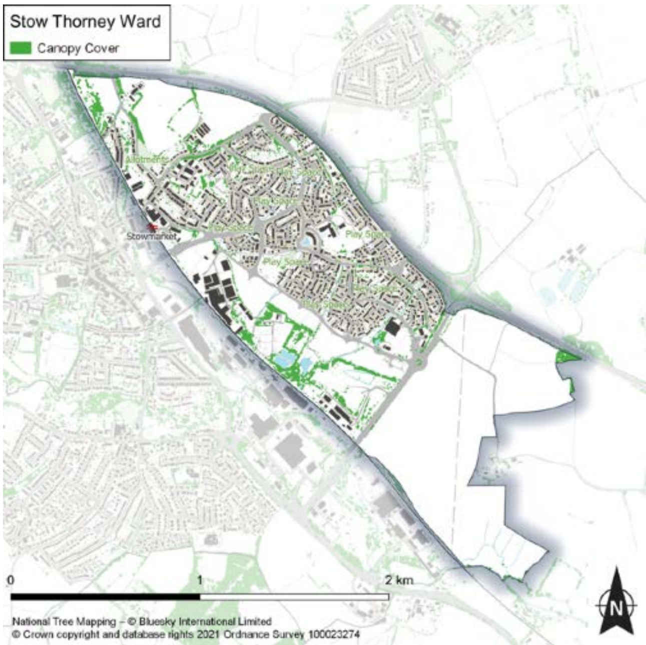
Rickinghall Ward: **9.7%** canopy cover



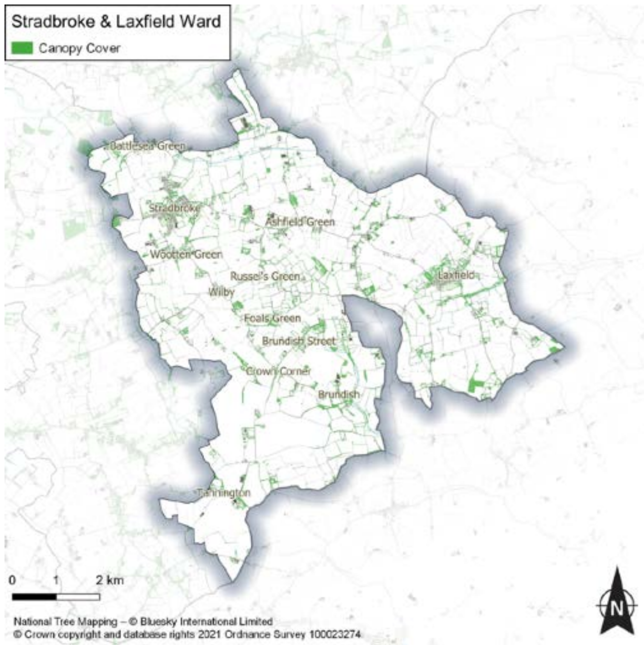
St. Peter's Ward: **12.7%** canopy cover



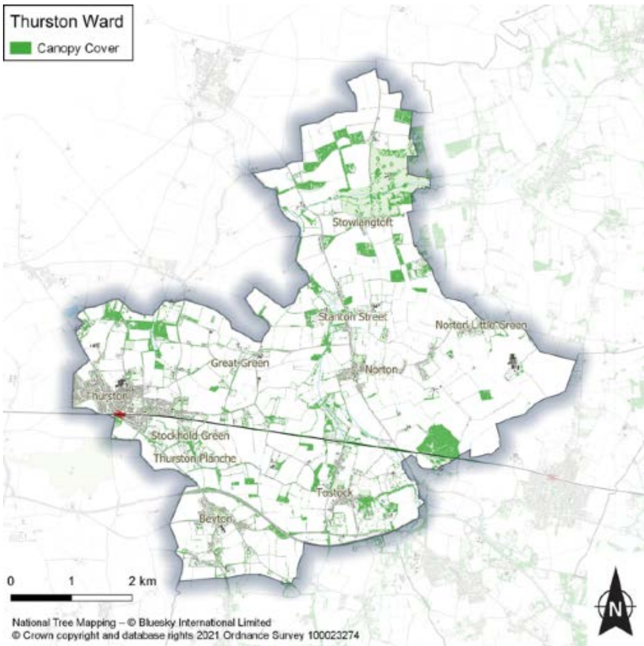
Stonham Ward: **7.5%** canopy cover



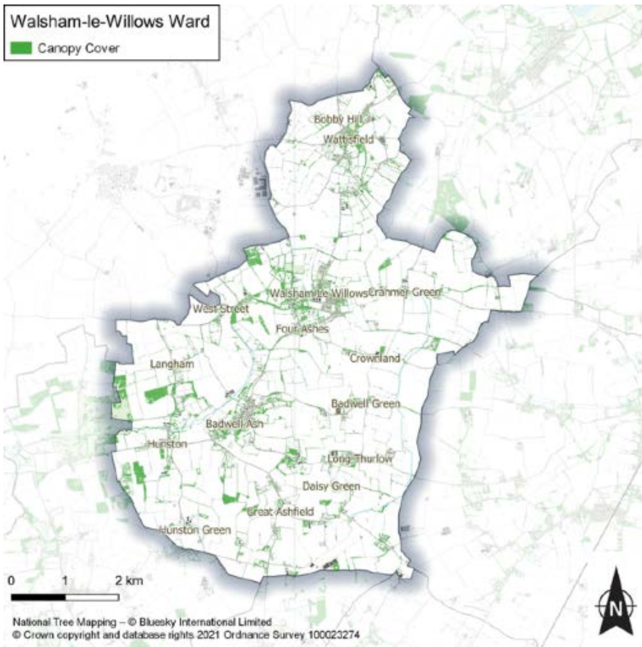
Stow Thorney Ward: **6.0%** canopy cover



Stradbroke & Laxfield Ward: **6.2%** canopy cover



Thurston Ward: **10.0%** canopy cover



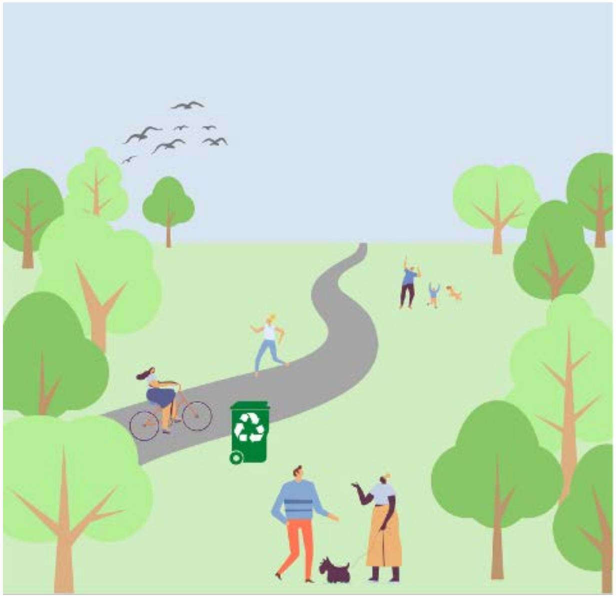
Walsham-le-Willows Ward: **6.8%** canopy cover

4. Canopy Cover and Communities

This section compares canopy cover with various quality of life indicators for Babergh and Mid Suffolk. These are shown for the ward level, for appropriate comparison to the canopy cover assessment. Where data was obtained at Lower Super Output Area[9] (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 13).



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.

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.

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

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

[9] LSOA refers to postcode areas, some of which cross over ward boundaries. This makes data more spatially coherent, but more difficult to report at ward level.

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%). The relationship between canopy cover and IMD rank is illustrated in figure 7.[10]

The data shows that for IMD, on average, wards with canopy cover below 10% had an average rank of 20728, compared with wards with more than 10% canopy cover which had a rank of 20815. Although this echoes the findings of most other canopy studies, whereby greener areas typically have lower levels of deprivation, the difference is very small to the point of being negligible in this area. In Mid Suffolk, contrary to expectation, areas with less than 10% tree cover have a far higher average IMD rank, meaning these areas are less deprived than areas with more than 10% canopy cover.

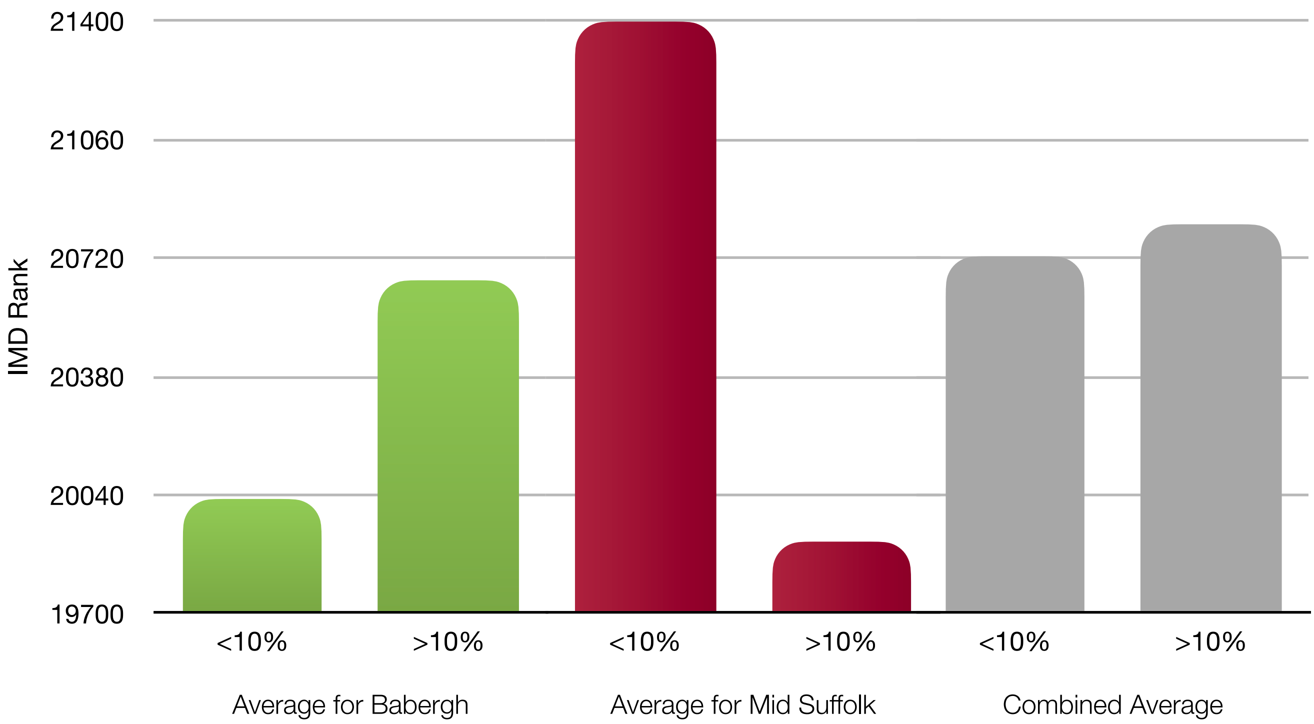


Figure 5: Graph of IMD by Ward and Canopy Cover

[10] Public Health England, 2020

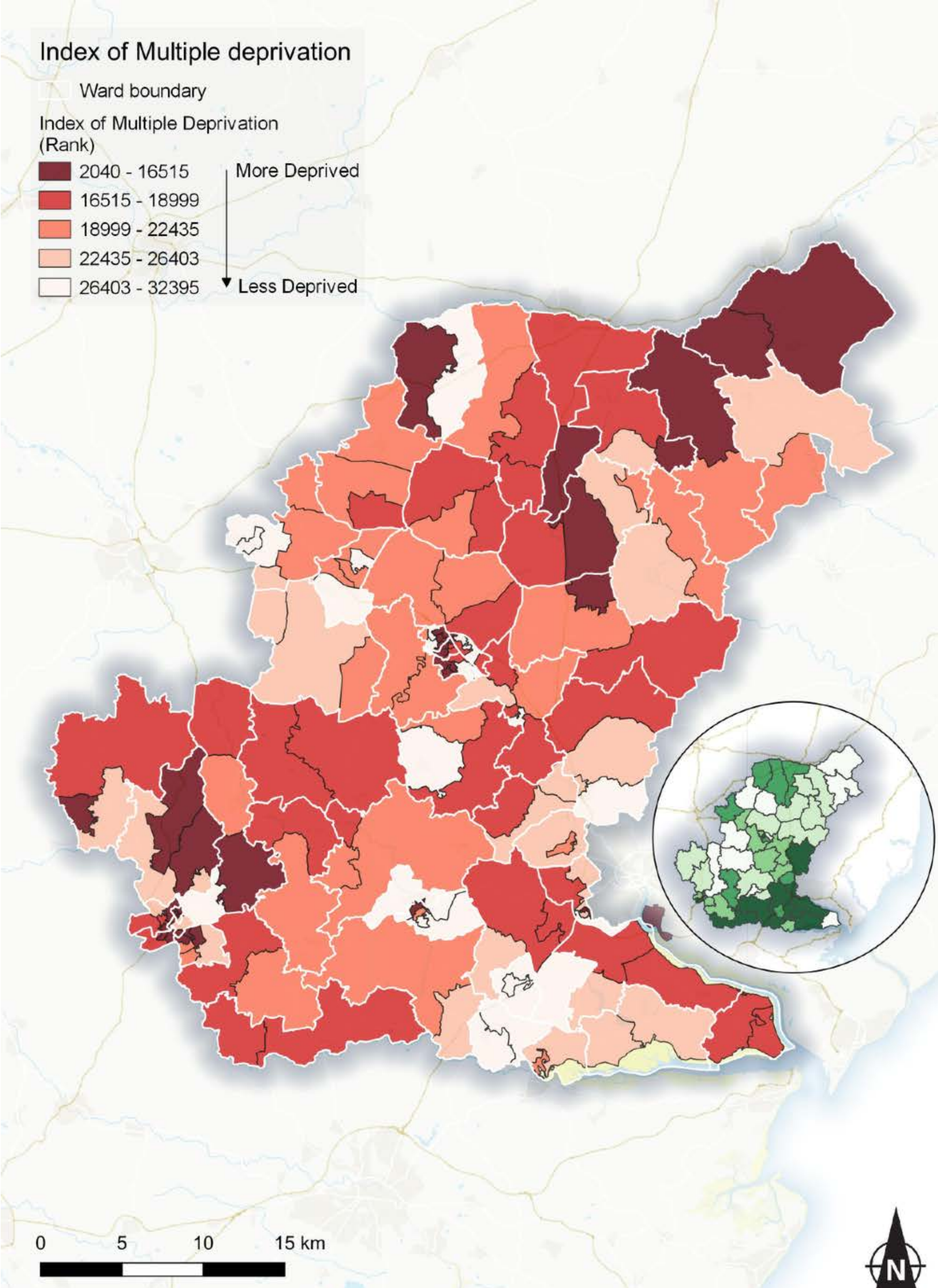


Figure 6: IMD by Ward and Canopy Cover

4.2 Median House Price

The Office for National Statistics (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.[11]

The ward with the highest average house price is Bures St. Mary and Nayland Ward, at £500,000, and the lowest is Sudbury North East Ward with an average house price of £182,000.

Across the whole of Babergh and Mid Suffolk, there is a difference of approximately £3,000 in average house prices between areas with below 10% canopy cover, and wards above 10% canopy cover, with the wards above 10% being worth slightly more. This is in line with the expected outcome, however this difference in average price is small. Individually, both Babergh and Mid Suffolk show the opposite trend, where areas with less canopy cover actually have higher average house prices. This difference is very small in Babergh, but in Mid Suffolk it is almost £14,000.

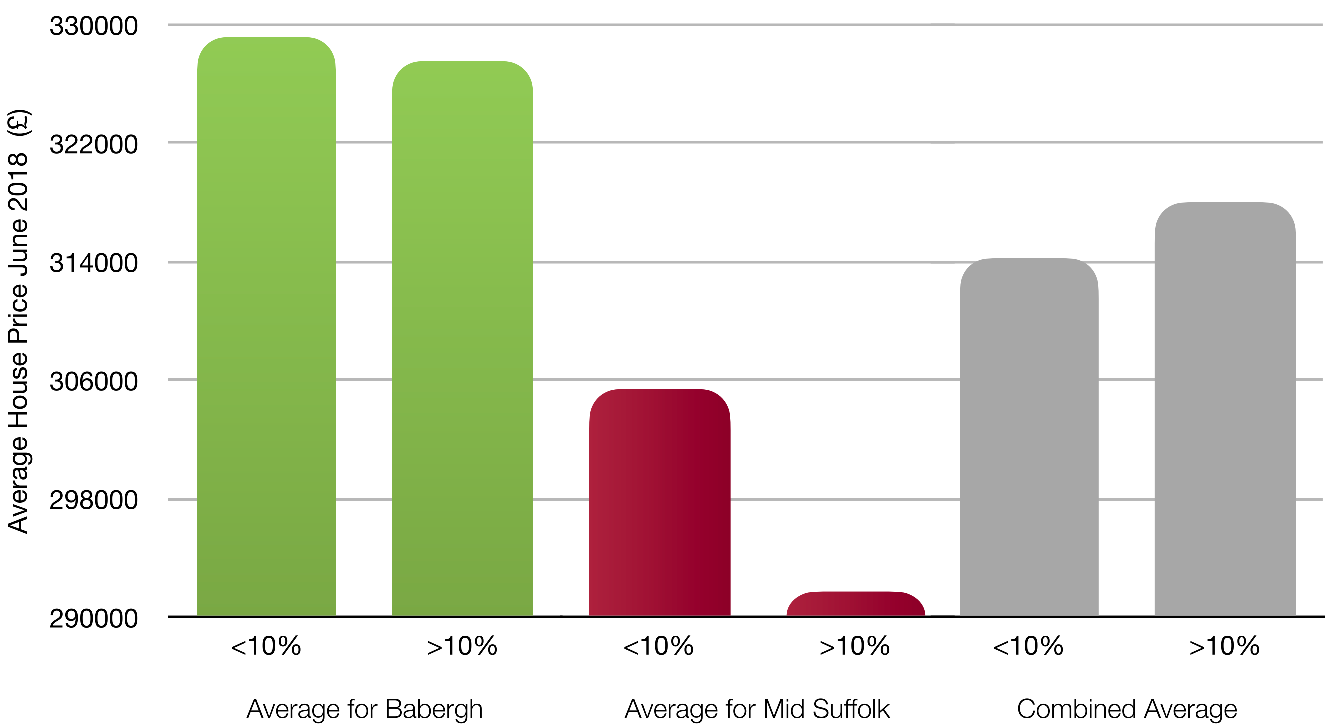


Figure 7: Graph of House Prices by Ward and Canopy Cover

[11] ONS, 2021

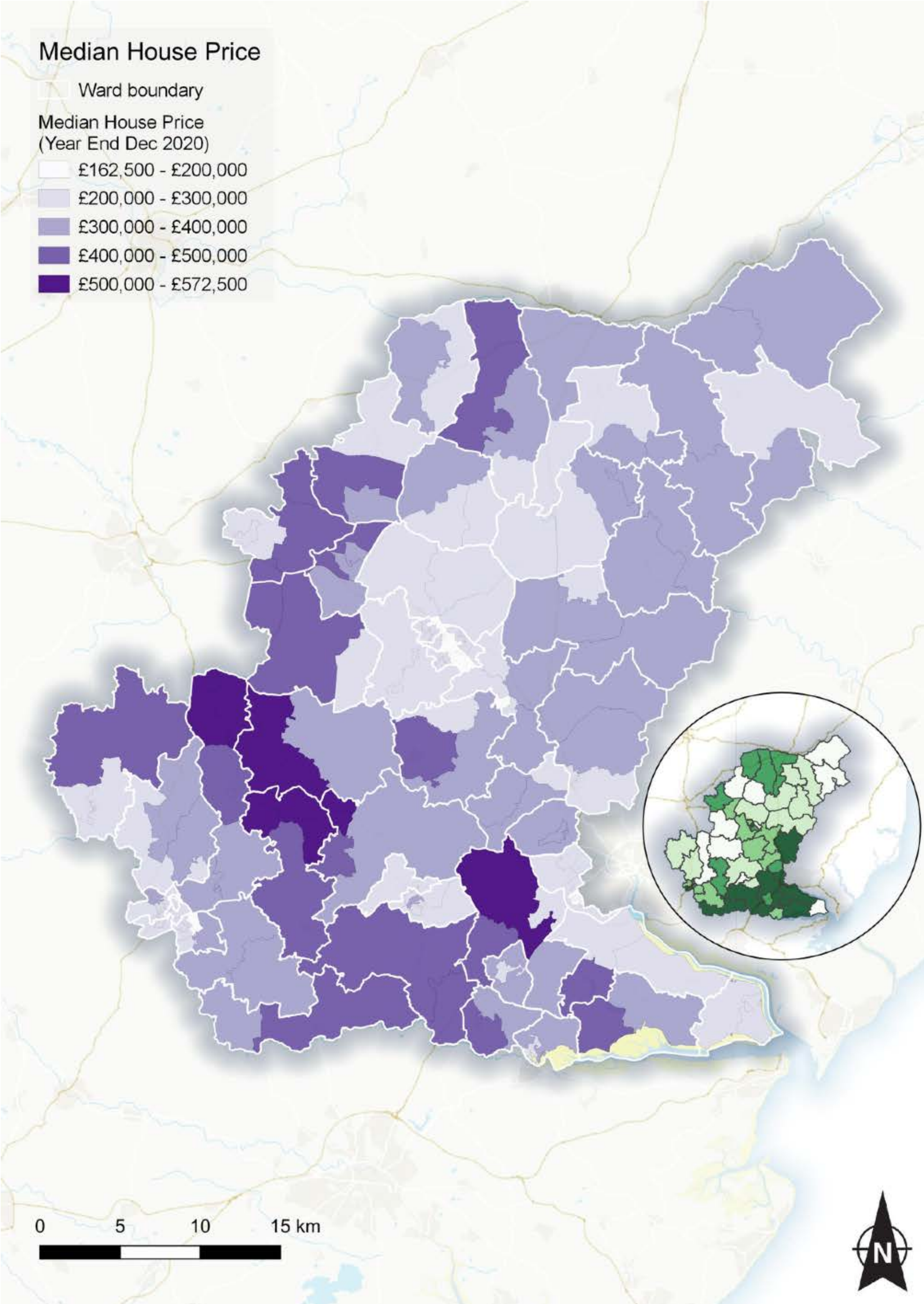


Figure 8: House Prices by Ward and Canopy Cover

4.3 Life Expectancy

Across the whole of Babergh and Mid Suffolk, life expectancy for women is on average 84.5 years for wards with above 10% canopy cover, and 85.4 years in wards with below 10% canopy cover. For males, life expectancy is around 82 years in all wards.[12] These findings for life expectancy contradict the expectation proven by other studies, however there is no significant difference in life expectancy for men in regards to tree canopy cover, and the difference for women is 0.9 years (equivalent to little under 11 months). This is a very small difference and many factors can effect life expectancy.

In Mid Suffolk, differences are more pronounced, with men reaching an average of 80 years in wards over 10% canopy cover, and 82 years in wards under 10% canopy cover. Meanwhile women are expected to exceed 85 years in wards under 10% canopy cover, and little under 84 years in wards over 10% canopy cover.

In Babergh, 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 cover. This statement is also true for the combined area of Babergh and Mid Suffolk.

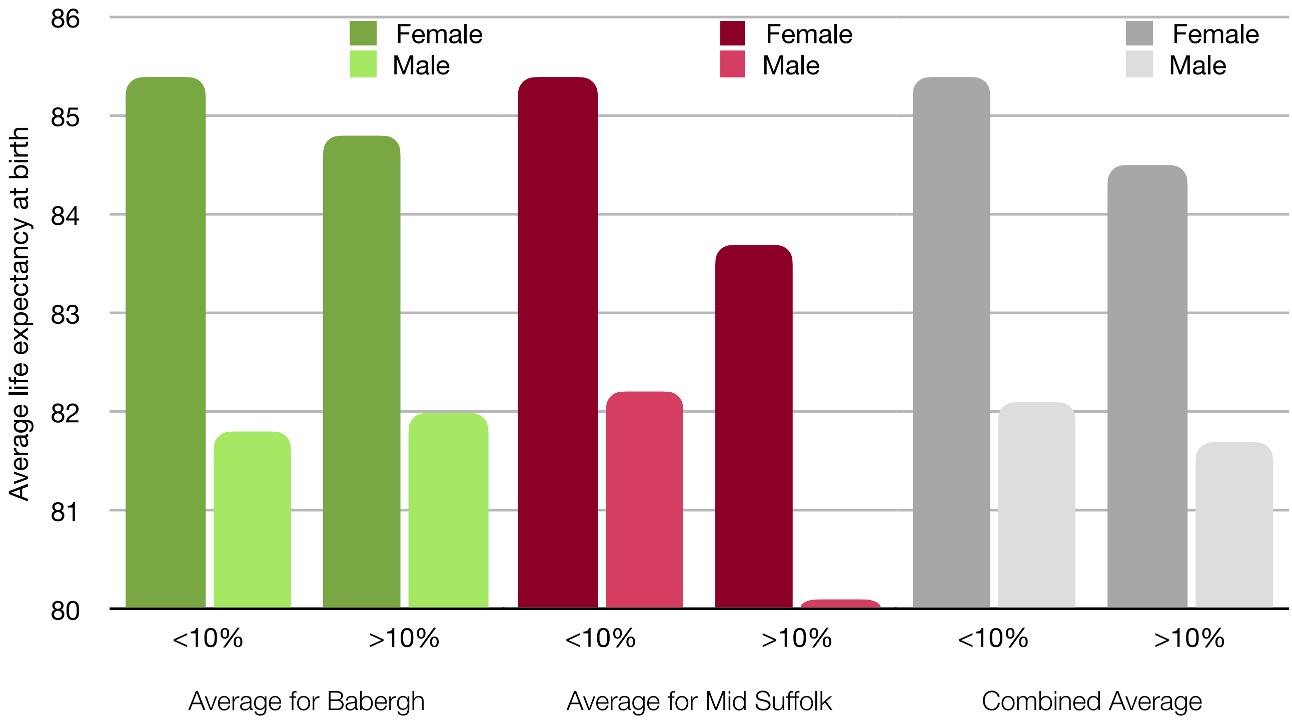
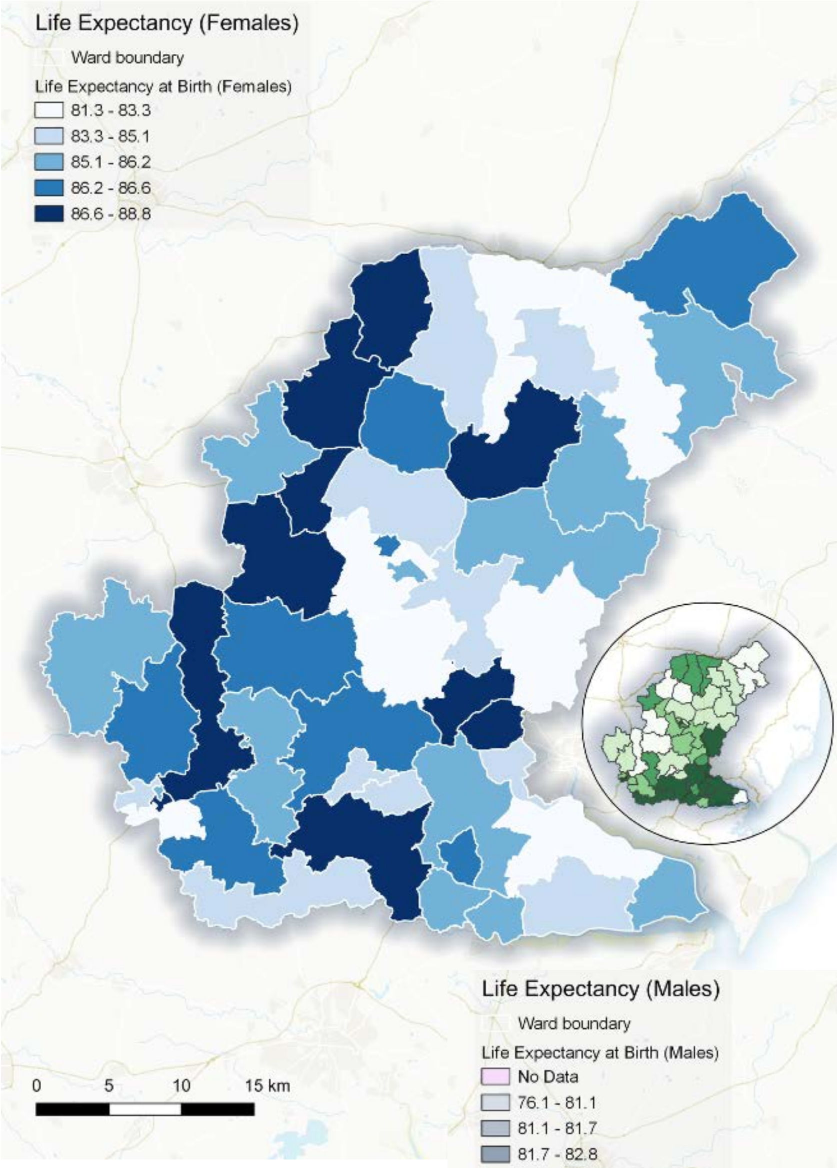


Figure 9: Life Expectancy for Males and Females by Ward and Canopy Cover

[12] Public Health England, 2020



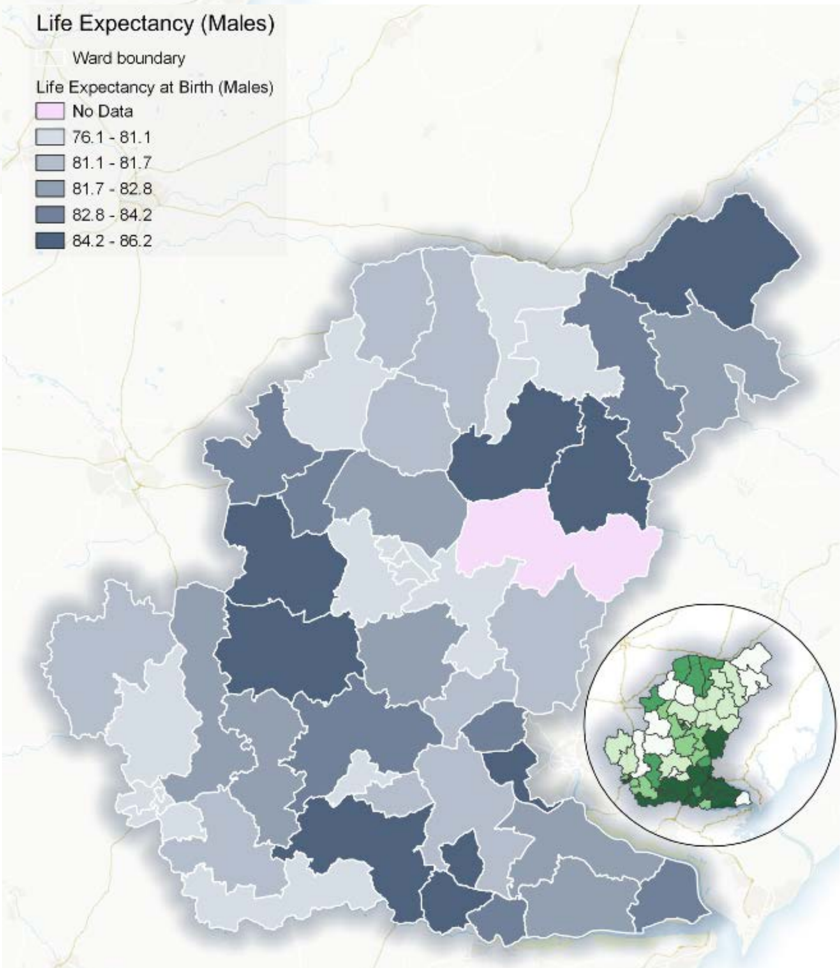


Figure 10: Life Expectancy for Males and Females by Ward and Canopy Cover

4.4 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.[13] Stress is one of the key contributing factors to mental health issues, which access to good quality green spaces can alleviate.[14] 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.[15] This is important because 1 in every 15 deaths in Europe is associated with a lack of physical activity.

Typically, we would expect fewer hospital admissions, particularly of Chronic Obstructive Pulmonary Disease (COPD) in areas with higher canopy cover. It appears however, that the rural setting of Babergh and Mid Suffolk means that this does not hold true across this area overall. However in Mid Suffolk, though all emergency admissions are higher in areas with greater canopy cover, the number of admissions for COPD is marginally lower.

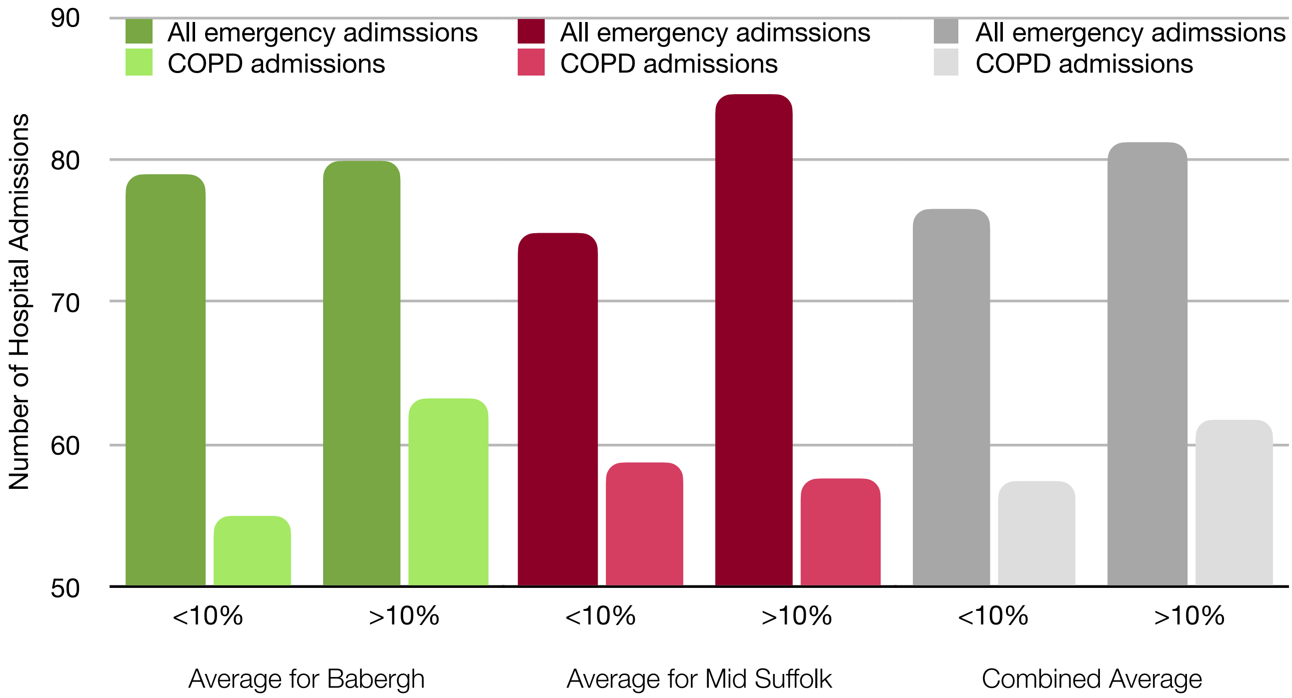
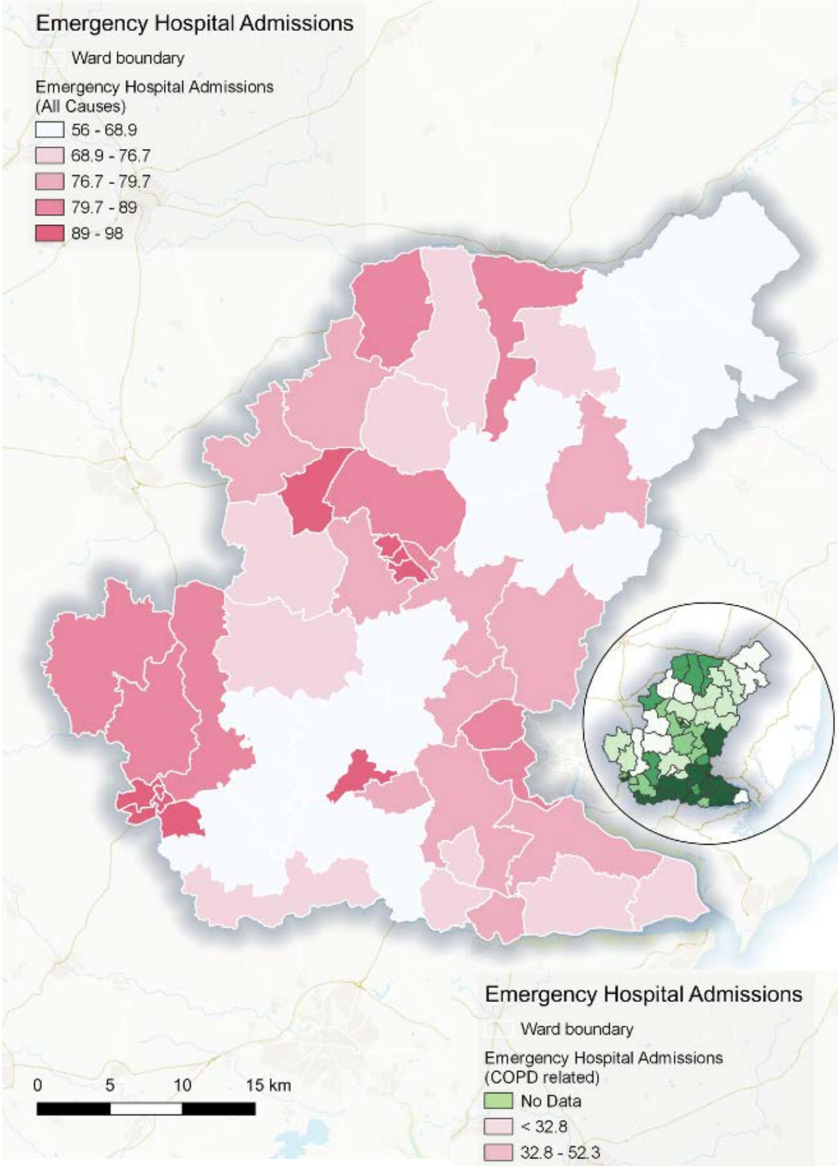


Figure 11: Hospital Admissions by Ward and Canopy Cover

[13] Hartig, 2003

[14] White, 2013

[15] Mitchell & Popham, 2008



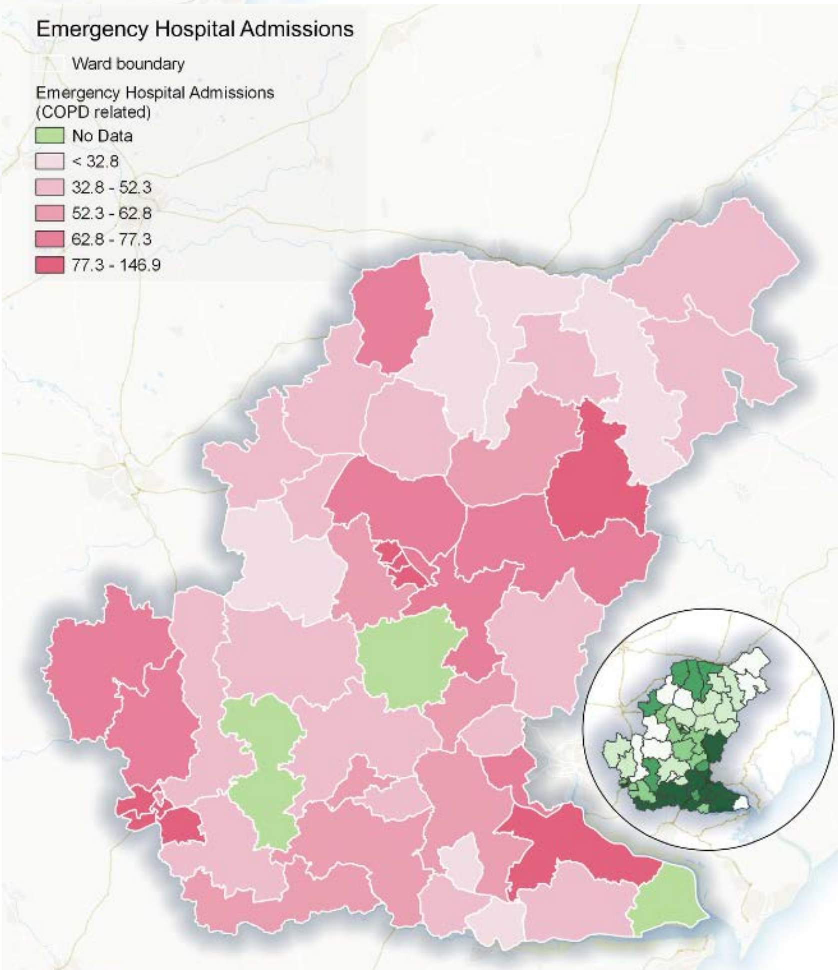


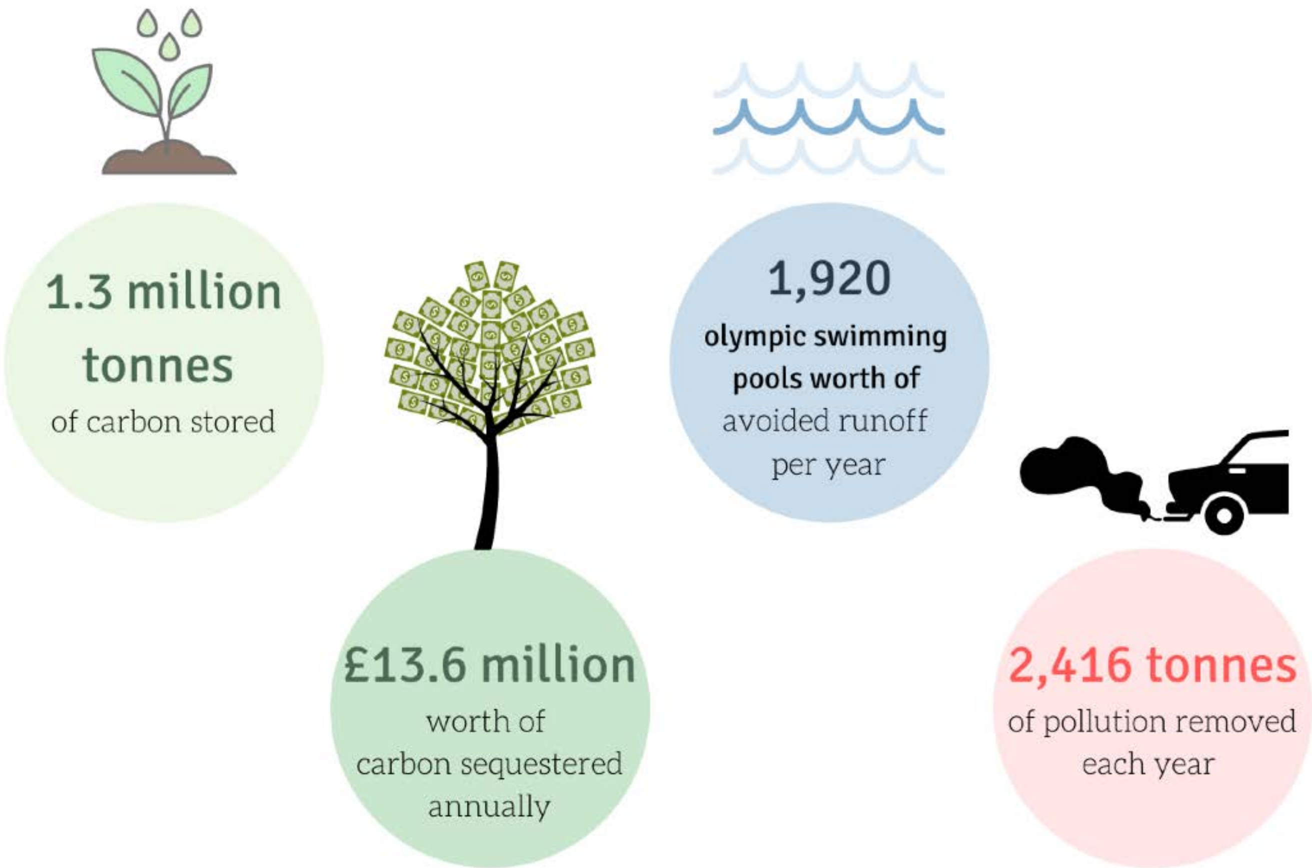
Figure 12: Hospital Admissions by Ward and Canopy Cover

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 (ES) provided by the urban forest of Babergh and Mid Suffolk are estimated using the i-Tree Canopy tool and the canopy cover estimates from the NTM data. As canopy cover estimates from i-Tree Canopy include both trees and shrubs, and therefore differ from those from the NTM data (which only counts trees over 3m high), ecosystem service amounts and values have been adjusted to account for this difference and thus give an overview of the ES provided by the tree cover only. This is a conservative estimate as some services cannot yet be measured accurately.

In total, the trees within Babergh and Mid Suffolk provide an estimated £63,623,000 worth of ecosystem services each year!


1.3 million
tonnes
of carbon stored
£13.6 million
worth of
carbon sequestered
annually
1,920
olympic swimming
pools worth of
avoided runoff
per year
2,416 tonnes
of pollution removed
each year

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.[16] 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 CO_2e as per the UK's central non-traded value for CO_2[17].

Overall, the trees of Babergh and Mid Suffolk store over 1.3 million tonnes of carbon with a value of almost £343 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 of Babergh and Mid Suffolk sequester 53,282 tonnes of carbon ever year. This service is valued at over £13.6 million.

The average newly registered car in the UK produces 228.2g CO_2 per mile, therefore carbon sequestration across the districts corresponds to around 856 million 'new' vehicle miles per year. This is equivalent to the annual carbon emissions of 102,647 cars registered in the UK.[18]

	Babergh		Mid Suffolk		Total	
	Carbon Storage	Annual Carbon Sequestration	Carbon Storage	Annual Carbon Sequestration	Carbon Storage	Annual Carbon Sequestration
Amount (t)	612,000	24,000	723,000	29,000	1,335,000	53,000
Value (£)	£157,000,000	£6,260,000	£186,000,000	£7,417,000	£343,000,000	£13,677,000

Table 5: Carbon storage and sequestration for Babergh and Mid Suffolk

16 Kuhns 2008, Mcpherson 2007

17 Table 3 of the 'Data tables 1 to 19: supporting the toolkit and the guidance'- https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal

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

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.[19] In urban areas, the large extent of impervious surfaces increases the amount of runoff. Trees are very effective at reducing runoff[20] 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 household measured sewerage treatment volumetric charge by Anglian Water is £1.5655/m^3 (2021/22).[21]

Across the whole of Babergh and Mid Suffolk, trees intercept a total of over 4.8 million cubic metres of surface runoff; this is valued at £7.6 million in avoided sewerage charges.

	Babergh	Mid Suffolk	Total
Amount (m^3)	2,337,000	2,513,000	4,850,000
Value (£)	£3,658,000	£3,934,000	£7,592,000

Table 6: Total annual pollutant removal and associated value, by pollutant type for Babergh.

[19] Hirabayashi 2012

[20] Trees in Hard Landscapes (TDAG) 2014

[21] https://www.anglianwater.co.uk/siteassets/household/about-us/customer-charges-scheme-2021-22.pdf

5.3 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.[22] Trees intercept and absorb airborne pollutants on to the leaf surface.[23] Removing pollution from the atmosphere can reduce the risks of respiratory disease and asthma, and thus reduce healthcare costs.[24]

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 across the whole of Babergh and Mid Suffolk filter out a total of 2,400 tonnes of pollutants from the surrounding atmosphere each year - a service worth over £42 million each year!

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. The US costs were used for Ozone and Carbon Monoxide only. Babergh and Mid Suffolk have been classified within the 'Road Transport Urban Large Category' for the purposes of valuation in this study. Values are set as NO_2-£11.738/kg, SO_2-£6.79/kg, PM2.5-£220.12/kg, CO-£0.96/kg, and O_3-£1.06/kg.

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[22] Tiwary *et al.*, 2009

[23] Nowak *et al.*, 2000

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

5.3.1 Pollution Removal in Babergh

Pollutant	Amount (t)	Value (£)
Carbon Monoxide	26	£25,000
Nitrogen Dioxide	201	£2,362,000
Ozone	771	£815,000
Particulate Matter 2.5	78	£17,138,000
Sulphur Dioxide	27	£183,000
Total	1,014	£20,523,000

Table 7: Total annual pollutant removal and associated value, by pollutant type for Babergh.

5.3.2 Pollution Removal in Mid Suffolk

Pollutant	Amount (t)	Value (£)
Carbon Monoxide	28	£26,000
Nitrogen Dioxide	248	£2,906,000
Ozone	923	£976,000
Particulate Matter 2.5	80	£17,698,000
Sulphur Dioxide	33	£225,000
Total	1,312	£21,831,000

Table 8: Total annual pollutant removal and associated value, by pollutant type for Mid Suffolk.

5.3.3 Pollution Removal Across Babergh and Mid Suffolk

Pollutant	Amount (t)	Value (£)
Carbon Monoxide	54	£51,000
Nitrogen Dioxide	449	£5,268,000
Ozone	1,694	£1,791,000
Particulate Matter 2.5	158	£34,836,000
Sulphur Dioxide	60	£408,000
Total	2,415	£42,354,000

Table 9: Total annual pollutant removal and associated value, by pollutant type for Babergh and Mid Suffolk.

6. Conclusions

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

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. Taking this data further in this way can lead to a tree planting strategy, where the most appropriate land can be identified for tree planting and certain areas can be prioritised.

This report highlights much scientific research that supports the assertion that trees provide a wide range of valuable ecosystem services. Whilst the trees across Babergh and Mid Suffolk offer many benefits including cleaner air, reduced stormwater run-off, and over 1 million tonnes of carbon storage, the combined area has the potential to do even more for the environment. **At the moment, total tree canopy cover for the whole area is at 9.4%.**

The average canopy cover across the UK is 16%. Forest Research suggest that 15% tree canopy cover is an appropriate target for coastal areas, and 20% is appropriate for localities outside of coastal areas. This being said, it is also well documented that rural areas in the UK often have lower canopy cover than urban areas as land has been cleared for farming, leaving tree cover mostly confined to hedgerows. Given the location and rural setting of Babergh and Mid Suffolk, and the existing canopy cover of both areas, **it would be suggested that 15% canopy cover is a sensible and attainable target for the area**, though a reasonable time frame for achieving this should be set. The 20% target should be a longer term aspiration for the area, in particular within the more built up areas.

Raising canopy cover to 15% would vastly improve the area, not only in terms of the aforementioned ecosystem services, but also by providing habitats and improving biodiversity, improving soil health, providing mental and physical wellbeing benefits to local people, improving the amenity of the area, and much more.

In some areas in both Babergh and Mid Suffolk, this canopy cover target may seem like a big task, but identifying the areas most at need will help to structure the development of an ambitious tree strategy including not only tree planting, but also the management and maintenance of this resource. A Tree Planting Strategy could be a useful tool for identifying areas where tree canopy can make the most impact and the best places to begin.

Contrary to the vast majority of studies, higher tree canopy cover does not correlate to lower levels of deprivation in the area, and both hospital admissions and life expectancy show little (or essentially no) correlation in Babergh and Mid Suffolk. This indicates that tree cover is not a primary factor in deprivation across Babergh and Mid Suffolk. Though this is not in line with some previous studies, it is not unusual for a rural area, and these quality of life indicators are often more useful as a metric across smaller communities or within more urban regions.

The rural setting of this area provides unique challenges, and though space may be more readily available in the countryside, often urban and peri-urban areas benefit more from improved tree cover. In towns and cities more people mean more pollution, higher stress levels and more enclosed landscapes. Urban trees, in particular street trees and those in parks can have the most effect on the lives of residents and visitors alike. This should be a key consideration going forward.

Babergh's urban forest covers 10.4% of the total area, and ranges quite significantly from 5.5% In Lavenham to 19% in Orwell. Lavenham and Ganges are the wards with the least canopy cover in Babergh, and improvements in canopy cover would be most noticeable in these areas. Ganges has an additional challenge of being close to the sea where salt in the air, soil and ground water can be an additional stress to the trees. Also high winds can cause small trees to fail, and large trees to drop branches which also reduces canopy cover. Here, species selection and a management plan will be a vital tool to ensure that new plantings survive to maturity. In Lavenham, improving hedgerows and woodlands would be incredibly beneficial, protecting the soil from erosion both by wind and rainwater runoff, rejuvenating top-soils with leaf fall each year, and providing valuable habitat for pollinator species.

Across Mid Suffolk canopy cover is 8.5%, and ranges from 6% in Stow Thorney to 12.8% in Claydon & Barham. This is lower than Babergh and almost half the UK average for canopy cover (16%). Mid Suffolk is a far larger area than Babergh however, and the ecosystem services provided by the trees in this area are higher, providing £31.2 million worth of annual benefits to Babergh's £28.6 million. Raising canopy cover to the recommended target of 15% will be challenging, however with the right strategy it is certainly achievable. Stow Thorny is a small ward, containing the North-East part of the town of Stowmarket and a portion of rural working land. Almost all of the trees here are in the town area, and many are within private gardens. Increasing the council-owned tree stock, particularly along highways could make a significant impact on the overall ward canopy cover.

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

Appendix I. Methodology

GIS Analysis

GIS Project boundaries of Babergh and Mid Suffolk and the individual wards were provided by Babergh and Mid Suffolk Councils. Additional background mapping data were obtained from various open source web portals, referenced on the maps.

Tree canopy cover within Babergh and Mid Suffolk was assessed using the Blue Sky National Tree Map. This data provides polygons of the canopy across Babergh and Mid Suffolk 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.

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. It's 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, random points were surveyed in each ward across Babergh and Mid Suffolk to assess the presence of trees and shrubs. The number of points surveyed depended on how many points were necessary to achieve a satisfactory standard error for canopy cover in each ward.

For each of the 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,
Non-Tree	All other land cover types which are not tree or shrub cover.	Grass, herbaceous borders, scrubland, soil, bare ground, sand, agricultural land, any and all buildings, industrial land, railway/ transportation networks including roads, exposed rock, and any other surfaces classed as impervious, sea, river, lakes and ponds.

Table 10: 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].

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 11: 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).

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

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