



Wycombe District Canopy Cover Assessment

Final draft



The authors

Jessica Goodenough – Green infrastructure researcher with Treeconomics

Phillip Handley – GIS specialist at Forest Research

Kenton Rogers – Forestry consultant and founder of Treeconomics

Philip Simpkin – Natural environment officer at Wycombe District Council

Executive summary

This study estimates tree canopy cover in Wycombe District using the Bluesky National Tree Map dataset. Estimates of canopy cover for each ward, as well as the district total were calculated. The results provide a snapshot of the current tree canopy cover and a baseline for comparison with future surveys.

The study also looked at other statistics from the Office for National Statistics (ONS) and reviewed other available sources of geographical data on human health, wellbeing and other societal factors (such as crime rates, house prices, social deprivation and life expectancy) in order to compare tree canopy cover with these data to observe if there was any correlation with tree canopy cover.

The canopy cover of Wycombe District is estimated at 25 percent and the canopy cover of the main urban areas within the district is as follows.

| Urban Area | % Canopy Coverage |
|--|-------------------|
| Princes Risborough | 13.74% |
| Stokenchurch | 16.76% |
| Walter's Ash/Naphill | 21.01% |
| Speen | 26.57% |
| Green End | 17.31% |
| Bledlow Ridge | 18.65% |
| Loosley Row | 16.01% |
| Longwick | 10.76% |
| Lane End | 12.40% |
| Marlow | 18.36% |
| Medmenham | 25.85% |
| High Wycombe Urban Area (Bourne End / Flackwell Heath, Great Kingshill, Hazlemere / Tylers Green and High Wycombe) | 19.39% |
| Hazlemere/Tylers Green | 24.90% |
| High Wycombe | 18.20% |
| Bourne End/Flackwell Heath | 19.49% |
| Great Kingshill | 17.63% |
| Hughenden Valley | 18.26% |

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Introduction

Background

Measuring tree cover has helped city planners, urban foresters and communities see trees and forests in a new way, focusing attention on green infrastructure as a key component of community planning, sustainability and resilience. It is an easy-to-understand concept that is useful in communicating messages about our urban forests with the public, policy makers and other stakeholders.

The importance of vegetation in urban areas has long been recognised (e.g. Oke, 1982, Huang et al., 1987, Nowak et al., 2010). For example, vegetation provides shading, evaporative cooling and rainwater interception (Gill et al., 2007). It has a strong influence on a number of factors including energy demand, air quality and noise pollution, biodiversity, mitigation of the urban heat island effect, human health and wellbeing.

Canopy cover assessments help to observe change over time at a relatively low cost in comparison to ground surveys. Quantifying tree canopy cover has been identified by many authors (Britt and Johnston, 2008; Escobedo and Nowak, 2009; Schwab, 2009) to be one of the first steps in the management of the urban forest.

“The first step in reincorporating green infrastructure into a community’s planning framework is to measure urban forest canopy and set canopy goals.” James Schwab

Canopy cover, which is often also referred to as tree canopy cover, urban tree 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. Canopy cover is a two dimensional metric, indicating the spread of canopy cover across an area. It is not to be confused with leaf area index (LAI), which is a measure of the number of layers of leaves per unit area of ground (although canopy cover studies can be used to estimate LAI).

Policy drivers

National policy drivers

The National Planning Policy Framework (NPPF) only mentions ‘trees’ in the context of ‘aged or veteran trees’ in paragraph 118. However, Trees and urban tree cover are implicitly linked to other key concepts that are emphasised and highlighted within the framework. Sustainability, ecosystem services and green infrastructure are all dependant on the significant contribution that trees in the urban forest make.

The ministerial foreword to this policy is particularly relevant:

“Sustainable means ensuring that better lives for ourselves doesn’t mean worse lives for future generations.”

“Our natural environment is essential to our wellbeing, and it can be better looked after than it has been.”

“Our standards of design can be so much higher.”

“Planning must be a creative exercise in finding ways to enhance and improve the places in which we live our lives.”

Of the 13 sections in the NPPF trees are able to contribute to meeting the objectives of 11 of them.

Trees, and the benefits which they provide are crucial to securing economic, social and environmental sustainable development - NPPF Introduction Paragraph 7. Trees also contribute to positive improvements in the quality of built and natural environment, Paragraph 9.

Increased tree cover can increase economic growth (Rolls and Sunderland, 2014) and prosperity as leafier environments improve consumer spending¹. Additionally, businesses are prepared to pay greater ground rents², also associated with higher paid earners who are also more productive (Kaplan, 1993; Wolf, 1998), house prices increase³, crime is reduced⁴ thereby (Section 1) Building a strong, competitive economy, (paragraph 18). This is also directly linked to (Section 2) Ensuring the vitality of town centres; and trees also contribute to (Section 3) Supporting a prosperous rural economy, through the provision of non woody forest products, wood fuel and timber.

Trees also improve journey quality (Davies et al., 2014) (Section 4 Promoting sustainable transport) and can encourage use of alternative transport corridors such as pavements and cycleways (Trees and Design Action Group, 2014). Additionally, trees near road networks absorb pollution and airborne particulates (Escobedo and Nowak, 2009), reduce noise (Van Renterghem, 2014; Van Renterghem et al., 2012) and lower traffic speeds (Mok et al., 2003) (paragraphs 34,35,37,38).

Trees improve property prices (Section 6 Delivering a wide choice of high quality homes) and also provide a positive contribution to good design (Section 7 Requiring good design) by positively making places better for people (paragraphs 56, 57), trees not only contribute to 'attractive' and 'comfortable' streetscapes (or tree-scapes) but also are an asset which appreciates, delivering even greater benefits as they grow, adding to the quality of the area in over and above the lifetime of the development (paragraphs 58, 63) . They are essential to the 'incorporation of green and other public space' and the 'Integration of new development into the natural, built and historic environment' (paragraph 61). Increases in tree cover have even been shown to reduce crime⁵ therefore helping to 'create safe and accessible environments' (paragraph 69), which are also 'visually attractive' (paragraphs 58, 59).

Trees (Section 8) Promote healthy environments. There is a growing body of research that shows people are happier in leafier environments: hospital recovery times (Ulrich, 1984) and stress (Korpela et al., 2008; Hauru et al., 2012) are reduced and birth weights are increased (Donovan et al., 2011), meaning fewer health issues later in life (paragraph 69). Conversely, when tree cover is reduced asthma rates and respiratory problems often increase. Trees thereby promote healthy communities⁶. They also provide a cultural link to the wider environment (paragraph 70) and act as a focal point for shared space and can frame high quality open space (paragraph 73).

In Protecting Greenbelt (Section 9) trees enhance biodiversity by providing habitat (paragraph 81) and places of recreation (paragraph 92).

Trees are fundamental to strategies which aim to help Meet the challenge of climate change, and flooding (Section 10). Trees reduce stormwater runoff by attenuating precipitation in their canopies (Thomas and Nisbet, 2007; Nisbet and Thomas, 2006) and also reduce peak summer temperatures in both the urban and wider environment by several degrees (Doick and Hutchings, 2012), thereby 'minimising vulnerability and providing resilience to the impacts of climate change, and supporting the delivery of renewable and low carbon energy and associated infrastructure' (paragraph 93).

Additionally, "local planning authorities should adopt proactive strategies to mitigate and adapt to climate change, taking full account of flood risk, coastal change and water supply and demand considerations (98) the plans should also take account of climate change over the longer term, including factors such as flood risk, coastal change, water supply and changes to biodiversity and landscape" (99).

¹ Shoppers claim that they will spend 9% to 12% more for goods and services in central business districts having high quality tree canopy (Wolf, 2005).

² 7% higher rental rates are achievable for commercial offices having high quality treescapes (Laverne and Winson-Geideman, 2003).

³ The presence of larger trees in gardens and as street trees adds from 3% to 15% to home values (Wolf, 2007).

⁴ Public housing residents with nearby trees and natural landscapes reported 25% fewer acts of domestic aggression and violence (Kuo and Sullivan, 2001a). Public housing buildings with greater amounts of vegetation had 52% fewer total crimes, 48% fewer property crimes, and 56% fewer violent crimes than buildings with low amounts of vegetation (Kuo and Sullivan, 2001b).

⁵ A 10% increase in trees roughly equals a 12% decrease in crime (Troy, 2012).

⁶ See <http://depts.washington.edu/hhwb/> for international peer reviewed research on this topic.

New development should be planned to avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure (GI) - this means trees, often the single largest component of GI.

Perhaps most commonly understood are trees' ability to conserve and enhance the natural environment (Section 11). Specifically, in Section 114 of the NPPF it states that local planning authorities should "set out a strategic approach in their Local Plans, planning positively for the creation, protection, enhancement and management of networks of biodiversity and green infrastructure".

A key reason for using tree canopy cover as a tool to maintain and enhance tree cover over Wycombe District and within individual developments is that it offers a means by which improvements and "opportunities to incorporate biodiversity in and around developments should be encouraged (118)"; it can be monitored and measured (113, 114). This is because you cannot manage what you have not measured (117).

As well as providing economic benefit previously planted trees provide a cultural link to the past (Section 12 Conserving and enhancing the historic environment) and protect and enhance valued landscapes (109, 126, 128).

The Government attaches great importance to the design of the built environment. Trees make good design and good design is a key aspect of sustainable development, is indivisible from good planning, and should contribute positively to making places better for people.

Regardless of any other 'external drivers', under the current legislation (TCPA Act), LPAs have a statutory duty to consider the protection and planting of trees when granting planning permission for proposed development. The potential effect of development on trees, whether statutorily protected (e.g. by a tree preservation order or by their inclusion within a conservation area) or not, is a material consideration that must be taken into account when dealing with planning applications.

In order to exercise that duty adequately, LPAs need to have an understanding of the existing tree resource so that they can make an informed judgement about what might be needed/appropriate, in terms of tree impact, from developments.

Other planning policy drivers

The 'Government Forestry and Woodlands Policy Statement'⁷ is the latest government statement which covers trees, and it makes it clear that 'We want to see more trees and woodlands in and around our towns and cities.'

Local policy drivers

The NPPF has Sustainable development at its heart. Setting this National standard within Local planning policy is supported by paragraph 152 of the NPPF.

In the context of local planning policy, there is less which has been produced locally which can be referenced, as a large proportion of High Wycombe's local planning policy is being superseded by the new Local Plan which is currently being written.

In line with the National Planning Policy Framework, Wycombe District Council is producing new planning policies which set the local context for making planning decisions and will influence the way in which the district develops economically, socially and environmentally. Trees provide a large number of benefits wherever they are found and as such they form a central role in the delivery of Green Infrastructure benefits. In new developments it is important to both retain existing trees which are of a suitable quality and also incorporate new trees which can grow successfully to provide the new urban forest. The aspiration to achieve a good level of tree canopy cover can only be ensured through planning policies which require a quantifiable level of canopy cover. This document (report or paper) can be considered as evidence which supports a canopy cover policy for new developments.

⁷ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/221023/pb13871-forestry-policy-statement.pdf

Tree retention in development

Site developers may argue that tree protection costs are prohibitive. Understanding potential market values in different forest conditions is an important step in understanding the economics of urban forest protection.

Generally, trees and forest cover in development growth areas add value. One study found that development costs were 5.5% greater for plots where trees were conserved (Hardie and Nickerson, 2004). Given increased plot and home valuations, builders have reported that they were able to recover the extra costs of preserving trees through a higher sales price for a house, and that homes on wooded lots sell sooner than homes on unwooded lots (Seila and Anderson, 1998).

Parks and open space

Over 30 studies⁸ have shown that people are willing to pay more for a property located close to an urban open space than for a house that does not offer this amenity, a finding known as the “proximate principle” (Crompton, 2001a). The studies evaluate the effects of parks and open spaces that usually contain trees and forests.

| Price Increase | Condition |
|----------------|---|
| 10% | Inner city home located within 1/4 mile of a park |
| 10% | House 2 to 3 blocks from a heavily used, active recreation park |
| 17% | Home near cleaned-up vacant lot |
| 20% | Home adjacent to or fronting a passive park area |
| 32% | Residential development adjacent to greenbelts |

Studies find that homes adjacent to naturalistic parks and open spaces are typically valued at about 8% to 20% higher than comparable properties (Crompton, 2001b).

Values show a linear decline with distance from the edge of an open space, with a positive price effect declining to near zero at about 1/2 mile away (Hammer et al., 1974; Tyrväinen and Miettinen, 2000; More et al., 1988). Other factors affecting property values include usage rate (more park users = lower property values), user activity (athletic fields and games = lower property values up to 150 metres away), and care and upkeep (lower maintenance = lower property values). For instance, the values of properties close to heavily used or unkept parks are typically lower than similar properties farther away.

Objectives

This report aims to provide a snapshot of Wycombe District’s canopy cover, to enable its protection and enhancement in the future. The “what gets measured gets managed” adage indeed applies to the urban forest. By providing a baseline for Wycombe District’s canopy cover, this report paves the way for evidence-based planting and protection strategies by enabling the setting of measurable targets.

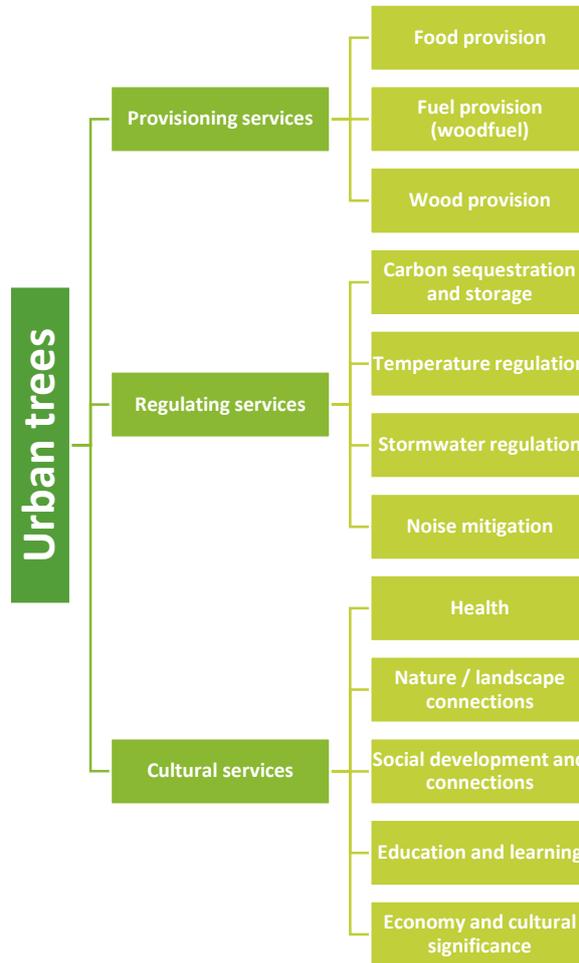
Furthermore, the study wanted to find out if there were correlations between tree canopy cover and human health and wellbeing by comparing with geographically explicit averrable data from the ONS and other sources.

The data presented here will hopefully inform tree management policies, so that the residents and visitors of Wycombe District can continue to enjoy the benefits of urban trees and that the district can build resilience to climate change.

⁸ https://depts.washington.edu/hhwb/Thm_Economics.html

Background to the role of trees in cities

Green infrastructure can deliver significant benefits to urban areas. Trees in particular can provide a wide range of benefits (or ecosystem services) such as storing carbon, reducing the urban heat island effect and improving air quality. Understanding the value of the Wycombe District’s green infrastructure can inform decisions that will improve human health and environmental quality. The following summary of ecosystem services provided by urban trees is based upon Davies et al. (2016) which should be referred to for more detailed information on each service.



Provisioning services

Food provision

Urban forests are regarded primarily as service providers rather than as sources of goods, however, trees and woodlands provide humans with food resources both directly (e.g. fruits, berries and nuts that are produced by the trees themselves) and indirectly (e.g. mushrooms and deer that reside in woodland habitats).

Fuel provision (woodfuel)

Woody biomass is the accumulated mass, above and below ground, of the roots, wood, bark, and leaves of living and dead trees and woody shrubs. Through the processes of harvesting and combustion, woody biomass can be used as a source of heat, electricity, biofuel and biochemicals.

Wood provision

Trees can provide timber for construction, veneers and flooring, as well as wood chip and pulp for boards and paper.

Regulating services

Carbon sequestration and storage

Trees act as a sink for carbon dioxide (CO₂) by fixing carbon during photosynthesis and storing excess carbon as biomass. CO₂ sequestration refers to the annual rate of CO₂ storage in above- and below-ground biomass. Increasing the number of trees can therefore slow the accumulation of atmospheric carbon, a contributor to climate change.

Temperature regulation

Trees are not only good reflectors of short-wave radiation, but their canopies also shade low albedo surfaces that would otherwise absorb such radiation, reducing surface temperatures and convective heat. Trees also reduce warming of the local environment through the process of evapotranspiration where the evaporation of water from leaf surfaces, solar energy is converted into latent rather than sensible heat, thus 'cooling' the surrounding air and improving human thermal comfort.

Stormwater regulation

Urban trees and woodlands regulate stormwater by intercepting and storing rainfall on their leaves, which either subsequently evaporates, or reaches the groundwater more slowly through gradual release as throughfall. Trees also improve infiltration into the soil by channelling water onto pervious surfaces around the trunk, and through the soil along root channels.

Air purification

Trees remove air pollutants from the atmosphere mainly through dry deposition, a mechanism by which gaseous and particulate pollutants are captured, and transported to plants that absorb them through their leaves, branches and stems.

Noise mitigation

Urban areas can be a source of unwanted sound, for example road noise. Trees can mitigate urban noise through the scattering and absorption of (typically mid to high frequency) sound waves by the leaves, branches and trunks, thus obstructing the pathway between the noise and the receiver.

Cultural services

Health

By providing a setting where the activities can take place, the urban forest can support physical activities such as walking, running and cycling, and relaxing activities such as bird watching, reading or having a picnic; thus encouraging physical well-being, mental restoration, escape and freedom, and enjoyment and fun.

Nature / landscape connections

Benefits arise from visual aspects of an ecosystem, e.g. trees and woodland can obscure unsightly structures, as well as other senses such as the smell of honeysuckle or the sound of birdsong. People can gain a sense of place from their local or favourite woodland, whilst physical interactions with trees such as fruit picking or conservation volunteering can add to feelings of connection with nature.

Social development and connections

Activities undertaken within woodlands and parks can strengthen existing social relationships, while organised activities within treed environments can create the opportunity for new relationships, including people's involvement with volunteer groups and community forests (known as social capital).

Education and learning

This category includes personal development for people of all ages, gained through informal learning, such as parents teaching their children tree names or where wood and paper comes from, and formal education via

approaches such as Forest School (O'Brien, 2009). Learning can also take place through activities such as volunteering, apprenticeships, and play for children.

Economy and cultural significance

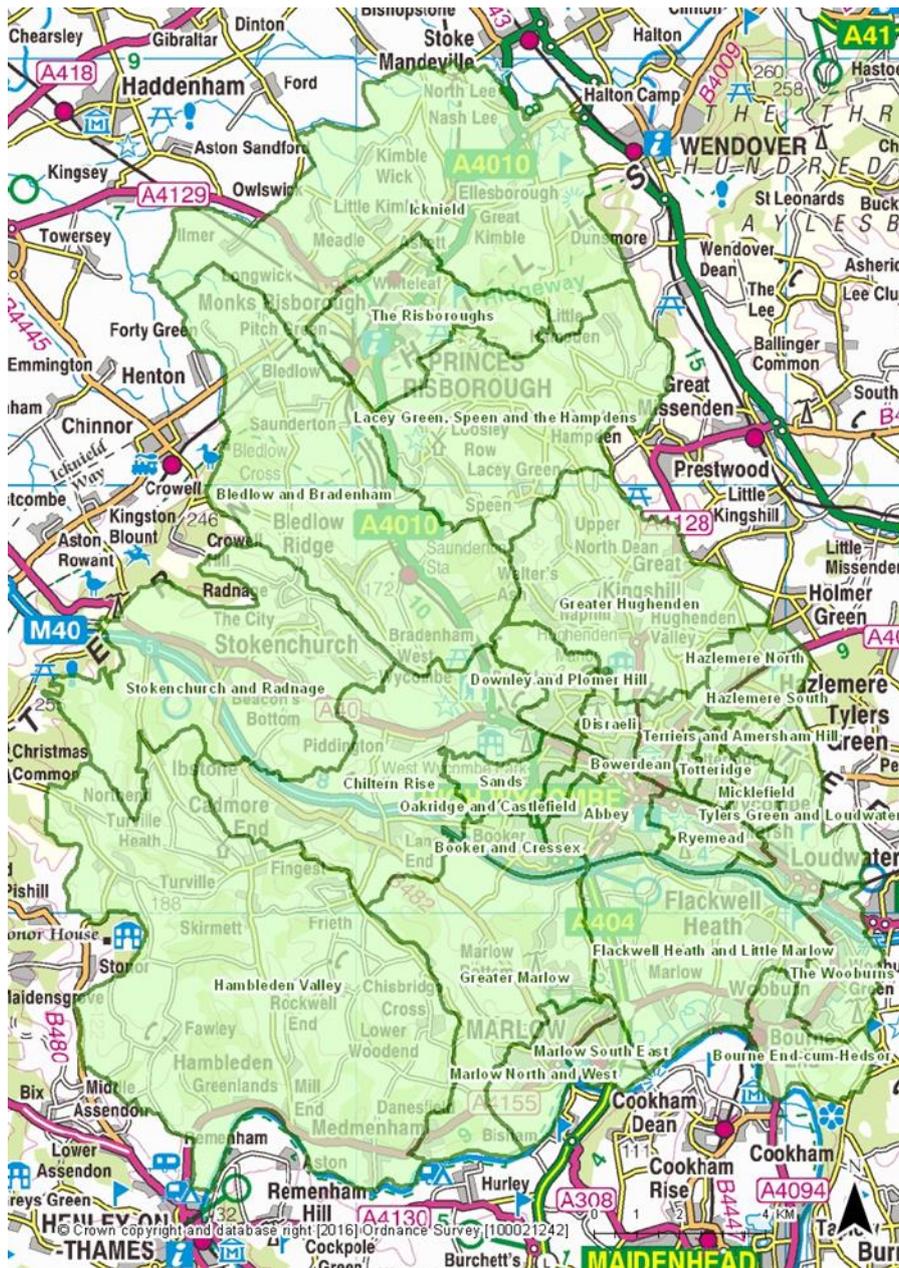
The urban forest can contribute to the economy by encouraging inward investment, boosting tourism, providing a setting for recreation industries such as climbing and paintballing, and by enabling environmental cost savings (EFTEC, 2013). The urban forest can also contribute directly to the economy through the generation of new employment, such as arboricultural consultants and tree surgeons, and to a lesser extent, through the provision of food, fuel or wood products.

Data analysis

Methodology

Bluesky National Tree Map was used to interpret aerial images across Wycombe District. The overall picture was built up by analysing the 28 wards (see figure 1) that make up Wycombe District. Additional administrative boundaries were used in the study to match the level at which the statistics were published. The amount of canopy in each area was calculated on a pro rata basis, i.e. where an individual tree has canopy in two administrative boundaries that canopy is assigned to the boundary into which it falls. This analysis allowed direct comparison with the published statistics. Where statistics were aggregated, statistics were calculated by area on a pro rata basis. All analysis was completed using ArcGIS 10.2 for desktop.

Figure 1: Wycombe District wards



The point locations of each tree in the ProximiTREE 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.

More information about the Bluesky National Tree Map can be found in Appendix 1.

Datasets used in the analysis

| Use | Description | Source |
|--------------|---|--|
| Canopy cover | National Tree Map | Bluesky |
| Boundary | Ward boundary | OS Boundary Line Data |
| Boundary | Parish boundary | OS Boundary Line Data |
| Boundary | Postcode areas | OS Boundary Line Data |
| Boundary | Lower Super Output Areas (LSOA) boundary | Census 2011 - Lower Super Output Areas (LSOA) |
| Boundary | Middle Super Output Areas (MSOA) boundary | Census 2011 - Middle Super Output Areas (MSOA) |
| Boundary | Urban areas | Census 2001 |
| Boundary | Wycombe's conservation areas | Wycombe District Council |
| Boundary | Wycombe's grass cutting areas | Wycombe District Council |
| Boundary | Land Owned by Red Kite | Wycombe District Council |
| Boundary | land owned by Wycombe District Council | Wycombe District Council |
| Boundary | Wycombe's open spaces areas | Wycombe District Council |
| Boundary | Wycombe's town centres | Wycombe District Council |
| Land Use | OS Master Map | Ordnance Survey |
| Statistics | Police Crime data | data.police.uk |
| Statistics | Index of Multiple Deprivation | Index of Multiple Deprivation |
| Statistics | Neighbourhood statistics in England: academic year 2013 to 2014 | Office for National Statistics |
| Statistics | House Price Statistics for Small Areas (1995–2013) | Office for National Statistics |
| Statistics | Subnational Health Expectancies | Office for National Statistics |
| Statistics | NHS health statistics | Public Health England |

Results

The average canopy cover across Wycombe District was estimated at 25%⁹. However, this value ranges from 9% in the Oakridge and Castlefield ward (to the west of the town centre) to 41% in the Downley and Plomer Hill ward, a largely residential ward to the north-east of High Wycombe (figure 2).

Figure 2: Canopy cover by ward

⁹ For comparisons with other UK cities, see Appendix 2

Interpretation of the results: correlations observed in Wycombe District

This section compares canopy cover with various quality of life indicators for Wycombe District. These are shown for the smallest geographical level that the data is produced at, in this case Middle layer Super Output Areas (MSOA) and Lower layer Super Output Areas (LSOA). Output Areas are built from clusters of adjacent unit postcodes. They were designed to have similar population sizes and to be as socially homogenous as possible based on tenure of household and dwelling type.

For the first chart of each indicator, we have grouped the Output Areas that possess less than 25% canopy cover and those that possess a canopy cover equal or greater than 25%. What the charts show are not necessarily causations or even clear correlations, however it seems that areas with higher tree canopy generally perform well on other indicators (e.g. are less “deprived”).

For some indicators, we have chosen to also display the data as a box-whisker plot. A box-whisker plot is a standard method to describe a dataset's distribution. The data's median is represented by the box's central line, with the bottom and top of the box showing the first and third quartile respectively. The lines, or whiskers, extending from the box represent maximum and minimum values; any outliers are shown as hollow circles. The mean value is displayed as a black diamond. The first box-whisker plot represents the whole dataset; “open spaces Removed” is where the open space has been removed before calculating tree canopy.

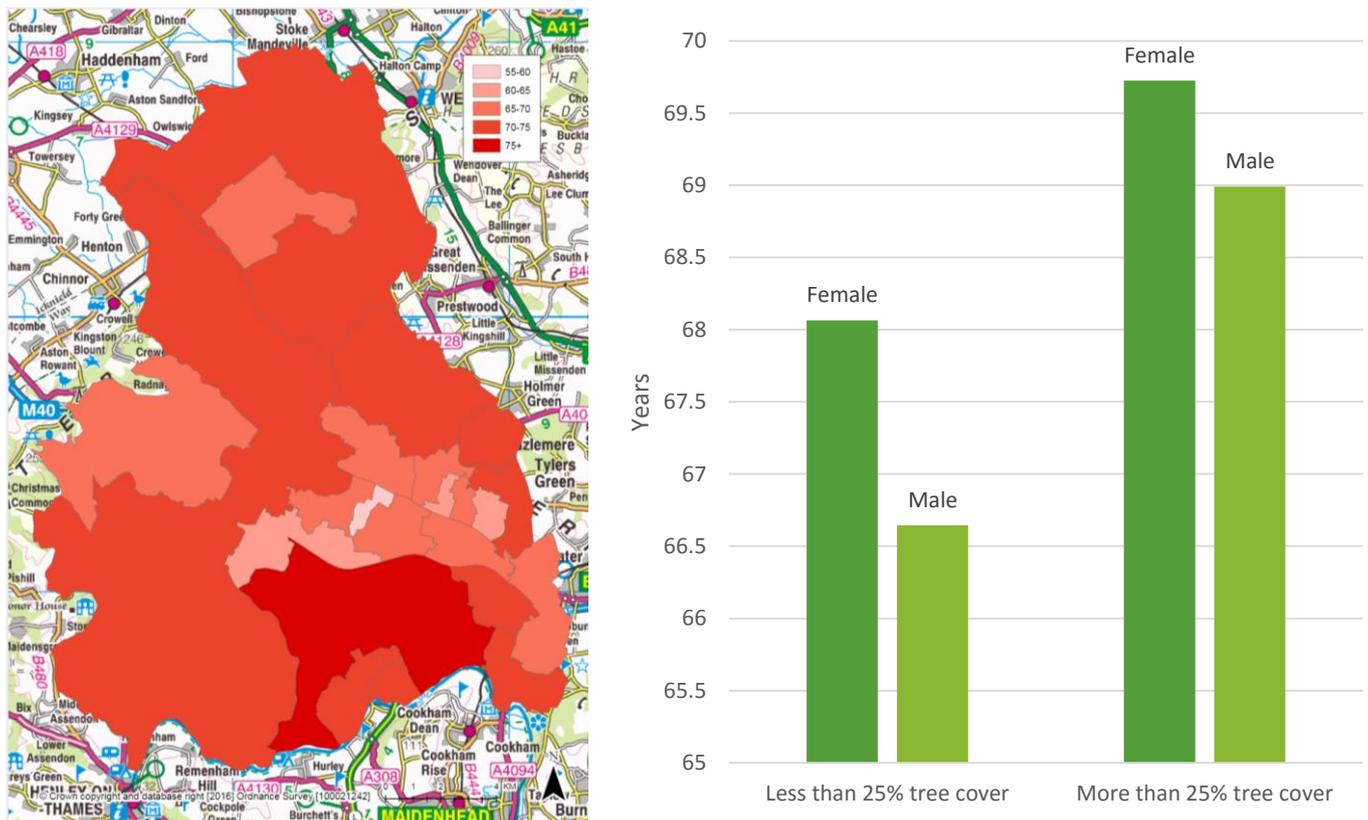
At MSOA scale

Healthy life expectancy

As life expectancy continues to increase, it is important to measure what proportion of these additional years of life are being spent in favourable states of health or in poor health and dependency. Healthy life expectancy (HLE) helps us to address this question by adding a dimension of quality of life to estimates of life expectancy.

HLE estimates the average number of years a person would live in ‘Very good’ or ‘Good’ health if he or she experienced the specified population’s particular age-specific mortality and health status for that time period throughout the rest of his or her life.

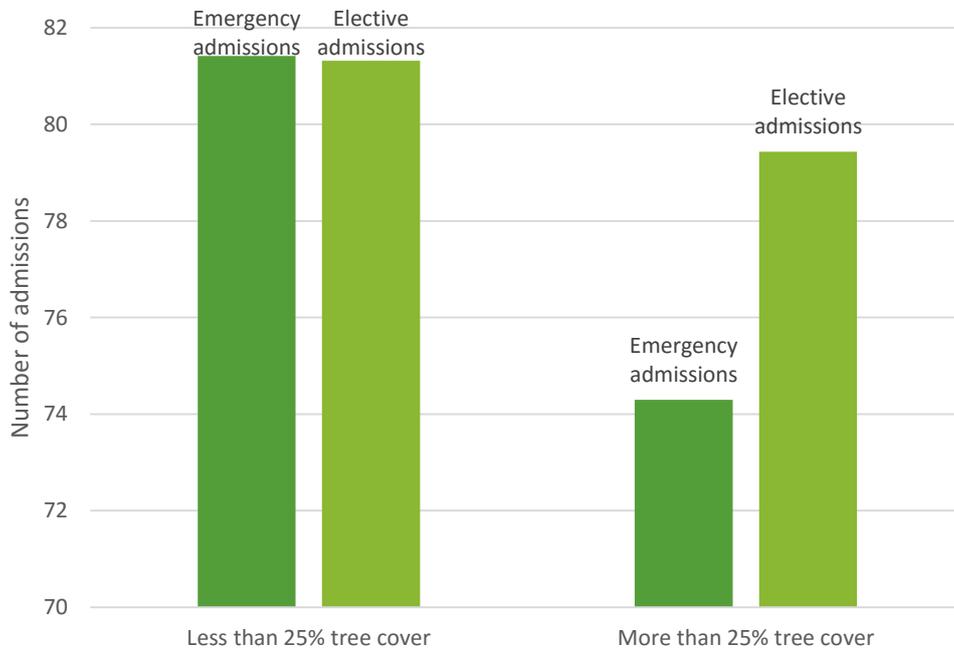
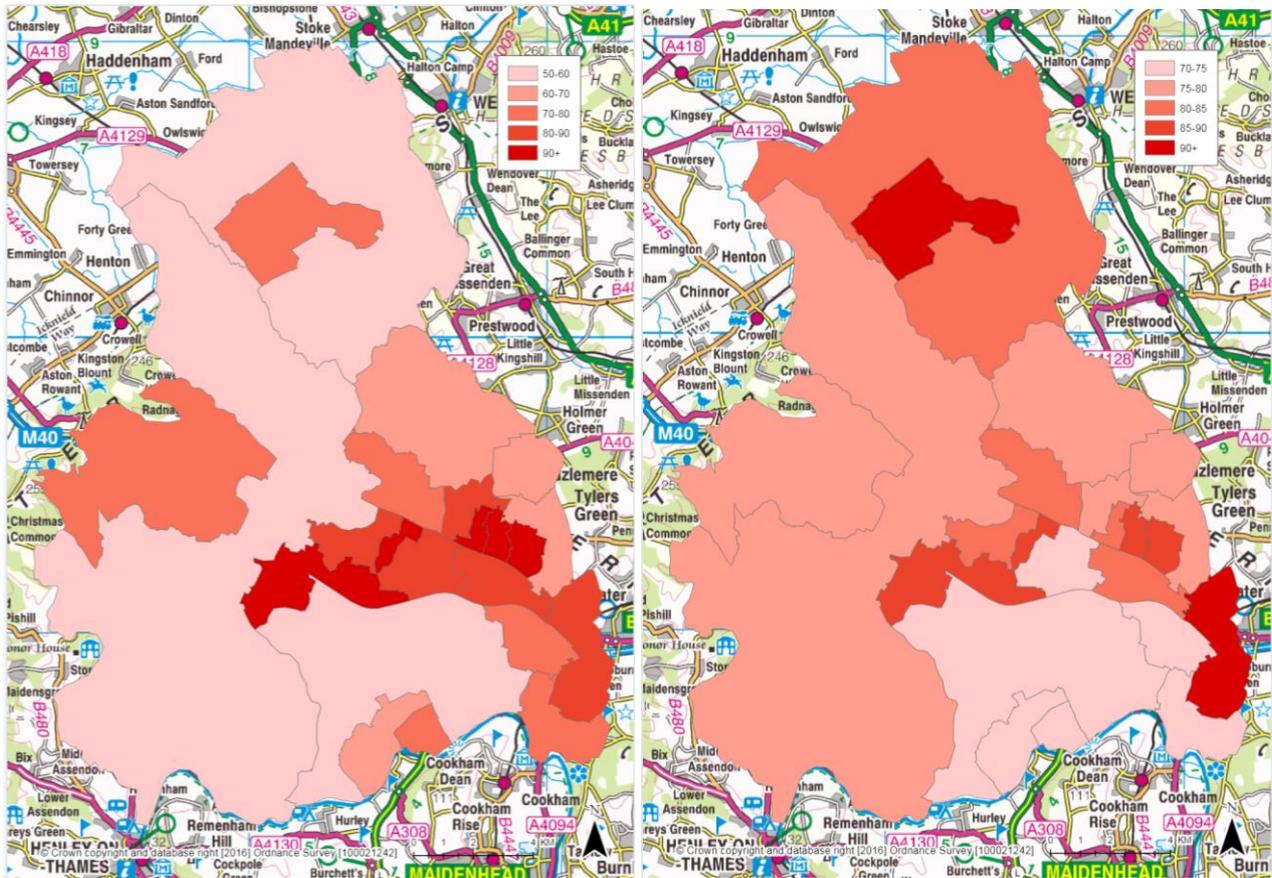
Figure 4: Average healthy life expectancy



Hospital admissions

In the same way that increased canopy cover correlates with higher life expectancy, more “treed” areas of Wycombe District have significantly fewer hospital admissions.

Figure 5: Emergency and elective hospital admissions



Educational achievement

The following charts show: the number of pupils achieving five A* to C grades in their GCSEs (including English and Mathematics) and the number of pupils achieving the expected level in each of the new 17 early learning goals.

Figure 6: GCSE achievement

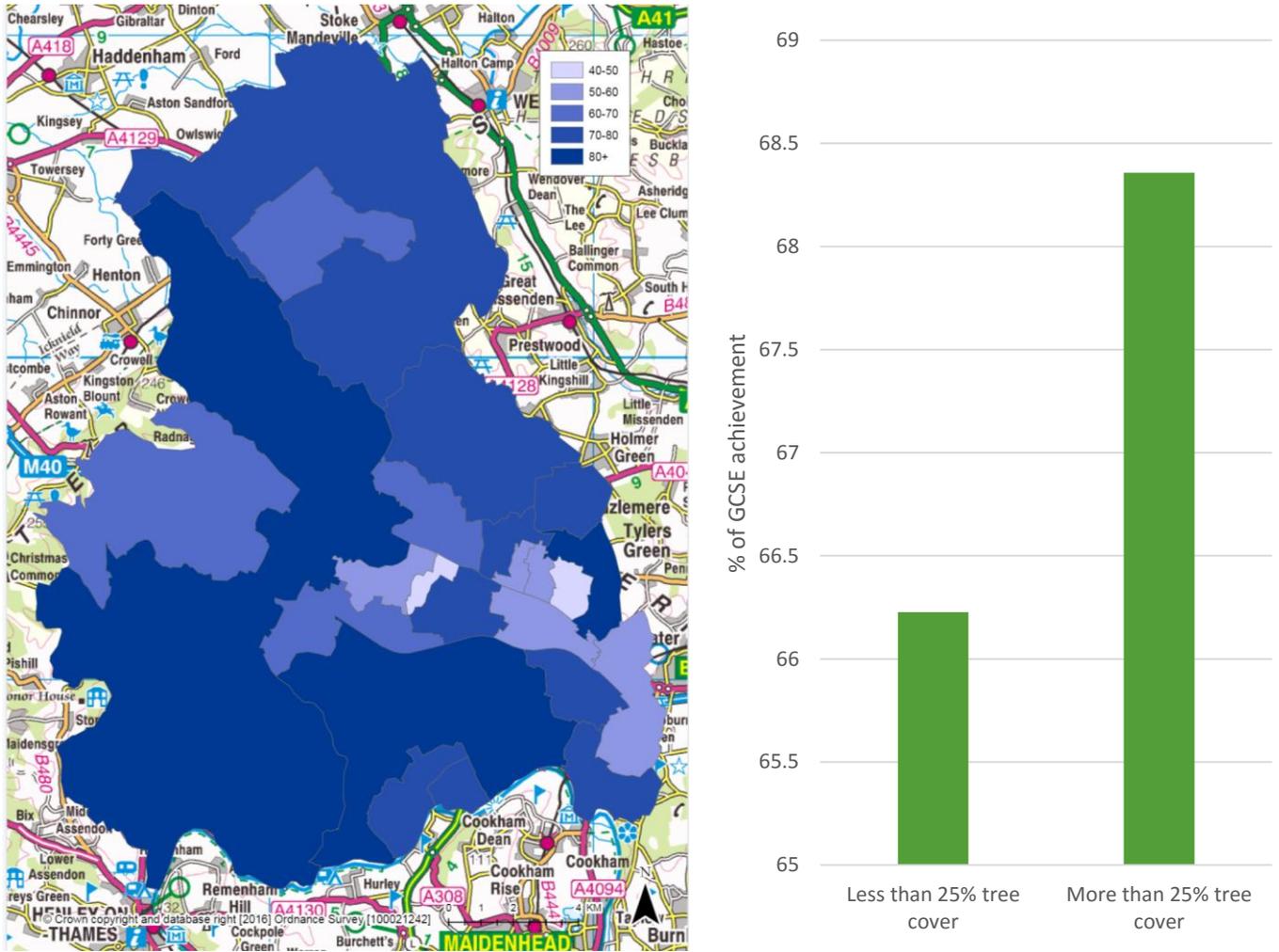


Figure 7: GCSE achievement distribution

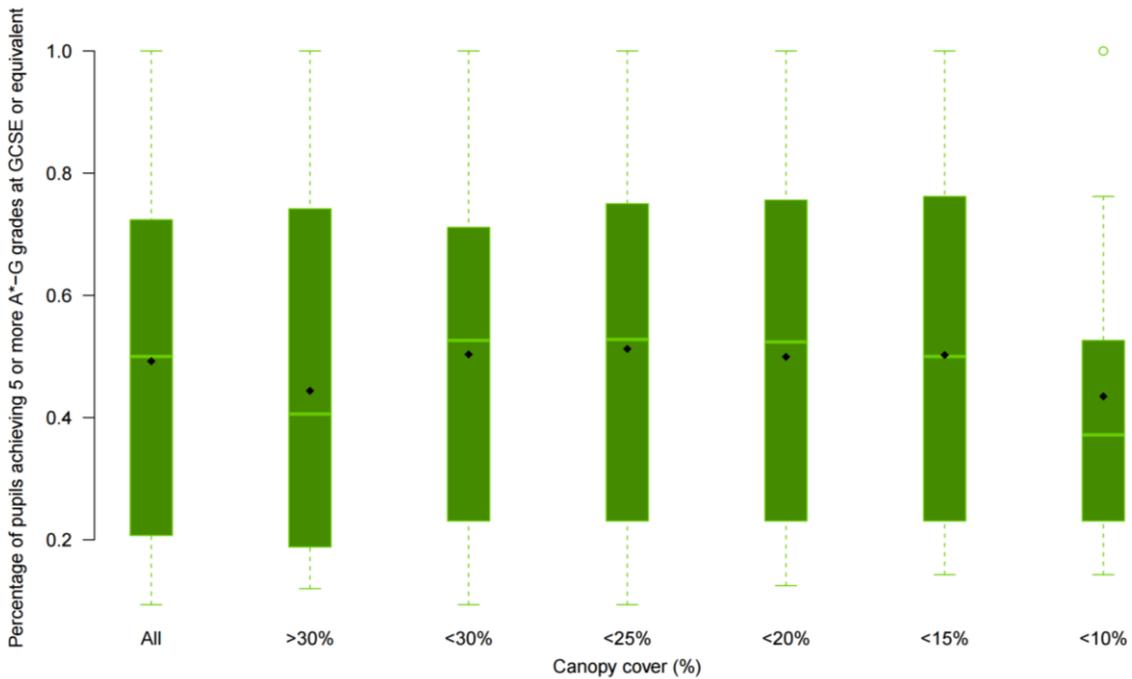


Figure 8: GCSE achievement distribution – open spaces removed

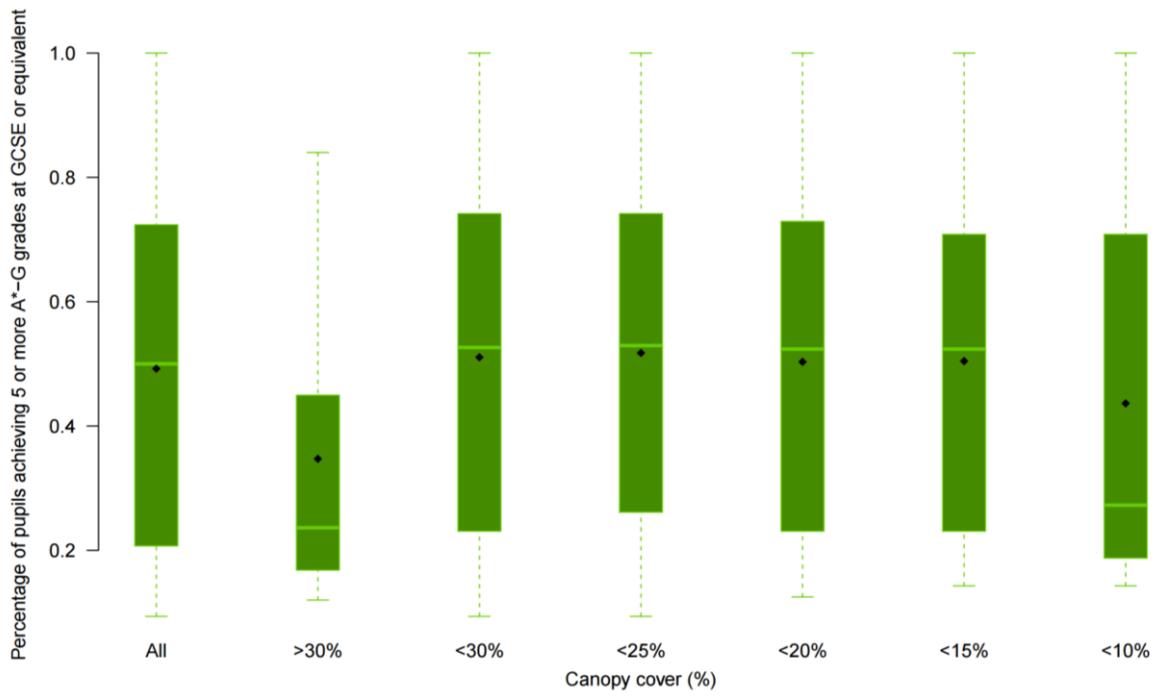


Figure 9: 17 early learning goals achievement distribution

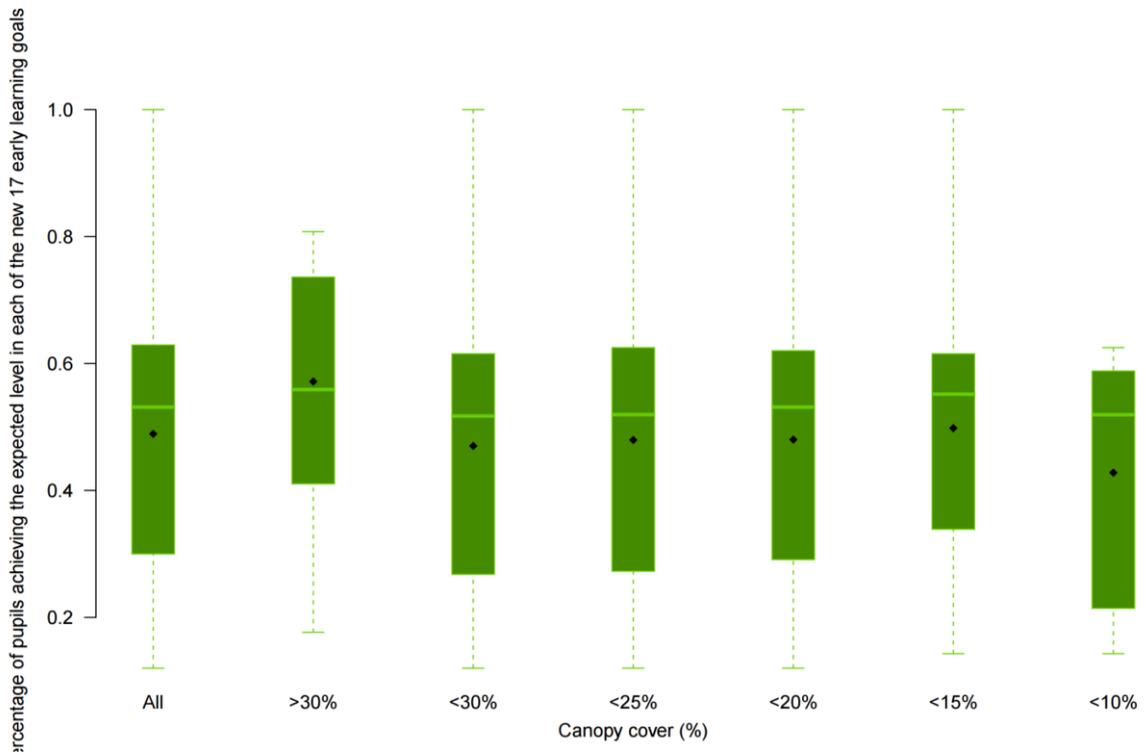
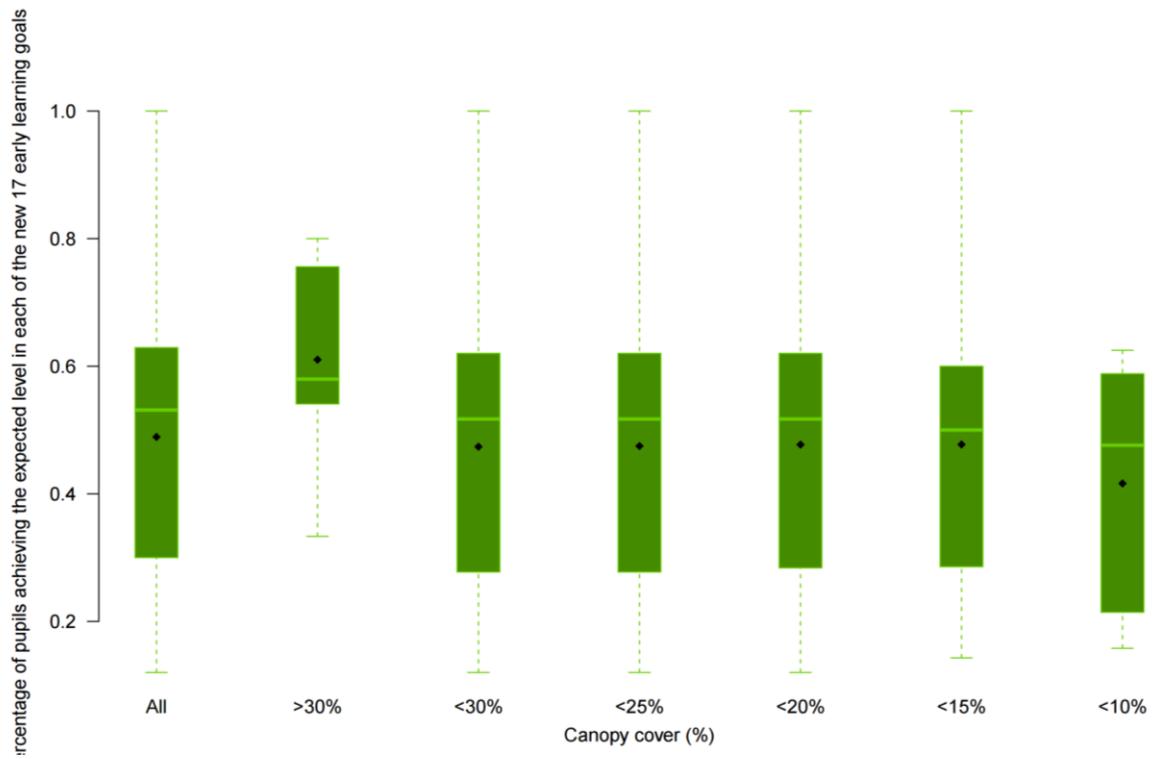


Figure 10: 17 early learning goals achievement distribution – without open spaces



Sale prices

These statistics report the median price paid for residential dwellings and are calculated using Land Registry data on property transactions. Houses on the leafier streets of Wycombe District sell for higher prices, as shown in the chart below.

Figure 11: Sale prices

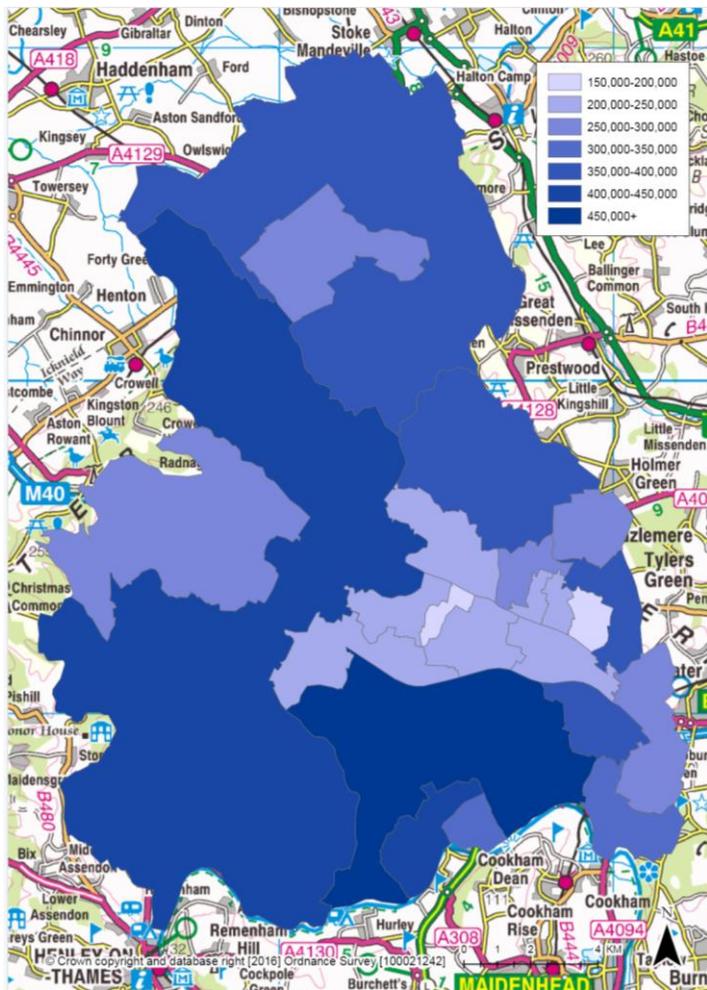


Figure 12: Sale prices distribution

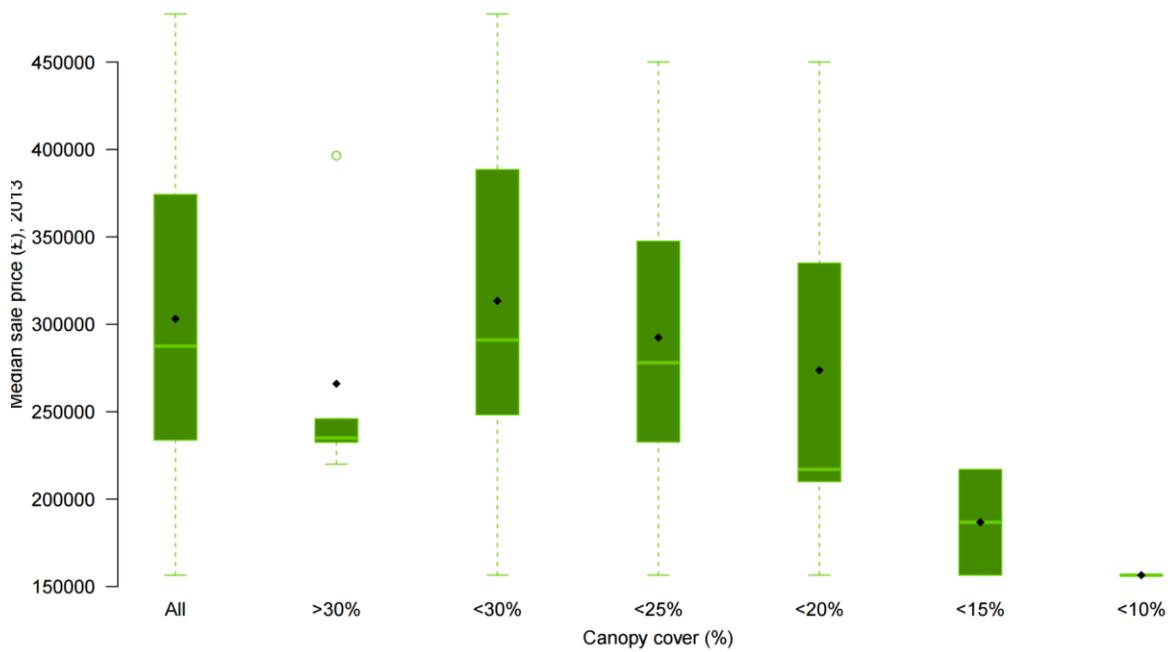
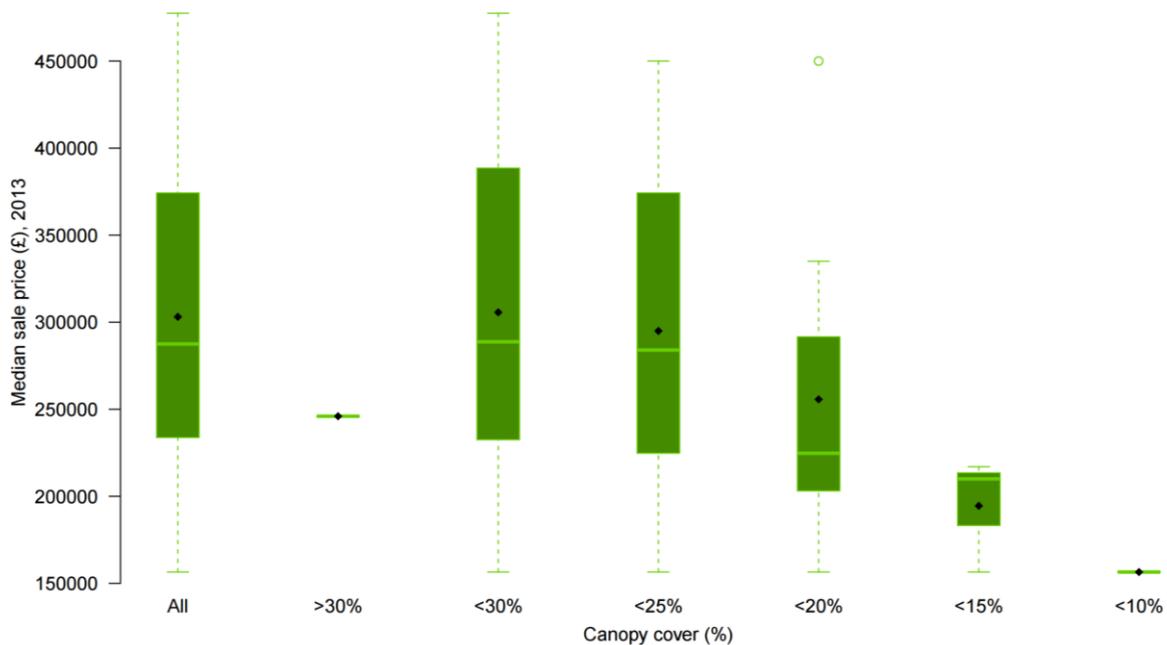


Figure 13: Sales prices distribution – without open space



At LSOA scale

Data concerning deprivation is collected at this scale and displayed in the charts below, again contrasting the Output Areas with less than 25% canopy cover and those with a canopy cover equal or greater than 25%.

In the case of the Income and Employment deprivation domains and the supplementary children and older people indices, the scores are meaningful and relate to a proportion of the relevant population experiencing that type of deprivation. So, for example, if a Lower layer Super Output Area has a score of 0.38 in the Income Deprivation Domain, this means that 38 per cent of the population is income deprived in that area. The scores for the Index of Multiple Deprivation and the other remaining domains are less easy to interpret, as they do not relate straightforwardly to the proportion of the population experiencing deprivation.

Index of Multiple Deprivation

The Index of Multiple Deprivation (IMD) combines information from seven domains to produce an overall relative measure of deprivation. The domains are combined using the following weights:

- 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 weights were derived from consideration of the academic literature on poverty and deprivation, as well as the levels of robustness of the indicators. Combining information from the seven domains produces an overall relative measure of deprivation, the Index of Multiple Deprivation.

Figure 14: Index of Multiple Deprivation score

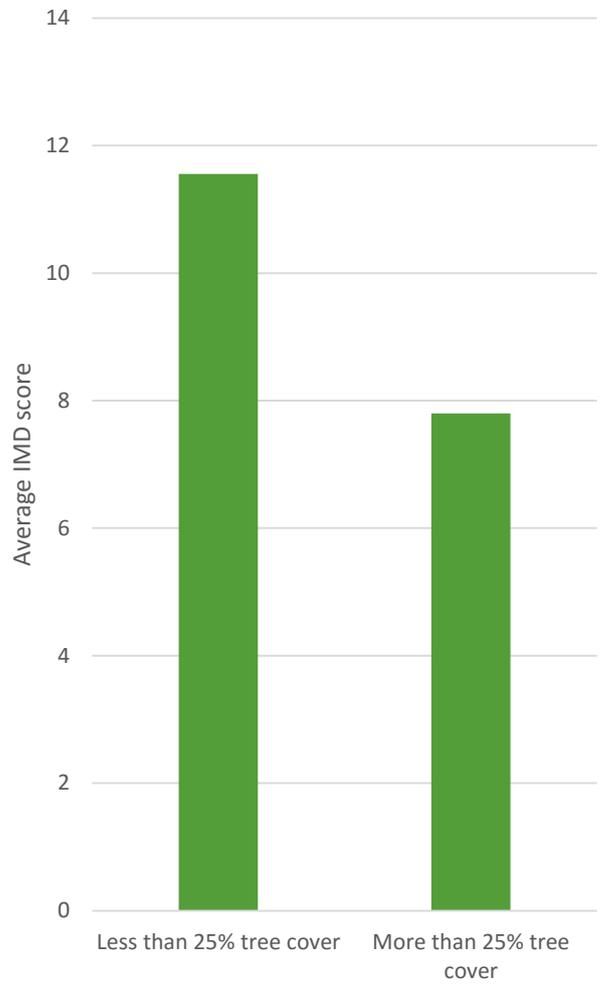
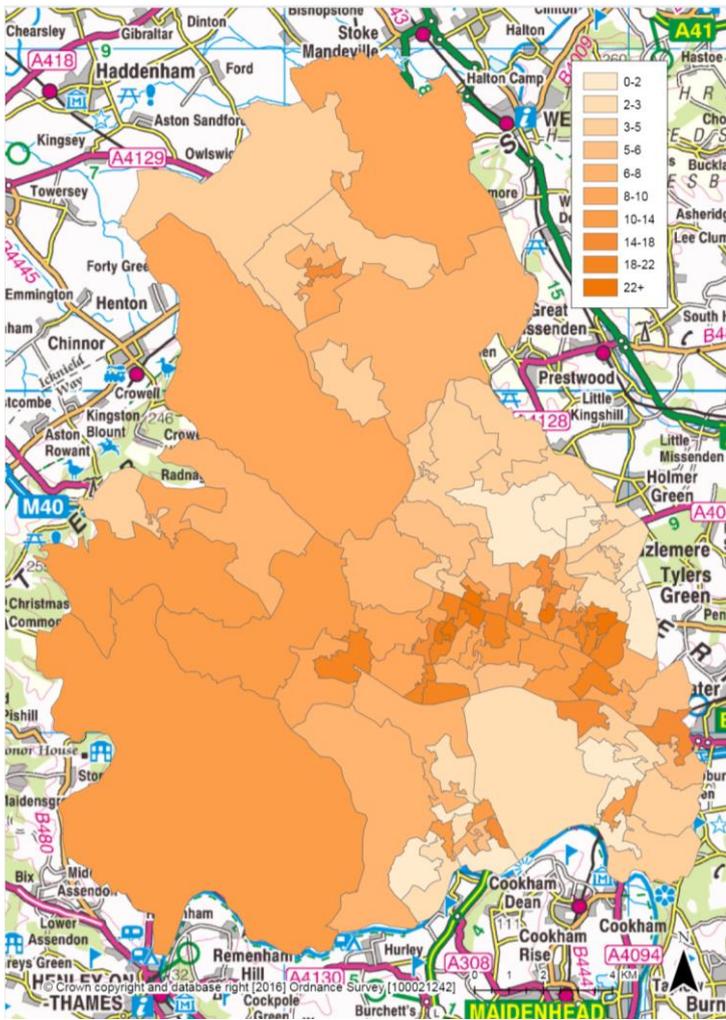


Figure 15: Index of Multiple Deprivation score distribution

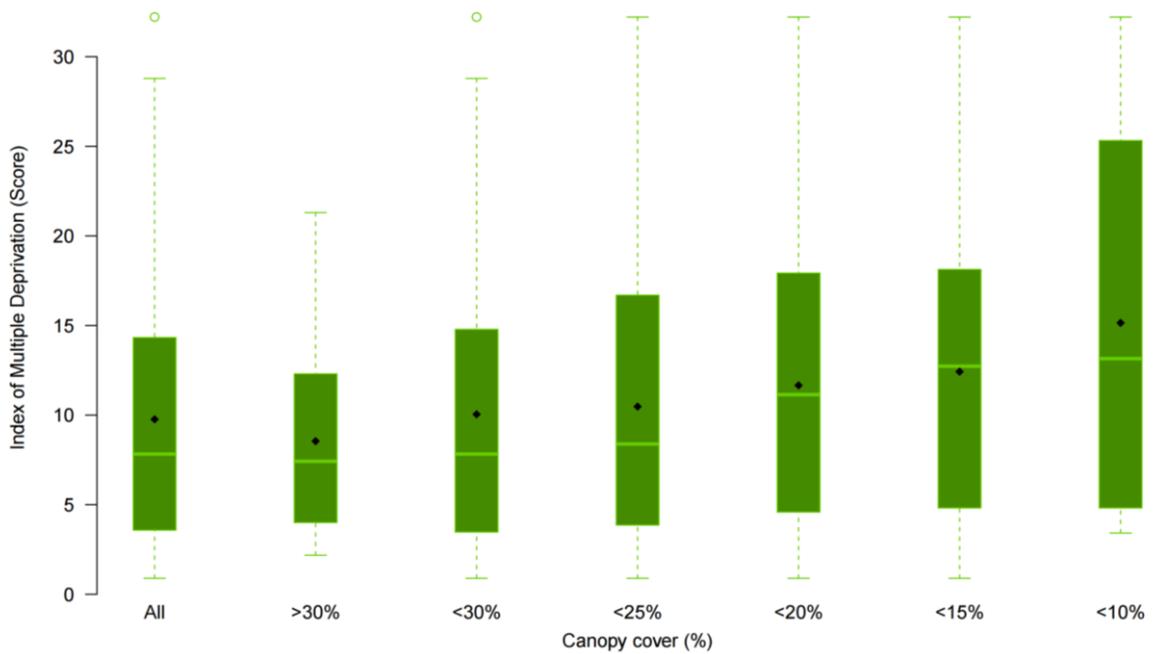
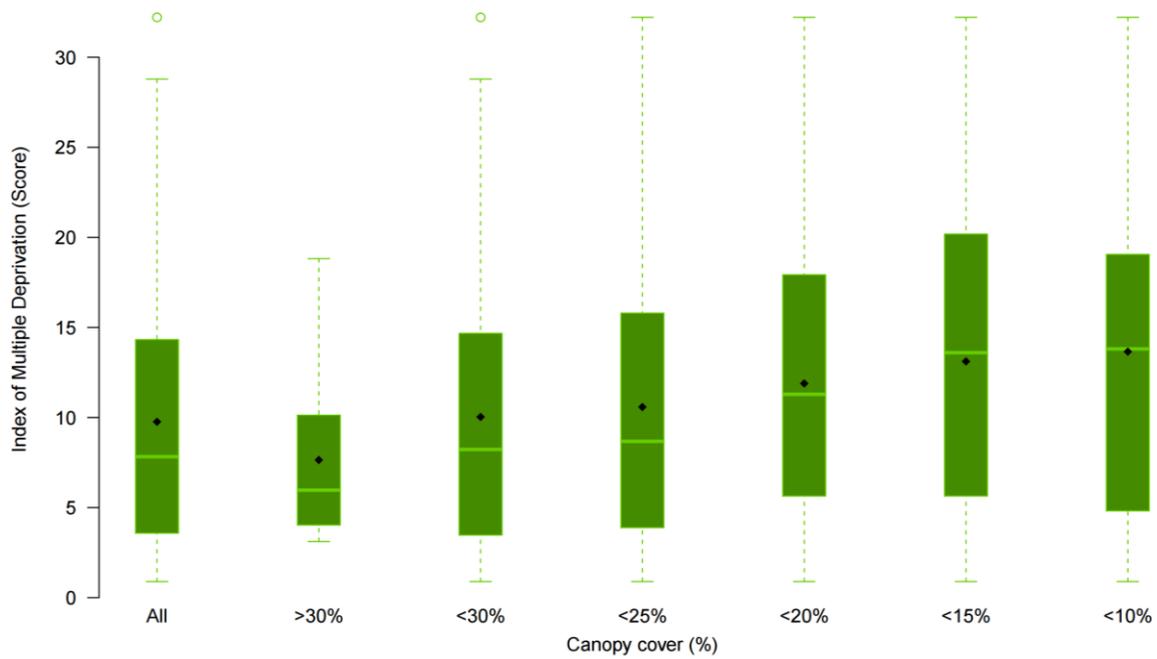


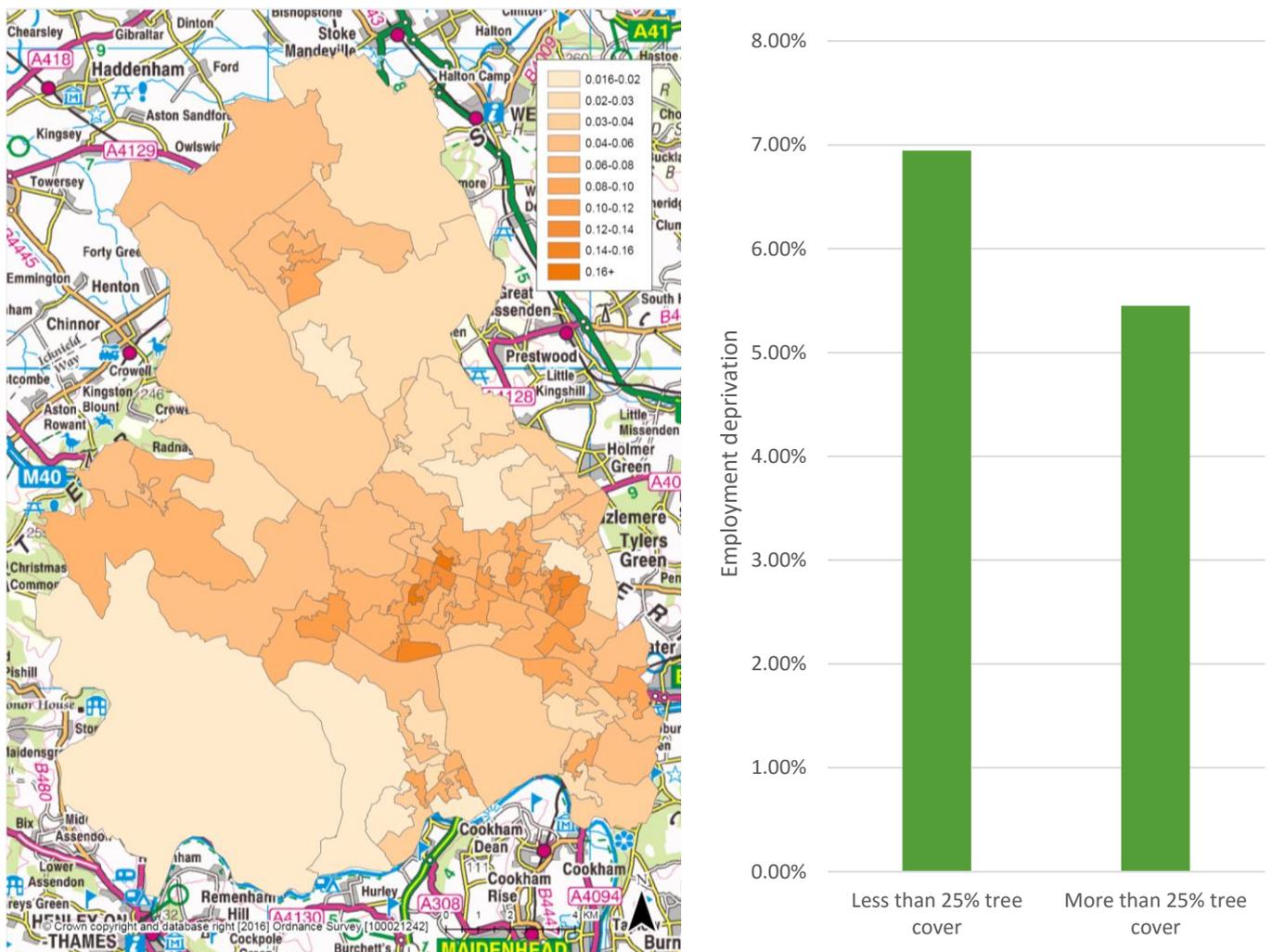
Figure 16: Index of Multiple Deprivation score distribution – with open spaces removed



Employment deprivation

The Employment Deprivation domain measures the proportion of the working-age population in an area involuntarily excluded from the labour market. This includes people who would like to work but are unable to do so due to unemployment, sickness or disability, or caring responsibilities.

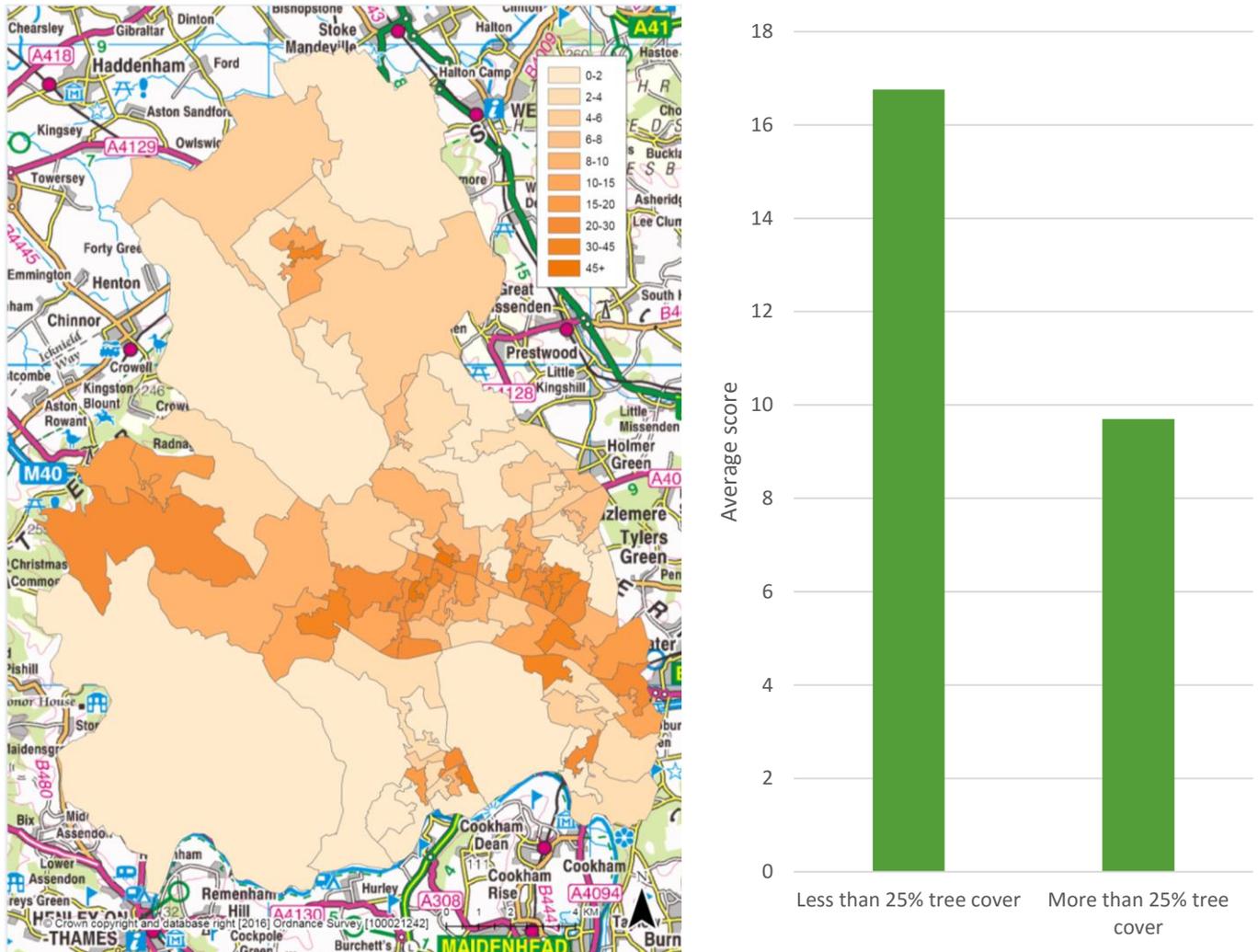
Figure 17: Employment deprivation



Education, Skills and Training Deprivation

The Education, Skills and Training Deprivation domain measures the lack of attainment and skills in the local population. The indicator is calculated by taking into account two sub-domains: one relating to children and young people and one relating to adult skills.

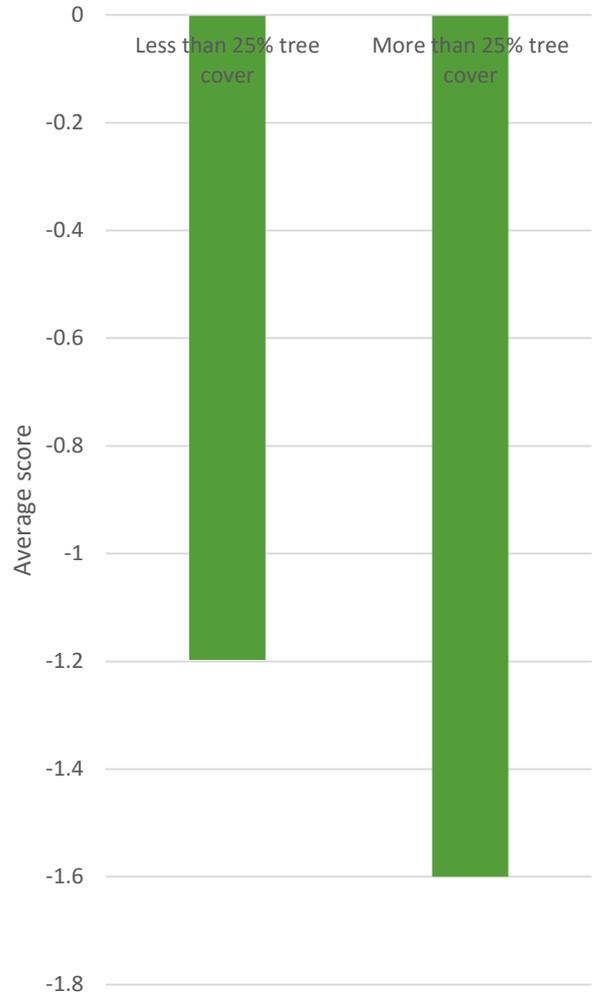
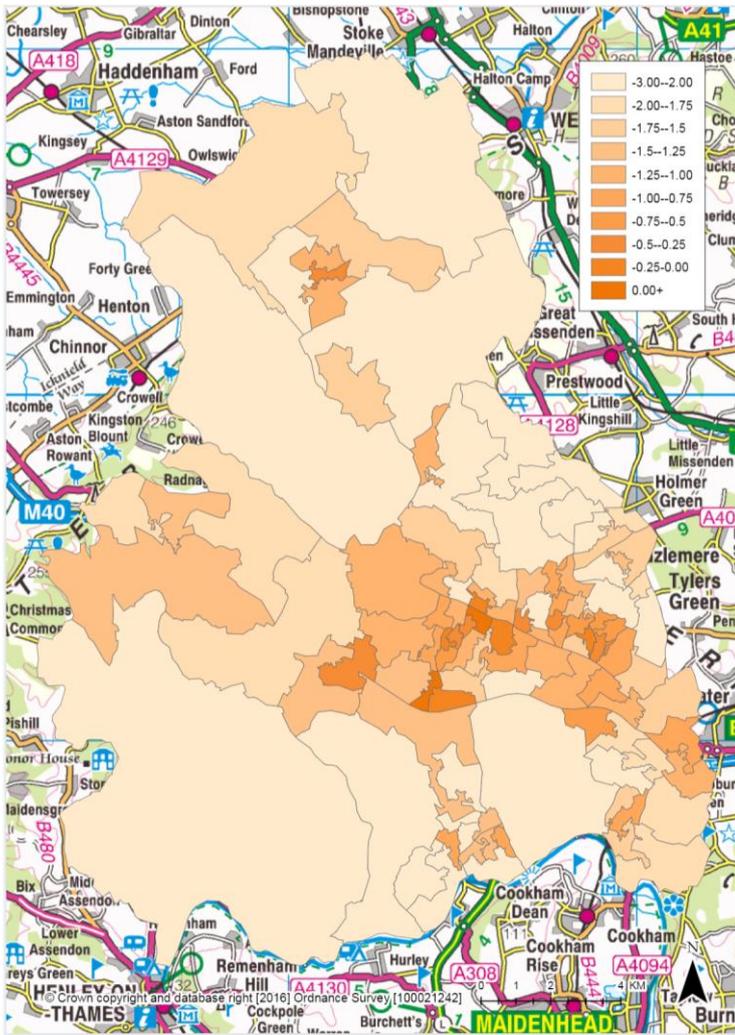
Figure 18: Education, Skills and Training Deprivation



Health Deprivation and Disability

The Health Deprivation and Disability domain measures the risk of premature death and the impairment of quality of life through poor physical or mental health. The indicator measures morbidity, disability and premature mortality. The bars being negative show that Wycombe District is performing relatively well as far as health indicators are concerned.

Figure 19: Health Deprivation and Disability



Crime

The Crime domain measures the risk of personal and material victimisation at local level. Similarly to the previous indicator, Wycombe District in general performs well, especially the areas with higher canopy cover.

Figure 20: Crime

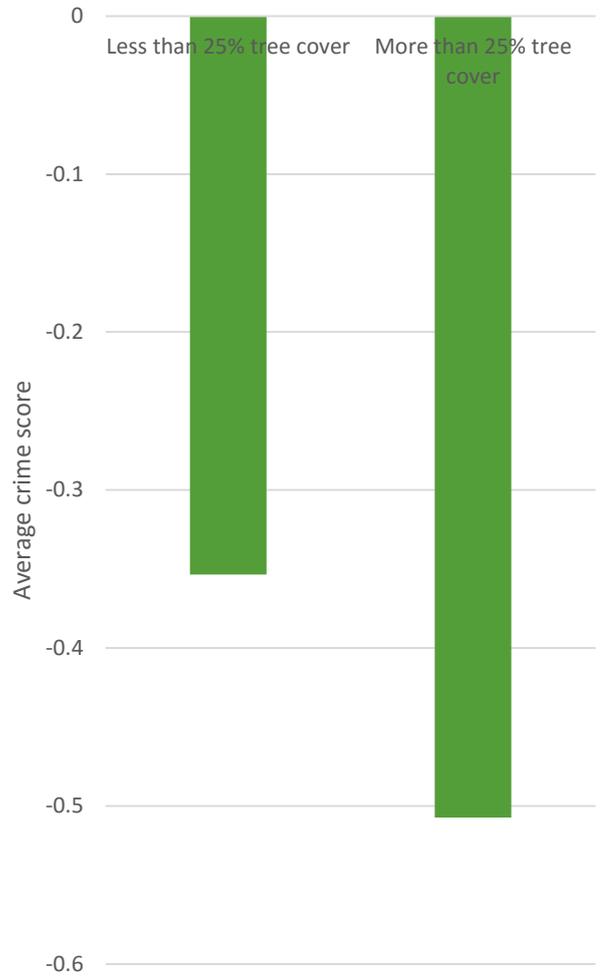
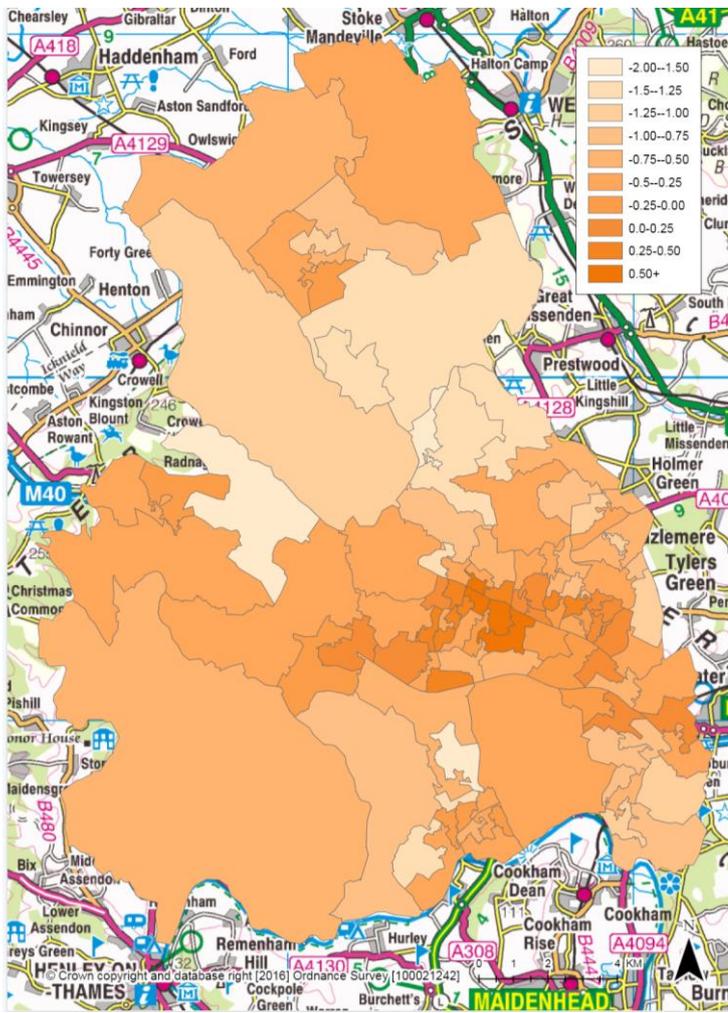


Figure 21: Crime distribution

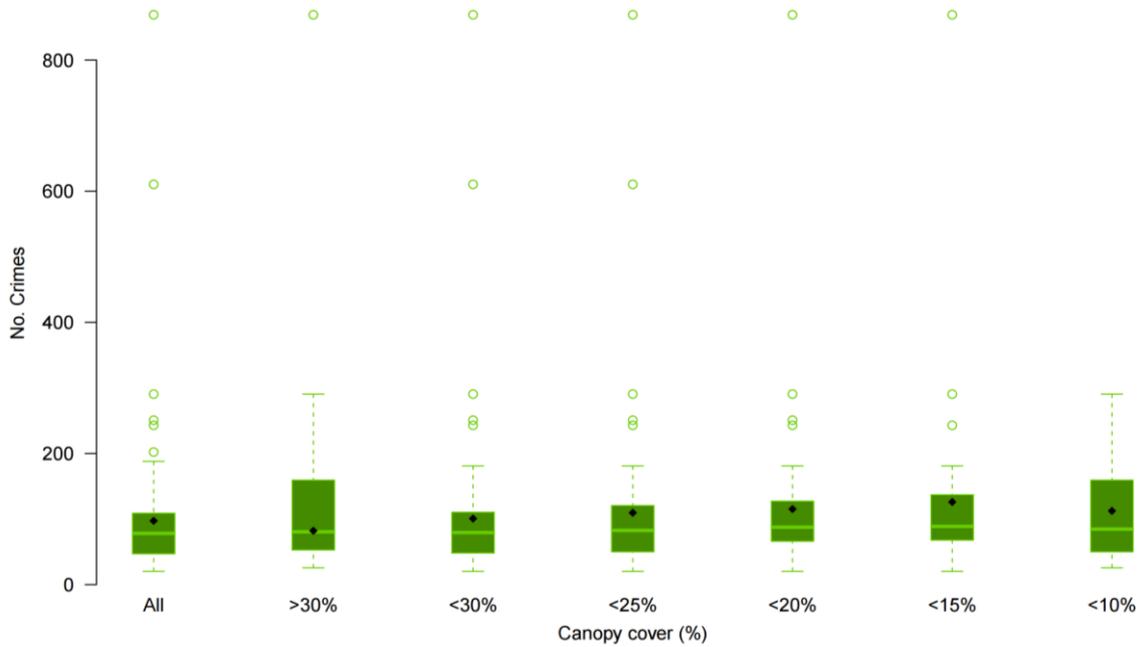
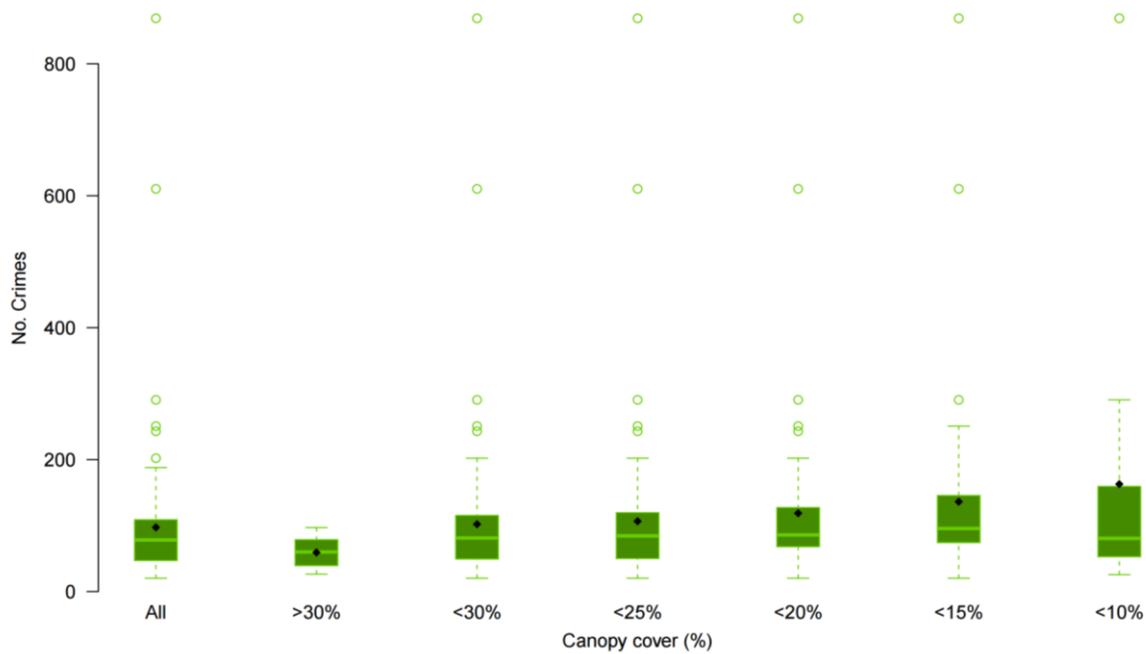


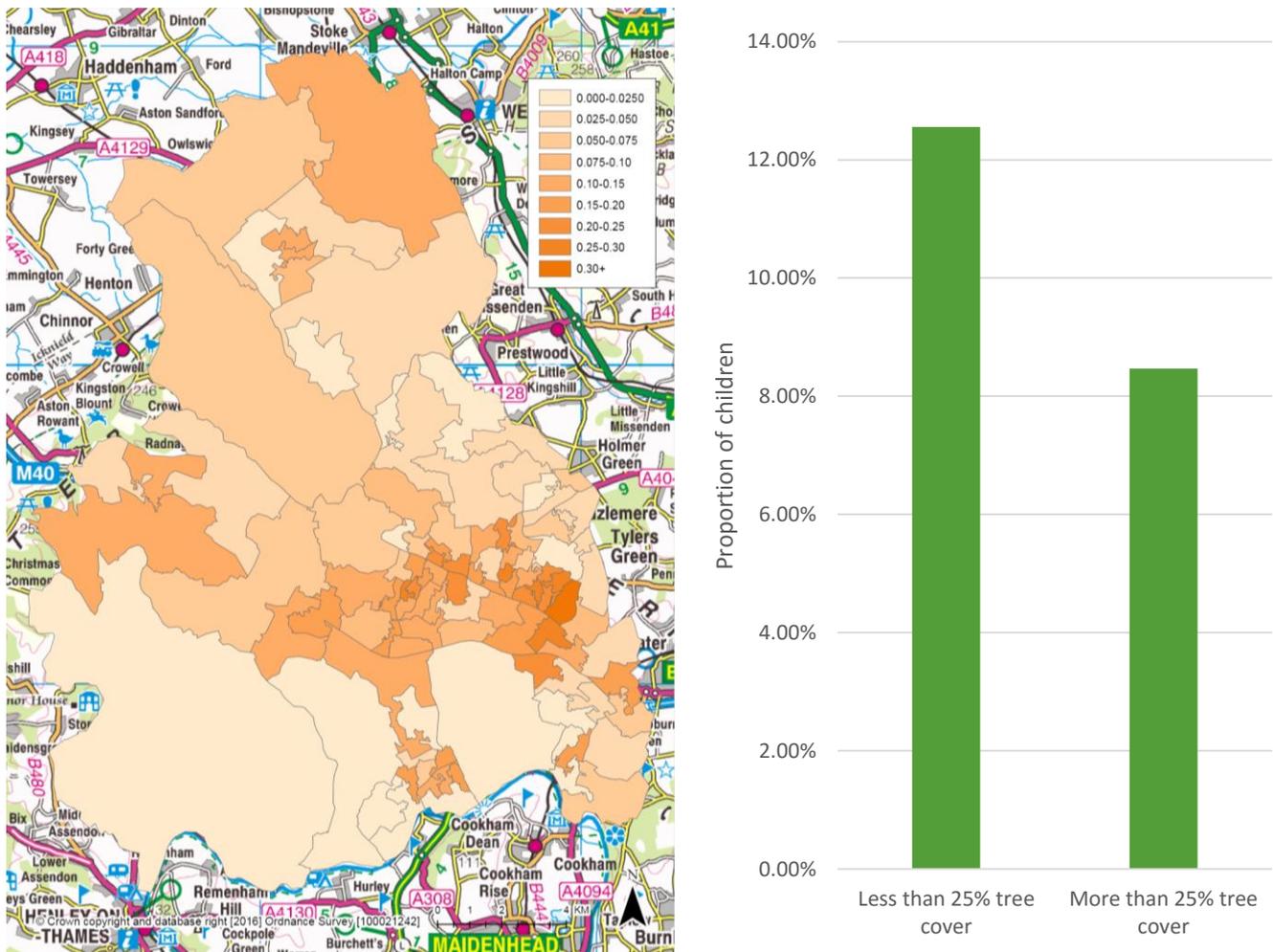
Figure 22: Crime distribution – with open spaces removed



Income Deprivation Affecting Children

The Income Deprivation Affecting Children Index (IDACI) measures the proportion of all children aged 0 to 15 living in families experiencing deprivation related to low income. The definition of low income used includes both those people that are out-of-work, and those that are in work but who have low earnings (and who satisfy the respective means tests).

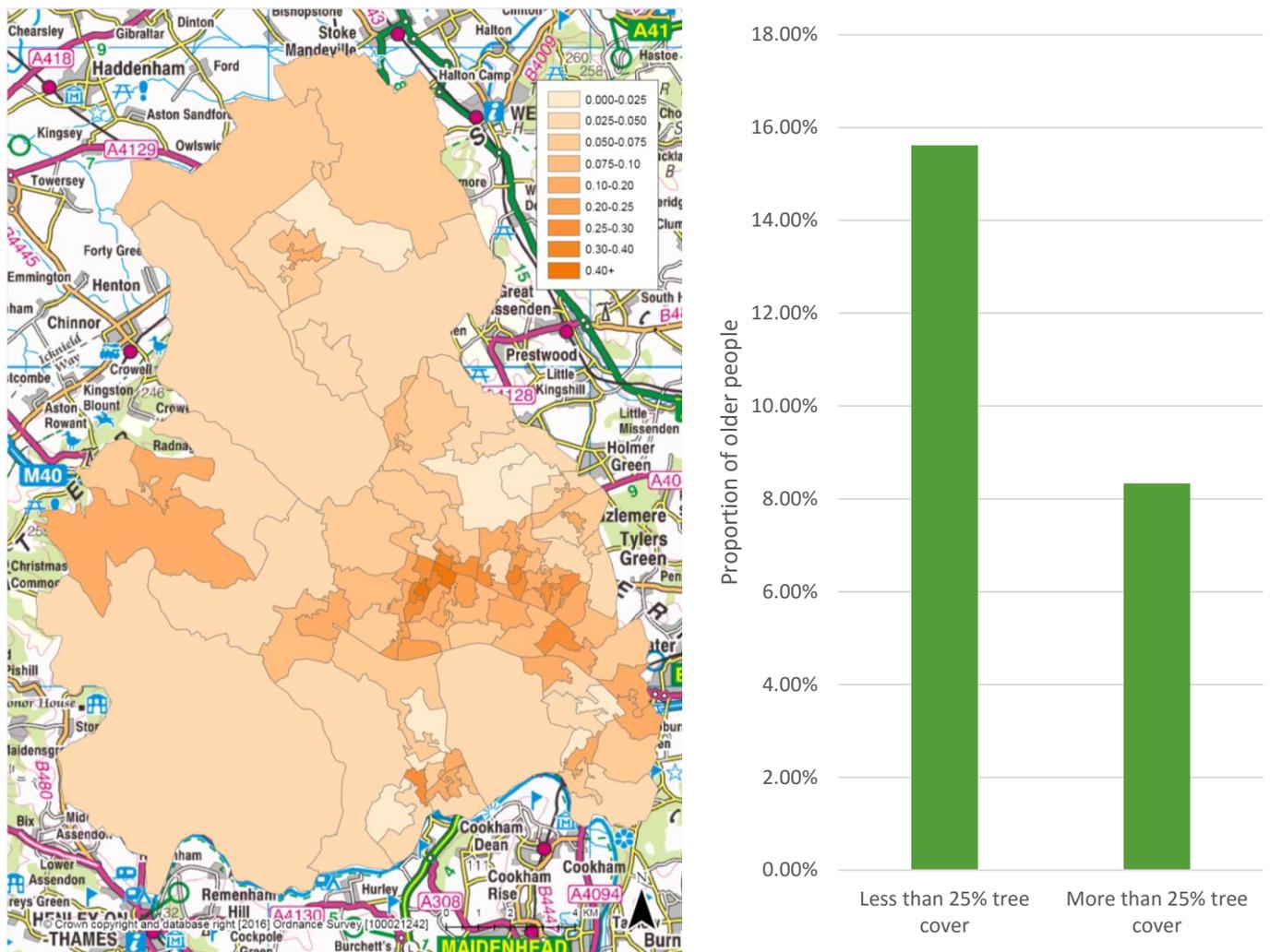
Figure 23: Income Deprivation Affecting Children



Income Deprivation Affecting Older People

Similarly, the Income Deprivation Affecting Older People Index (IDAOP) measures the proportion of all those aged 60 or over who experience income deprivation.

Figure 24: Income Deprivation Affecting Older People



Conclusions for policy inception

This preliminary study presents basic data on the canopy cover found in Wycombe District and within its smaller geographic boundaries. It also establishes a baseline which can be used to monitor future progress or in further research, for example the data could be used to further study the relationships between tree cover and house prices, social deprivation or flooding (where data exists). These relationships are often very useful in making the case for retaining or increasing canopy cover.

Figure 25: Photo of High Wycombe treescape



The many benefits provided by trees justify the investment required to establish and maintain very large trees in the urban environment, yet equally points to the vulnerability arising when a high proportion of value resides in a single or a few species. A more detailed study of Wycombe District's treescape with ground surveys would detail the benefits provided and the threats faced by each species of tree.

More specifically the following recommendations are also suggested.

Recommendations

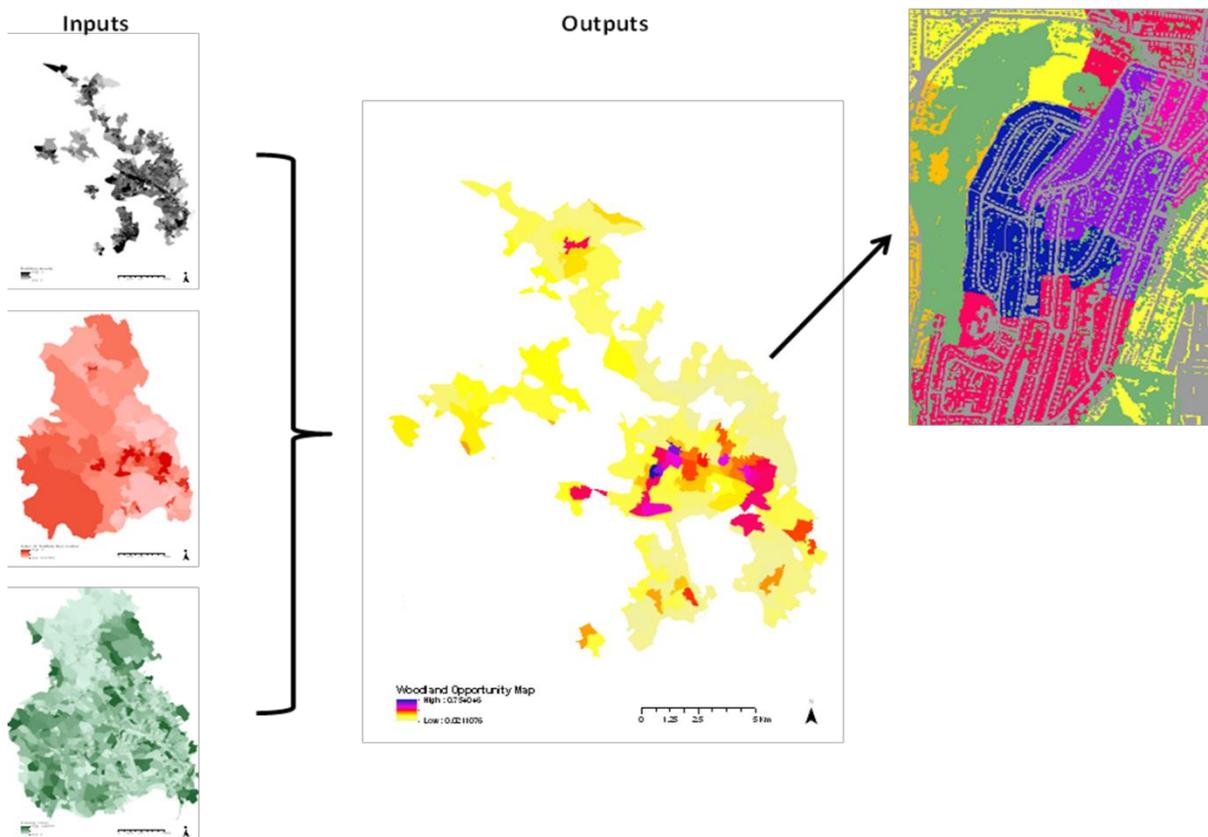
1. Undertake a iTree Eco phase 2 'bottom-up' survey of trees within the Wycombe District administrative area in order to:
 - I. Provide more detailed information on the structure and composition of the urban forest such as the species present, the size and age (structural diversity) and health of the trees to inform and facilitate planning of future planting and maintenance activities to ensure that current canopy levels can at least be sustained, if not improved where appropriate;
 - II. Quantify and estimate the value the benefits trees are delivering;
 - III. Provide an evidence base for a comprehensive tree strategy.

2. Prepare a comprehensive tree strategy for public and privately owned trees which will:
 - I. Describe the nature and extent of the urban forest that exists within Wycombe District and provide a vision for the urban forest that is needed in the future, together with an action plan for delivery and monitoring;
 - II. Set canopy cover targets for key land uses and/or geographic areas as well as for the whole of Wycombe District;
 - III. Monitor canopy cover as a key performance indicator for management of the urban forest;
 - IV. Identify and prioritise action through planting and management to ensure that tree cover is maintained, sustained and improved where this is appropriate;
 - V. Describe the role of trees within the landscape setting of Wycombe District.

The canopy results presented within this report could also be used within Multi Criteria Decision Analysis (MCDA). As a proof of concept we present a simple MCDA looking at opportunities to expand trees and woodlands within the Wycombe area. In this example we look at three factors: 1. Building density (includes all artificial surfaces: roads, paths, houses, etc), the Index of Multiple Deprivation (IMD) and Canopy cover. Each factor was mapped from its original value to a range between 1 and 0. All factors were equally weighted and combined to give an overall score, the higher the score the greater the opportunity to create woodlands and to plant trees. The map should identify areas where there is: a high level of deprivation, low canopy cover and the room to plant more trees. In figure x we have identified a single LSOA which, according to the MCDA, offers a good opportunity to increase its canopy cover. It has a high IMD value (32.215), a low tree cover of 5.7% and a low density of buildings (16%)

We have presented a simple example of MCDA as a proof of concept. However, a more complex analysis could be used to answer a number of questions. For example, we could identify public/private land with low canopy cover and target different strategies within each geographic area to increase canopy cover.

Figure 26: Example of a Multi Criteria Decision Analysis



Appendix 1: Bluesky National Tree Map¹⁰

The National Tree Map (NTM) by Bluesky International Ltd. is a commercial product which seeks to identify all trees and bushes 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 (0). The map operates a 5 year rolling update program (NTM, 2015).

Figure 27: Bluesky datasets



Coverage

England and Wales

Variables

The National Tree Map consists of three GIS datasets:

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

The variables contained in each dataset are given in table 2:

Table 2: National Tree Map variables

¹⁰ Source: Handley and Doick (2015)

| Field Name | Type | Description |
|------------|-------------------|---|
| NTM_ID | Text | Unique Id for each crown feature |
| Max | Numeric (decimal) | Maximum height value of the crown (m) |
| Mean | Numeric (decimal) | Average height value of the crown (m) |
| STD | Numeric (decimal) | Standard Deviation of all height measurements |
| Perimeter | Numeric (decimal) | Perimeter of the idealised crown (m) |
| Area | Numeric (decimal) | Area of the crown (m ²) |

Accuracy

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).

Appendix 2: Comparison with other UK cities

McPherson et al. (1998) highlight how canopy cover is a useful metric for comparison across and between cities, regardless of size of total land cover. Wycombe District compares very favourably with other UK towns and cities (see table 3 below) that have completed canopy surveys, although urban tree cover in the UK is generally lower than that found in continental Europe and the US.

The following figures are from the Urban Tree Cover website¹¹; the footnotes refer to the surveys the data originate from. Where data is missing in this table, it is because the city has not set a canopy cover goal or has not measured the potential plantable space or the number of trees. These numbers provide snapshots of the urban forests at different times, but can be used to have an idea of how the cities compare.

Table 3: Tree cover of UK cities

| City | Area (ha) | Population | Canopy cover | Canopy cover goal | Potential plantable space | Number of trees |
|---------------------------------------|-----------|------------|--------------|-------------------|---------------------------|-----------------|
| Crawley ¹² | 4,495 | 108,971 | 25.1% | / | / | / |
| Wycombe District ¹³ | 32,457 | 174,878 | 25% | / | / | / |
| Birmingham ¹⁴ | 598,900 | 1,092,330 | 23% | / | / | 6,000,000 |
| Sidmouth ¹⁵ | 4,300 | 12,570 | 23% | / | 60% | 405,000 |
| Exeter ¹⁶ | 4,703 | 117,773 | 23% | / | / | / |
| London ¹⁷ | 157,200 | 8,400,000 | 21.9% | 30% | 29% | 8,421,000 |
| Worcester ¹⁸ | 3,328 | 98,768 | 21.9% | / | / | / |
| Oxford ¹⁹ | 4,559 | 155,000 | 21.4% | / | / | / |
| Dudley ²⁰ | 9,795 | 312,925 | 20.5% | / | / | / |
| Southampton ²¹ | 7,280 | 253,651 | 20.4% | / | / | / |
| Walsall ²² | 10,395 | 269,323 | 17.3% | / | / | / |
| Cambridge ²³ | 11,560 | 123,900 | 17.1% | / | / | / |
| Edinburgh ²⁴ | 26,400 | 487,500 | 17% | / | / | 638,000 |
| Wrexham ²⁵ | 3,833 | 61,603 | 17% | / | 28% | 364,000 |
| Eastbourne ²⁶ | 4,416 | 99,412 | 15.9% | / | / | / |
| Manchester ²⁷ | 63,030 | 514,417 | 15.5% | / | / | / |
| Glasgow ²⁸ | 17,550 | 596,550 | 15% | / | 32% | 2,000,000 |
| Portsmouth ²⁹ | 4,028 | 205,400 | 14.7% | / | / | / |

¹¹ <http://www.urbantreecover.org/>

¹² 2014 i-Tree Canopy Survey

¹³ 2016 Canopy Cover Assessment

¹⁴ 2012 i-Tree Survey

¹⁵ 2014 i-Tree Survey

¹⁶ 2013 i-Tree Survey

¹⁷ 2014 i-Tree Survey: <http://www.forestry.gov.uk/london-itree>

¹⁸ 2015 i-Tree Canopy Survey

¹⁹ 2015 Canopy Cover Assessment: <http://www.urbantreecover.org/wp-content/uploads/2015/08/Oxford-Canopy-Report.pdf>

²⁰ 2015 i-Tree Canopy Survey

²¹ 2013 Southampton City Council Lidar Survey

²² 2012 i-Tree Survey

²³ 2014 Cambridge City Proximitree Study

²⁴ 2012 i-Tree Survey

²⁵ 2014 i-Tree Survey: <http://www.urbantreecover.org/wp-content/uploads/2015/01/Wrexham-Tech-Report-2014.pdf>

²⁶ 2012 i-Tree Survey

²⁷ 2007 Red Rose Forest survey

²⁸ 2014 i-Tree Survey

²⁹ 2015 i-Tree Canopy Survey

| | | | | | | |
|------------------------------|--------|---------|--------------|-----|----|---------|
| Bristol ³⁰ | 11,000 | 432,500 | 14% | / | / | / |
| Telford ³¹ | 7,803 | 170,300 | 12.5% | / | / | / |
| Torbay ³² | 6,375 | 134,000 | 12% | 20% | 8% | 818,000 |

Although a number of towns in the UK have identified the importance of green infrastructure, many councils fall short of attributing appropriate resources to increasing canopy cover, and thus improving the quality of life of their residents and the urban fabric's resilience to climate change. Where additional funding is provided for urban trees, inventories and datasets are more complete and up to date, and as a result, tree planting and management strategies are more comprehensive. One of the best examples of this is the enthusiasm following the valuation of the urban forest benefits in Torbay.

³⁰ 2009 Bristol Tree Survey

³¹ 2012 i-Tree Survey

³² 2011 i-Tree Survey: <http://www.urbantreecover.org/wp-content/uploads/2015/01/Torbays-Urban-Forest.pdf>

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