Birmingham's Urban Forest.

Measuring and monitoring longer Term Change.

Simon Needle – Parks and Green Space Strategy and Delivery Lead

Tree Cities OF THE WORLD

Food and Agriculture Organization of the United Nations

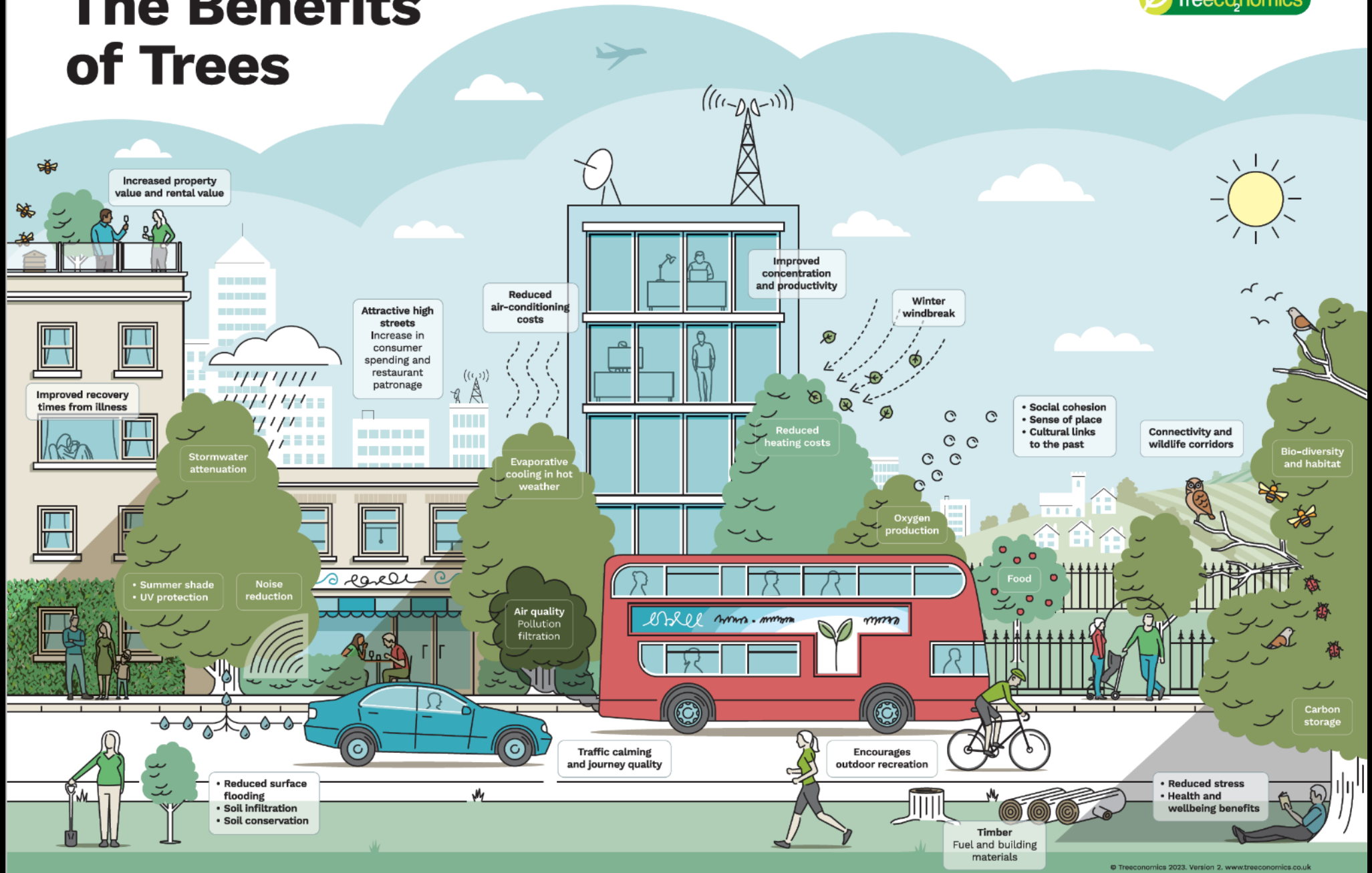
Arbor Day Foundation

BiophilicCities

Birmingham: A Nature City

The Benefits of Trees

Treeco$_2$nomics



© Treeconomics 2023. Version 2. www.treeconomics.co.uk

The Challenges

- Population at 1.1million and rising
- One of the youngest populations in Europe
- Significant number of wards in top 10 percentile IMD
- High levels YLL in certain quarters
- Air Pollution
- UHI
- Pluvial and Fluvial flooding
- Need for 89,000 additional homes by 2031; currently space identified for 51,000

COVID19 pandemic has brought to the fore the inequality of accessible green space. Minority ethnic communities more impacted by pandemic

Higher levels of minority ethnic communities in areas of low GI, poorer air quality and high UHI.

Liaison with other Departments such as Public Health are critical to understanding impacts and benefits.

Birmingham's Climate Risk and Vulnerability Assessment

Background:

On 11 June 2019 the council declared a climate emergency. In this declaration, the council recognised that the impacts of climate change, such as increased extreme weather events such as flooding, droughts and heatwaves will affect Birmingham residents. With this, the council is also committed to preparing Birmingham for the effects of climate change to make sure our city and residents are resilient to future climate risks. This resulted in Birmingham's Environmental Justice Map, which is helping with the planning and delivery of the City of Nature Plan, reducing the risks of climate change for the most vulnerable and working towards building a more resilient and greener city.

To help the council develop the city while also adapting to climate change, a climate risk and vulnerability assessment (CRVA) is needed to help identify where the needs of Birmingham are greatest. The council has developed a CRVA map, which builds on the success of the Environmental Justice Map.

Methodology:

The CRVA map scores areas of Birmingham based on compiling the presence and extent of 11 different factors that may influence the effect of climate change. These factors are:

- Concentration of nitrogen dioxide (an air pollutant)
- Concentration of fine particulate matter (an air pollutant)
- Fluvial (river) flood risk
- Pluvial (surface) flood risk
- Surface temperature
- Local climate zone classification
- Deficit in open green space
- Deficit in other green space
- Deficit in tree canopy cover
- Excess years life lost
- Indices of Multiple Deprivation

Most of these datasets are open source and can be viewed using geographic information system (GIS) mapping software, such as ArcMap or QGIS.

To create the CRVA map, the map of Birmingham was divided into a 100m^2 grid and a score from 0 to 1 was generated per grid square for each factor. The higher the score in a layer, the more at risk or vulnerable that area is to the factor. The scores for all the layers were then summed to create the final CRVA score for the grid across Birmingham, where the higher the score, the more at risk and vulnerable that area is to the compound effects of climate change, now and in future.

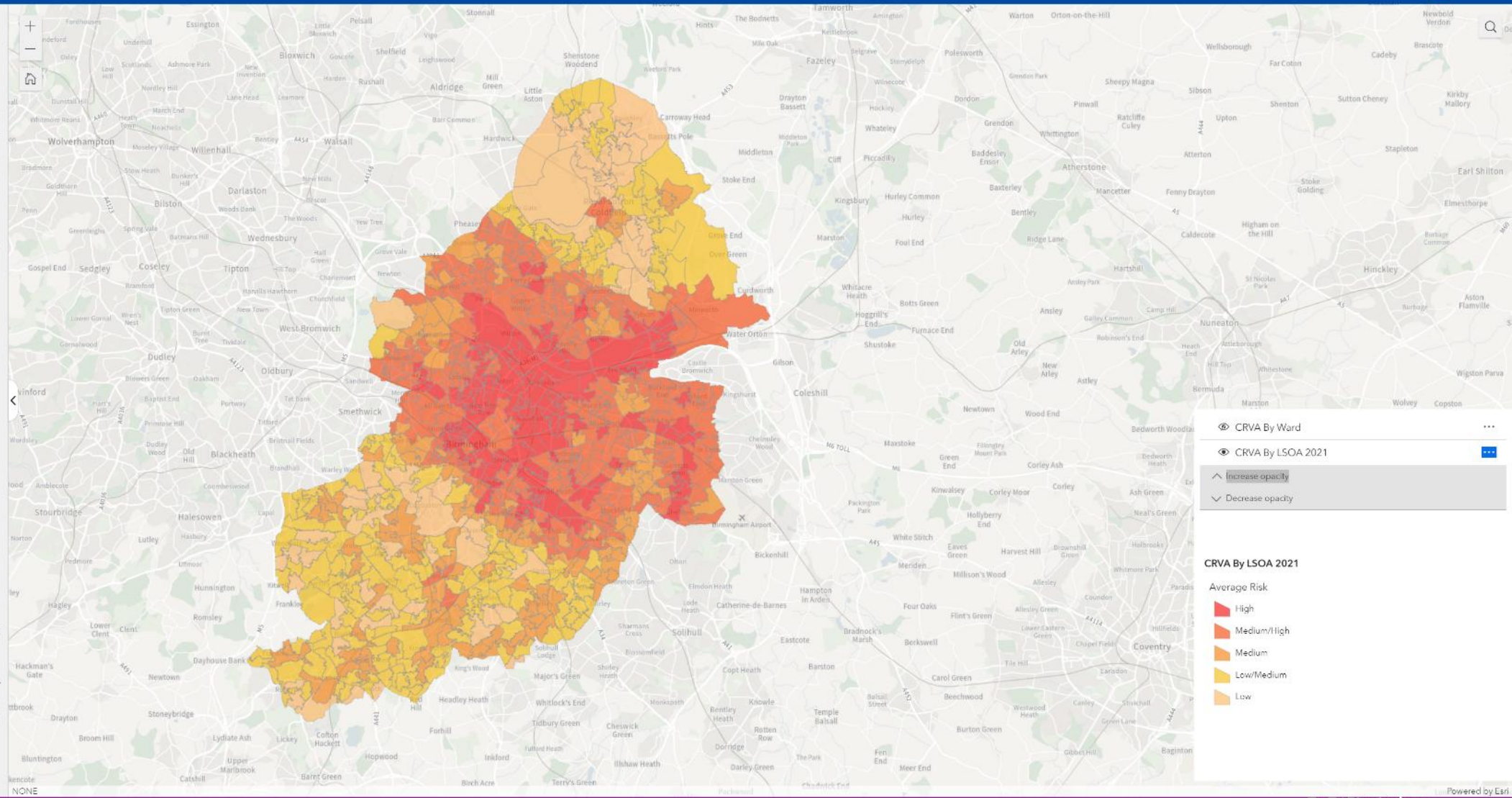
For the list of data sources and a more in-depth description of the methodology see here

How is the risk defined?

This map defines climate risk from low to high in five descriptive categories, where the higher the combined CRVA score, the higher its risk category. It is important to note that the risk categories are only relative to the score within Birmingham. This means that an area with a high risk score is only what is understood to be high within the city – there could be other parts of the UK with a higher risk, as the values of some of the factors could be greater than the maximum value recorded for Birmingham. The same applies for low risk – there could be other parts of the UK at a lower risk than the lowest scores in Birmingham. It is also important to note that a high risk classification does not necessarily mean that its score is high for every factor. Some factors may score higher in some places than others, and this will depend on the area.

Contact Us

For more information on the CRVA please email Route to Zero Carbon



BE BOLD BE BIRMINGHAM

Birmingham City Council

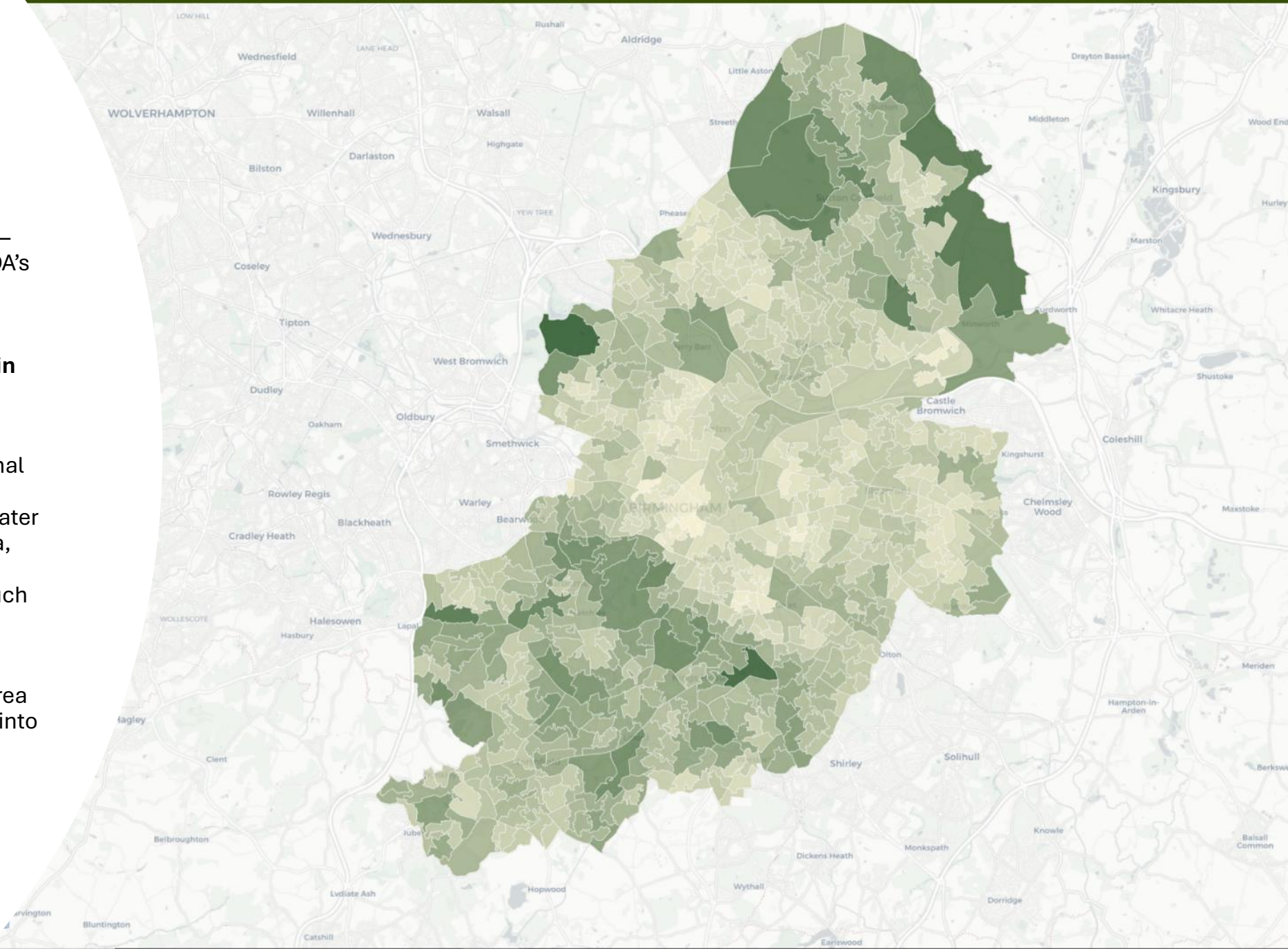
Canopy Cover by Lower Super Output Area

Smallest unit for ONS stats – approx. 1000 – 1500 residents/ 650 households – 639 LSOA's

- **Establishing Canopy Cover levels in the City**

- Canopy cover derived from UK National Tree Map (Blue Sky) and land area but factoring in area of exclusion such as water bodies, dedicated sporting areas (stadia, cricket, football, bowls etc.) and some designated nature conservation sites such as SSSI's.

- Overall, approx. 18.6% CC by total area but with excluded areas that increases into the low 20% range.
Distribution uneven across the city.



Birmingham I-Tree Eco study 2023 – Headline results

Birmingham's Structure and Composition Headline Figures		
Number of Trees (estimate)	1,129,000	
Tree Density (trees/hectare)	42	
Tree Canopy Cover	15% (4,017 ha)	
Shrub Cover	11.8%	
Most Common Tree Species	Silver Birch (11.1%), Sycamore (9%) & Holly (8.3%)	
Replacement Cost (CTLA)	£858 million	
Amenity Valuation (CAVAT)	£25.3 billion	
Proportion of Trees in Good or Excellent Condition	72.9%	
Birmingham's Ecosystem Services Headline Figures		
Total Carbon Storage	419,000 tonnes	£407 million
Annual Carbon Sequestration	12,800 tonnes	£12,500,000
Annual Pollution Removal	80.4 tonnes	£6,420,000
Annual Avoided Runoff	481,000 m^3	£776,000
Total Annual Benefits	£19,696,000	

	West Midlands Total	Coventry	Solihull
Number of Trees (estimate)	2,966,000	574,000	1,263,000
Canopy cover (ha)	7,496 (13.8%)	1,144 (11.6%)	2,336 (13.1%)
Total Carbon Storage	1,068,000 tonnes	284,000 tonnes	365,000 tonnes
Annual Carbon Sequestration	33,150 tonnes	7,950 tonnes	12,400 tonnes
Annual Pollution Removal	144 tonnes	16.4 tonnes	47.2 tonnes
Annual Avoided Runoff	936,000 m^3	161,000 m^3	294,000 m^3

Table 1: Headline figures for The West Midlands and a comparison of outputs from the component i-Tree Eco studies.

Insight - Economic valuation for baseline and growth scenarios for Birmingham's Urban Forest

A reality check!

Birmingham City is slowly losing Tree Canopy Cover (TCC).

A 'business as usual' approach will do nothing to stem this, with continued reduction from today's 17.3% to a level of 16.5% by 2051.

This relatively modest-sounding change would mean the loss of tens of thousands of trees - some 65,000 if they were all the size of the current average across the city.

A reduction in the treescape on this scale for Birmingham is a reduction is amenity of £1.2 billion in amenity; it is the potential release of up to 19,000 tonnes of carbon valued at £19 million; it is a reduction of £1 million in annual ecosystem services to the people of Birmingham.

The city-wide figures hide the disproportionate impact of the changes. The model tested indicates a substantial de-greening of the urban areas - a loss of a fifth of the current levels of tree canopy cover, with a concentration of TCC within existing woodlands and green open spaces.

The green gets greener, and the grey get greyer.

Altering this picture means pro-active intervention, with timing the vital aspect.

Intervention to arrest the decline by 2031 indicates that the topline TCC figure of 17.3 % will recover by 2051.

Leaving such an intervention another decade to 2041 means the loss of an additional 110 ha of TCC, a 10-fold greater loss in carbon stored and a 5-fold greater loss in annual ecosystem services.

Increasing all wards to a TCC of 25% will mean a trebling of the canopy in 4 wards and a doubling in another 17.
Such a change would not only mean a more equal sharing of the tree canopy cover, but it would also mean better access to an additional £13 billion in amenity and £10 million in annual ecosystem services.

To deliver this entirely through new planting is estimated to cost £21 million annually over the period to 2051.

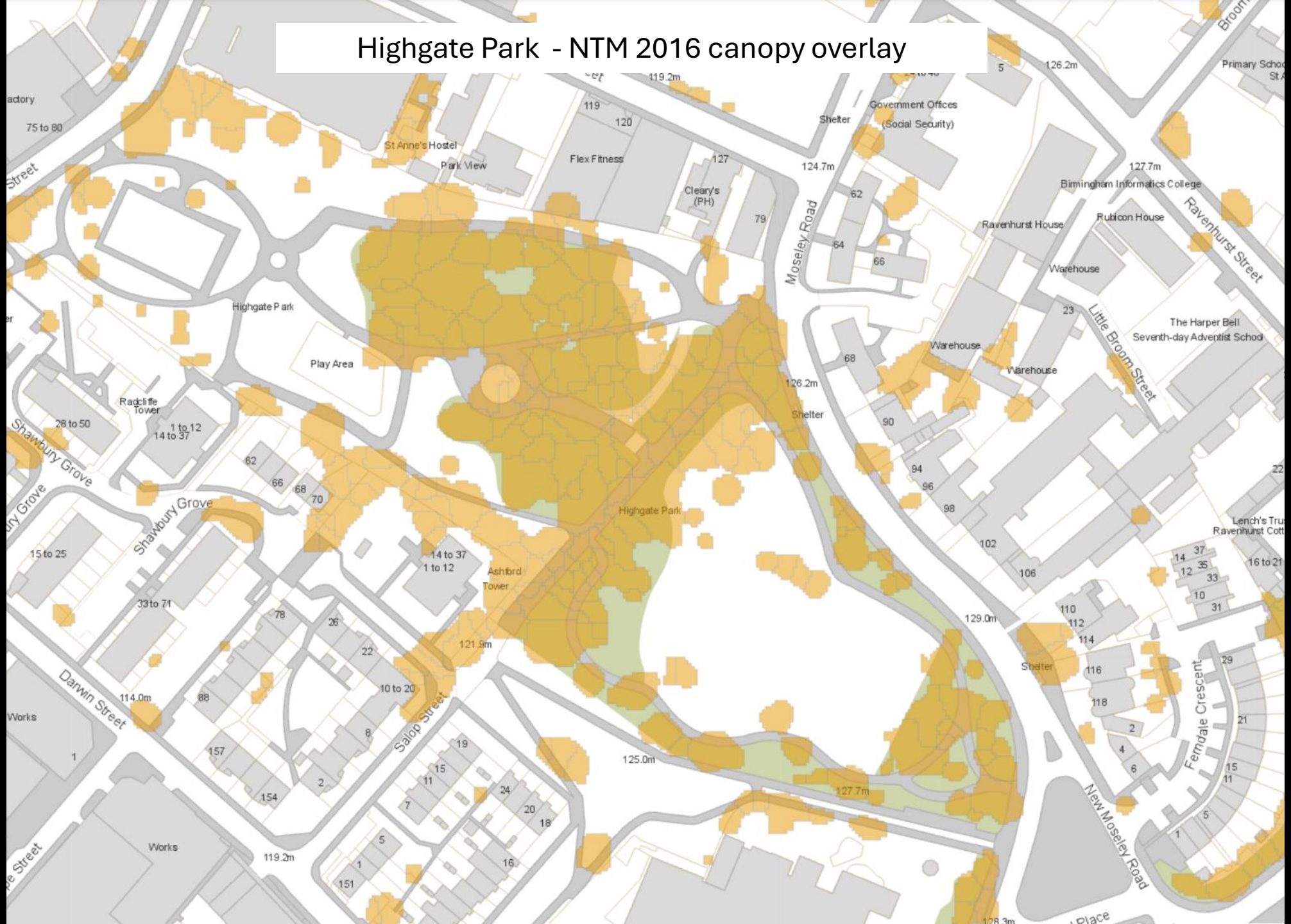
To deliver it in combination with a programme of active maintenance of the existing trees to maturity can dramatically reduce that figure.

Early intervention, with a balanced approach between new planting and maintenance of existing trees for growth looks to be the most cost-effective route to Birmingham's TCC growth ambitions.

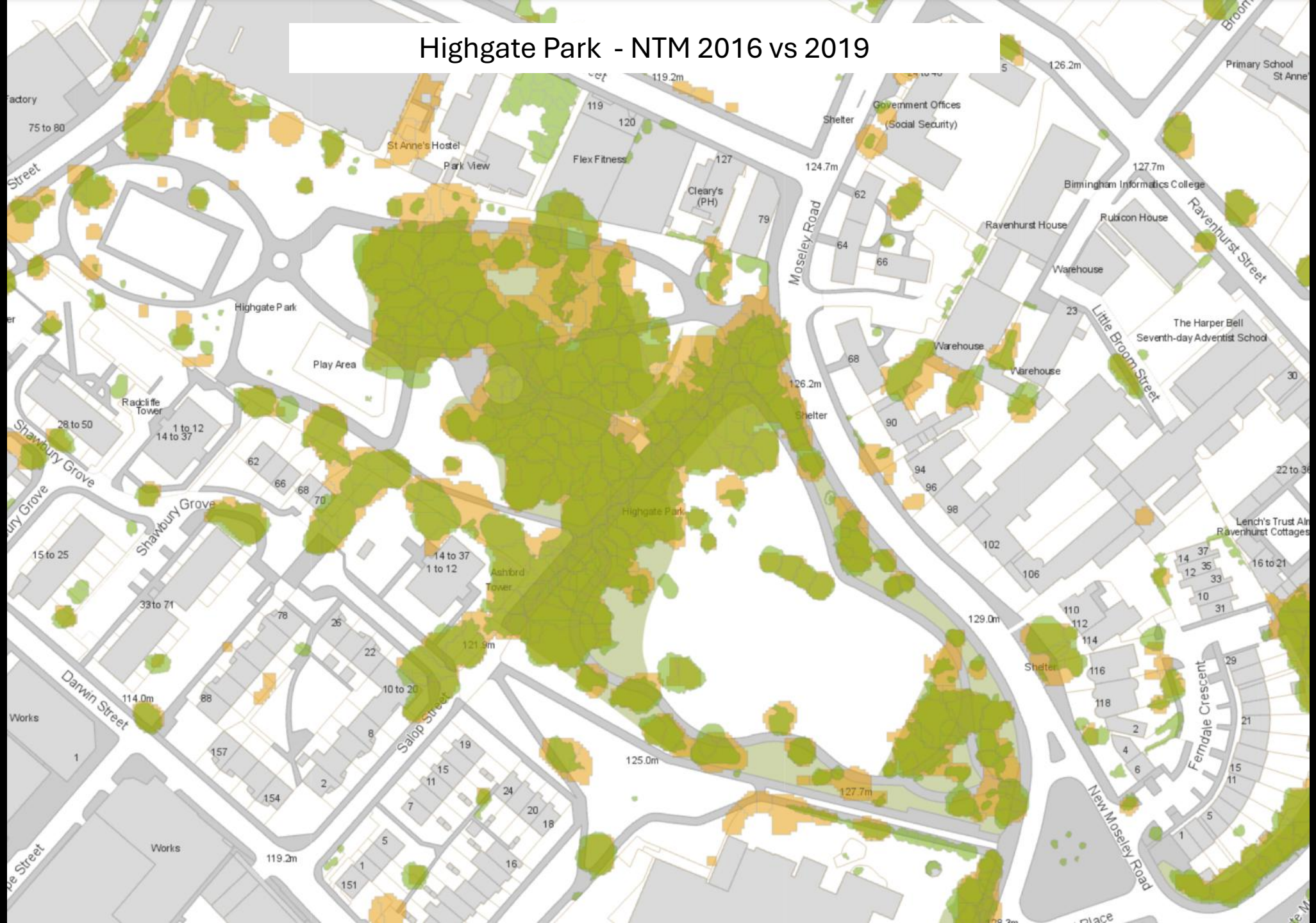
Highgate Park - Central Birmingham

Highgate Park - NTM – 2019 canopy overlay
(NTM data sets available for 2013,16,19,23)

Highgate Park - NTM 2016 canopy overlay



Highgate Park - NTM 2016 vs 2019



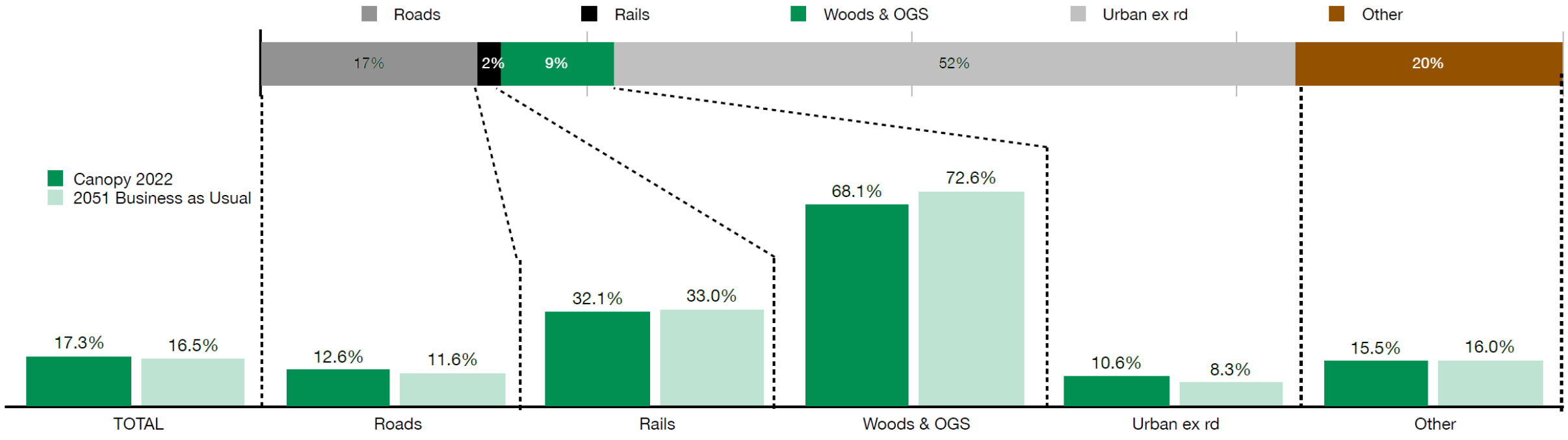


Figure 7. Canopy cover shares over different land use type groups for business as usual compared to 2022 (lower, column chart) The division of land area by landuse is shown across the top (upper, bar chart)

OFFICIAL

Tree Diversity

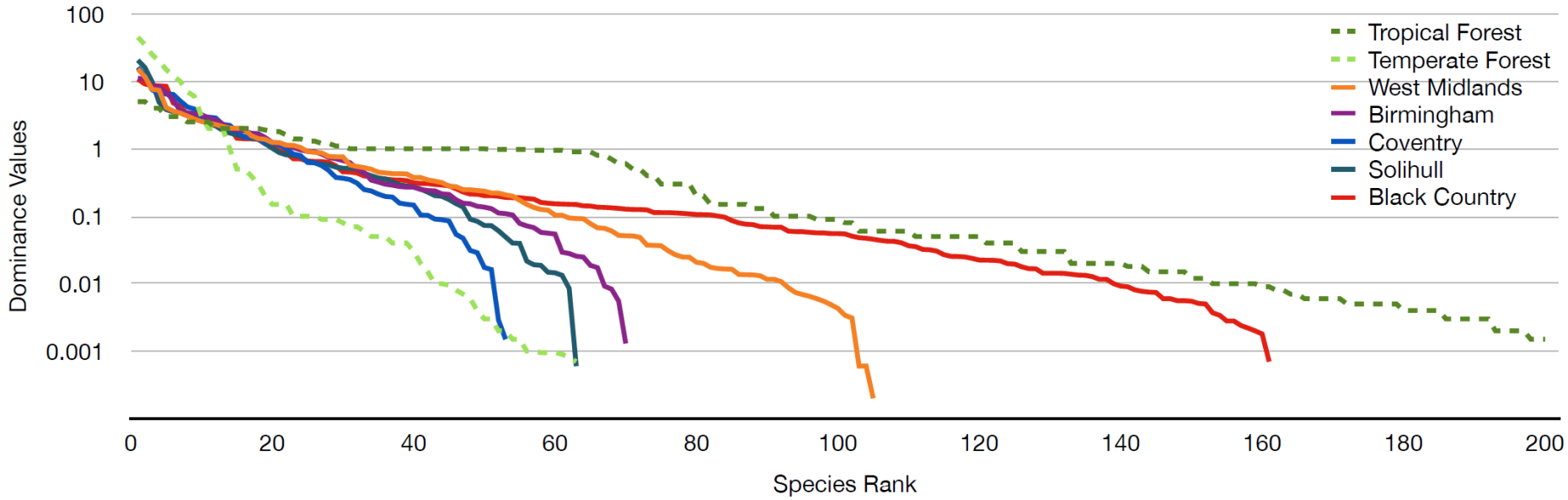


Figure 5: Hubbell's Dominance Diversity Curve showing example forest types and selected UK cities.

Maintaining a species rich urban forest is vital in providing resilience to pests & diseases and climate change. A diverse urban forest can support a range of pollinators and wildlife, whilst enhancing aesthetic value by providing a variety of colours, textures and shapes throughout the year. Overall, promoting diversity in urban forests leads to healthier, more resilient ecosystems that provide a wide range of benefits to both humans and the environment.

Many native species are not able to thrive in the artificial environments of our landscaped areas, and the effects of climate change will exacerbate the situation[2]. Maintaining a careful balance of native and non-native species within the population will ensure that habitats are protected whilst providing resilience to our ever-changing climate.

According to most metrics, Birmingham has a good level of diversity. Whilst Birmingham is more diverse than a typical temperate forest, the city still has potential to improve diversity to the level of some other cities in the UK. It is not uncommon for cities to rank highly in diversity often due to non-native tree species.

In Birmingham 69.2% of trees are a native species. These species are important for biodiversity and the ecology of the landscape; however, non-native trees will become increasingly important in a changing climate.

Birmingham I-Tree Eco study 2023 – results breakdown

Urban Forest Structure

In this survey trees were sized by their stem diameter at breast height (DBH) at 1.3m. DBH can be considered a proxy for age, bearing in mind species and potential ultimate size and form.

Trees with a DBH of 7-15 cm constitute 27% percent of the tree population of Birmingham's urban forest. Larger trees have a greater functional value and provide increased benefits (details of functional value and the resulting benefits are discussed later). It has been estimated in previous studies[7] that a 75cm diameter tree can intercept 10 times more air pollution, can store up to 90 times more carbon and contributes up to 100 times more leaf area to the tree canopy than a 15cm tree[8].

Size class distribution is also an important factor in managing a sustainable tree population. Having a large population of smaller trees is important as this will ensure that there are enough young trees to replace those older specimens that are eventually lost through old age or disease (Figure 8).

Most regions in England only have 10-20% of trees with a DBH that is greater than 30cm*, but in Birmingham it is 35.1%

*Trees in Towns II

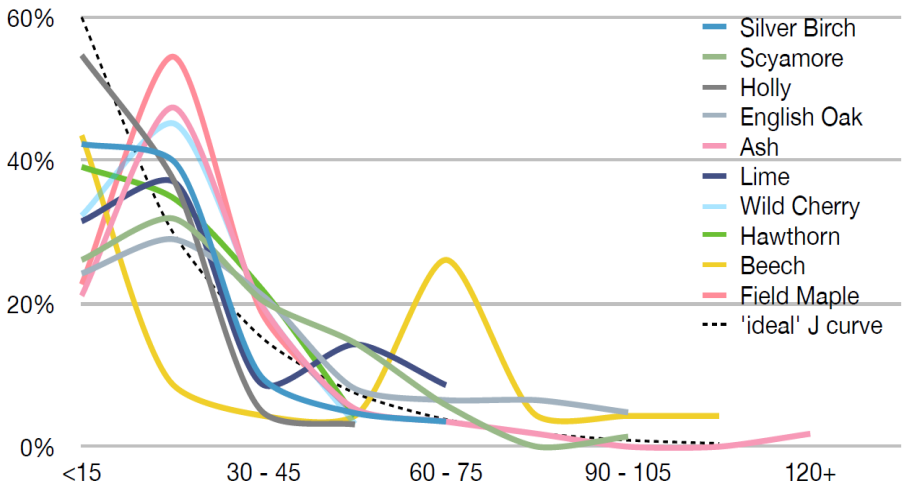


Figure 8: Spread of size classes amongst the top ten species, showing comparison to 'ideal' J-curve
'ideal' J-curve values reduce by half for each increase in DBH class

Where the goal is to continually maintain tree cover within a landscape, a guiding principle is an inverse J-curve of age going from many young to few mature trees[9] (Figure 8). Forests are unique and there is no 'one size fits all' target distribution. However, it is noted that Birmingham will benefit from a greater proportion of larger trees as the tree stock matures, if correctly managed.

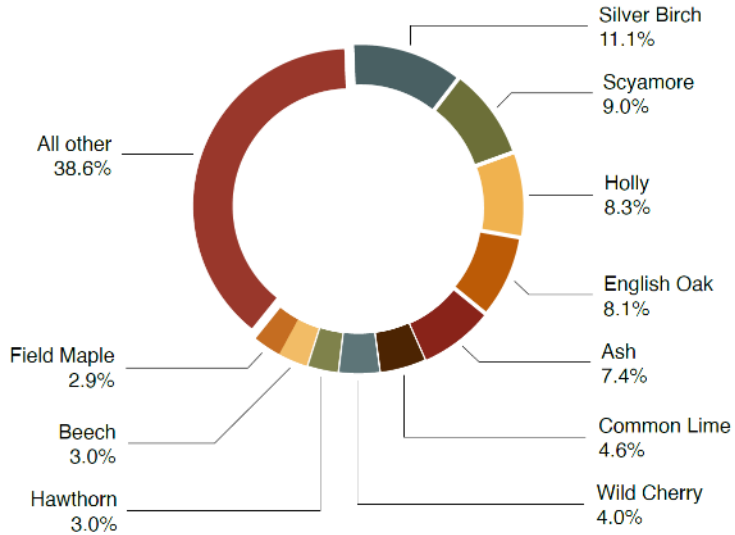


Figure 6: Species composition (most common species).

Santamour's 10-20-30 rule of thumb

This suggests upper limits for a tree population as follows:

- Single species 10%
- Single genus - 20%
- Single family - 30%

Many old city park and urban tree populations do not adhere to this rule due to historic plantings, but the rule can help inform future plantings.

Tree condition

One of the most important factors when dealing with any potential pest or disease impact is to consider the health of the tree. Tree condition was measured as part of the survey and Figure 19 shows the health of the ten most common trees in Birmingham. Overall, tree health in Birmingham is very positive, with 52.8% rated as excellent condition and a further 32.5% rated good or fair. 14.7% of trees were rated as poor or worse. Approximately 2.9% are dying or already dead.

63.1% of Ash trees in Birmingham are in an excellent or good condition. However, Ash is the second most common species in the West Midlands and the resulting loss from an increased impact of Ash Dieback, as seen in other parts of the country, remains a high risk.

Improving the diversity of species, and particularly the evenness of species across the population, will increase the resilience of the urban forest as a whole.

It will be important to tackle Ash Dieback and prepare to replace the trees which will inevitably be lost. Selecting species which are suitable replacements for Ash is key to replacing the lost canopy cover and replacement species should have roughly the same potential for ecosystem service provision as those which are lost.

Holly may be a species of serious concern as they makeup a large portion of the overall population, with over 50% of trees being recorded as poor or worse.

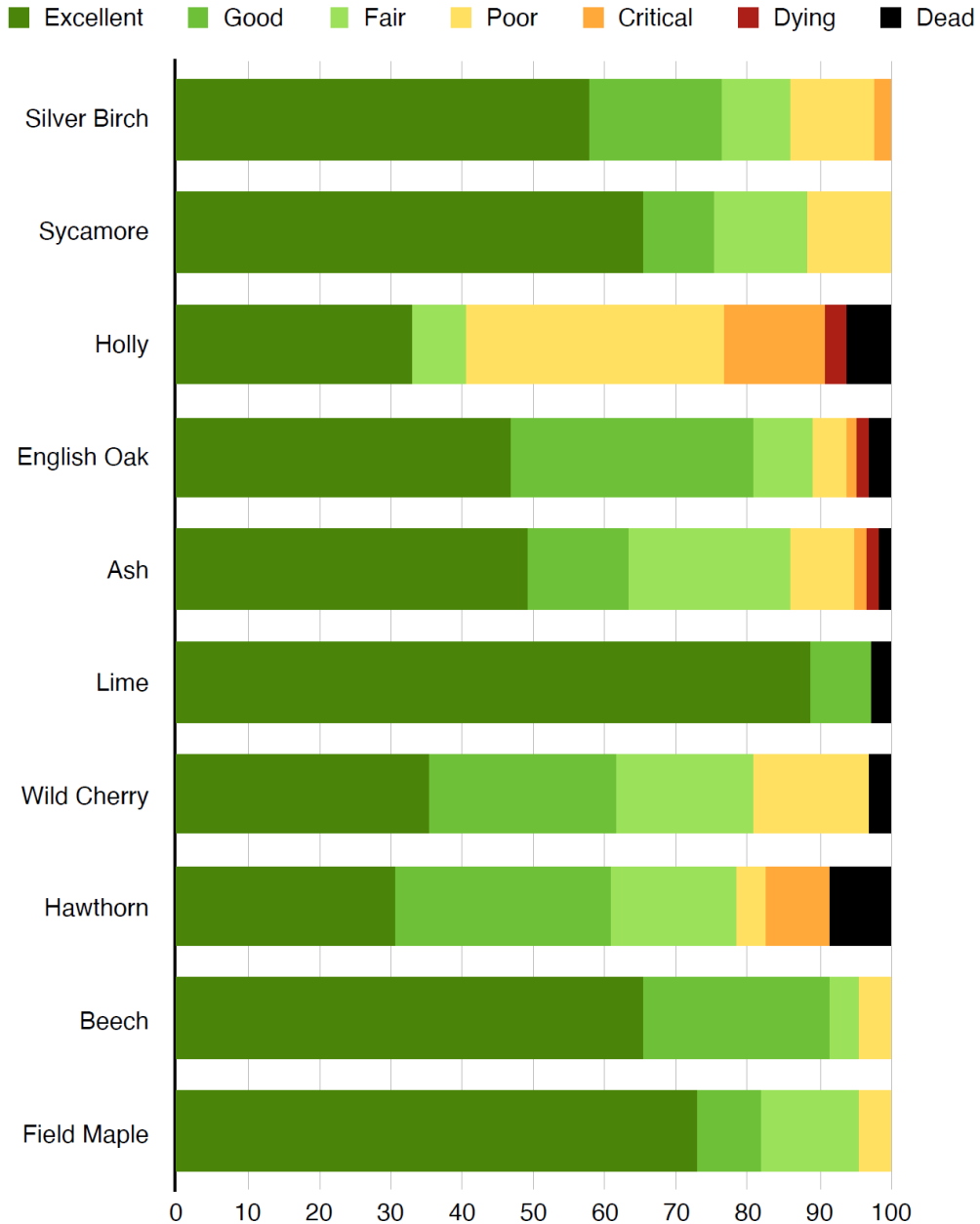


Figure 19: Condition of the 10 most common tree species in Birmingham

Tree condition as part of cyclical inspection programme

Feature

Newtown / TR: Zone 1 [2010.00]

Action | Create

Details Live

Feature Type *
TR: Zone 1 (T017) - TR: Tree Single

Feature Id
--

Site *
Newtown (NEWN)

Plot Number
2010.00

Central Asset Id *
22222634

Location
--

Notes
--

Feature Image | Additional Details

Parent Feature — Current & Future

Attributes 14

Map

Inspection Routes 2

Inspection Route	Assigned Action Officer	Next Inspection Due Date
T: 5Y Newtown (T539) - T: Full Inspection (5 Yr Insp) (TR02)	--	--
T: Ann Newtown (TA82) - T: Annual Inspection (Fast) (TR01)	--	13 Apr 2027 15:34

Current Conditions 23

Observation Type	Grade	Score
T: DBH(cm) (TR01)	DBH (cm) (5)	8.0000
T: Height (TR02)	Tree Height (m) (5)	8.0000
T: Crown Spread (TR05)	Diameter (m) (5)	6.0000
T: Tree Life Stage (TR03)	Young (5)	0.0000
T: Symmetrical Crown (TR04)	Symmetrical (15)	0.0000
T: Previous pruning (TR08)	None (NA)	0.0000
T: Deadwood (TR09)	None (20)	0.0000
T: Epicormic growth (TR10)	None (20)	0.0000
T: Included Unions (TR11)	No (10)	0.0000
T: Root condition (TR12)	GOOD (5)	0.0000
T: Stem Condition (TR13)	GOOD (5)	0.0000
T: Canopy Condition (TR21)	GOOD (5)	0.0000
T: Overall Condition (TR19)	Good (5)	0.0000
T: Cavities (TR14)	Not Assessed (NA)	0.0000
T: Pests (TR15)	Not Assessed (NA)	0.0000
T: Diseases (TR16)	Not Assessed (NA)	0.0000
T: Fungus (TR17)	Not Assessed (NA)	0.0000
T: Tree Status (TR18)	Standing Alive (5)	0.0000
T: Cavat Life Expectancy (TC02)	20 - 39 years (20)	20.0000
T: Cavat Function Value (TC01)	100% Function Reduction Value (0)	100.0000
T: Failure Potential (TR22)	1 - Low: Minor defects (01)	0.0000
T: Size of Part Rating (TR23)	1 - Small: <150mm diameter (1)	0.0000
T: Target Rating (TR24)	1 - Low: Occasional use (1)	0.0000

Maintenance Regimes

Job History

Defect History

Documents 1

Tree Species P&D – now and future?

The UK plant risk register contains 1,240 entries, and is multifaceted,
considering the current extent of a disease, the likelihood of its
spread, the severity of its damage and the ability to mitigate it.

The pest which could potentially have the greatest estimated impact across Birmingham's urban forest is the Asian Longhorn Beetle (though this is not currently present in the UK), which could affect 57% of its trees - worth £489 million.

The greatest risk, which is already present in the UK are threats to the Oak population from Acute Oak Decline and Oak Processionary Moth which threaten 11% of the total tree population valued at £117 million.

Some pests and diseases only affect a small proportion of the population, for example Dothistroma Needle Blight only threatens 2% of the species in Birmingham.
However, these seemingly low risk pests and diseases can be widespread and are therefore one of the greater threats. The population at risk from Dothistroma Needle Blight is valued at £7.45 million.

Pest/Pathogen	Major tree hosts affected	Prevalence in UK	Replacement cost of trees	Tree Population at risk (%)
Acute Oak Decline	Oak species	Central and SE England, Welsh borders and SE Wales	£117,000,000	10%
Asian Longhorn Beetle	Many broadleaf species	None (previous outbreaks contained)	£489,000,000	57%
Beech Leaf Disease	Mainly American Beech species but also others	None	£66,800,000	3%
Bronze Birch Borer	All Birch species	None	£55,100,000	12%
Ash Dieback	Many Ash species	Occurs in most parts of the UK	£55,000,000	8%
Citrus Longhorn Beetle	Many broadleaf species	None	£396,000,000	45%
Dothistroma Needle Blight	Many Pine species	Widespread	£7,450,000	2%
Elm Zigzag Saw Fly	Some Elm species	Present in SE England and East Midlands	£1,900,000	0%
Emerald Ash Borer	Common Ash and Narrow-Leaved Ash	None	£55,000,000	8%
Great Spruce Bark Beetle	Spruce species	Present	£1,140,000	0%
Horse Chestnut Leaf iner	Horse Chestnut	Present in all parts of GB	£7,360	1%
Mountain Ash Ringspot	Rowan	Widespread through Scotland and the North. Likely present across the whole UK.	£29,500	3%
Oak Lace Bug	Oak species	None	£117,000,000	10%
Oak Processionary Moth	Oak species	Established in Greater London and some surrounding counties	£117,000,000	10%
Oriental Chestnut Gall Wasp	Sweet Chestnut	Around London and the South East	£4,420	0%
Phytopthora austrocedri	*Juniperus spp, Chamaecyparis lawsonia, Chamaecyparis nootkkatensis*	Scotland and England only	£49,100,000	2%
Phytophthora lateralis	*Chamaecyparis formosensis, Chamaecyparis lawsoniana, Chamaecyparis obtuse, Chamaecyparis pisifera, Rhododendron spp., Thuja plicata, Thuja occidentalis, Pseudotsuga menziesii, Taxus brevifolia*	Occurs across the whole of the UK	£65,900,000	4%
Pine Processionary Moth	*Pinus nigra, Pinus sylvestris, Pinus pinea, Pinus halepensis, Pinus pinaster, Pinus contorta, Pinus radiata, Pinus canariensis, Cedrus atlantica, Larix decidua, Pseudotsuga menziesii*	None	£7,580,000	3%
Plane Lace Bug	Plane species	None	£72,100,000	1%
Plane Wilt	Plane species	None	£72,100,000	1%
Rednecked Long-horn Beetle	Cherry species	None	£15,200,000	6%
Sirococcus tsugae	Cedar and Hemlock species	Yes	£2,320,000	1%
Sweet Chestnut Blight	Chestnut species	Yes but uncommon	£199,000	0%

Horizon scanning - information on tree species choices

Tree Species Selection for Green Infrastructure

A Guide for Specifiers

Written by:
Dr Andrew Hirons and Dr Henrik Sjöman

Trees & Design Action Group

Primary Project Funder: NERC Science of the Environment

Academic Partners: Lancaster University; University Centre Myerscough; SLU

Quercus ilex (Holm oak)

Contents page
Alphabetical Index

Tree Selector
Use potential
Mature size
Crown form
Crown density
Environmental tolerance
Ornamental qualities

Use potential
Park; Paved; Coastal; Transport corridor

Tree size and crown characteristics
A large tree capable of growing to 25m. (15-25M)
A globular crown, capable of getting almost as wide as it is tall in open environments.
A dense crown.

Natural habitat
Native to the Mediterranean basin region and western Asia. Found in pure or mixed forest and is particularly well adapted for coastal sites. Adaptable to a wide range of soils, including calcareous, providing they are well drained and not too organic.

Environmental tolerance
Moderately tolerant to shade.
Tolerant to drought.
Sensitive to waterlogging.

Ornamental qualities
Male and female flowers held separately on the same tree, emerging in late spring with the leaves. Female flowers are inconspicuous, male catkins are attractive but not prominent. (LATE SPRING)
Acorns mature by early autumn the year of pollination. (EARLY AUTUMN)
An evergreen broadleaved tree: older leaves are shed during early summer.
Single-stemmed. Thick dark-grey bark, becoming fissured and platy at maturity.

Issues to be aware of
Is considered to be invasive, particularly in warm-temperate regions.

Notable varieties

Upright	'Fordii'.

Notes
- Observed to have some tolerance to salt and air pollution.
- Drought tolerance is at least partly derived from its ability to root deeply so where rooting depth is constrained it will not exhibit such good tolerance to drought.
- It is also possible to use this species as a hedging plant.
- *Quercus* spp. are known to be high emitters of Biogenic Volatile Organic Compounds (BVOCs).

The tree and its features

A mature *Quercus ilex* provides deep shade with its dense, globular crown.
© Andrew Hirons

Left: *Quercus ilex* has evergreen leaves. Older leaves tend to be shed during early summer. © Andrew Hirons
Right: Acorns of *Quercus ilex* mature the autumn after pollination.
© Duncan Slater

Birmingham Tree People

NEWLY PLANTED STREET TREE- INVENTORY PROJECT

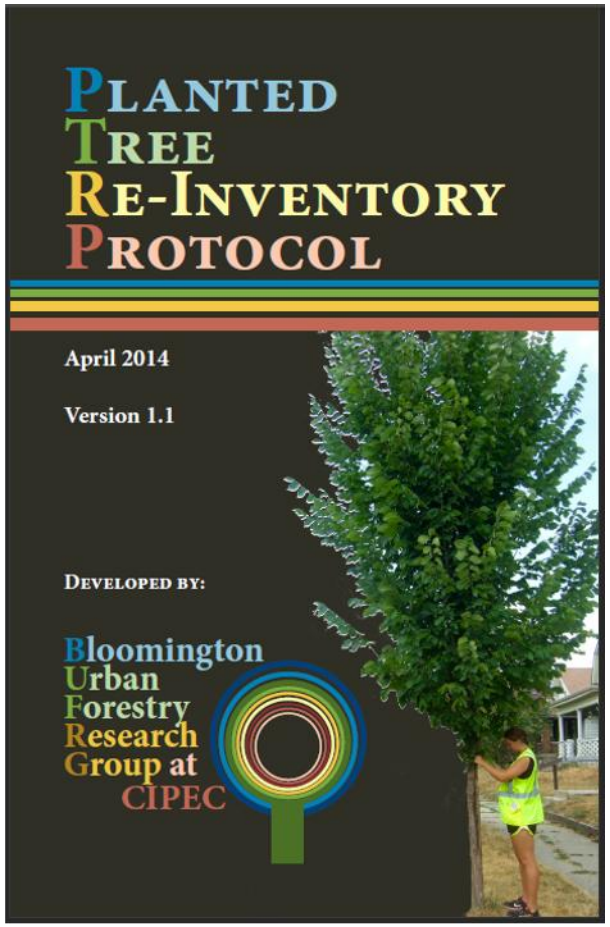
List of Variables

Variable	Name	Page #
Tree Characteristics		
Identifying Information		
V1	*Tree ID#*	26
V2	*Location*	26
V3	*Species*	27
Size		
V4	*DBH*	29
V5	*Caliper*	30
V6	*Total Height*	33
V7	*Height to Crown*	33
Canopy		
V8	*Crown Dieback*	34
V9	*Crown Exposure*	37
V10	*Chlorosis*	39
Trunk		
V11	*Root Flare*	42
V12	*Lower Trunk Damage*	43
Tree Condition		
V13	*Other Damage*	44
V14	*Overall Tree Condition*	45
Local Environment		
Near Tree Environment		
V15	*Utility Interference*	47
V16	*Building Interference*	47
V17	*Fences Interference*	47
V18	*Sign Interference*	47
V19	*Lighting Interference*	47

24

Variable	Name	Page #
V20	*Pedestrian Traffic Interference*	47
V21	*Road Traffic Interference*	47
V22	*Ground Cover At Base*	47
V23	*Ground Cover Under Canopy*	47
Planting Area Characteristics		
V24	*Planting Area Type*	50
V25	*Planting Area Relative to Road*	53
V26	*Planting Area Width*	54
V27	*Planting Area Length*	56
V28	*Curb Presence*	56
Proximity to Other Things		
V29	*Number of Trees In 10-m Radius*	58
V30	*Number of Trees In 20-m Radius*	58
V31	*Number of Trees In Same Planting Area*	58
V32	*Distance To Road*	59
V33	*Distance To Building*	59
Management		
Evidence of Maintenance		
V34	*Pruning*	62
V35	*Mulching*	64
V36	*Staking*	66
Community		
Evidence of Care		
V37	*Water Bag*	68
V38	*Bench*	68
V39	*Bird Feeder*	68
V40	*Yard Art*	68
V41	*Trash/Debris*	68

25

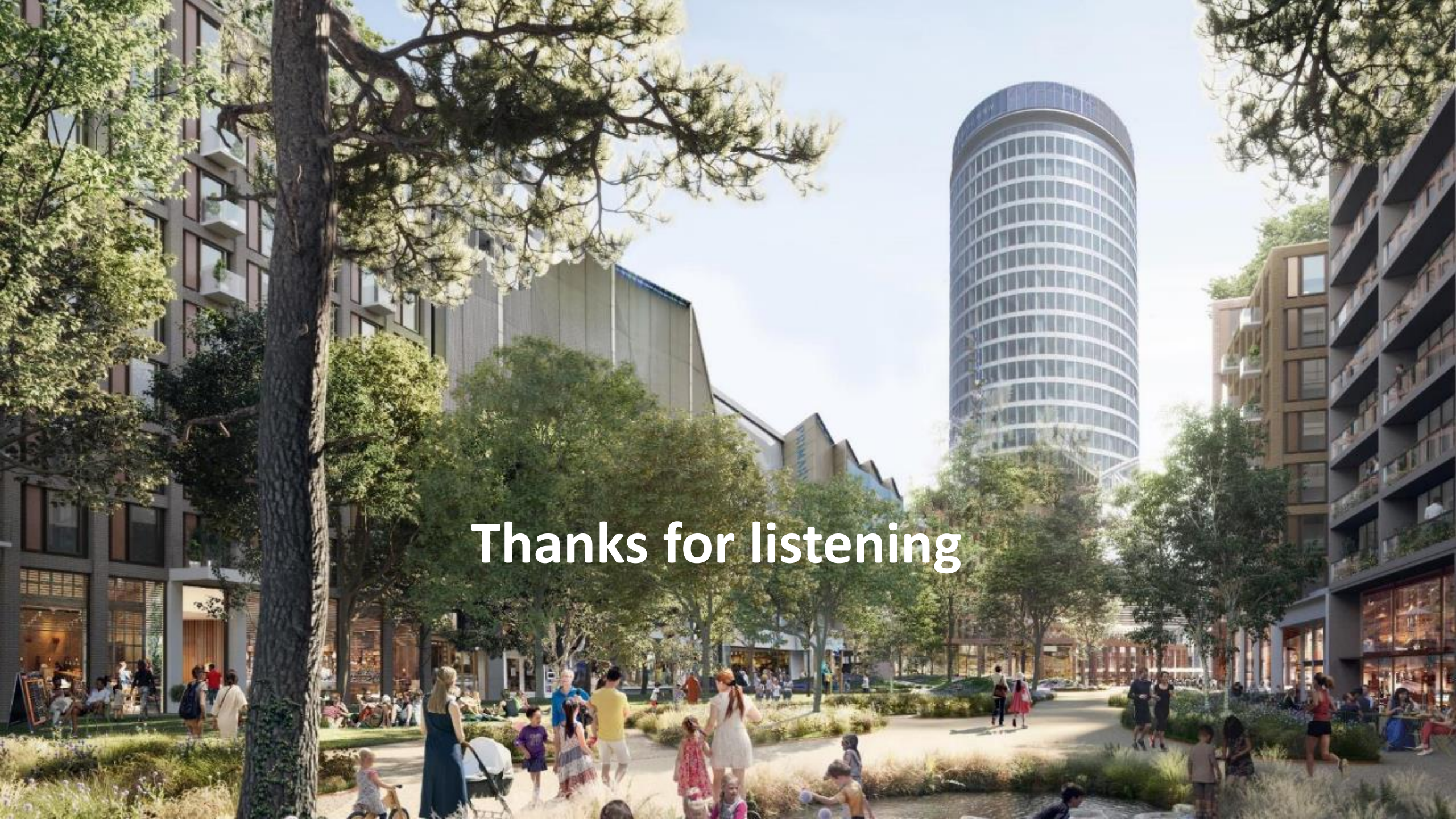


April 2014

Version 1.1

AUTHORS:

Jessica M. Vogt
Sarah K. Mincey
Burnell C. Fischer
Matt Patterson


Thanks for listening