

Understanding and Improving the Urban Forest: Lessons from the UK

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@KieronDoickFR

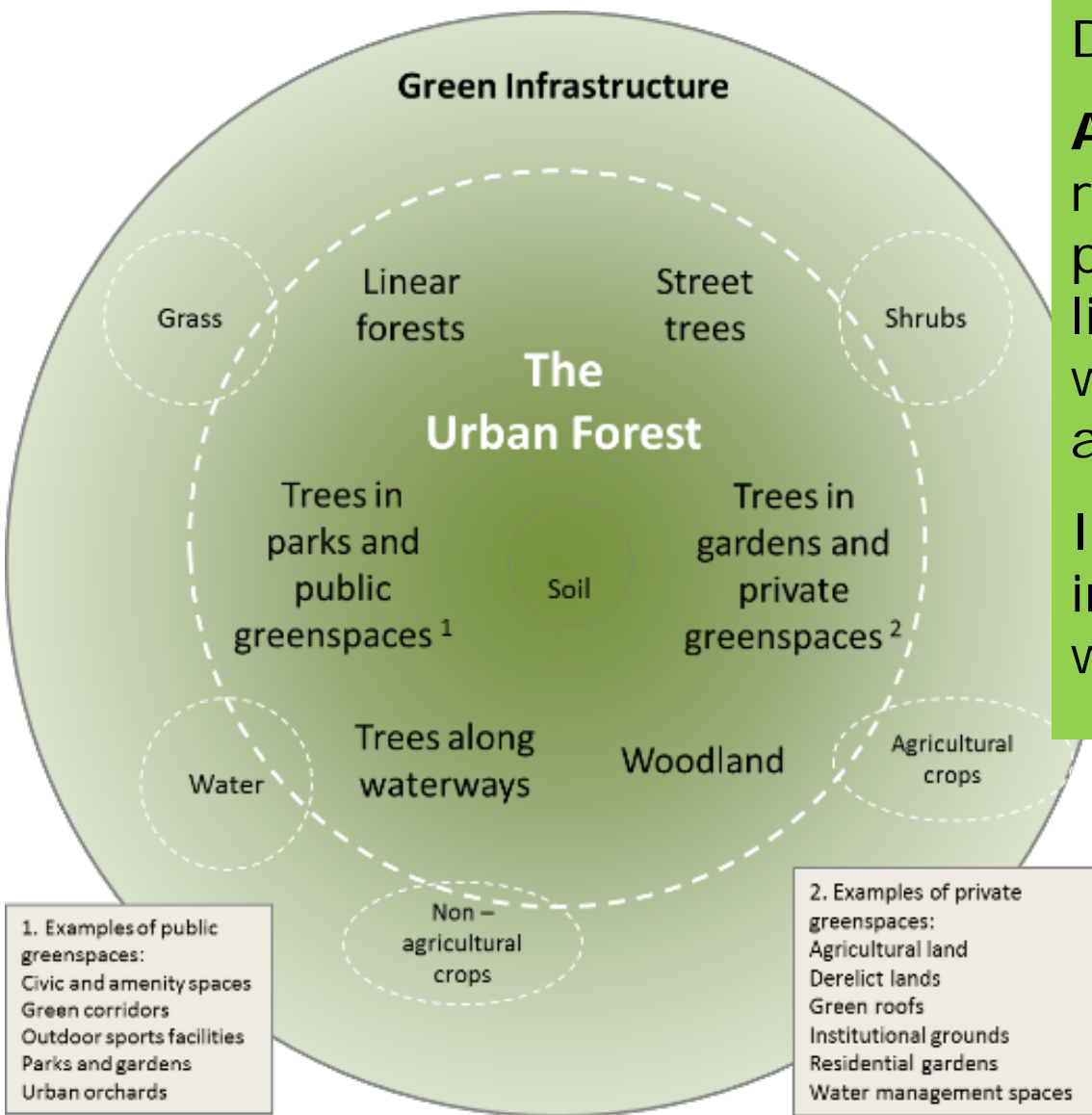
1. Profile of the urban forest in the UK
2. Supporting profile change:
 - Canopy cover
 - Inventory and valuation
3. Where next for the UK



Defined as:

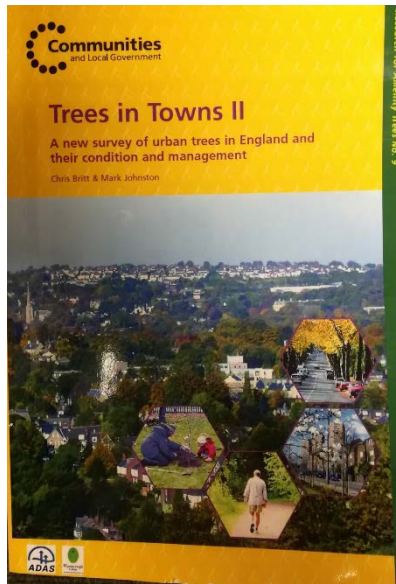
All the trees in the urban realm – in public and private spaces, along linear routes and waterways and in amenity areas.

It contributes to green infrastructure and the wider urban ecosystem.



1. Examples of public greenspaces:
- Civic and amenity spaces
 - Green corridors
 - Outdoor sports facilities
 - Parks and gardens
 - Urban orchards

2. Examples of private greenspaces:
- Agricultural land
 - Derelict lands
 - Green roofs
 - Institutional grounds
 - Residential gardens
 - Water management spaces



Trees in Towns II - a UK seminal publication but...

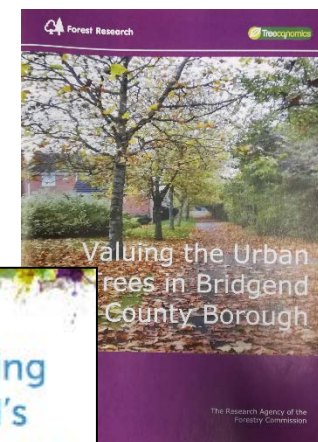
- published in 2008 : very dated now
- lack of Central 'leadership'
- fragmented roles and responsibilities

- Legislation to govern tree felling
- Health-and-safety 'Duty of Care'

But:

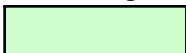
- no statutory requirement for 'strategy'
- fragmented understanding across the country
- no targets for planting, canopy, care

- 1,000,000 urban tree commitment
- 'one tree per child' in many cities
- canopy cover aspirations
- urban forest assessment becoming 'norm'
- a suite of new Urban Forest publications



The relationship between GI and the Urban Forest

GI typology	Urban Forest Component			
	Single Tree	Line of Trees	Tree Cluster	Woodland
Street trees	Commonly	Commonly	Rarely	Rarely
Amenity spaces	Commonly	Sometimes	Sometimes	Sometimes
Derelict land	Commonly	Rarely	Sometimes	Sometimes
Institutions	Commonly	Sometimes	Sometimes	Rarely
Sports	Sometimes	Commonly	Sometimes	Rarely
'Corridors'	Sometimes	Commonly	Rarely	Rarely

Key: 'commonly'  'sometimes'  'rarely' 

Benefits delivered by the urban forest

Ecosystem Service	Urban Forest Component			
	Single Tree	Line of Trees	Tree Cluster	Woodland
Carbon capture	Commonly	Commonly	Commonly	Commonly
Temperature regulation	Commonly	Commonly	Commonly	Commonly
Stormwater regulation	Commonly	Commonly	Commonly	Commonly
Air purification	Sometimes	Commonly	Commonly	Commonly
Noise mitigation	Commonly	Commonly	Commonly	Commonly

Key: 'commonly'  'sometimes'  'rarely' 


Benefits delivered by the urban forest

Ecosystem Service	Urban Forest Component			
	Single Tree	Line of Trees	Tree Cluster	Woodland
Health				
Landscape connections				
Social development				
‘learning’				
Economy				

Key: ‘commonly’ ‘sometimes’ ‘rarely’

Disservices (disbenefits) delivered by the urban forest

Disservice	Urban Forest Component			
	Single Tree	Line of Trees	Tree Cluster	Woodland
Fruit/leaf fall	Commonly	Commonly	Rarely	Rarely
Blocking light, or signal	Commonly	Commonly	Commonly	Commonly
Decrease air quality	Commonly	Commonly	Commonly	Commonly
Allergenicity	Commonly	Commonly	Commonly	Commonly
Damage to infrastructure	Commonly	Commonly	Rarely	Rarely

Key: 'commonly'  'sometimes'  'rarely' 

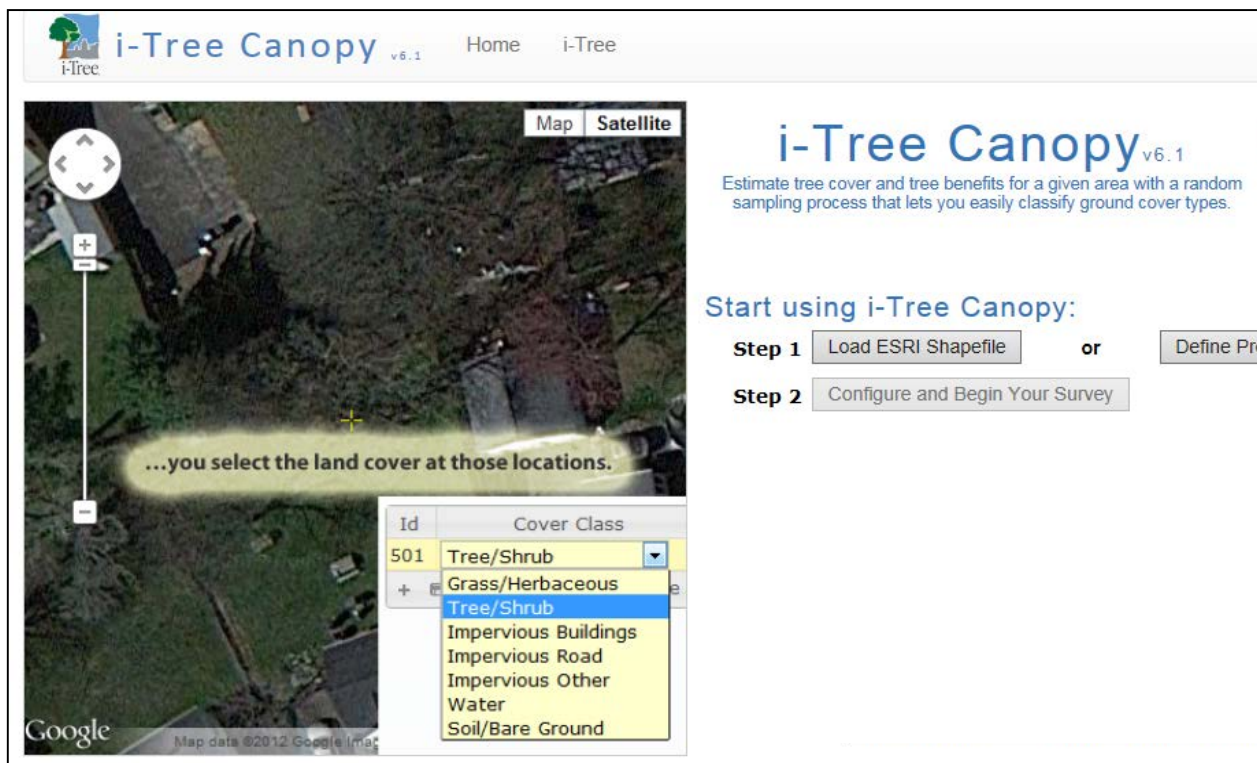
Source: Davies et al. (2017). Delivery of Ecosystem Services by Urban Forests

- Definition
 - A clear definition facilitates understanding and a vision that people can relate to
- High quality literature
 - Local context helps build the vision and 'ownership'
- Get 'trees' used in the language of the day

- Champions are important
 - these can be leading politicians
 - especially important where there isn't a national lead (Government department)
- Trees don't fight for themselves
 - Need the evidence and justification to maintain and protect
- Trees deliver multiple objectives
 - From health to housing, trees are a useful mechanism to help deliver wider policies

Urban canopy cover

- Establish a baseline for comparisons and...

The screenshot shows the i-Tree Canopy v6.1 web application. On the left is a satellite map with a yellow highlight and a text box that says "...you select the land cover at those locations." Below the map is a legend table:

Id	Cover Class
501	Tree/Shrub
+	Grass/Herbaceous
	Tree/Shrub
	Impervious Buildings
	Impervious Road
	Impervious Other
	Water
	Soil/Bare Ground

On the right side of the interface, the text reads: "i-Tree Canopy v6.1 Estimate tree cover and tree benefits for a given area with a random sampling process that lets you easily classify ground cover types." Below this, it says "Start using i-Tree Canopy:" followed by two steps:

- Step 1: Load ESRI Shapefile or Define Project
- Step 2: Configure and Begin Your Survey

...to
monitor
change

Urban canopy cover



- Methodology:
 - i-Tree Canopy
 - Remote sensing (NDVI)
 - Aerial photography
- How to choose:
 - Cost
 - Repeatability
 - Future-proof
 - Understandable

Baselining canopy cover

- 283 towns and cities in England
- The major cities of Scotland and Wales

Summary statistics

Canopy Cover	Number of Towns	Size
		Mean
under 10%	40	11.6
10-20%	175	24.5
20-30%	60	26.9
over 30%	8	9.1

England	15.8%
Scotland	15.1%
Wales	21.0%


Variability in canopy cover within towns and cities

- City-wide statistics can't inform strategy, or action plans
- Analysis of 300 cities cost £15,000
[5,824 wards would cost >£250,000]
- Automated systems don't [yet] offer reliability

step-by-step guide: <https://bit.ly/2PT8Mlo>

Help build an urban tree canopy cover map for the UK!

Carry out a canopy cover assessment for your local area using our clear step by step guidance and help us to build a canopy cover map for the UK!



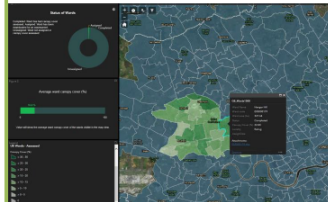
How to estimate canopy cover?

The free-to-use online tool i-Tree Canopy makes the assessment as easy as possible for you. It allows canopy cover to be estimated robustly and quickly (in around 1 hour) in comparison to other methods.

Visit our website for more information and instructions of how to use i-Tree Canopy.
<https://www.forestresearch.gov.uk/research/i-tree-eco/UrbanCanopyCover>

View canopy cover in your area!

Visit our online, interactive webmap to view individual ward canopy cover results, stats on average canopy cover and to check project progress.
<https://bit.ly/2PT8Mlo>










Figure 1.

Status of Wards

Completed: Ward has had canopy cover assessed.
 Assigned: ward has been downloaded for an assessment.
 Unassigned: Ward not assigned or canopy cover assessed.

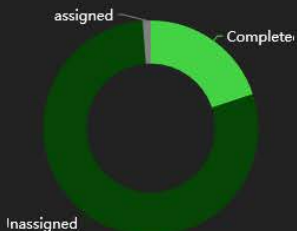
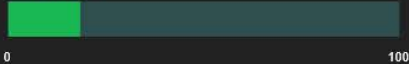


Figure 2.

Average ward canopy cover (%)

18.4 %

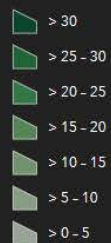


Value will show the average ward canopy cover of the wards visible in the map view.

Legend

UK Wards - Assessed

PerCanCov

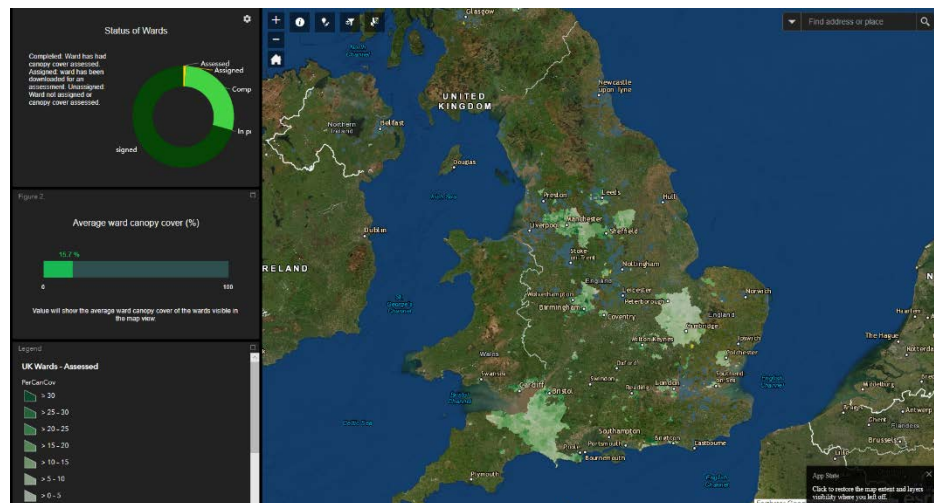


App State
 Click to restore the map extent and visibility where you left off.

Variability in canopy cover within towns and cities

Results so far:

- Citizen scientists
 - 77 participants so far
 - 31 active in last 2 months



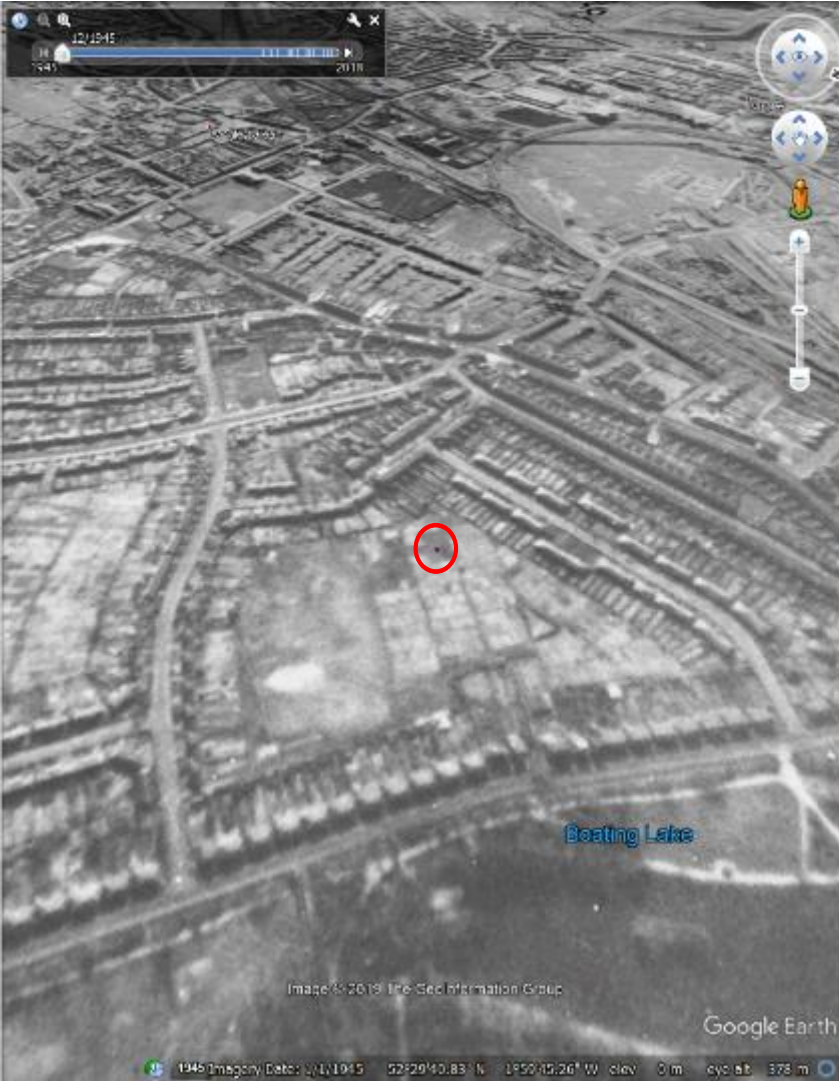
- 5,824 urban wards
- 1,464 completed (25%)
- Average canopy cover: 16.3%
- Range 0-80%
- 6,091 rural wards
- 1,731 completed (28%)
- Average canopy cover: 11.5%
- Range 1-39%

Is Urban Tree Canopy Cover Changing?

- Ten cities

 - (2 Scottish, 2 Welsh, 6 English cities)

- Decadal trend analysis,
from the 1940 to 2018



Birmingham, 1945

www.britainfromabove.org.uk



1999



2001



2003



2007

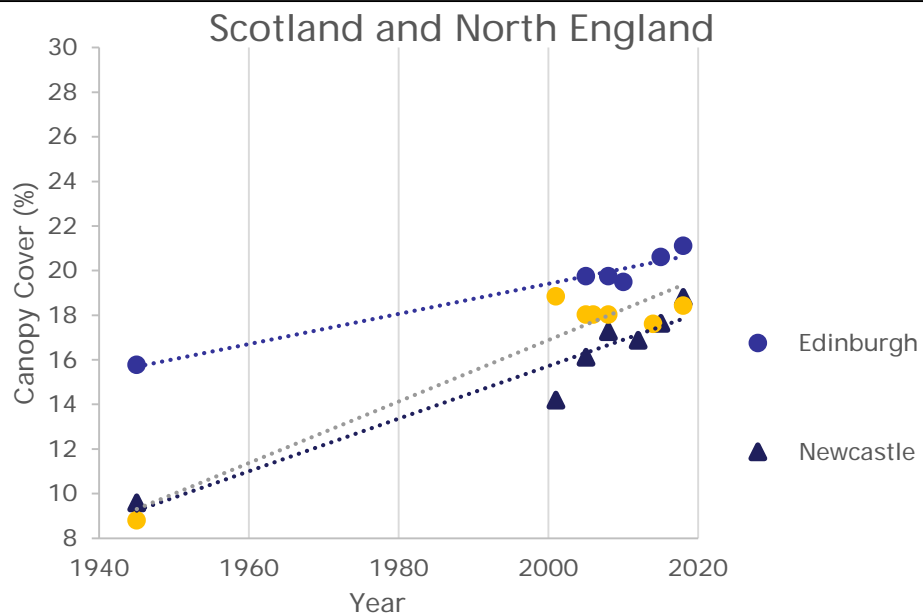
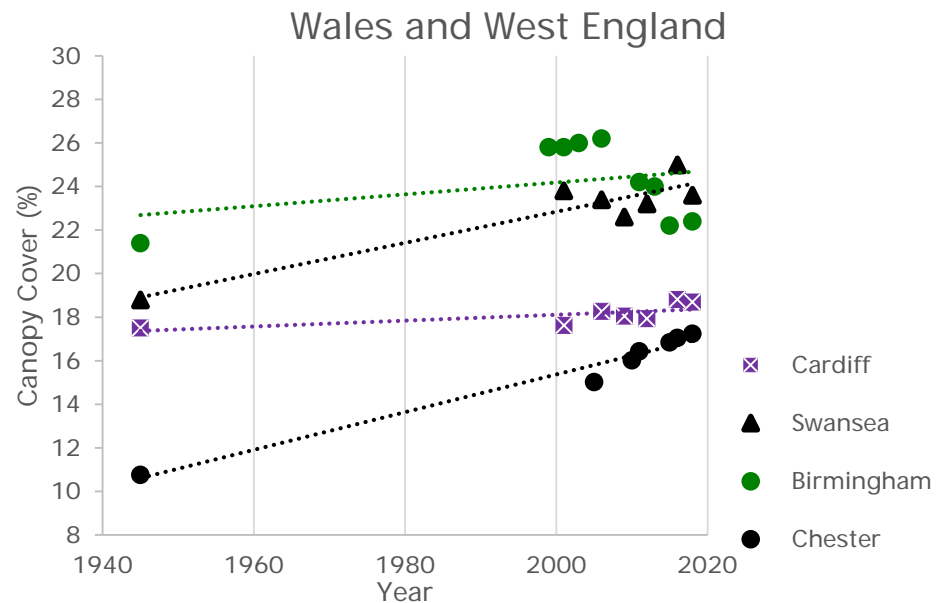


2013



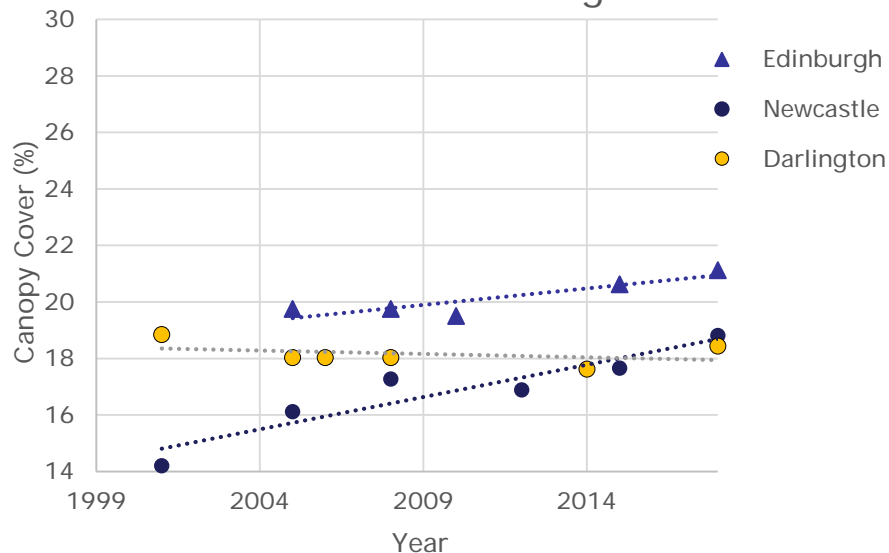
2018

Birmingham

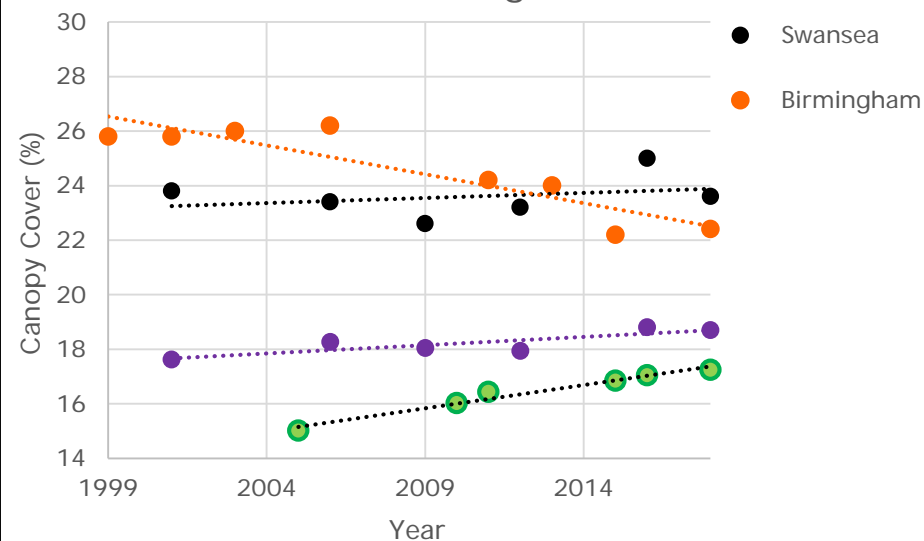


- General trend is "up"
- less clear over the past two decades...
- ...possibly in decline?

Scotland and North England



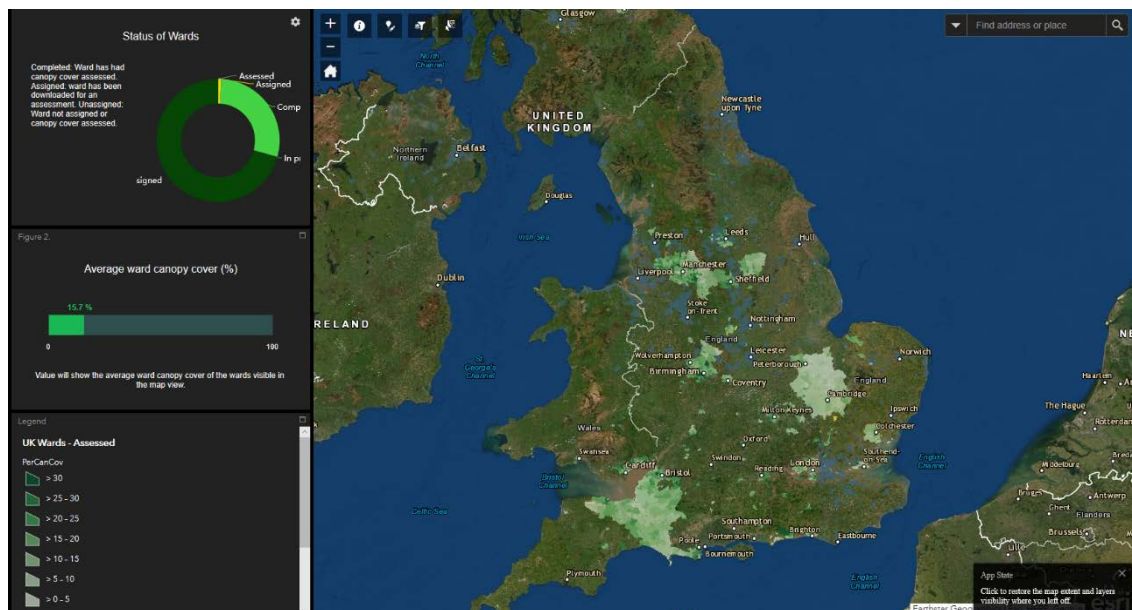
Wales and West England



- 7 urban areas show increase, 4 significant
- One city (Maidstone) showed significant decline
- Cardiff and Darlington little or no change

- Trust statistics, not anecdotes
- Know your coverage 'today'
 - Street
 - Neighbourhood
 - District
- Know how coverage has changed over time

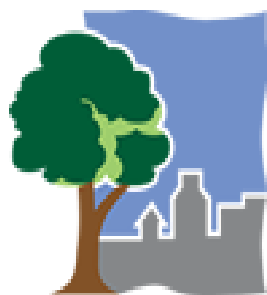
- Get people involved: good for them, cheaper for you
- Why wait, baseline today



i-Tree: a suite of tools

- Eco, Hydro, Canopy

www.itreetools.org



i-Tree

By the USDA
Forest Service
and Davey

Urban Trees

Ecosystem service provision

Quantification and valuation

= Decision making

Provisioning	Regulating	Supporting	Cultural
Food Fibre (material for crafts)	Climate regulation Air pollution removal Rainfall interception	Habitat creation Soil-making	Amenity Recreation Heritage Biodiversity Cohesion

- **Urban forest structure and composition**
 - Canopy cover, Species diversity, Condition, Age class
 - Land use, Ground cover
 - Leaf area, by species
- **Ecosystem services**
 - Air pollution removal: CO, NO₂, SO₂, O₃, particulates
 - Carbon storage, and annual uptake
 - Rainfall interception
 - [Energy savings by buildings]

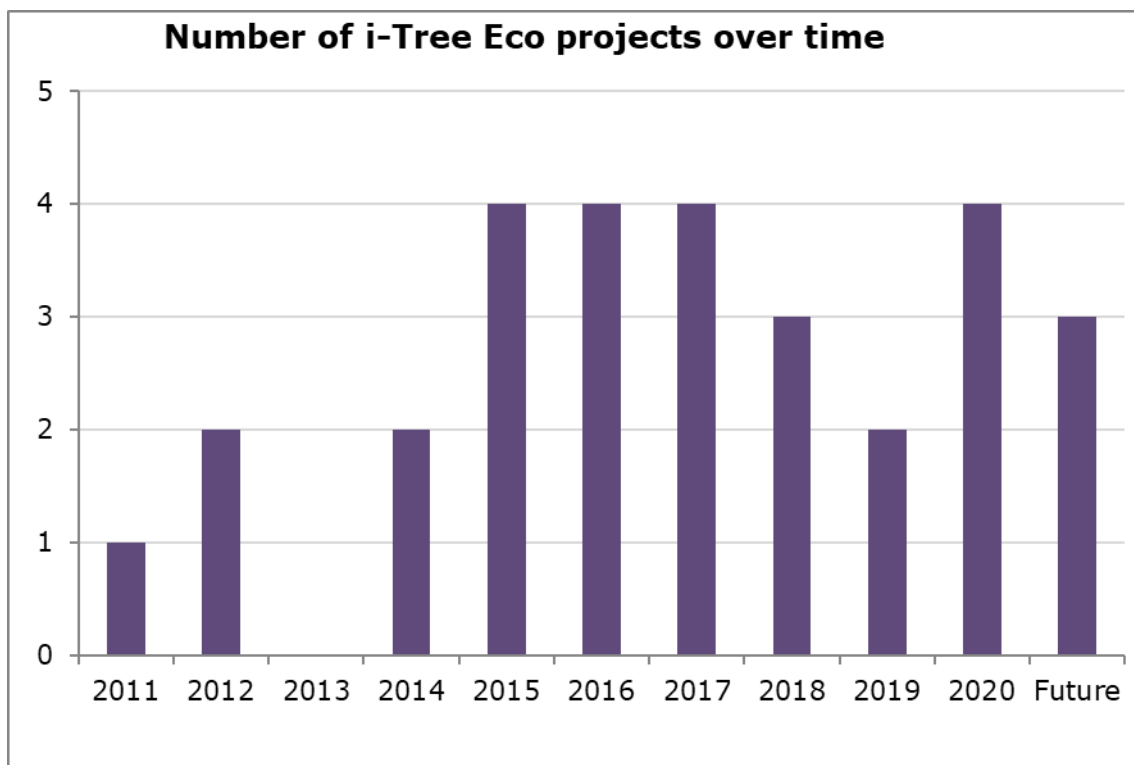


- 2010 Torbay (reported in 2011)
- 2011 Victoria Business District in London
- 2012 Edinburgh (first in Scotland)
- 2014 Wrexham (first in Wales)
- 2015 London



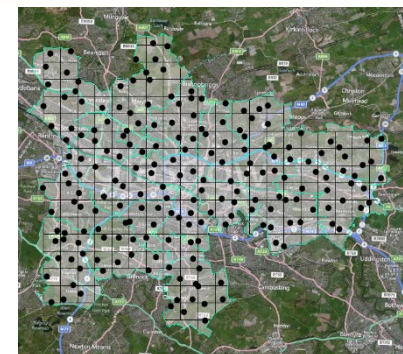
Each project is slightly different

Unique selling point



Headline comparisons

- Most important are 'aliens' and 'scrub'
- Need to better manage tree condition



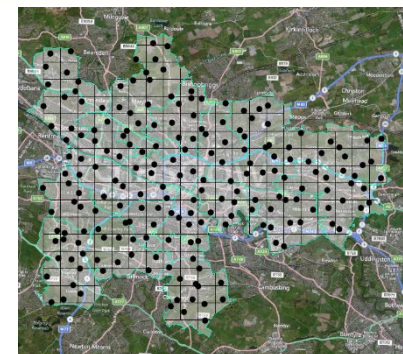
	Torbay	Edinburgh	Wrexham	Glasgow
Est. tree pop	818k	630k	364k	2 million
Est. tree cover	12%	17%	17%	15%
Most common species	L. cypress Ash Sycamore	Sycamore Holly Silver birch	Sycamore Hawthorn Silver birch	Ash Hawthorn Alder
Most 'Important' species	Ash Sycamore L. cypress	Sycamore Holly Plum sp.	Sycamore Silver birch Hawthorn	Ash Hawthorn Sycamore
Condition: Excel.	59%	71%	90%	90%
Condition: Good	20%	17%	3%	3%

Headline comparisons

- Asset value: £Billions
- Per tree per annum: £2 - £3.65



i-Tree



	Torbay	Edinburgh	Wrexham	Glasgow
ES del per annum	£1.7 mill	£2.3 mill	£1.2 mill	£4.4 mill
Carbon storage	£5 mill	£15 mill	£14 mill	£38 mill
CAVAT (£)	(n/d)	(n/d)	1,200 mill	4,000 mill
ES del. per annum per tree	£2.08	£3.65	£3.30	£2.20
CAVAT (£/tree)	(n/d)	(n/d)	£3,296	£2,000

Sustainability indicators

- Local knowledge is important, but you need context
- City comparisons has guided criteria selection

Region	Town/ City	1. Canopy cover	2. Size diversity	3. Taxonomic diversity	4. Tree condition	5. Cold hardiness suitability
Scotland	Edinburgh	Green	Red	Red	Green	Green
	Glasgow	Green	Red	Red	Green	Green
Wales	Bridgend	Green	Red	Red	Green	Green
	Cardiff	Green	Green	Red	Green	Green
	Swansea	Green	Yellow	Red	Yellow	Yellow
	Wrexham	Green	Red	Red	Yellow	Green
England	Burton	Red	Yellow	Red	Green	Green
	London	Yellow	Yellow	Yellow	Green	Green
	Oldham	Yellow	Red	Red	Green	Green
	Petersfield	Green	Yellow	Red	Green	Green
	Southampton	Green	Green	Red	Red	Green
	Torbay	Green	Red	Red	Green	Green

<https://doi.org/10.1093/forestry/cpz054>.



UK science to underpin tree valuation

- Species and location specific growth rates
- Species specific allometric relationships (e.g. biomass)
- Leaf area
 - Leaf area index (LAI)
 - Shading factors
- Building energy use coefficients



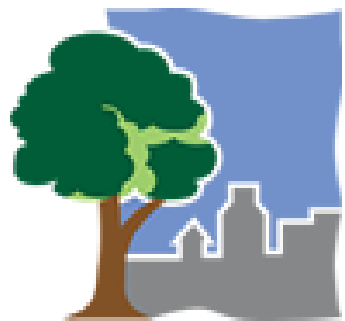
Understanding, Funding and Delivering

- Public perceptions
 - What do people want
- Carbon markets
 - New funding for trees
- Mapping benefit delivery
 - Equality in distribution and focus for future planting



- “ i-Tree ” makes a difference
 - Inventory information
 - Quantified benefits
 - Allows you to communicate with politicians and the public
- i-Tree is NOT the solution
 - i-Tree provides information, only
 - Use the information to drive change, effort *is* required
 - Social impacts not fully considered

- Economic value of trees
 - Trees are an 'asset' to society, we need to learn to manage them as assets
 - Economic valuation supports Return-on-Investment (ROI) decision making
- Comparisons lead to targets
 - Comparing district with district reveals inequality and can drive improvement



i-Tree



Cyfoeth
Naturiol
Cymru
Natural
Resources
Wales



WOODLAND
TRUST



Forestry Commission



Trees & Design
Action Group



cares for trees



The Open
University

My thanks to:

- Davey Institute and the USDA's Forest Service
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- my Group at Forest Research
- Open University (UK)