



Sustainable treescapes for everyone

Tree species selection for a changing climate -

Using what we've got

Kenton Rogers - Co-Founder and CEO

kenton@treeconomics.co.uk



**Trees & Design
Action Group**

Long Term Canopy ... The aspiration



The Reality



What have we got?

- Our Experience and Knowledge (as individuals and collectively)
- Street Tree Inventories
- i-Tree Eco studies
- Botanical Gardens
- Other Free to Use Resources and Decision Support Tools

Experience and Knowledge



Street Tree Inventories

Appendix II. Species Dominance Ranking List

Scientific Name	Common Name	% Population	% Leaf Area	Dominance value
<i>Quercus robur</i>	English oak	20.8%	31.0%	51.8
<i>Fraxinus excelsior</i>	Ash	16.9%	31.9%	48.8
<i>Acer pseudoplatanus</i>	Sycamore	10.2%	17.4%	27.6
<i>Fagus sylvatica</i>	Beech	8.6%	15.3%	23.9
<i>Betula pendula</i>	Silver birch	4.9%	12.1%	17.0
<i>Pinus nigra</i>	Corsican pine	3.7%	8.7%	12.4
<i>Picea abies</i>	Norway spruce	3.1%	8.4%	11.5
<i>Alnus glutinosa</i>	Alder	3.9%	6.7%	10.6
<i>Acer campestre</i>	Field maple	3.5%	7.0%	10.5
<i>Tilia platyphyllos</i>	Broad-leaved lime	4.6%	5.4%	10.0
<i>x Hesperotropsis leylandii</i>	Leyland cypress	1.3%	4.8%	6.1
<i>Prunus spinosa</i>	Blackthorn	0.7%	5.2%	5.9
<i>Salix fragilis</i>	Crack willow	1.9%	3.7%	5.6
<i>Ulmus glabra</i>	Wych elm	1.5%	3.2%	4.7
<i>Cedrus libani</i>	Cedar of Lebanon	1.1%	2.9%	4.0
<i>Betula pubescens</i>	Downy birch	1.1%	2.6%	3.7
<i>Corylus avellana</i>	Hazel	0.8%	1.8%	2.6
<i>Quercus rotundifolia</i>	Holm oak	1.0%	1.5%	2.5
<i>Acer platanoides</i>	Norway maple	0.7%	1.7%	2.4

Scientific Name	Common Name	% Population	% Leaf Area	Dominance value
<i>Pyrus calleryana</i>	Callery pear	0.6%	1.6%	2.2
<i>Crataegus monogyna</i>	Hawthorn	0.4%	1.7%	2.1
<i>Prunus avium</i>	Wild cherry	0.4%	1.7%	2.1
<i>Thuja plicata</i>	Western red cedar	0.9%	1.1%	2.0
<i>Acer saccharinum</i>	Silver maple	0.8%	1.1%	1.9
<i>Ilex aquifolium</i>	Holly	0.1%	1.6%	1.7
<i>Pinus sylvestris</i>	Scots pine	0.5%	1.2%	1.7
<i>Carpinus betulus</i>	Hornbeam	0.6%	1.1%	1.7
<i>Malus sylvestris</i>	Wild crab	0.4%	0.9%	1.3
<i>Pinus radiata</i>	Monterey pine	0.4%	0.9%	1.3
<i>Alnus cordata</i>	Italian alder	0.5%	0.8%	1.3
<i>Castanea sativa</i>	Sweet chestnut	0.5%	0.8%	1.3
<i>Salix caprea</i>	Goat willow	0.2%	1.0%	1.2
<i>Populus nigra</i>	Black poplar	0.2%	0.9%	1.1
<i>Tilia x europaea</i>	European lime	0.3%	0.8%	1.1
<i>Trachycarpus fortunei</i>	Chusan palm	0.0%	1.0%	1.0
<i>Sequoiadendron giganteum</i>	Giant sequoia	0.9%	<0.1%	0.9
<i>Malus domestica</i>	Orchard apple	0.2%	0.7%	0.9
<i>Sambucus nigra</i>	Elder	0.0%	0.8%	0.8
<i>Laurus nobilis</i>	Bay	0.1%	0.6%	0.7
<i>Sorbus aucuparia</i>	Rowan	0.1%	0.6%	0.7

Street Tree Inventories

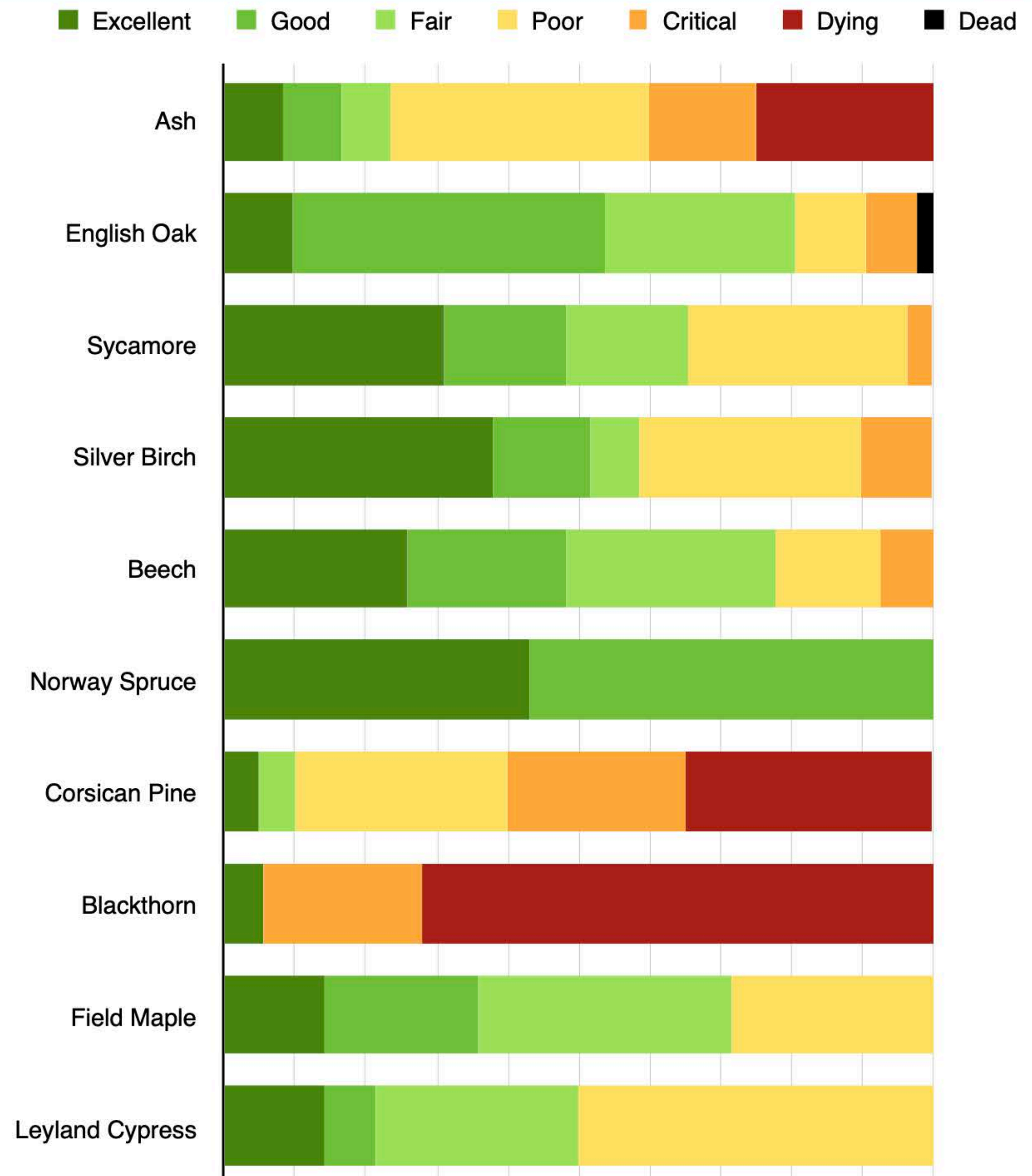
One of the most important factors when dealing with any potential pest or disease impact is to consider the health of the tree. Tree condition was measured as part of the survey and Figure 19 shows the health of the 10 most common trees in Exeter. Overall, tree health in Exeter requires improvement, with 23.8% rated as excellent condition and a further 35.6% rated good or fair. 40.6% of trees rated as poor or worse. Approximately 10% are dying or already dead.

Over 75% of Ash trees in Exeter are in a 'poor' condition or worse. 25% are categorised as 'Dying'. This indicates the severity of the Ash Dieback disease in Exeter, and as Ash is the most common tree species, this is a serious concern.

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.

Blackthorn and Corsican Pine also have serious concerns regarding the proportion their population which can be considered critical or worse.



Street Tree Inventories

Exeter City Eco Sample Report V4.pdf
Page 35 of 55

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	£38,300,000	11%
Asian longhorn beetle	Many broadleaf species	None (previous outbreaks contained)	£34,500,000	62%
Beech leaf Disease	Mainly American beech species but also others	None	£9,430,000	7%
Bronze Birch Borer	All birch species	None	£2,750,000	9%
Chalara dieback of ash	Many ash species	Occurs in most parts of the UK	£8,390,000	15%
Citrus longhorn beetle	Many broadleaf species	None	£34,500,000	47%
Dothistroma Needle Blight	Many pine species	Widespread	£5,600,000	6%
Elm zigzag saw fly	Some elm species	Present in SE England and East Midlands	£844,000	2%
Emerald ash borer	Common ash and narrow-leaved ash	None	£8,390,000	15%
Great Spruce Bark Beetle	Spruce species	Present	£4,380,000	5%
Horse chestnut leaf miner	Horse Chestnut	Present in all parts of GB	£0	0%
Mountain ash ringspot	Rowan	Widespread through Scotland and the North. Likely present across the whole UK.	£896	0%
Oak Lace bug	Oak species	None	£38,300,000	11%
Oak processionary moth	Oak species	Established in Greater London and some surrounding counties	£38,300,000	11%
Oriental Chestnut gall wasp	Sweet Chestnut	Around London and the South East	£448	0%
<i>Phytophthora austrocedri</i>	<i>Juniperus spp, Chamaecyparis lawsonia, Chamaecyparis nootkatensis</i>	Scotland and England only	£58,000	0%

Street Tree Inventories

5. Current Species Suitability

Species suitability refers to a species ability to survive in certain conditions such as differing climate and soils. In urban spaces, it also includes tolerances to urban pressures, such as pollution levels, high salinity, reduced access to light, water and more. Belfast has an exceptionally wet climate compared to the rest of the UK. It also experiences more storm events accompanied by high winds.

The Climate Assessment Tool (CAT) asserts the likely suitability of taxa to predicted future climate scenarios - informing which of these species will be most vulnerable, and best suited to these anticipated changes in climate. Species were analysed under RCP 4.5 by 2050, and RCP 7.0 by 2090. By comparing 3 climates, a suitability score can be generated, determining how likely the species is to occur at the mean annual temperature for each selected pathway. A list of street tree species and their suitability according to the CAT is in Appendix III.

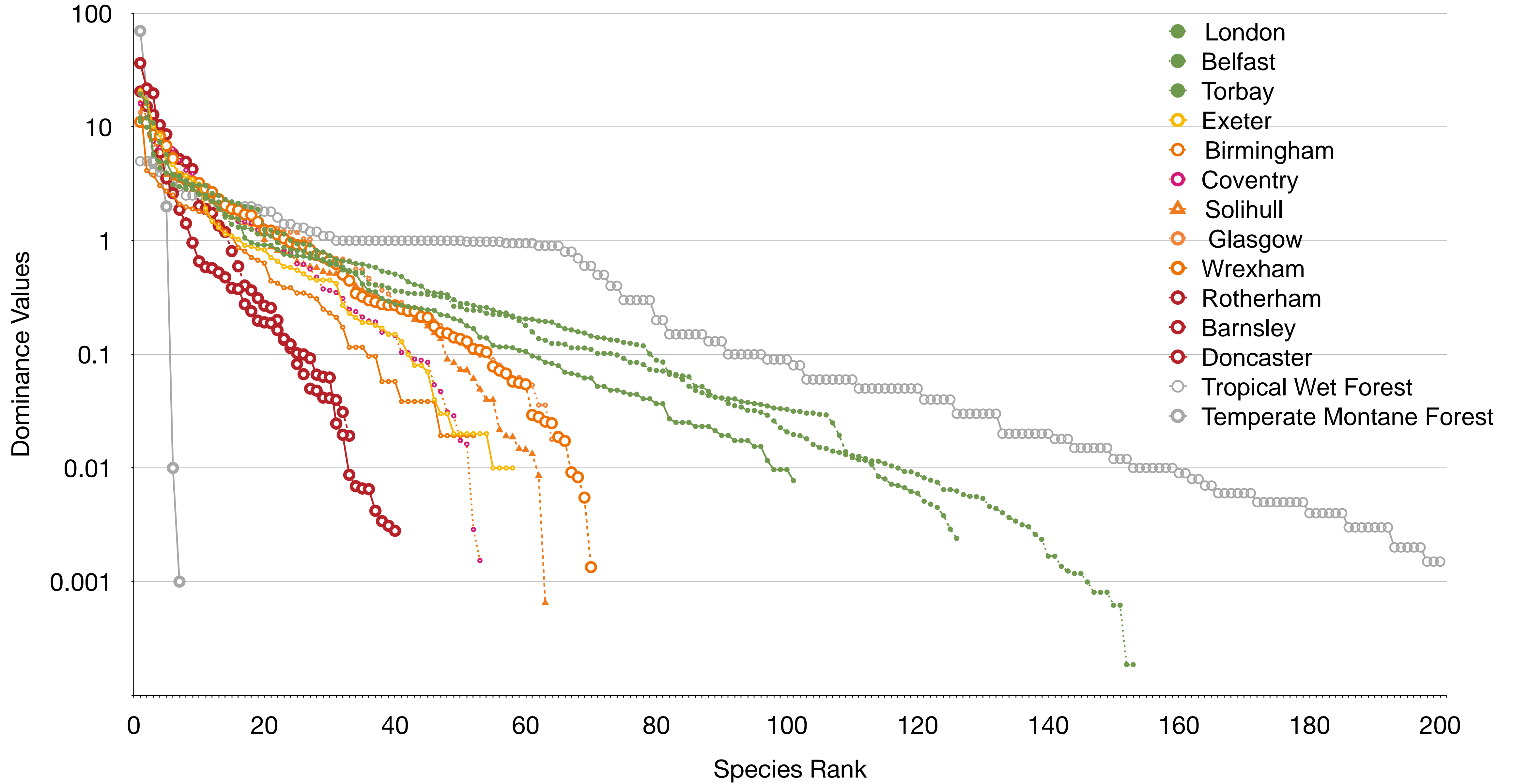
Of particular note, *Pinus sylvestris* and *Cuprocyparis x leylandii* are the least suited to current and expected 2050 conditions, and *Larix decidua* and *Pinus sylvestris* are the least well suited to potential 2090 conditions in Belfast. *Acer pseudoplatanus* and *Chamaecyparis lawsonia* are the most well suited to current and future conditions.

Scientific Name	Current Suitability	2050 Suitability	2090 Suitability
<i>Fraxinus excelsior</i>	Green	Green	Orange
<i>Acer pseudoplatanus</i>	Green	Green	Green
<i>Fagus sylvatica</i>	Green	Green	Orange
<i>Prunus avium</i>	Green	Green	Orange
<i>Quercus robur</i>	Green	Green	Orange
<i>Larix decidua</i>	Green	Green	Red
<i>Pinus sylvestris</i>	Orange	Orange	Red
<i>Chamaecyparis lawsonia</i>	Green	Green	Green
<i>Crataegus monogyna</i>	Green	Green	Orange
<i>Cuprocyparis x leylandii</i>	Orange	Orange	Orange
<i>Tilia x europaea</i>	Green	Green	Green
<i>Tilia cordata</i>	Green	Green	Green
<i>Acer platanoides</i>	Green	Green	Green
<i>Crataegus crus-galli</i>	Green	Green	Green
<i>Populus nigra</i>	Green	Green	Green
<i>Quercus palustris</i>	Green	Green	Green
<i>Cedrus atlantica</i>	Green	Green	Green
<i>Tilia x euchlora</i>	Green	Green	Orange
<i>Prunus padus</i>	Green	Green	Red
<i>Ulmus glabra</i>	Green	Green	Red

Table 3: Potential suitability of the to 10 most common trees of the total existing population (top), the 3 most common street tree species (middle), and some other street tree species for consideration (bottom) in 2050 and 2090 .

i-Tree Eco Studies







Botanical Gardens

Sidmouth ARBORETUM



Free to Use Resources

The screenshot shows a web browser window with the URL `cat.bgci.org`. The page title is "Climate Assessment Tool" and there is a "How To Use" link. A progress bar at the top indicates four steps: 1. Location (highlighted), 2. Taxon, 3. Climate Change Scenario, and 4. Assessment. The main content area features a background image of a tree canopy and the text "Select a garden". Below this is a search input field with the placeholder text "Enter a country or garden name...". Further down, it says "or enter the latitude and longitude of a location:" followed by two input fields labeled "Latitude" and "Longitude".

Free to Use Resources

cat.bgci.org
How To Use

Climate Assessment Tool

Assessment Results
 for taxon *Eucalyptus camaldulensis* Dehnh.
 at garden Royal Botanic Gardens, Victoria - Melbourne Gardens (Australia)
 with climate change scenario Current conditions

Source	Records	MAT	Temperature in Celsius																Updated At	Hottest Month	Coldest Quarter	Annual Precipitation	Driest Quarter		
			7°	8°	9°	10°	11°	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°						23°	
GBIF BGCI	33249	15.7 °C	0	0	0	0	0	0	0	1	2	3	3	3	3	2	2	2	1	1	2019-06-13	30.4 °C	10.1 °C	549 mm/year	74 mm/qtr
GBIF Current	20575	16.5 °C	0	0	0	0	0	0	0	0	2	3	3	3	3	2	2	2	2	2	2020-10-09	31.2 °C	10.5 °C	587 mm/year	66 mm/qtr
Model	0	15.7 °C	0	0	0	1	1	1	2	3	3	3	3	2	2	1	1	1	0	0	2021-06-17			0	0
UrbanPlants	48	16.7 °C	0	0	0	0	0	0	1	2	3	3	3	3	3	2	2	2	2	2	2020-06-29	28 °C	10.8 °C	706 mm/year	88.5 mm/qtr
PlantSearch	83	16.5 °C	1	1	1	2	2	2	2	3	3	3	3	3	3	2	2	2	2	2	2022-09-27	28.9 °C	11.2 °C	728.5 mm/year	91.5 mm/qtr

Projected climate details at garden based on selected climate scenario:

Mean Annual Temperature (BIO1): **15.1 °C**

Maximum temperature of the hottest month (BIO5): **26.1 °C**

Minimum temperature of the coldest quarter (BIO11): **10.4 °C**

Annual precipitation (BIO12): **654 mm/year**

Precipitation of the driest quarter (BIO17): **142 mm/qtr**

Risk Codes

- 0 Species not known to occur at this temperature
- 1 At the edge of the known temperature for the species
- 2 Species known to occur at this temperature
- 3 Species mostly occurs at this temperature

Assessment results for a single taxon

The analysis of climate suitability of species is based on Mean Annual Temperature (MAT). Research suggests that this is a useful predictor of a taxon's fundamental niche in global cities, as other climate variables such as precipitation can be artificially mitigated by the application of irrigation or providing better soil drainage. Temperature is a parameter that is

Free to Use Resources

Belfast Tree Establishment Strategy_2.3.1.pages

View Zoom Add Page Insert Table Chart Text Shape Media Comment Share Format Document

2 Comments + Comment Highlight Accept Reject Paused On

46

Taxon	Climate Rating 2020	Climate Rating 2050	Climate Rating 2090
<i>Populus alba</i>	11	11	11
<i>Populus nigra</i>	11	11	11
<i>Prunus avium</i>	11	11	9
<i>Prunus cerasifera</i>	11	11	11
<i>Prunus padus</i>	9	9	6
<i>Prunus virginiana</i>	9	9	6
<i>Pyrus calleryana</i>	9	9	11
<i>Pyrus communis</i>	11	11	9
<i>Quercus cerris</i>	11	11	9
<i>Quercus palustris</i>	11	11	11
<i>Quercus robur</i>	11	11	9
<i>Quercus rubra</i>	11	11	9
<i>Salix caprea</i>	11	11	9
<i>Sorbus xthuringiaca</i>	11	11	5
<i>Sorbus aria</i>	11	11	9
<i>Sorbus aucuparia</i>	11	11	6
<i>Sorbus commixta</i>	11	11	8
<i>Sorbus discolor</i>	11	11	11

Taxon	Climate Rating 2020	Climate Rating 2050	Climate Rating 2090
<i>Sorbus sargentiana</i>	11	11	11
<i>Taxus baccata</i>	11	11	9
<i>Thuja plicata</i>	11	11	9
<i>Tilia xeuclora</i>	11	11	8
<i>Tilia xeuropaea</i>	11	11	9
<i>Tilia cordata</i>	9	9	9
<i>Tilia mongolica</i>	11	11	11
<i>Tilia platyphyllos</i>	11	11	9
<i>Tilia tomentosa</i>	11	11	9
<i>Ulmus glabra</i>	9	9	6

Table 11: Potential suitability of street tree species in 2050 and 2090.
 11-middle of natural range, 10-middle of urban range, 9-middle of botanic garden range, 8-shoulder of natural range, 7-shoulder of urban range, 6-shoulder of botanic garden range, 5-edge of natural range.

The Climate Assessment Tool is based purely upon temperature and does not take into account precipitation.

47

Appendix IV. Individual Ward Maps



Alnarp, Sweden

Join us at the 4th European Urban Releaf and i-Tree Conference in Dundee, Scotland



Follow us for updates



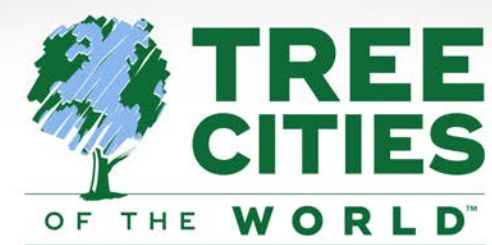
i-Tree and Beyond – Turning data into action in and around the Urban Forest

Gold Sponsors:



Silver Sponsors:





<https://treecitiesoftheworld.org/>

<https://www.itreetools.org/>



<https://www.greehill.com/>

<https://unece.org/forestry-timber/documents/2023/03/informal-documents/trees-resilient-green-cities-strategic>





kenton@treeconomics.co.uk

www.treeconomics.com

Thank You

Any Questions ?

