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Determining Tree Growth in the Urban Forest

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Forest Research

Treeeco$_2$nomics

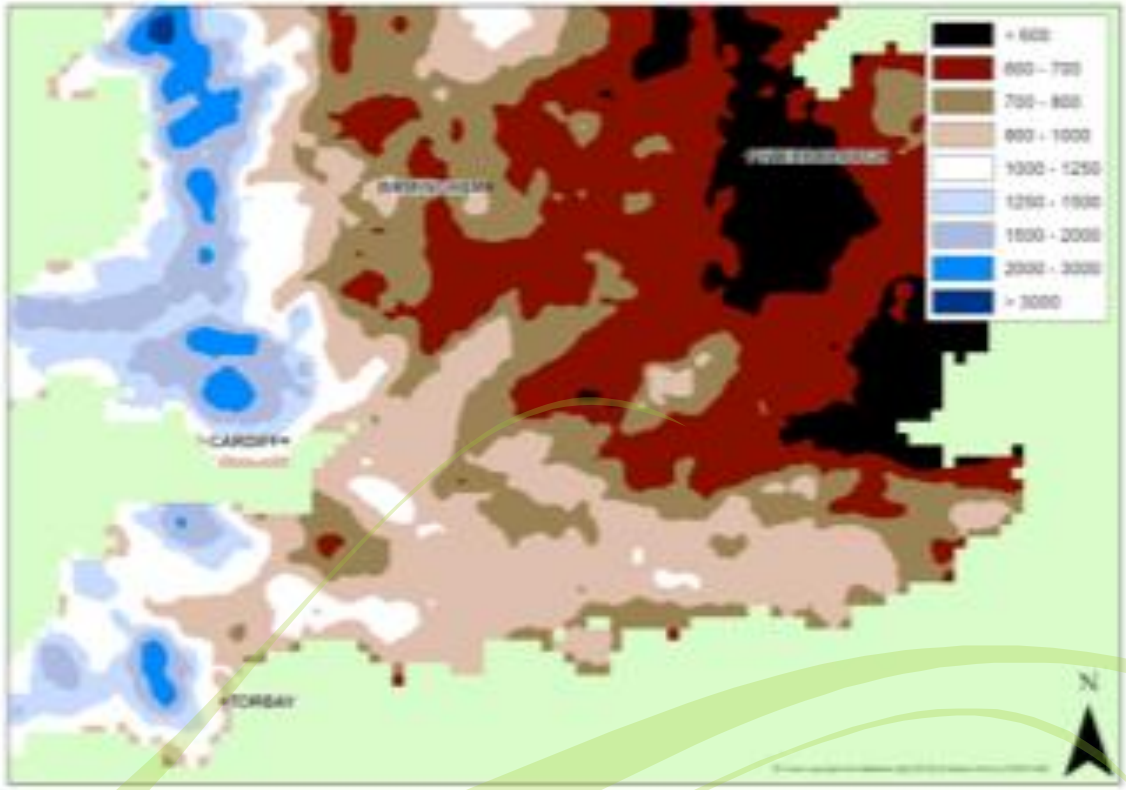
Why?

Area 63.75 km²

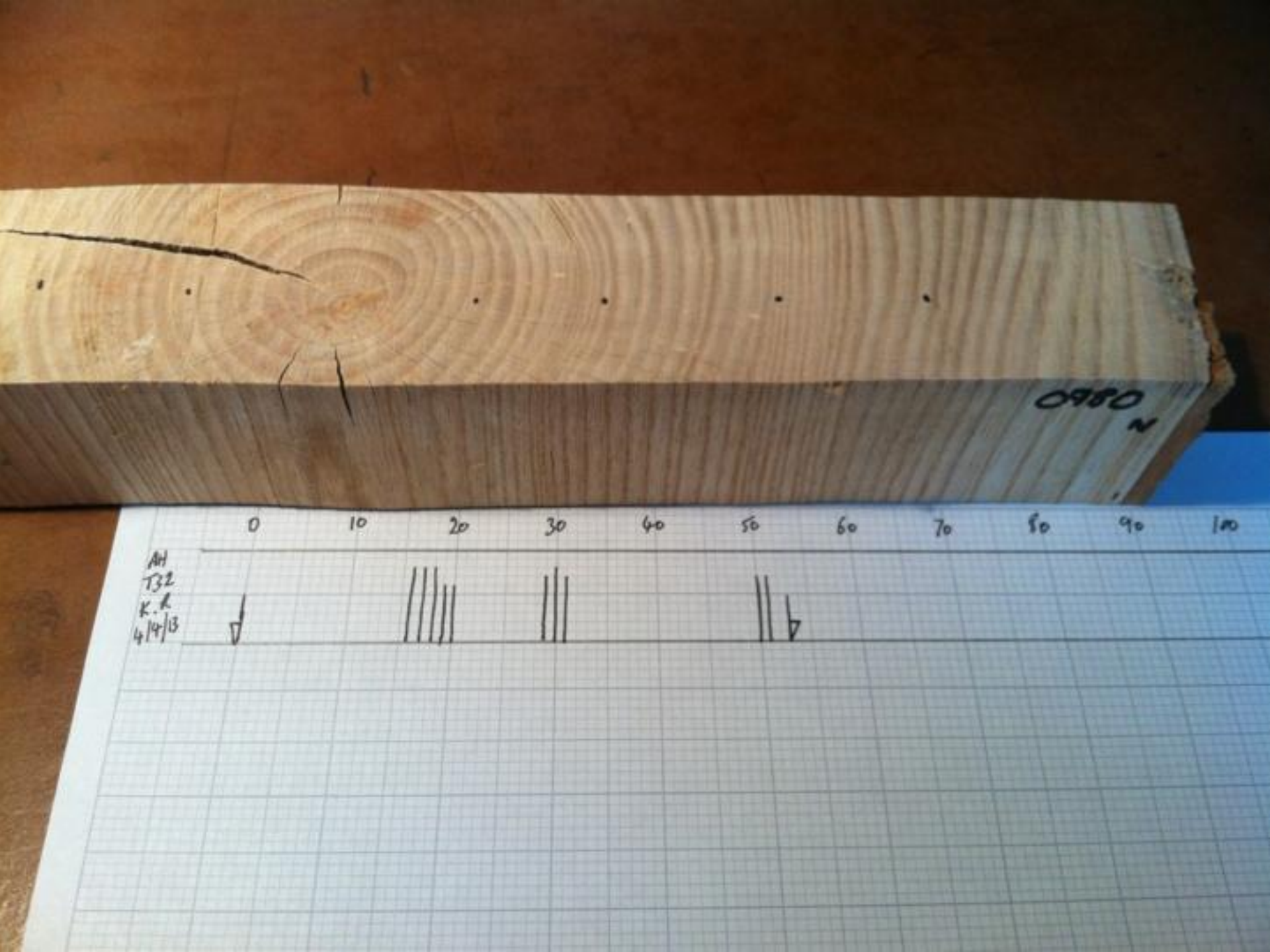
Population 134,000

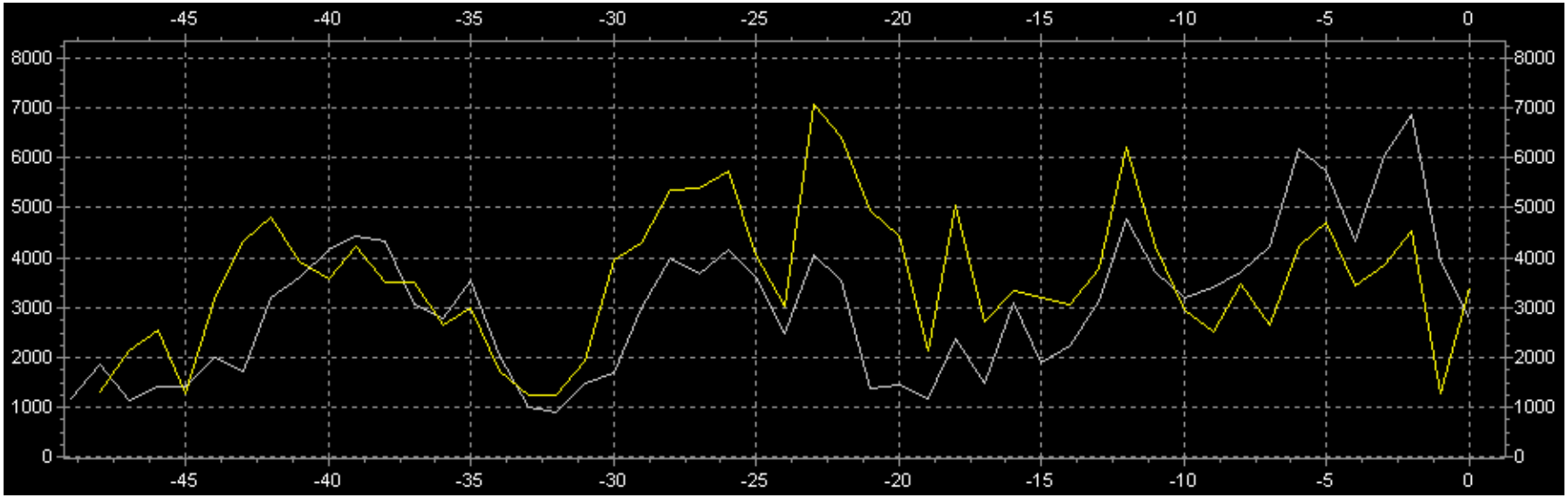
Canopy Cover
11.8%

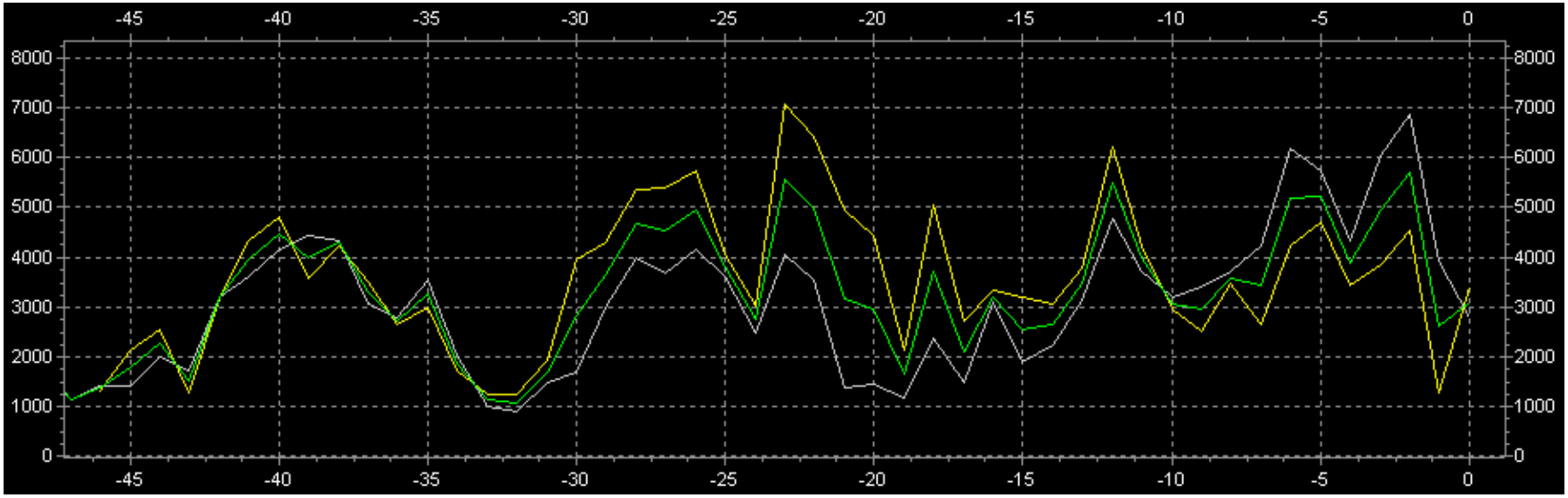
Population 134,000



Source: Met Office


0980
N
0
10
20
30
40
50
60
70
80
90
100
AH
T32
K.K
4/14/13


-45 -40 -35 -30 -25 -20 -15 -10 -5 0
8000 7000 6000 5000 4000 3000 2000 1000 0


-45 -40 -35 -30 -25 -20 -15 -10 -5 0
8000 7000 6000 5000 4000 3000 2000 1000 0

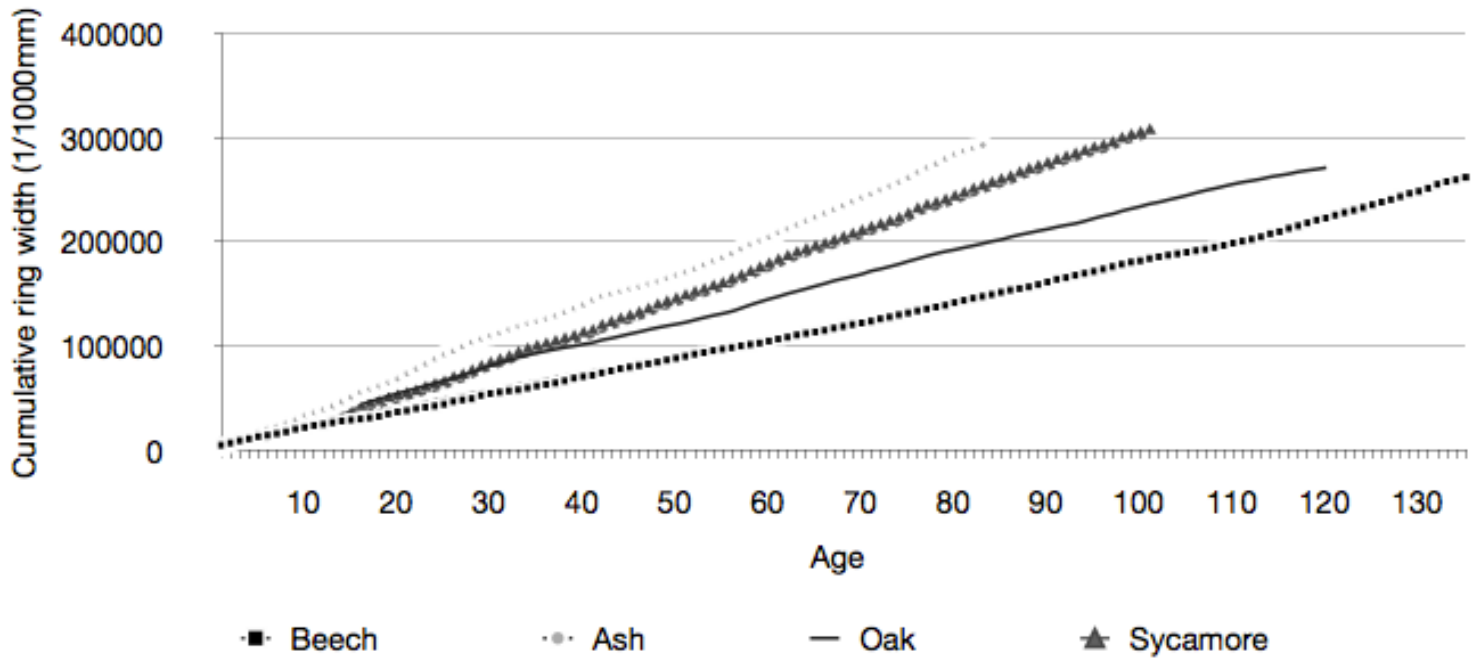
The Gliechlaeufigkeit Test:

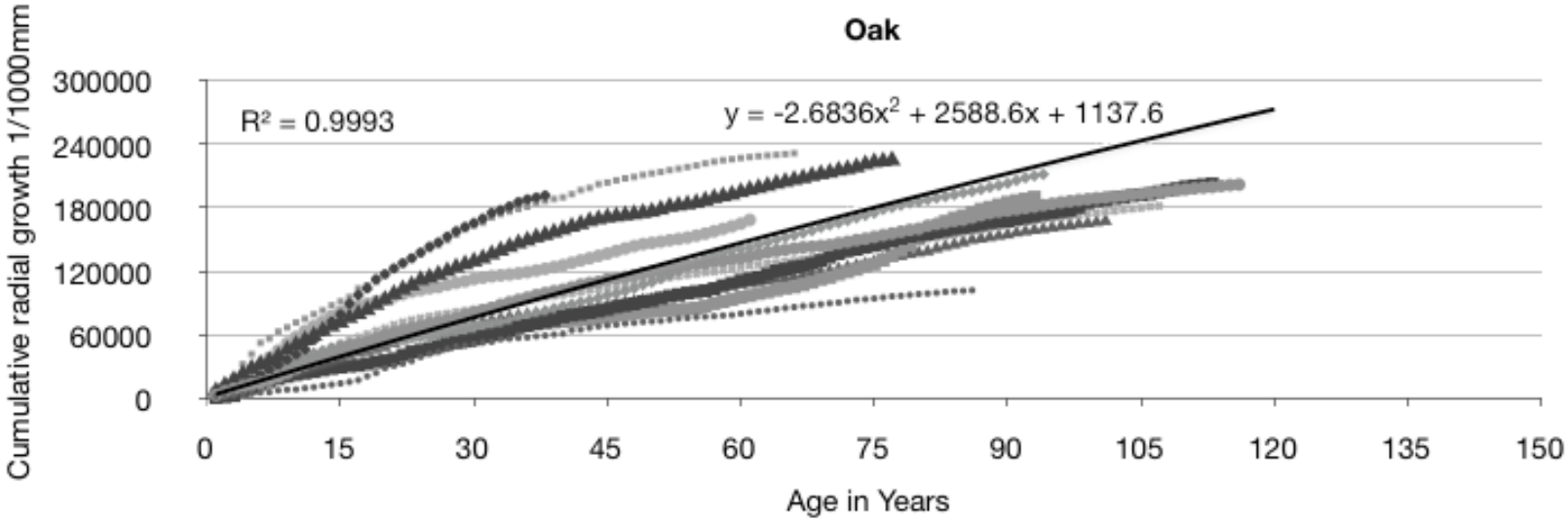
$$Glk = \sum (yi_j = x_{ij})$$

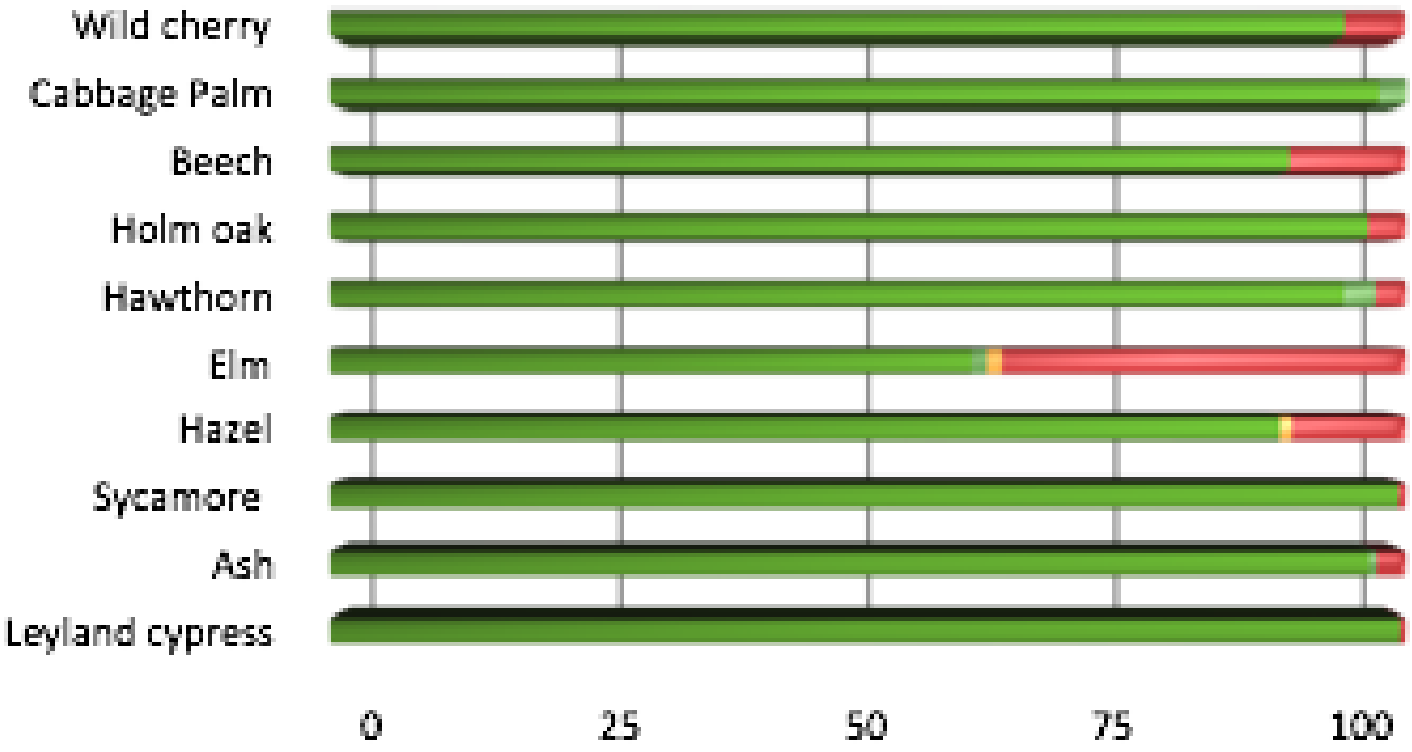
The Gliechlaeufigkeit test asks; ‘are two samples increasing or decreasing in growth at the same time?’ (Speer 2010).

Above: Ash sample from a cut stump displaying very distinct annual rings.
Below: Oak sample set into baton with tight rings (arrowed).

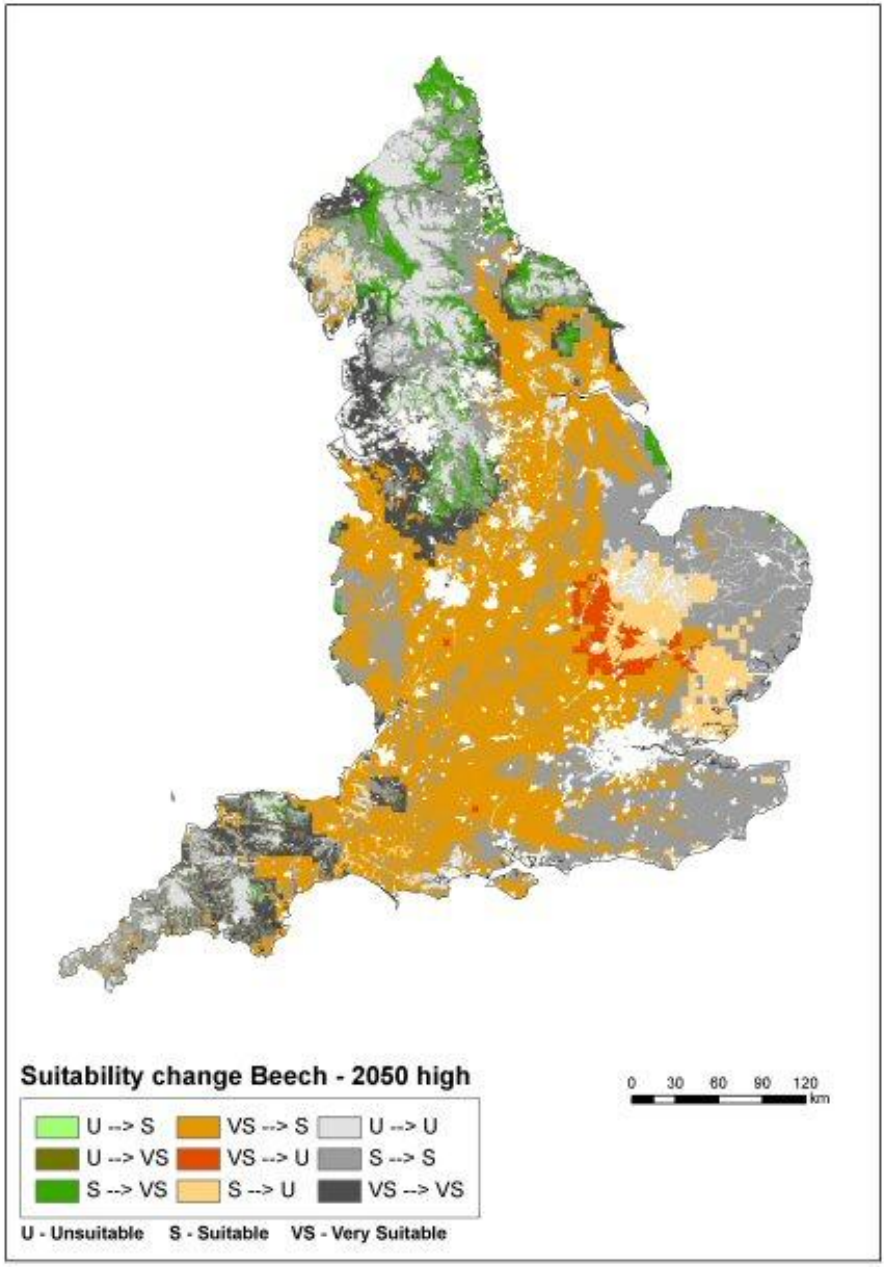
Above: Beech sample set in baton (a discontinuous ring formed by medullary ray arrowed) The pencil mark denotes the pith of the tree.
Below: Sycamore sample set in baton. The pencil marks were to aid with the identification of annual rings which were actually more difficult to determine with the microscope as they are very feint.


Cumulative ring width (1/1000mm)
400000
300000
200000
100000
0
10
20
30
40
50
60
70
80
90
100
110
120
130
Age
Beech
Ash
Oak
Sycamore


Oak
Cumulative radial growth 1/1000mm
300000
240000
180000
120000
60000
0
R² = 0.9993
y = -2.6836x² + 2588.6x + 1137.6
0
15
30
45
60
75
90
105
120
135
150
Age in Years

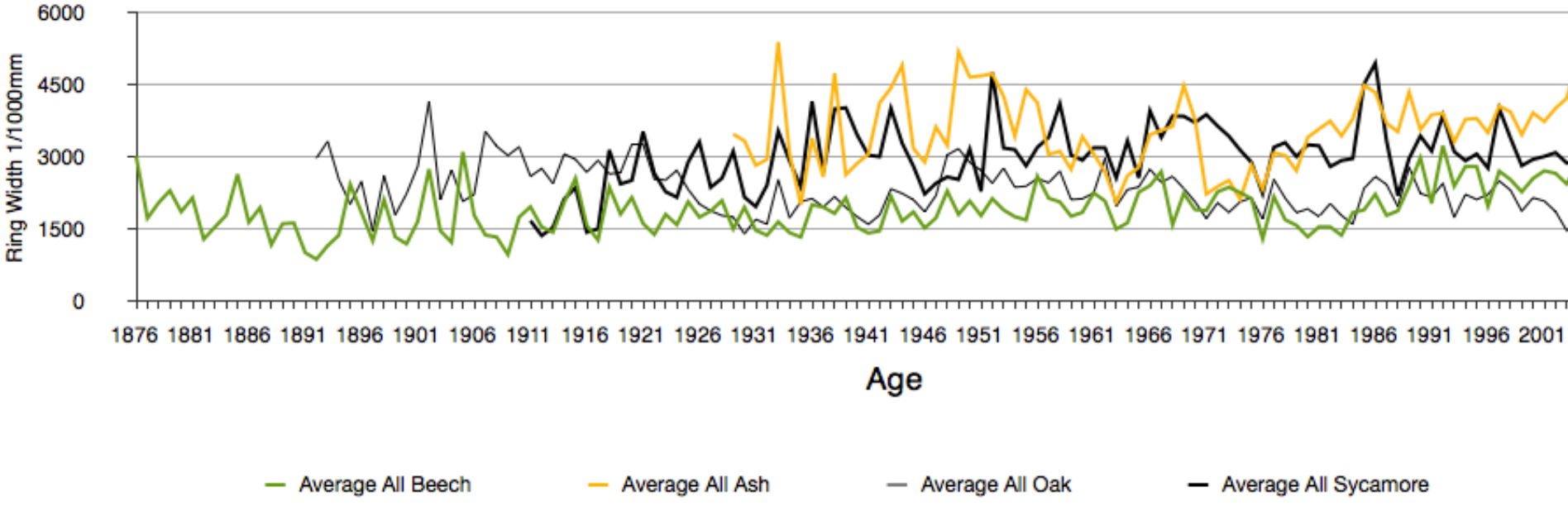


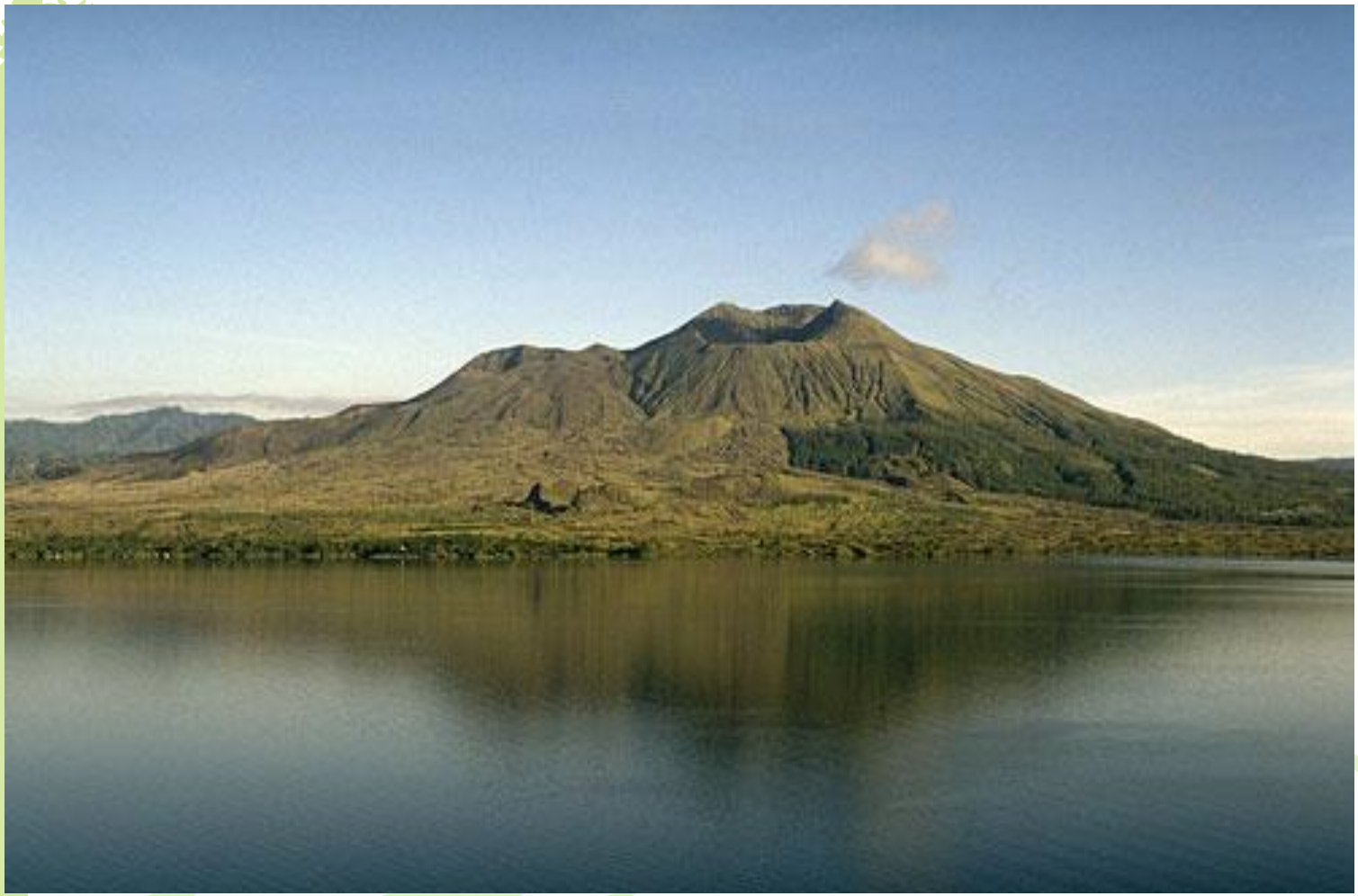
Source: Torbay's Urban Forest - i-Tree Eco report



Source: Forest Research

	Average Rain	*r*	Average Sunlight Hours	*r*	Average Temp	*r*
	Growth Season					
	Year					
Ash	*NS P > 0.05*	*0.117*	*NS P > 0.05*	*0.166*	*NS P > 0.05*	*0.253*
	NS P > 0.05	*-0.069*	< 0.05	*0.301*	< 0.05	*0.282*
Oak	*NS P > 0.05*	*-0.036*	NS P > 0.05	*0.186*	NS P > 0.05	*-0.020*
	NS P > 0.05	*-0.082*	< 0.05	*0.229*	NS P > 0.05	*0.056*
Beech	*NS P > 0.05*	*0.052*	NS P > 0.05	*0.195*	< 0.05	*0.296*
	NS P > 0.05	*0.164*	< 0.05	*0.264*	< 0.05	*0.502*
Sycamore	*NS P > 0.05*	*0.114*	NS P > 0.05	*-0.82*	NS P > 0.05	*0.079*
	NS P > 0.05	*0.038*	NS P > 0.05	*-0.103*	NS P > 0.05	*-0.121*


6000
4500
3000
1500
0
Ring Width 1/1000mm
1876 1881 1886 1891 1896 1901 1906 1911 1916 1921 1926 1931 1936 1941 1946 1951 1956 1961 1966 1971 1976 1981 1986 1991 1996 2001
Age
Average All Beech
Average All Ash
Average All Oak
Average All Sycamore



Forest Research are now undertaking a UK wide urban tree survey to determine growth rates

5 cities – Cardiff, Birmingham, Peterborough, Glasgow and Edinburgh

4 tree species – Sycamore, Common Ash, Birch and English Oak

165 tree cores per city

Tree size classes

For each species 15 trees will be selected from the following diameter at breast height size classes (cm)

Fewer classes needed for B. pendula as maximum growth is smaller

Trees with a dbh less than 10cm will be excluded from the survey.

Species	Size class 1	Size class 2	Size class 3
A. pseudoplatanus	<20	20-40	>40
B. pendula	<20	>20	-
F. excelsior	<20	20-40	>40
Q. robur	<30	30-55	>55

Tree criteria

- They are growing in a park i.e. the ground cover beneath their canopy is 100% grass, they are not alongside a major road
- They are free standing or overlap with other trees is very little
- They are growing straight, with no obvious lean that would cause wood compression on one side
- They have no obvious pest or disease damage.

Objectives

- Determine the growth rate of urban trees by taking tree cores for dendrochronological analysis
- Determine if geographical differences affect this rate by sampling from five different cities within different climactic zones
- Compare cities, species and rates compared to forest stand rates

Predicting Urban Ecosystem Services

- Ecosystem service models for urban areas such as i-tree rely heavily on US figures, where climate and tree species differ from that of the UK
- UK urban growth rates will help calculate age class structure, biomass and leaf area index of urban trees.
- These figures can feed into new and existing models (like i-tree) to determine carbon storage and sequestration, pollution removal and avoided storm water runoff of UK urban trees.

Thank you
Questions Welcome

And Thank you too!

RinnTech for software licence

Torbay for study area

Richard Baden for advice and lab space