

The overarching aim for the study group is to calculate tree-canopy growth rates and projections for existing and newly planted trees including hedges and groups of trees.

One potential mathematical approach is to create species-specific ordinary differential equations (ODE) based models for tree and tree canopy growth with future 2D and 3D projections for:

- Existing Trees
- Newly Planted Trees

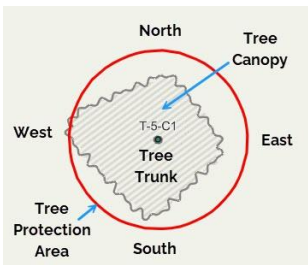
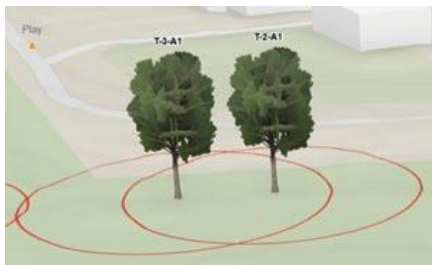
The ODEs will link to our existing methods of estimating carbon sequestration in trees and hedges. The quantities of interest are:

- **For single trees:** the tree height, species, diameter of trunks and “iTree” growth rates.
- **For groups of trees:** average tree height, predominant tree species, average diameter of trunks, iTree growth rates.
- **For hedges:** length of hedge, hedge species, hedge width and iTree growth rates.

The dynamic visualisation of the tree canopy growth with future projections ODE is intended to be represented within our bespoke software by a timeline slider in intervals of 5 years. Any additional data capture for the tree canopy growth with future projections would need to build into the software data capture web form. At present, for existing trees, the software projects to 2050. For newly planted trees the projections would need to be for a minimum of 50 years + 100 years+ to account for tree life cycles. The trees in question are trees and hedges found in urban and rural environments as opposed to a crop of trees found in forest plantations.

Some considerations and environmental constraints:	
Soil type and climatic factors complicate standardisation.	Account for tree age and its growth rate and lifecycle stage.
Regional Variation.	Movement of the Sun.
Spacing between trees	Vertical structure as trees in proximity grow.

The visualisation of trees in our software package is illustrated below. Groups of trees are displayed as a polygon and hedges are displayed as a single line in 2D and a volume area in 3D.

 <p>A 2D diagram of a tree. A central point is labeled 'Tree Trunk'. A red circle around it is labeled 'Tree Protection Area'. A larger, irregular red shape around the circle is labeled 'Tree Canopy'. The diagram is oriented with North at the top, South at the bottom, West on the left, and East on the right. A label 'T-5-C1' is near the trunk.</p>	 <p>A 3D perspective view of two trees. Each tree has a green canopy and a brown trunk. Red circles on the ground represent the Tree Protection Areas (TPA) for each tree. The trees are labeled 'T-3-A1' and 'T-2-A1'. A 'Play' button icon is visible in the top left corner of the 3D view.</p>
<p>A scale representation of a Tree, a Tree Trunk and Tree Protection Area (TPA) in 2D</p>	<p>A representation of a Tree, a Tree Trunk and Tree Protection Area in 3D (Tree height and TPA are to scale).</p>