Tree Planting Design Guide Supporting Notes

Purpose

This document gives guidance to aid the selection of trees for planting in streets and green space as set out in the 'Tree Planting Design Guide'. This guide is intended to be used by officers of Bristol City Council, but it also acts as a point of reference for interested parties.

Why plant trees?

There is considerable documentary evidence to confirm the value of planting trees in urban areas. Simply, trees make us feel good, clean the air, reduce temperatures, attract wildlife, increase property value and support business. See www.bristol.gov.uk/page/tree-management and www.bristol.gov.uk/treebristol

Tree Planting Design Guide, is set out in a logical sequence, viz:


1. Function

The first step is to decide the reason for planting the trees: what function will they provide? A number of functions are listed for guidance, including:
Table 1 Tree Function Categories

<table>
<thead>
<tr>
<th>Tree Planting Function</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air pollution control</td>
<td>Atmospheric purification through cleansing and conditioning of the air affording health benefits</td>
</tr>
<tr>
<td>Beautify</td>
<td>Visual pleasure, diversity and 'naturalness'</td>
</tr>
<tr>
<td>Complement</td>
<td>Repetition of building scale, colours and shapes</td>
</tr>
<tr>
<td>Continuity</td>
<td>Unification or connection of divergent areas</td>
</tr>
<tr>
<td>Emphasis</td>
<td>Emphasis locations, e.g. announce or provide advanced notice of an entrance or intersection The tree is the point of emphasis (averting the eye from a less desirable view)</td>
</tr>
<tr>
<td>Food</td>
<td>Growing and encouraging the growing of food, including 'wild food'</td>
</tr>
<tr>
<td>Glare and reflection control</td>
<td>Interception of bright light from sun or artificial light (street lights, vehicle headlights, windows) sources</td>
</tr>
<tr>
<td>Noise control</td>
<td>Attenuation of noise through deflection, reflection, refraction and absorption of especially traffic noise</td>
</tr>
<tr>
<td>Pedestrian safety</td>
<td>Strengthening of the physical and perceived separation between vehicles and pedestrian ways. Using trees to slow traffic.</td>
</tr>
<tr>
<td>Road alignment reinforcement</td>
<td>Strengthening of the linear character of the roadway corridor</td>
</tr>
<tr>
<td>Screen</td>
<td>Blocking view of an objectionable object, activity and / or view</td>
</tr>
<tr>
<td>Temperature control</td>
<td>Interception of direct and reflected solar radiation and casting of shadows. Scale planting to achieve reduction in 'urban heat island' effect.</td>
</tr>
<tr>
<td>Water surface run off control</td>
<td>Interception of rainfall reducing its velocity and absorption of water</td>
</tr>
<tr>
<td>Wildlife</td>
<td>Encouraging wildlife into urban street / green space and connecting green space and fragmented habitats</td>
</tr>
<tr>
<td>Wind control</td>
<td>Obstruction, guidance, deflection and filtration of air flow by affecting its velocity, turbulence, momentum or direction</td>
</tr>
</tbody>
</table>

To aid-decision making, restrict the choice of functional categories to no more than three by priority (e.g. 'beautify', 'noise attenuation' and 'pedestrian safety').

Once clear about the expected function(s), identify those tree species that will deliver these expectations most closely. Avoid trees that would be detrimental, for example avoid trees that are known to add to air pollution if looking to plant a number of trees close to the highway.

A number of web based search programmes are available to select a range of tree species for their specific attributes / performance. The most appropriate UK system is 'right place, right tree', but a US based program is also referenced as this allows a wider search of species and attributes.

Table 2 Tree selector guides - web based

<table>
<thead>
<tr>
<th>Web Site</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="http://www.right-trees.org.uk/members/Search.aspx">http://www.right-trees.org.uk/members/Search.aspx</a></td>
<td>UK based: London (Forestry Commission)</td>
</tr>
<tr>
<td></td>
<td>Right trees for a changing climate</td>
</tr>
<tr>
<td><a href="http://selectree.calpoly.edu/attribute_search.lasso">http://selectree.calpoly.edu/attribute_search.lasso</a></td>
<td>US based: California (Urban Forest Ecosystems Institute)</td>
</tr>
<tr>
<td></td>
<td>Lists 1,481 trees with up to 49 attributes and over 6,050 photos for 1,068 trees available from tree detail records. Search by tree attribute or by name</td>
</tr>
</tbody>
</table>

1 Bristol is in USDA hardiness zone 9, but close to zone 8 (climate change likely will lead to a higher hardiness zone over time).
Species should be selected from the BCC list of 'proven adaptive species'. Generally, the tree species selected should be 'tried and tested'. 'Experimental' or untried species may be selected, but with caution and not at any scale until the species is given a 'tried and tested' status. If selecting untried species, the planting site should closely match the trees physical requirements i.e. avoid marginal sites.

2. Diversity

Having considered which 'proven adaptive species' meet the desired function(s), the second consideration is the impact of choosing such species on diversity in the tree population at a local and citywide scale.

Diversity in a population is generally good. Reliance on too few species increases the risk of disastrous loss to disease or pest. Use of too many species may be visually detrimental and increase management costs.

Streets with the same species should be somewhat evenly dispersed throughout the community.

If the preferred tree is 'over-represented' in the population, such as lime or London plane these may still be selected, but should be avoided if an alternative species matches performance to an acceptable degree.

Generally, a conscious effort should be made to avoid over dependence on a few tree species. A summary of the diversity in the population of council owned street trees is given below:

Table 3. Diversity in the Population of Street Trees in Bristol\(^1\) (9,543 tree records)

<table>
<thead>
<tr>
<th>Family</th>
<th>Genus</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rosaceae</td>
<td>29%</td>
<td>Tilia</td>
</tr>
<tr>
<td>Malvaceae</td>
<td>23%</td>
<td>Acer</td>
</tr>
<tr>
<td>Spindaceae</td>
<td>20%</td>
<td>Prunus</td>
</tr>
<tr>
<td>Platanaceae</td>
<td>13%</td>
<td>Platanus</td>
</tr>
<tr>
<td>Betulaceae</td>
<td>6%</td>
<td>Sorbus</td>
</tr>
<tr>
<td>Malus</td>
<td>5%</td>
<td></td>
</tr>
</tbody>
</table>

General rule: limit Family representation to \(30\%\) General rule: limit Genus representation to \(20\%\) General rule: limit Species representation to \(10\%\)

\(^1\) Bristol's street tree population comprises 27 Families, 54 Genus and 192 Species

3. Design

In parks and green space, a tree planting design plan will be informed by a site's character, use and history. The design ideas given in Table 4 below may be relevant, but predominantly the tree planting design will be specific to the site.

In streets, a tree planting design plan will be heavily influenced by the arrangement of the road and the juxtaposition with adjacent land use. Most trees in streets will be planted at uniform spacing in rows parallel with the adjacent street.

For row planting or linear groupings, unity is achieved only when the planting is perceived as a continuous row rather than as individual elements.
The four basic design principles include: **repetition**, **sequence**, **balance** and **scale** but also including **accentuation** (i.e. a single tree that deliberately stands out):

### Table 4 Principles of Design: definitions, comments and pictorial examples

<table>
<thead>
<tr>
<th>Design Principle</th>
<th>Comments</th>
<th>Pictorial Examples</th>
</tr>
</thead>
</table>
| **Repetition** | Produced by duplication or repeated use of identical or similar units, or combinations of units | • Simple and most frequently used form of order  
• Achieved by a shared characteristics e.g. two species each of same colour and form but different texture  
• Absolute repetition is harmonious, but can be monotonous  
• Variety provides visual relief via changing a characteristic or adding sequential patterns | Repetition of a single species on both sides of street  
Repetition comprised of two species duplicated on opposite side of street (also basic Sequence) |
| **Sequence** | Produced by consecutive or successive interchange of differing units or modules | • Achieved through:  
- **Repetition** - the simplest form of sequence  
- **Graduation** - progressive change of characteristics in uniform or gradual steps  
- **Alternation** - repetition of modules establishing a rhythm  
• Should be logical connection and relationship between units  
• All characteristics should not be changed at once, as the change will not appear to be sequential  
• As an effect, sequence suggests movement, direction and cadence  
• Rhythm relies on anticipation of change and continuation of regularly occurring breaks or accents  
• Sequential change can lead to an ending or emphasis | Sequence provided through graduation of a physical characteristic e.g. foliage or colour  
Sequence provided through the repeated alternation of two species or alternation of a modular block comprised of a two-species combination  
Sequence provided through repeated alternation of a two single-species modules  
Sequence provided through repeated alternation of single species with repeated uniform gaps between modules |
Balance
Produced by equal distribution or symmetrical placement of units about a horizontal axis (centre line of composition)

- Exact inverted repetition on one side of the axis (street) of every unit that occurs on the other side
- Symmetrical units need not be identical provided they are similar

Scale
Produced by complementary relationship between the size or mass of a unit and other units or its surroundings or passersby

- Size of unit should be controlled by the design, rather than controlling itself

The four physical characteristics that have the greatest influence on design decisions are: **size**, **form**, **texture** and **colour**

Table 5 Primary physical characteristics: appearance factors of healthy, mature tree species under normal conditions

<table>
<thead>
<tr>
<th>Physical Characteristics of Trees at Maturity (without restrictive pruning)</th>
<th>Comments</th>
</tr>
</thead>
</table>
| **Size** Height and spread | • Tree height, crown spread, trunk diameter  
• Function of rate of growth  
• Cause of spatial conflicts  
• Basis for scale and proportion relationships  
• Affected by variable environmental conditions |
| **Form** Crown shape | • Outline or silhouette of mature crown  
Influenced by dimensional relationship between height and spread or horizontal and vertical axis  
• Usually changes as trees matures  
• Habit of growth  
• Strongest design element |
| **Texture** Leaf form | • Size, shape, pattern and proportion of leaves  
• Influenced by tips and margins, stiffness, veining, thickness and surface quality of leaves  
• Influences density and mass of crown  
• Course texture is dominant over other textures |
| **Colour** Summer - autumn foliage graduations | • Influenced by nutrition and soil conditions  
• Colour can affect emotions  
• Coloured foliage is an excellent means to give accent |

4. **Species**

Species that are judged suitable for a planting scheme are those that deliver the desired function(s), add positively to population diversity and meet the design criteria.

5. **Support**

Gaining community support for tree planting is an essential part of process.

For less complex schemes, it is suggested that consultation focus on a choice of tree species that have been selected based on a judgement of function, diversity and design.
For more complex schemes or in response to particular community demands, consultation should take place earlier in the process testing the principle of whether tree planting is acceptable including exploration of why people want trees (and hence what functions they expect).

6. Placement

Positioning decisions will vary depending on factors such as the width of the street, width of the pavement (grass verge if present), location of intrusive elements, proximity of adjacent buildings and specific design criteria.

Factors to take into account to inform final placement include:

a) Achieve minimum offsets from intrusive elements;
b) Achieve minimum highway 'site lines';
c) Generally plant in an opposite pattern but consider alternate for narrow streets;
d) Plant at final spacing reflecting mature crown spread;
e) Mature crown spread should avoid exceed one-half the distance between trunk and adjacent building: the more this rule is broken the higher will be the maintenance costs to restrict the ultimate size of tree;
f) Closer spacing / changing species towards junction to create the illusion of driving speed and hence a means to encourage deceleration;
g) The re-use existing tree pits, done on cost grounds, may compromise design and lead to a design review, and
h) The location of services may compromise the design and lead to a design review.

**Figure 1** Proximity to adjacent buildings taking account of anticipated mature crown diameter of unrestricted tree