Thesauruses, not encyclopedias

Beyond ‘Right tree, right place’

Dr Harry Watkins

ST ANDREWS BOTANIC GARDEN

URBAN PLANT LAB

Bio-ID

Urban ecology in 2026: what do we know?

Urban ecosystems face unique risks from climate change and at the same time, the construction industry relies on processes that commit us to a pathway we know we do not want.

These issues operate at a systemic level.

Three core challenges need to be overcome:

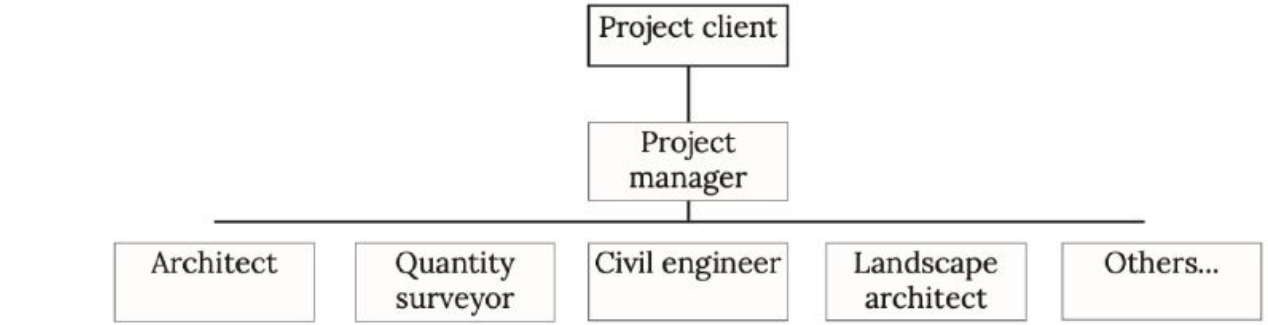
- Poor delivery of projects
- Substandard practices for plant selection
- Digital design workflows are rooted in a Twentieth century mindset

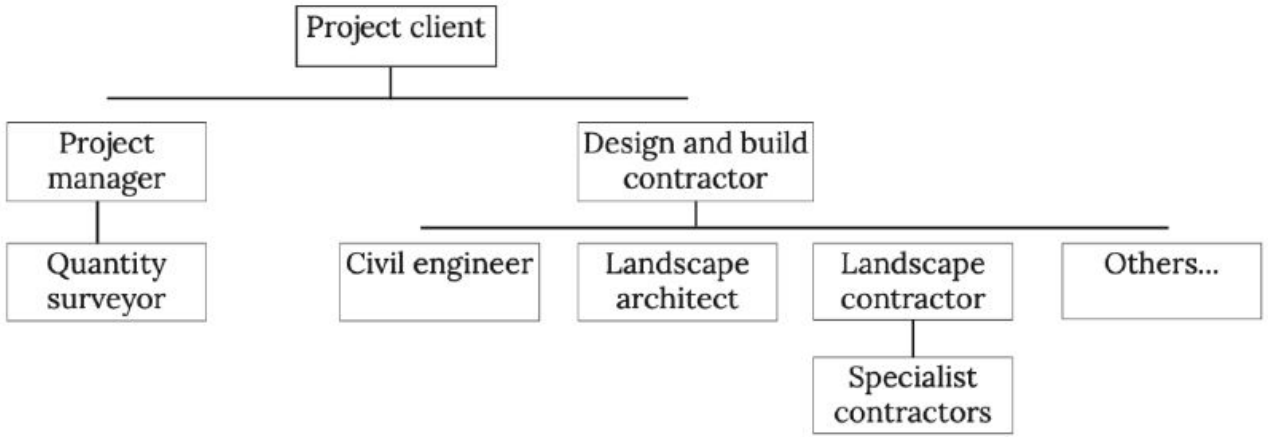
Challenge #1

Substantial under-delivery of biodiversity enhancement in Green Infrastructure projects across Scotland

- Widespread variations to contract
- Areas of planting not created or smaller than approved
- Plants poorly maintained
- Complex and fragmented supply chains

Only 24% of Green Infrastructure schemes meet the specifications approved by the Local Authority





As projects progress, responsibility becomes more fragmented

Challenge #2

Poor species selection leads to under-delivery of ecosystem services

- Limited ability to adapt to climate change
- Biosecurity threats
- Ecosystem service delivery constrained
  - Habitat provision
  - Water and carbon sequestration
  - ‘Sense of place’

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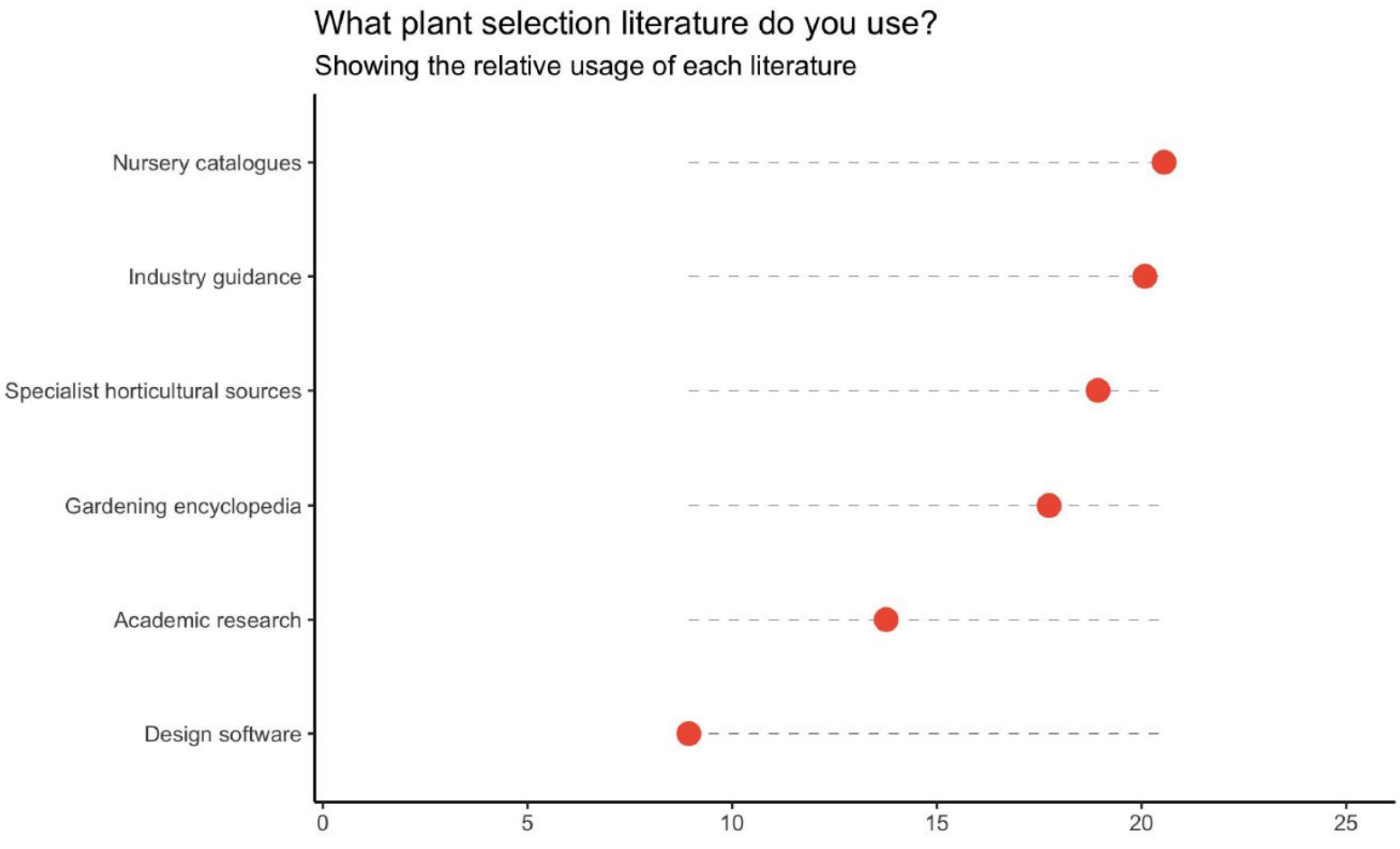
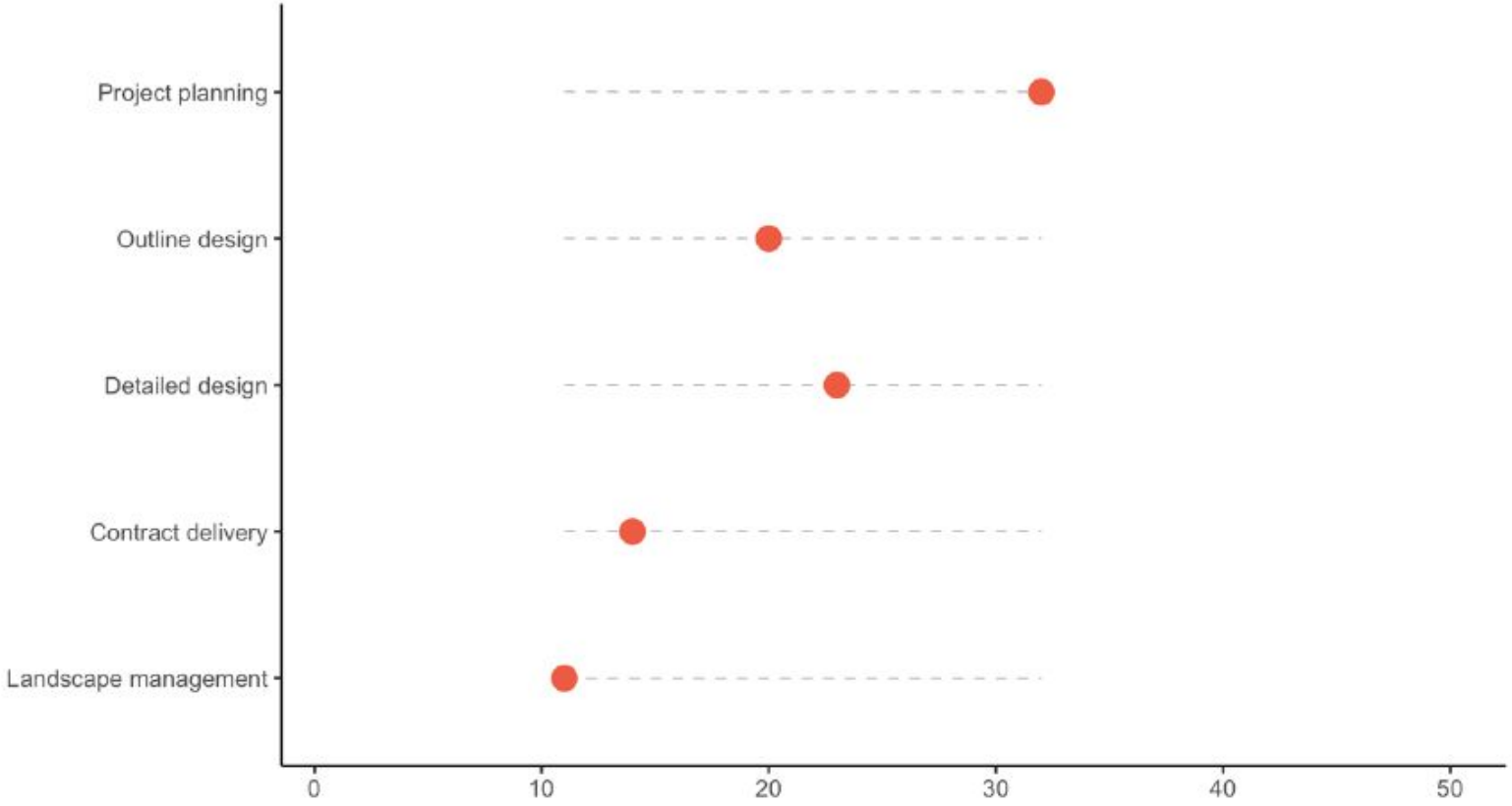
The most widely specified plant species in green infrastructure projects in England and Scotland

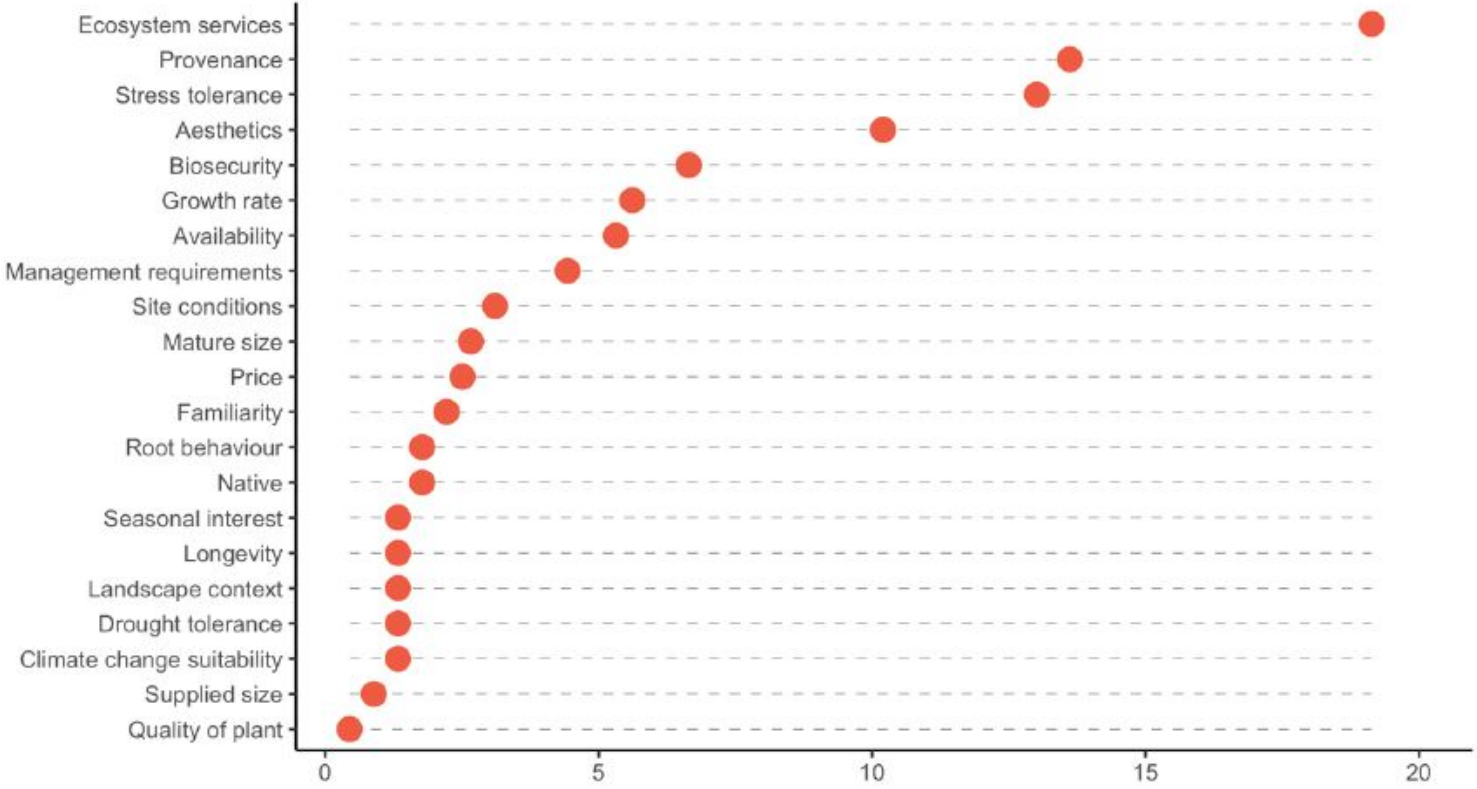
Shrub and herbaceous planting		Hedges		Trees	
Species	**%**	**Species**	**%**	**Species**	**%**
Pachysandra terminalis	2.79	*Carpinus betulus*	32.84	*Fagus sylvatica*	21.95
Lavandula angustifolia 'Hidcote'	2.54	*Fagus sylvatica*	16.55	*Crataegus monogyna*	10.78
Sarcococca confusa	2.45	*Ilex aquifolium*	9.01	*Betula pendula*	9.24
Prunus laurocerasus 'Otto Luyken'	2.27	*Prunus spinosa*	7.45	*Corylus avellana*	8.98
Mahonia aquifolium	2.16	*Crataegus monogyna*	6.25	*Carpinus betulus*	6.22
Cornus sanguinea 'Midwinter FIre'	1.77	*Photinia x fraseri* 'Red Robin'	3.23	*Sorbus aucuparia*	4.17
Hedera helix	1.4	*Acer campestre*	3.21	*Alnus glutinosa*	4.05
Hakonechloa macra 'Alboaurea'	1.2	*Fagus sylvatica* 'Atropurpurea Group'	2.47	*Ilex aquifolium*	3.6
Liriope muscari 'Monroe White'	1.16	*Escallonia* 'CF Ball'	2.34	*Quercus petraea*	3.17
Viburnum tinus 'Eve Price'	1.09	*Rosa canina*	1.75	*Prunus avium*	2.82



Fitter Flora scoping report for Defra. Watkins et al., 2020



The proportion of time allocated to project phases by landscape architects



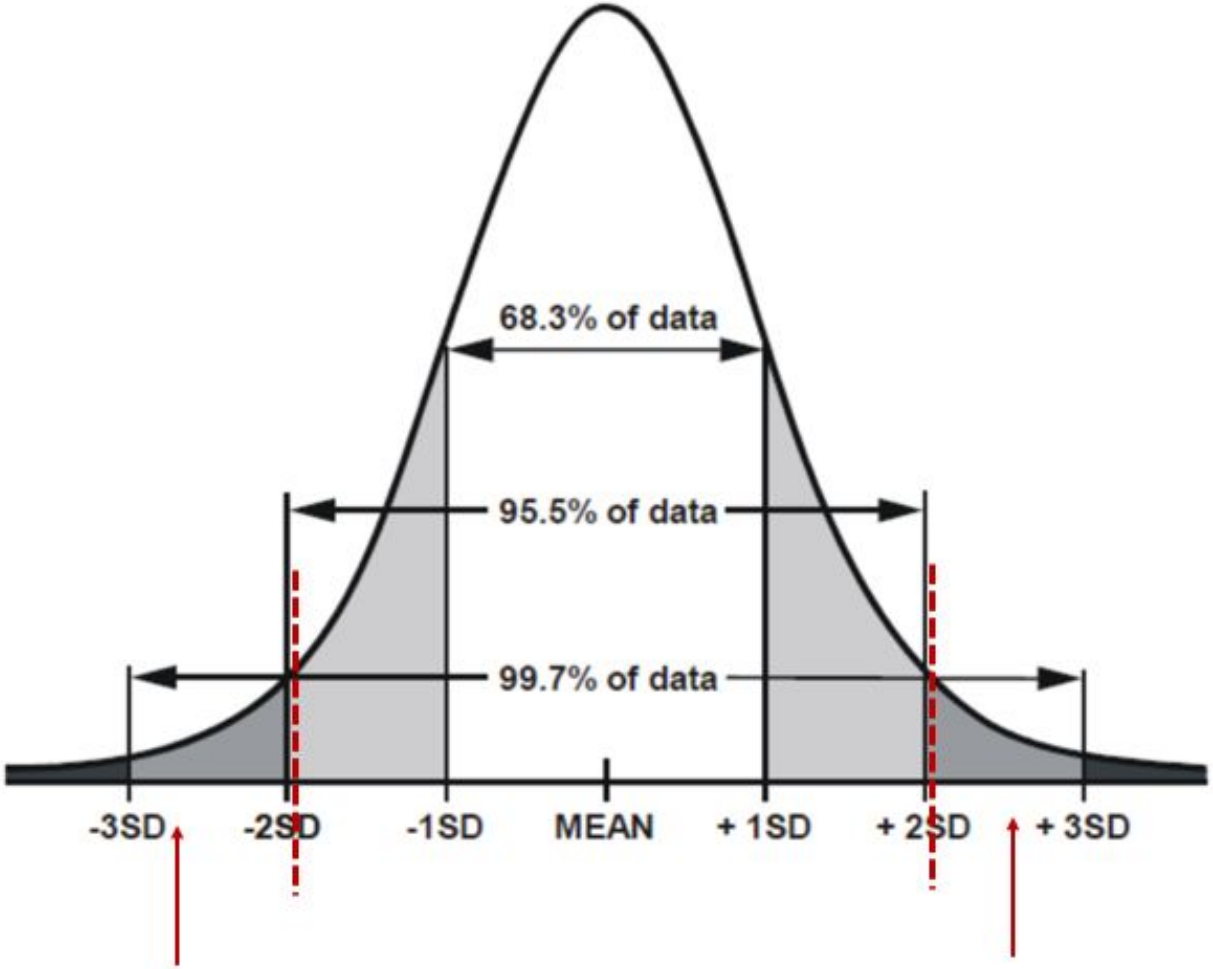
The relative importance of species selection criteria considered by landscape architects

Challenge #3

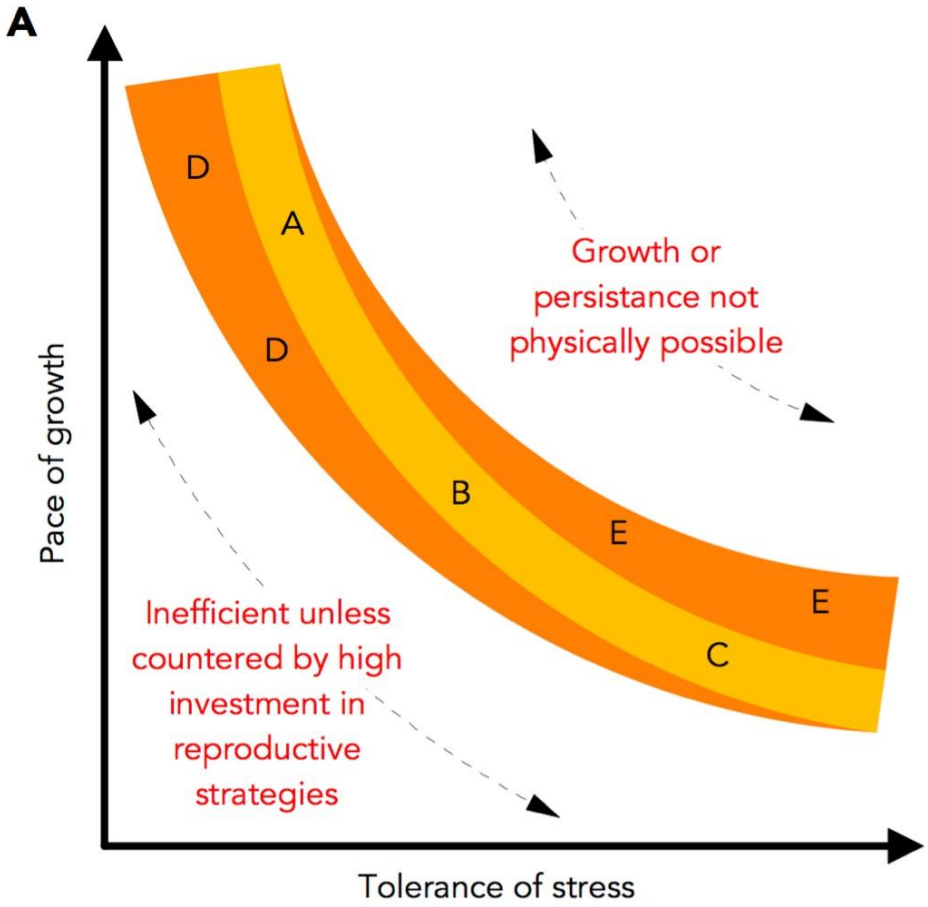
Digital design workflows are rooted in CAD

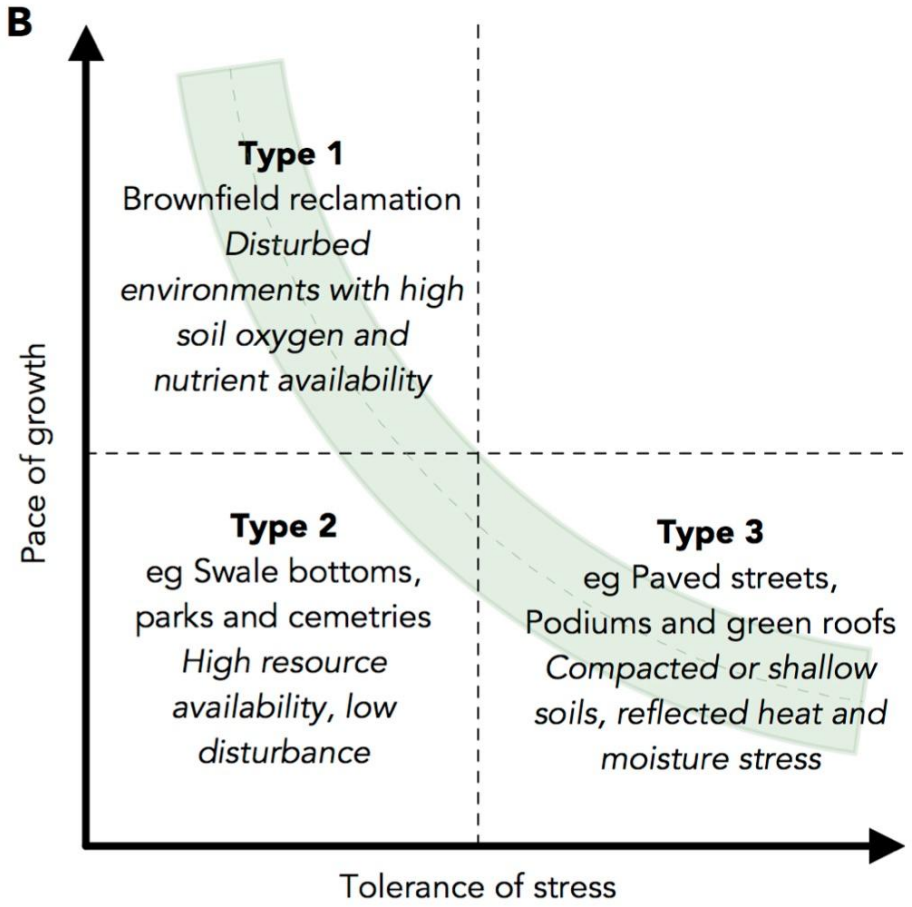
- Designers are committed to using AutoCAD, Revit and Vectorworks in a limited way
- Limited integration between data and vectors
- Plant data tends to be copied from generic resources - and not based on quantitative information

“A tree is not a thing: it is a strategy.”
Dan Ridley Ellis



We tend to know most about the extreme ends of the moisture and temperature gradients but not so much about the middle, where most plants are.





Can trait-based schemes be used to select species in urban forestry?

Watkins et al (2021)

Dimensionality is a blessing, not a curse

Our challenge is to understand how these dimensions of variation are coordinated to maximise fitness

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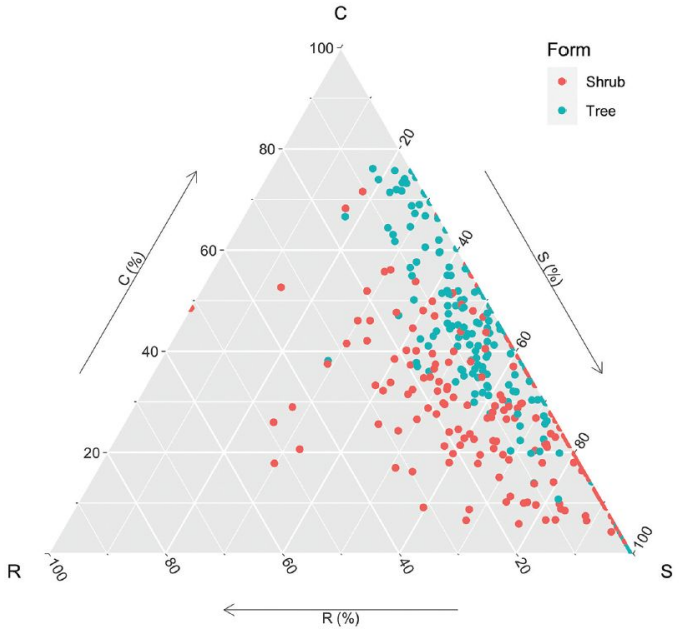
Using the CSR Theory when Selecting Woody Plants for Urban Forests: Evaluation of 342 Trees and Shrubs

By Henrik Sjöman, Andrew Hirons, and Harry Watkins

Abstract. Background: The development of a framework for optimising plant selection, with the objective of integrating plant resilience for site and function, is crucial for urban forest managers and designers. The principal objective of this study was to evaluate the leaf economics spectrum of trees and shrubs and to categorise them using the CSR classification system, classifying plants according to 3 principal strategies (Competitors [C], Stress tolerators [S], Ruderal [R]), which represent a spectrum of plant forms and functions arising under conditions of competition, abiotic restriction to growth, or periodic disturbance, respectively. The second objective was to discuss how the CSR classification system applied plant ecological strategies to plant specification in urban environments. Methods: The method for ordinating species in CSR space is based on leaf economic data including Leaf Area, Leaf Dry Matter Content, and Specific Leaf Area. Data were assembled at the Swedish University of Agricultural Sciences Campus Arboretum. Results: A total of 342 taxa (170 tree and 172 shrubs) were examined in this study. The study taxa were distributed along the Competitor-Stress tolerator (CS) axis of the ternary plots. The data analysis indicated that shrubs exhibited a more expansive position in the model, displaying a greater prevalence of stress tolerators and species with a more comprehensive approach to disturbance, competition, and stress compared to trees. Conclusion: The results provided an understanding and rationale for how species-specific selection for urban environments could be carried out. This was based on trait-oriented plant selection using the CSR classification, which was then adapted to different urban situations and functions. As a result, not only can quadratic equations be derived which describe the distribution of shrubs and trees of evolutionary variation, but also the uses of tree and shrub species in urban environments can be quantitatively described.

Keywords. Climate Change; Diversity; Plant Selection; Urban Environments.



Ways and Means

Our reference materials embed decisions and value systems that we take for granted: focusing on the ‘right’ plant means we will always struggle when we need to make substitutions.

We need to re-think not only the **MEANS** we have for improving selection but the **WAYS** available to us for integrating this with procurement and supply chains.

Establishing a gold standard for specification

We need to know about:

- Plant physiology - *the tipping points for when it will outcompete other plants or succumb to stress*
- Biosecurity risks - *the risks and counter-measures to take*
- Acceptable substitutions - *so that clients, contractors and designers can quickly agree variations*

Next steps

The Urban Plant Lab are delivering projects for Scottish Government, Woodland Trust and University of St Andrews that will propose new and improved PDTs for pilot palette of trees, shrubs and perennials that are used in GI.

We are looking for cross-sector collaboration and consultation on three critical challenges:

- Industry consensus on a revised format of PDTs for plants
- Capacity building to develop and host a full suite of PDTs
- Training and skills development