

# NURSERY PAPERS

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## WHICH PLANT WHERE?

A key challenge for greening Australia's urban environments is to ensure that plantings are made with trees, shrubs and turf that will survive and thrive for many decades to come.

This Nursery Paper outlines the aims of a five-year research project which brings together a consortium of research and industry partners to investigate the suitability of various plant species under current and future climate scenarios and in various urban areas, from street plantings to housing developments and open spaces.

### Summary

- The *Which Plant Where* project will develop an interactive online tool containing information about which species of plants and turf will thrive in urban spaces under particular soil, water, aspect and climatic conditions, in specific geographical areas.
- It will include available information on whether a plant attracts native fauna or mitigates heat or air pollution, is a potential allergen risk, or is likely to drop limbs.
- This project draws on input from diverse stakeholders including nursery and turf growers, developers, landscape planners and designers, and state and local government representatives.

## BACKGROUND

The idea of the *Which Plant Where* project emerged from the 2020 Vision Growing the Seeds national tour in 2015, where there were consistent calls for a tool that could be used to select plants, backed by evidence and data on climate, species, position and other features.

The *Which Plant Where* research program aims to test the performance of major and new urban landscape species with scientific validity and accuracy under new and more extreme urban conditions.

The project is the first of its kind, and will culminate in an online interactive tool that will map the distribution of suitable habitats for various plant species across urban areas of Australia.

To ensure the research and tools will be relevant to end-users, the initial stages of the project included five interactive workshops across Australia which attracted more than 110 participants from 86 organisations.



PHOTO: Denys Nevozhai.



# THE PROJECT

The *Which Plant Where* project is a collaboration between Macquarie University, Western Sydney University and the New South Wales Office of Environment and Heritage, as part of the Green Cities Fund, a strategic partnership initiative of Hort Innovation.

Although the project is not directly funded by the nursery industry levy, growers are an integral part of this project and six growers are members of the project's Advisory Group.

The aims of the project are to:

- provide guidelines to councils, planners, residents, landscapers and horticulturalists about what to plant
- support local councils' climate adaptation programs
- mitigate risks associated with poor plant selection
- inform better local labelling of plants at a consumer level.

The online interactive tool will be designed for use by a wide range of stakeholders, from nursery and turf growers to developers, landscape planners and designers, councils, and individuals.



Western Sydney University is hosting some of the trials for *Which Plant Where*, growing key target plants in climate controlled glasshouses to see how well they tolerate urban heatwaves, and to seek even better horticultural varieties to withstand them. PHOTO: David Thompson.

# THE RESEARCH

There are four modules of research that form the basis of *Which Plant Where*.

## SPECIES ATTRIBUTES AND CLIMATIC TOLERANCE

The first module will focus on 100 plant species identified in the project's Target Species List, and will develop maps that demonstrate each species' suitability to both current and future climates across Australia.

These maps will be used to demonstrate how well or poorly a particular species will be able to tolerate future conditions in urban centres across Australia as the climate changes, based on current understanding of species' climatic requirements.

The project will use information from national herbaria and other sources to quantify each species' climatic limits – the warmest, coldest, driest or wettest conditions they can cope with.

Researchers will also be working with growers, nurseries and landscape architects to capture their recordings of major plant traits including:

- growth rate and form
- height
- canopy density
- ground cover
- longevity
- seasonality
- water-use efficiency
- insect resistance
- allergenicity
- biodiversity benefits.

## GREEN CITIES

The Green Cities Fund encourages co-investment in research to inform nursery industry business decisions and customer advice, and its aim is to invest in strategic, longer term research which drives a measurable increase in urban green space.

The *Which Plant Where* project comes under the Green Cities Fund's climatic and environmental theme, which targets research that will develop tools and knowledge to assist Australia to overcome its current and future climatic and

environmental challenges, such as extreme weather patterns and the urban heat island effect.

It has three key objectives:

- To increase understanding of the current climatic and environmental barriers to expanding urban green space
- To increase understanding of the role that urban greening plays in mitigating the effects of climatic and environmental change
- To develop the tools and resources which will lead to increased application of urban greening in design.



## FACTORS THAT CONTRIBUTE TO THE SUCCESS OR FAILURE OF URBAN PLANTINGS

These include the conditions to which species are exposed during their early establishment phase, such as soil quality, nutrient supply, watering and heat stress, that might affect their early survival; and long-term climate factors such as urban heat effects, drought stress or insect or fungal damage, or subsequent groundworks that might damage plant roots.

By working with stakeholders across all links throughout the plant supply chain, the project can obtain a wide range of data on the factors that make or break a successful urban planting.

The project will identify partners, such as councils, that are willing to share data and results of historic plantings across a range of urban settings.

A range of target locations will be selected for much more detailed and longer-term monitoring of sites, with consideration of climatic conditions, soil attributes, watering regime, fertiliser use and the presence of pathogens.

New test-planting sites will be established where the performance of a range of species will be monitored under contrasting climatic and soil attributes, to assess how they respond to more challenging climatic conditions.

There will also be investigation of the additional benefits that urban greening brings, such as greater numbers of birds, insects and other wildlife, cleaner air and cooler temperatures at street level, and associated benefits to human health and well-being.

## HEAT AND DROUGHT-TOLERANT SPECIES THAT WILL THRIVE

Some plants can cope with adverse weather conditions better than others, and it is important to understand just how much heat and drought stress each of the project's 100 target species could potentially tolerate.

Using both glasshouse and field trial sites, they will be subjected to some of the toughest conditions they are likely to face over the coming century, including lengthy or intense heatwaves; extensive drought periods or periods of drought followed by intense rainfall; and high average temperatures at unusual times of the season.

This regime will assist understanding of the abilities of different plants to cope when they are exposed to more than one climate stressor simultaneously. Watering is clearly a crucial element of a plant's success, so different watering regimes combined with different soil types and media will be tested to reveal a plant's water use efficiency and drought limits.

In real-world situations, plants can be affected by multiple factors at once so it is important to impose a combination of conditions that is 'realistic but tough' to see how the plants really respond.

## INTERACTIVE PLANT FEATURES TOOL

The interactive database will use the data collected in previous modules to build a national tool that helps to select plants against a range of filters.

Previously-developed tools provide a good number of options to select plants for purpose, colour, flowering, height or availability, but there are none that are backed by extensive testing of plants under current and future climatic conditions.

The Interactive Plant Features Tool aims to offer a large range of filters that include not just plant features but also factors such as safety, amenity value, location and co-benefits.

The Interactive Plant Features Tool will contain:

- maps that show the changes in climate suitability for plants under predicted climate change scenarios
- filters that reflect common urban planting needs, such as rooftops, verges, water-sensitive design, parks or urban forests
- value-added characteristics that may include heat mitigation, wildlife and biodiversity benefits, pollinator-friendliness or tolerance to urban constraints such as footpaths.

The expected release date of the Interactive Plant Features Tool is 2021.



To ensure that the research will be relevant to end-users, the initial stages of the Which Plant Where project included interactive workshops across Australia which attracted more than 110 participants from 86 organisations. PHOTO: David Thompson.



## NEXT STEPS

The project sets out a number of milestones to be delivered over the five years from 2017 to 2021.

An Advisory Group has been formed, stakeholders advised and engaged, and identification of potential demonstration and field testing sites is underway.

By 2018 it is anticipated that a species list will be finalised, a standardised screening protocol established, and success/failure planting sites and growth trial sites established.

It is anticipated that the final version of the Plant Features Tool will be launched in 2021, although streamlined versions may be available sooner.

A national best practice technical design guide will also be developed as part of the project, to demonstrate best-practice case studies of species selections around Australia.

## IMPLICATIONS FOR THE NURSERY INDUSTRY

Confidence that tomorrow's urban plants will survive and thrive is crucial for the long-term viability of the nursery industry, and this project will assist the industry to identify future-proof native and exotic species for enhancing urban greening.

The *Which Plant Where* research will deliver a host of outputs including new research on plant water efficiency and heat stress, case-study demonstration sites and a website which makes it easier to select plant species across the country based on future climate predictions.

**The *Which Plant Where, When And Why Database For Growing Urban Greenspace (GC15002)* has been funded by Hort Innovation with co-investment from Macquarie University, Western Sydney University and the New South Wales Office of Environment and Heritage.**



PHOTO: Chris Barbalis.

The project will provide an Interactive Plant Features Tool that nurseries can use to inform their own production and share with customers along the supply chain, to ensure plantings in urban spaces are sustainable, resilient, attractive and durable under the toughest of climates.

Growers have a key role to play in better understanding which, where and how urban plants can best provide health, wellbeing and liveability outcomes both now and in the future, if the industry is to meet the goal of increasing urban green space by 20% by 2020.

## LINKS TO RESOURCES

*Which Plant Where* project: [www.whichplantwhere.com.au](http://www.whichplantwhere.com.au)

Hort Innovation project page: Which Plant Where Project:  
<http://horticulture.com.au/co-investment-project/gc15002>

Hawkesbury Institute for the Environment, Western Sydney University:  
[https://www.westernsydney.edu.au/hie/research/research\\_projects/green\\_cities\\_which\\_plant\\_where](https://www.westernsydney.edu.au/hie/research/research_projects/green_cities_which_plant_where)

Centre for Smart Green Cities, Macquarie University:  
<http://www.mq.edu.au/research/research-centres-groups-and-facilities/secure-planet/centres/centre-for-green-cities/our-projects>

Green Cities Fund: <http://horticulture.com.au/co-investment-fund/green-cities-fund>

**PAST EDITIONS OF NURSERY PAPERS ARE AVAILABLE ONLINE on the Nursery & Garden Industry Australia website**  
[http://www.ngia.com.au/Section?Action=View&Section\\_id=46](http://www.ngia.com.au/Section?Action=View&Section_id=46)