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UNIVERSITY OF CALIFORNIA

Integrating data for tree crop modeling under climate change

Alessandro Ossola, PhD

Is climate (change) affecting your productions?

AGRICULTURE

Heatwave hits California lemons sending prices soaring

PUBLISHED MON, JUL 23 2018•3:46 PM EDT | UPDATED MON, JUL 23 2018•5:31 PM EDT

Jeff Daniels
@JEFFDANIELSCA

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KEY POINTS

- A heatwave in Southern California's major lemon growing region this month caused a loss of lemons and squeeze in supplies.
- The decline in supplies has driven up wholesale prices about 40 percent or more in some markets.
- Some are predicting the supply crunch could continue into September and October.

EUROFRUIT

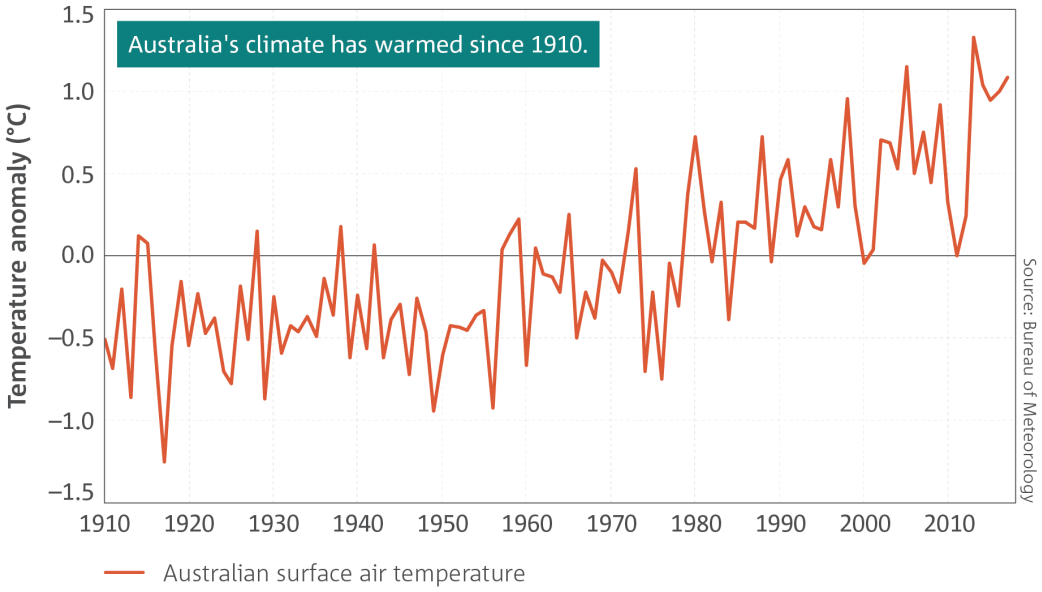
Heat wave slashes Spanish citrus crop

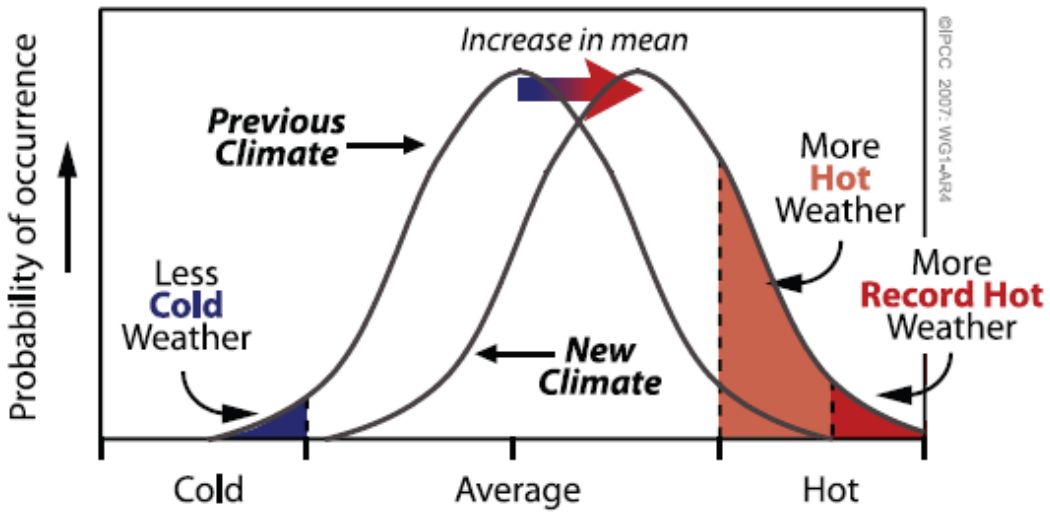
By Maura Maxwell | 22 September 2015

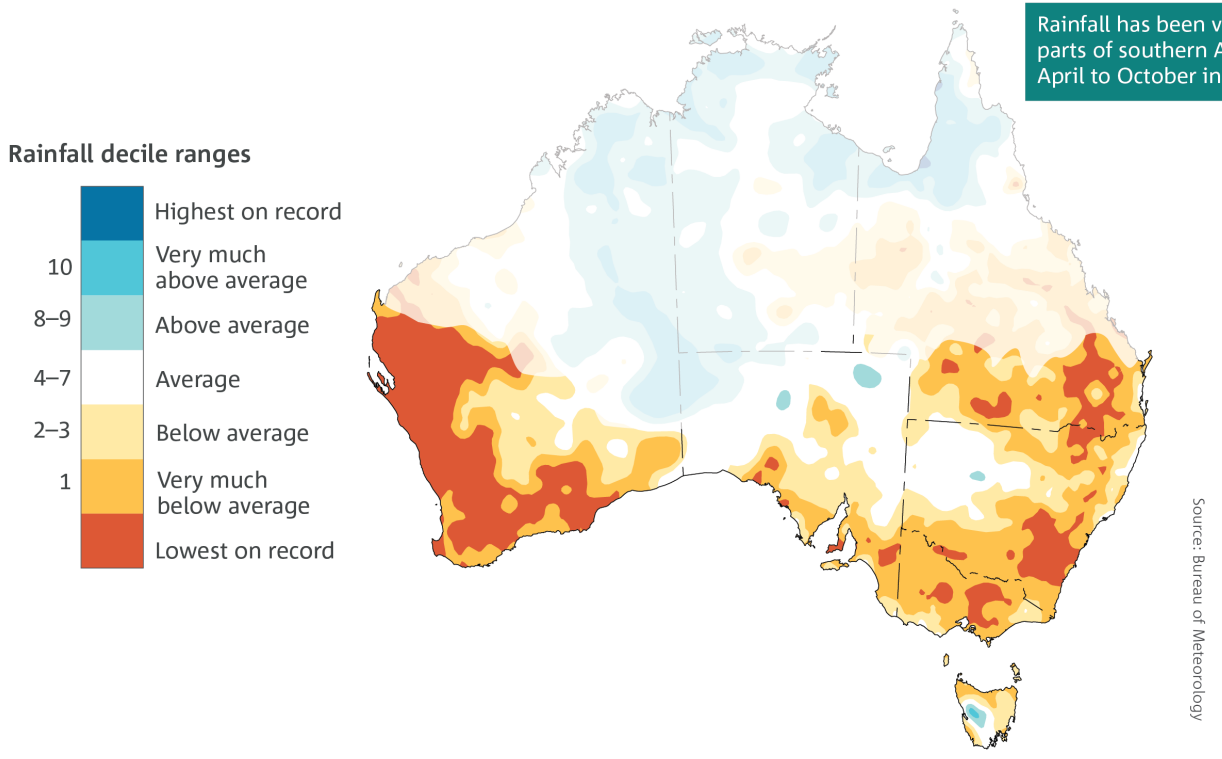
A sharp fall in citrus production in the coming season is being hailed by the Spanish government as welcome news for the national industry and the European market as a whole. The drop is due to the prolonged heat wave that engulfed much of the country during the spring and early summer, bringing record temperatures and leaving several dead.

At a meeting held last week at the Ministry of Agriculture to analyse the start of the new campaign, representatives from the main producer groups presented the latest crop forecasts showing that early season mandarin varieties including Satsuma, Okitsu and Nules are down by as much as 25 per cent compared to last year. Volumes of early oranges – principally the Navelina variety – are projected to fall by 7-10 per cent.

This is what is going on in Australia…







.. I will tell you a story ..

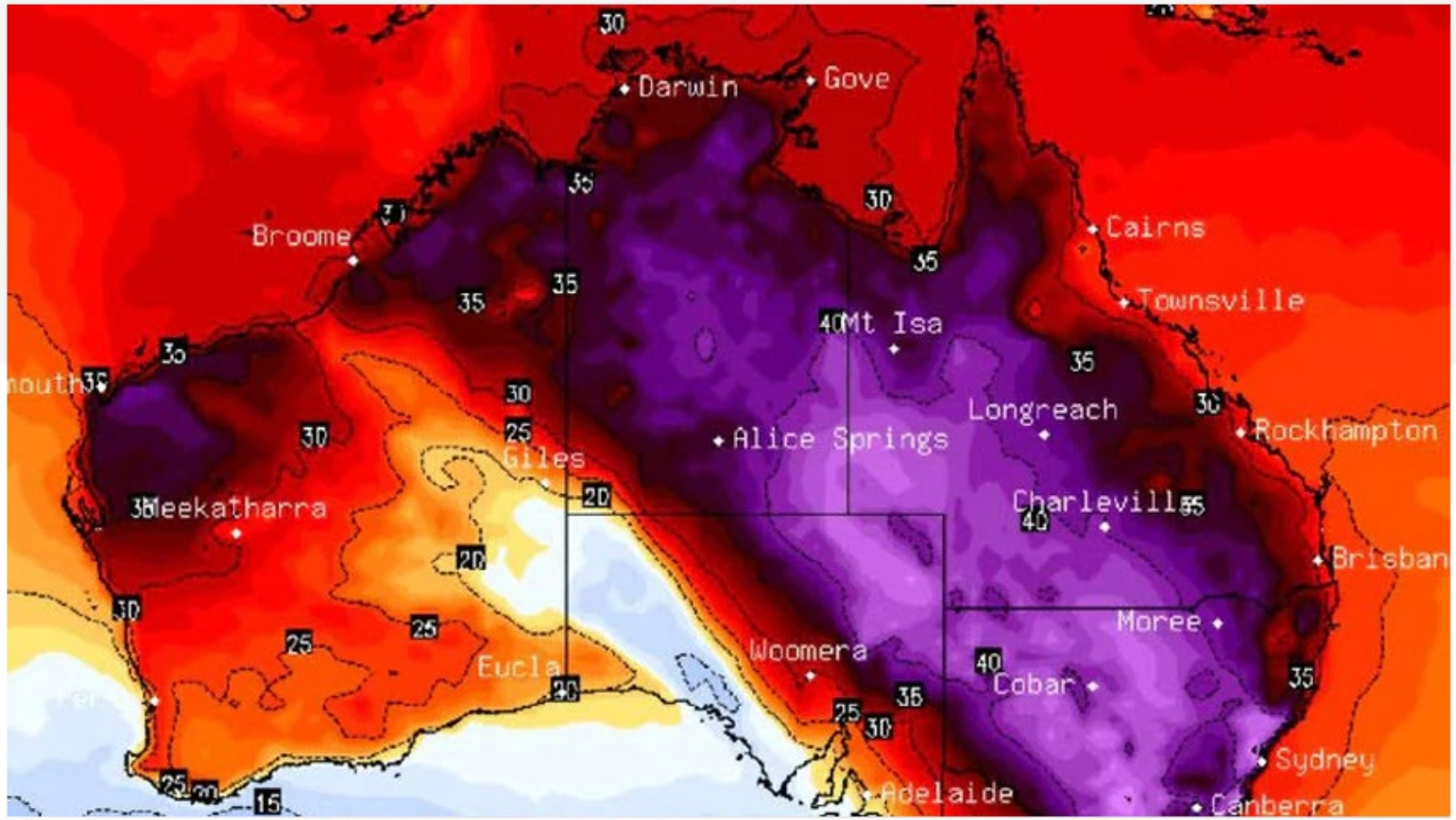
Impacts on the ornamental horticulture industry are <u>severe</u>

Platanus acerifolia
London planetree,
Richmond 9th Jan. 2018

Banksia serrata
Old Man Banksia, Sydney
10th Mar. 2019

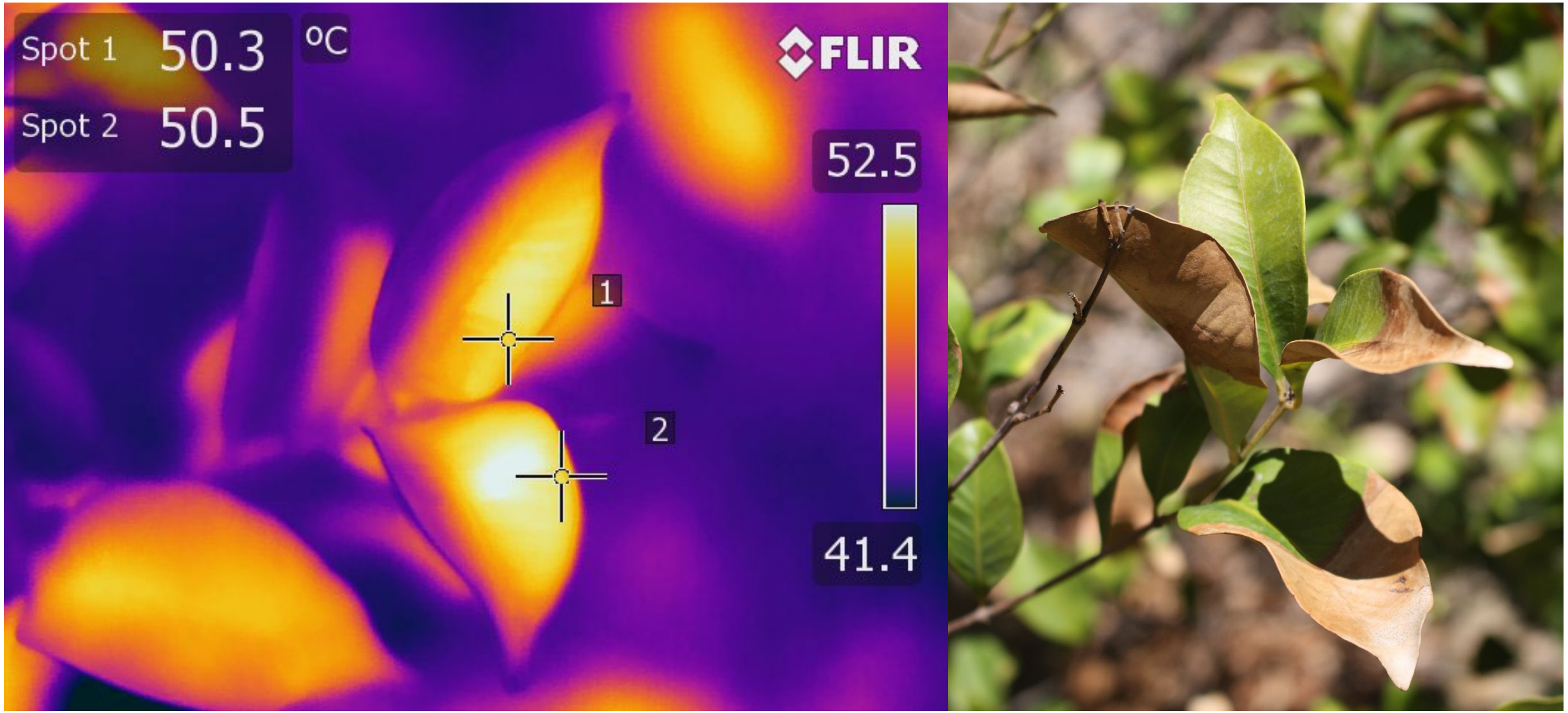
SBS News

Sydney's Penrith the hottest place on Earth amid devastating bushfires



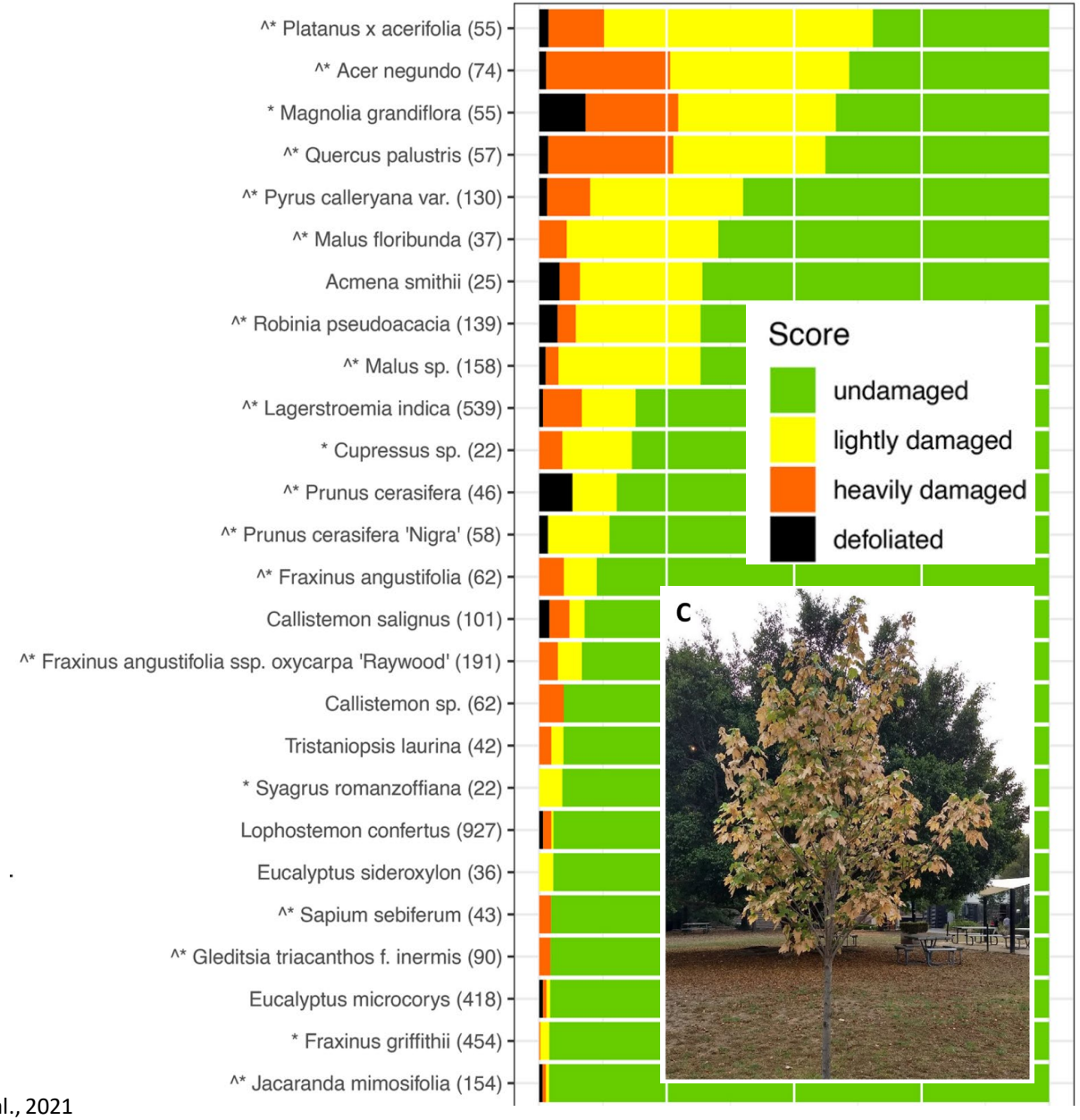
Penrith was the hottest place on Earth on Saturday, reaching a high of 48.9C. Source: BSCH

48.9 ˚C (120˚F)



Measured in W. Sydney on 10th Feb. 2017, 14:00 AEDT, Air T = 40.7 °C, 32% RH

Multi-million $ damage to tree assets



Almost 10% of street trees experienced canopy damage

Tabassum et al., 2021

Helping Australia's horticultural industry adapt to climate change

KEY ISSUES

1. Inability to forecast climate change impacts

2. Need for long-term planning, market diversification

3. Increase resilience and opportunities for growers

Hort Innovation

hort frontiers
Strategic partnership initiative

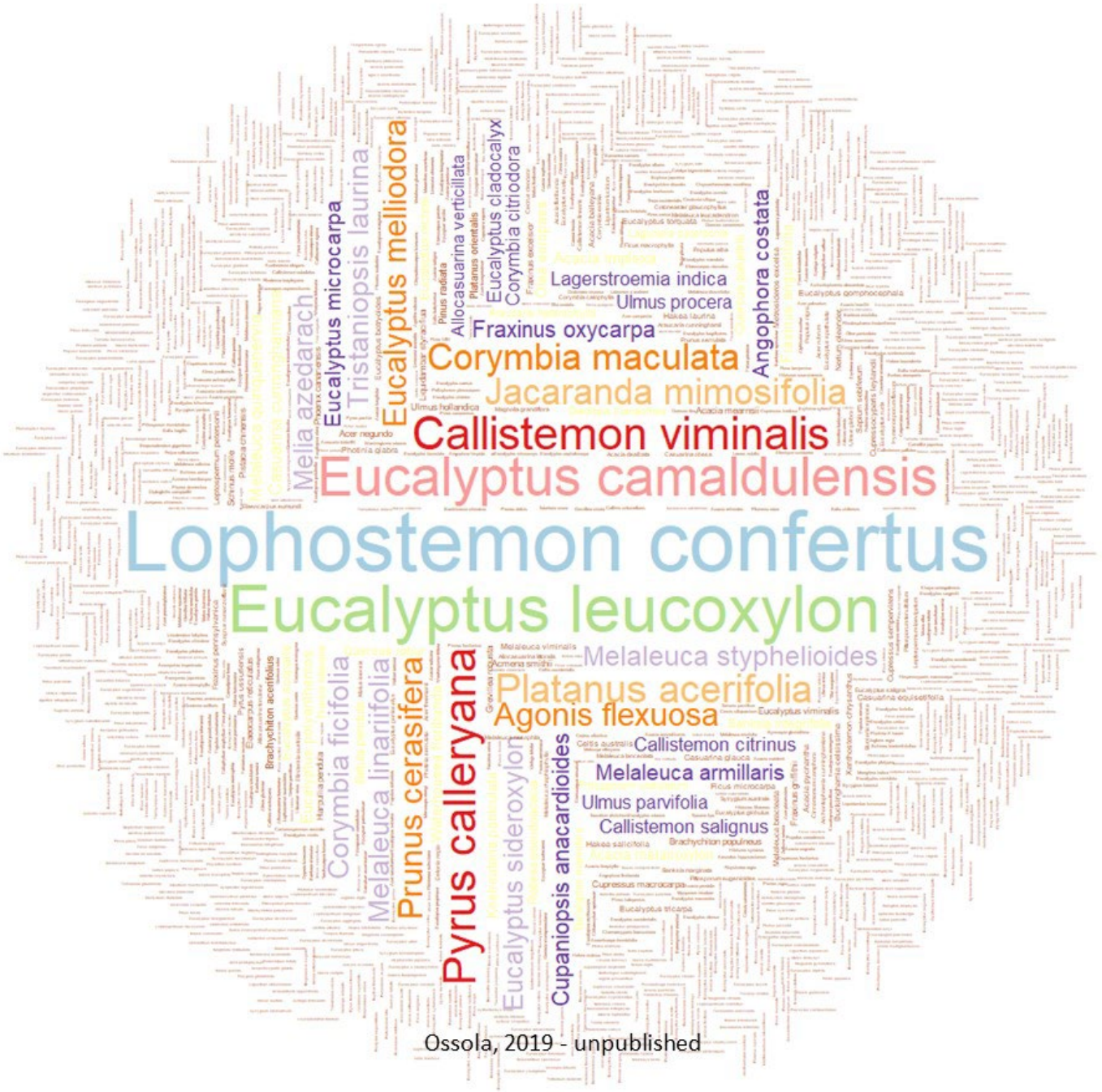
GREEN CITIES FUND

Which Plant Where

SMART GREEN CITIES

Do you love diversity?

Which one is '*climate ready*'?

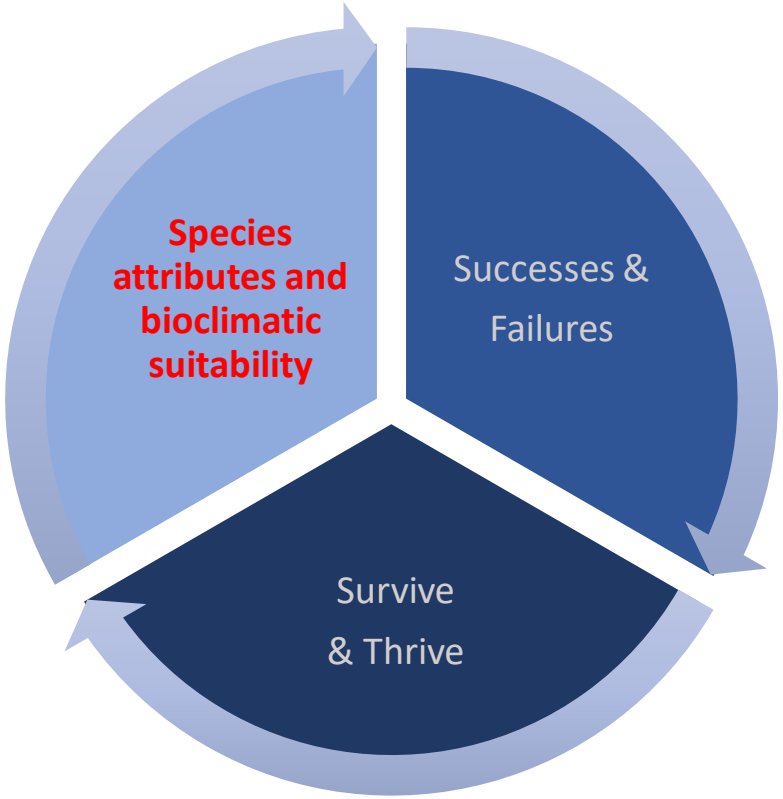


Australia's ornamental horticulture sector

Some 3,000-5,000 cultivated species, varieties, etc

Australia has some 20,000 native species

We built an evidence base from multiple data streams

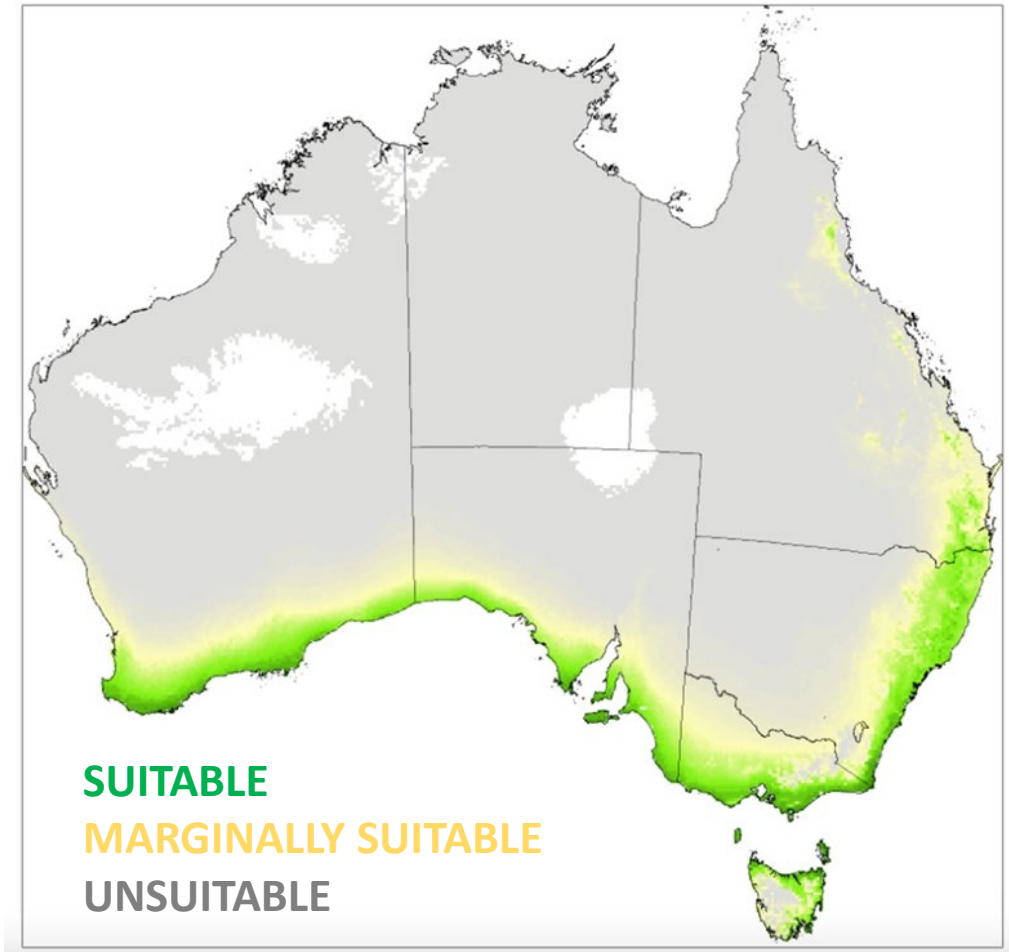


Bioclimatic models to estimate areas of climatic suitability for each species under a changing climate in 2030, 2050 and 2070.

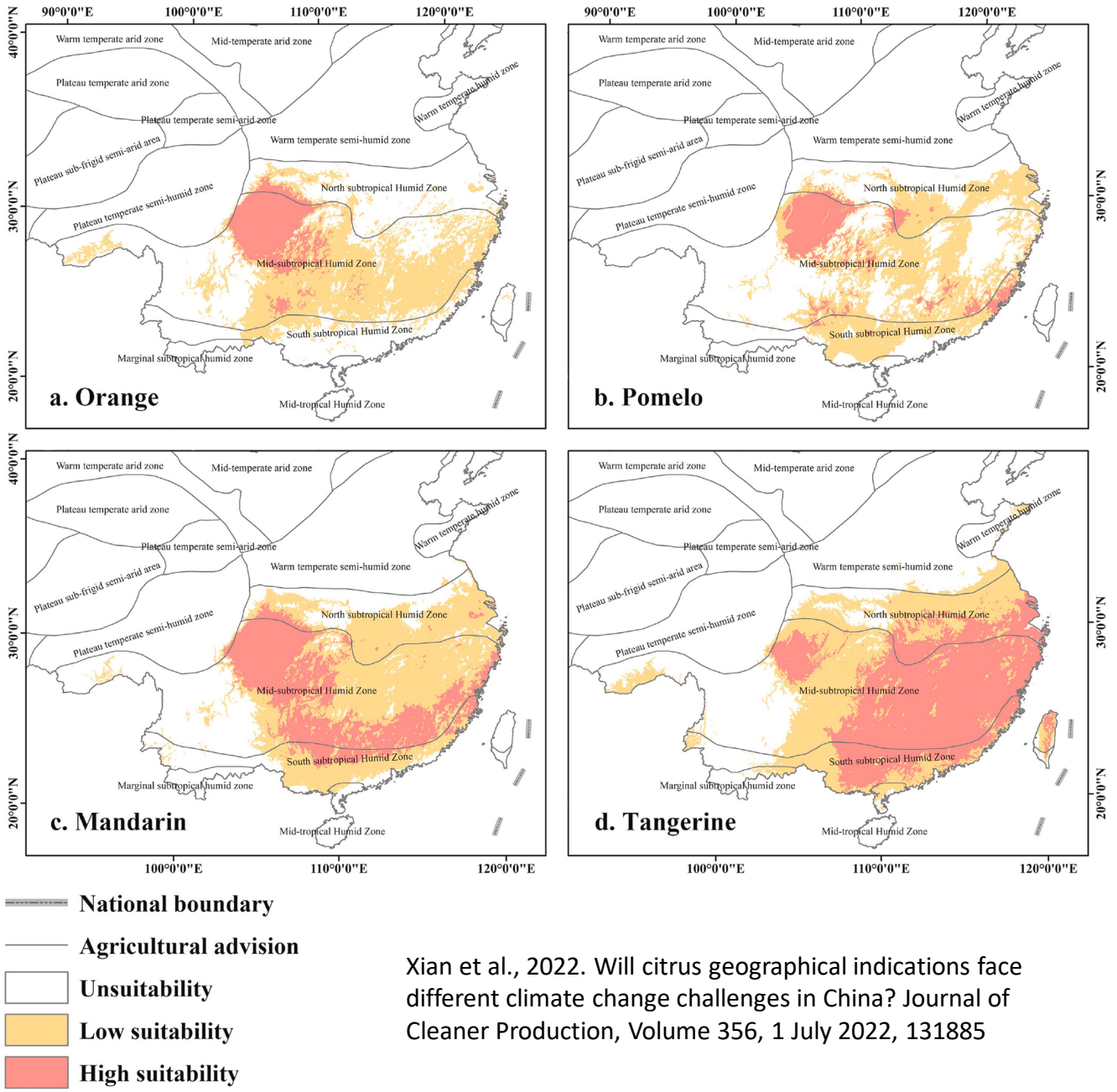
Trait database that includes information for >2500 species & cultivars on species' attributes (biology, tolerances, site context, hazards)

Which Plant Where

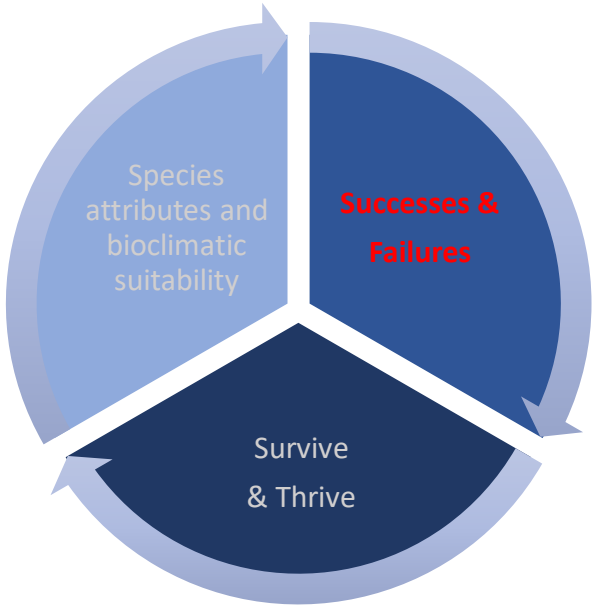
Hort Innovation



Bioclimatic models = estimated areas of climatic suitability for each species under a changing climate in 2030, 2050 and 2070.

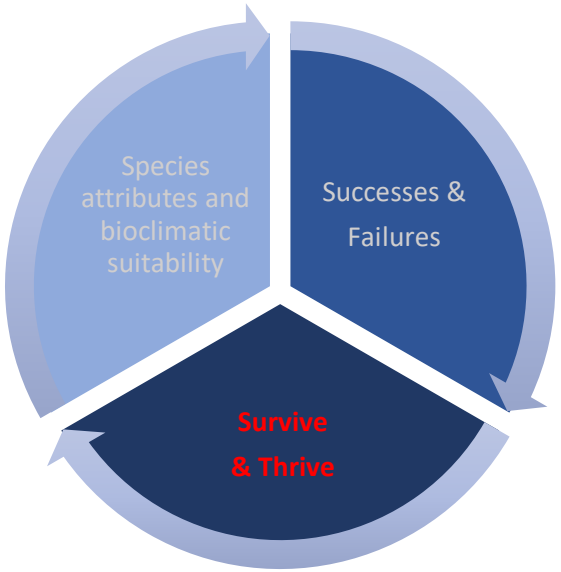


Xian et al., 2022. Will citrus geographical indications face different climate change challenges in China? Journal of Cleaner Production, Volume 356, 1 July 2022, 131885



This module accessed success and failures of urban tree plantings in relation to local conditions as well as variables such as planting and management techniques.

12 **'Living Labs'** were established across Australia



This module subjected a sample of 113 species to controlled heatwave and drought conditions in glasshouses to assess the abilities of different species to withstand:

- Drought tolerance
- Heat tolerance
- Plant stress indicators

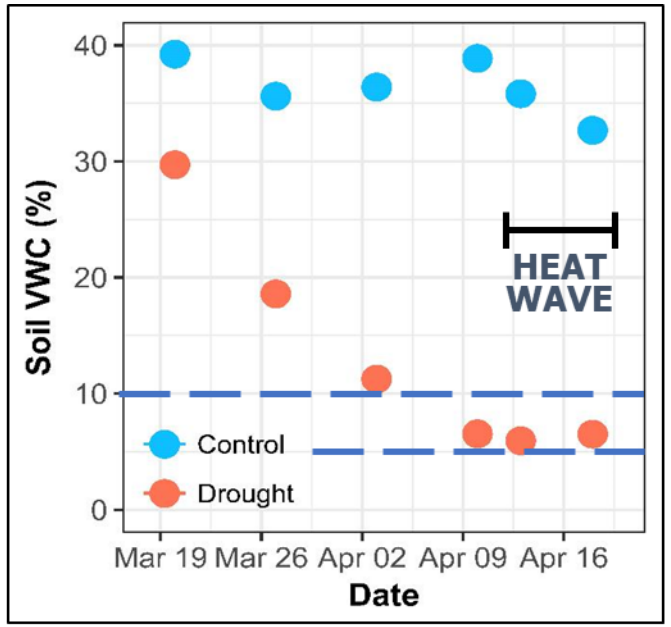
We built simulated drought and heatwave effects

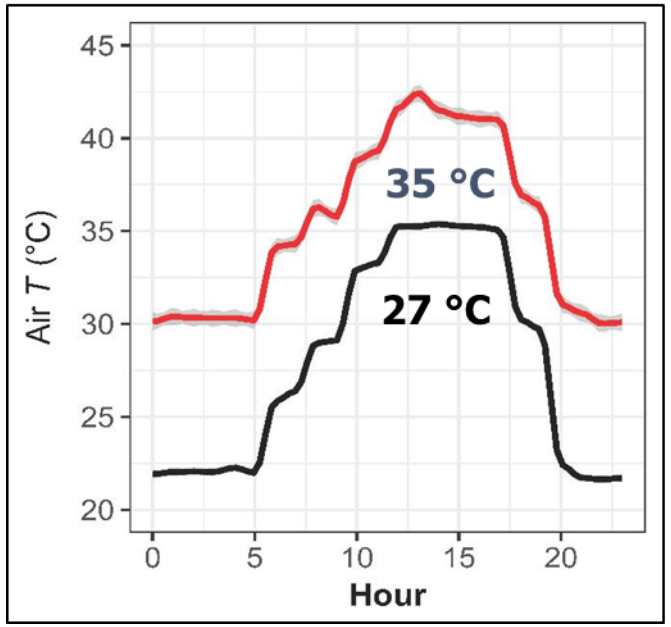
ORIGINAL RESEARCH
published: 21 January 2020
doi: 10.3389/fpls.2019.01715

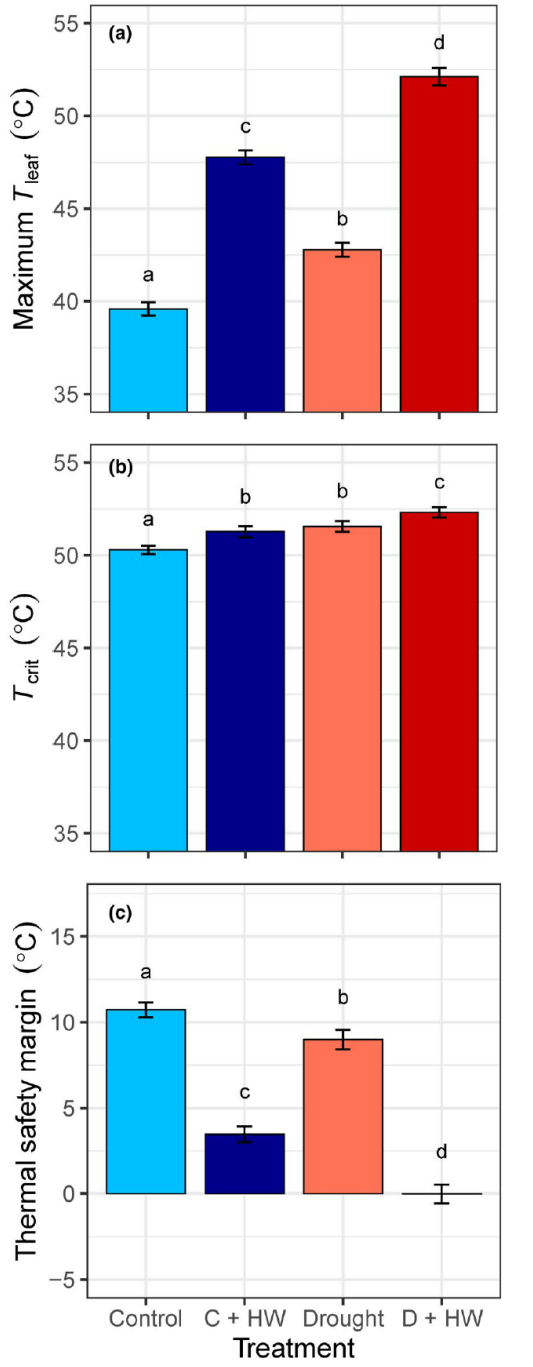
A Simple Method for Simulating Drought Effects on Plants

Renée M. Marchin[1], Alessandro Ossola[2], Michelle R. Leishman[2] and David S. Ellsworth[1]*

[1] Hawkesbury Institute for the Environment, Western Sydney University, Penrith, NSW, Australia, [2] Department of Biological Sciences, Macquarie University, North Ryde, NSW, Australia

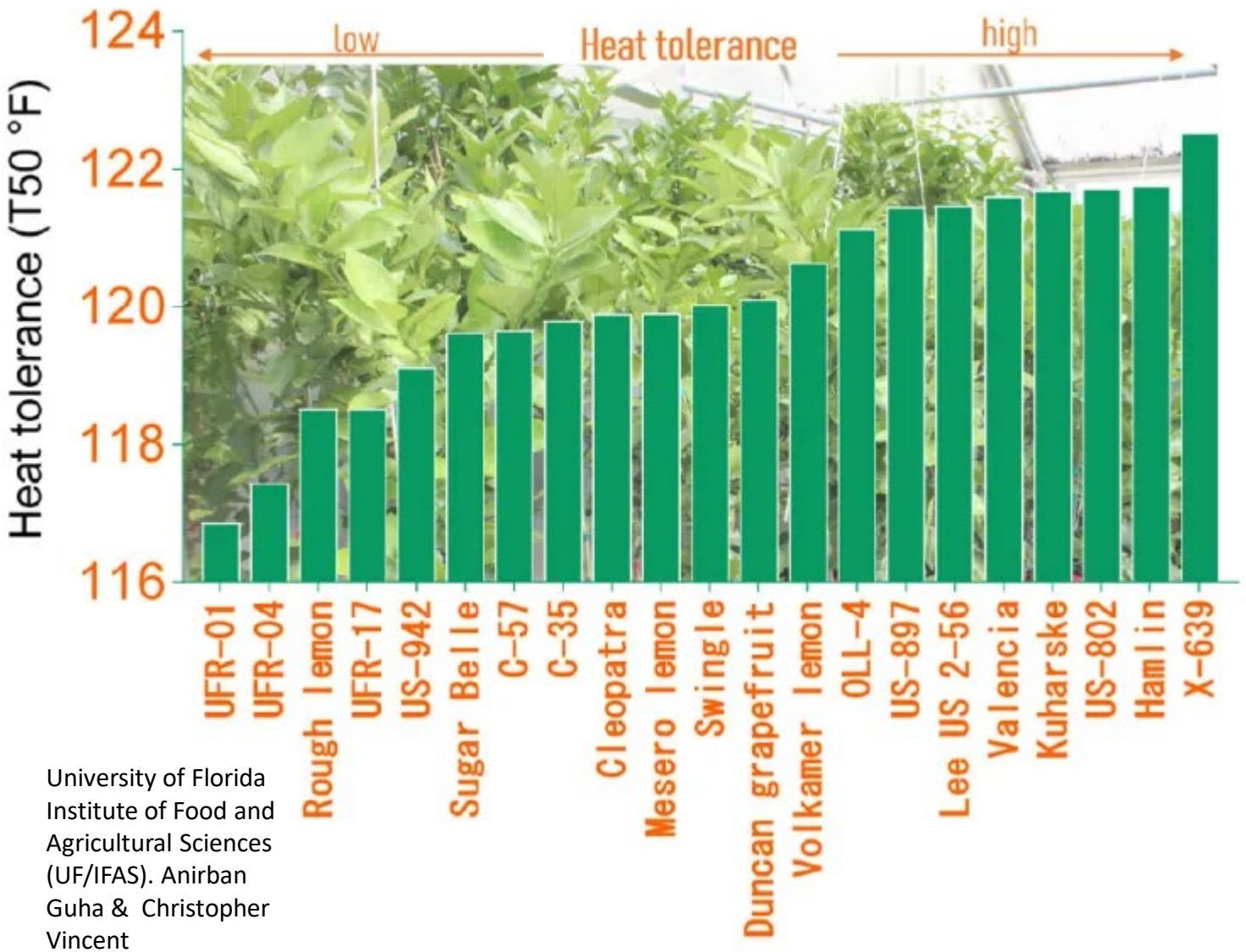






Spurflower (*Plectranthus argentatus*)
Drought sensitive

Lilly pilly
(*Syzygium wilsonii*)
Heat sensitive



University of Florida Institute of Food and Agricultural Sciences (UF/IFAS). Anirban Guha & Christopher Vincent

+ heat interactions with huanglongbing (HLB) disease and altered transpiration and leaf cooling

https://citrusindustry.net/2022/05/23/high-summer-temperatures-take-a-toll-on-trees/

We built a climate-ready species selection tool

Which Plant Where

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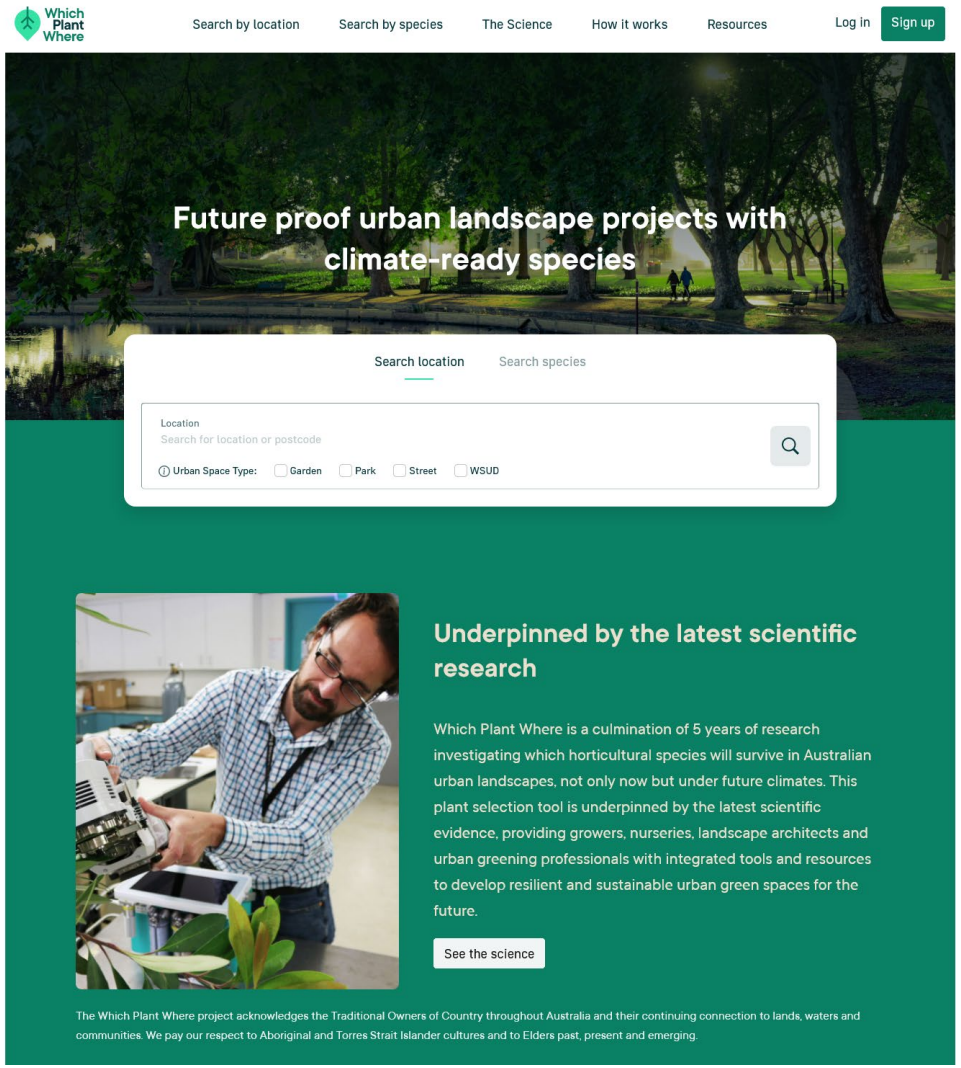
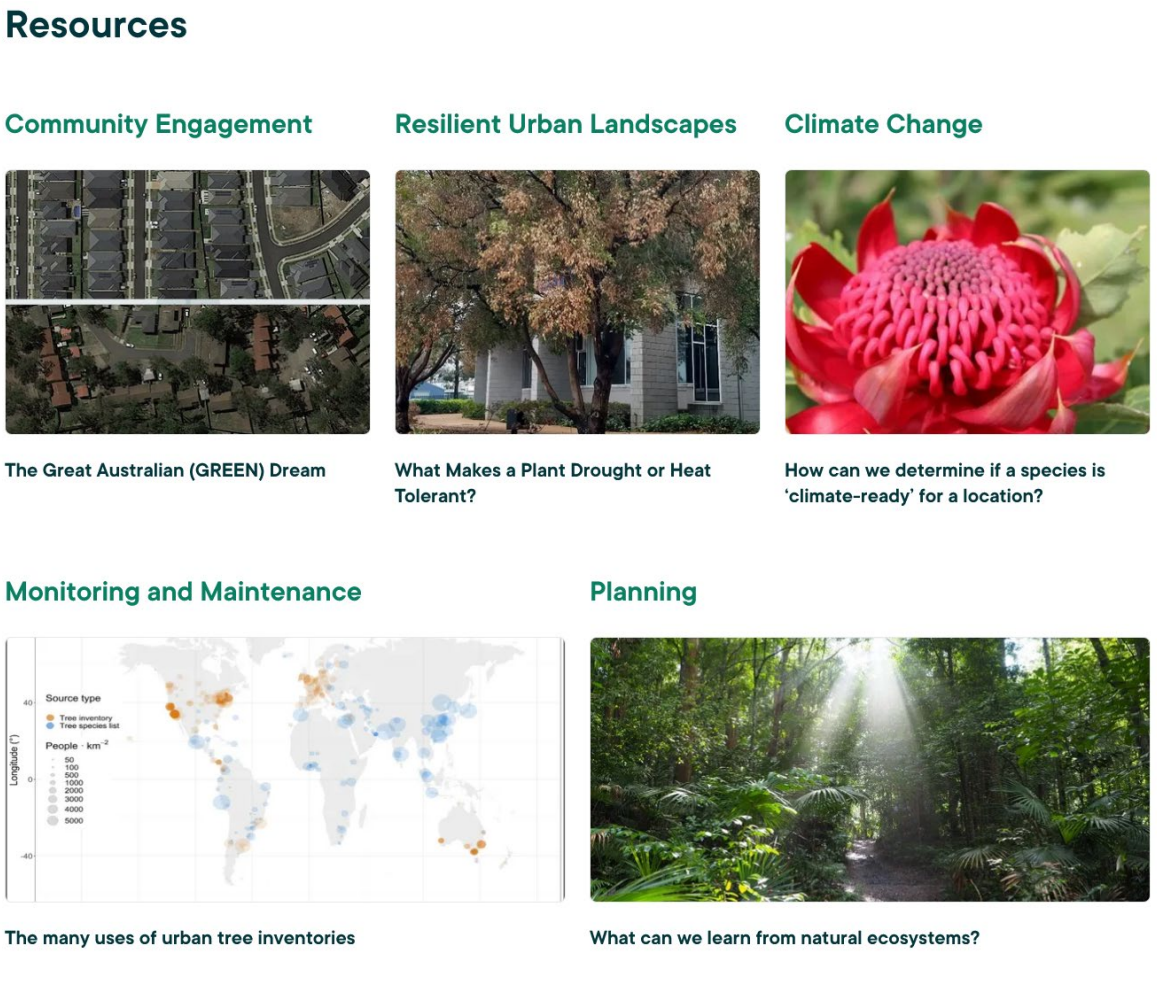
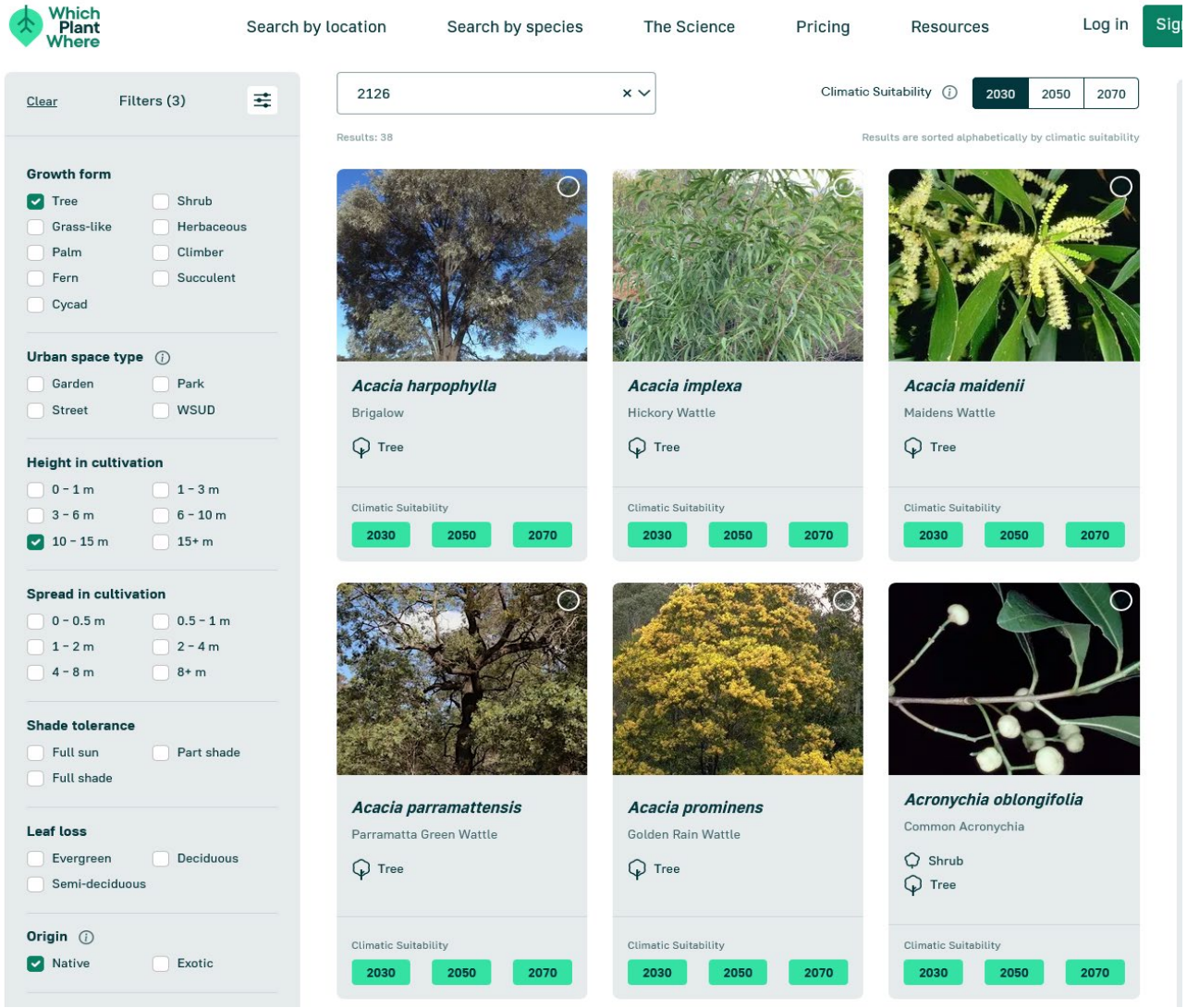
https://whichplantwhere.com.au







- >2500 species, cultivars and varieties
- Climate suitability in relation to postcode
- Information on environmental tolerances, appearance, uses
- Calculates canopy area and planting diversity of your chosen species palette
- Calculates shade, carbon and biodiversity value of your chosen species palette

Which Plant Where

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Lophostemon confertus

Brisbane Box

Tree

Climatic Suitability

2030 2050 2070

Angophora floribunda

Rough Barked Apple

Tree

Climatic Suitability

2030 2050 2070

Agonis flexuosa

Burgundy Western Australian Weeping Peppermint

Shrub

Tree

Climatic Suitability

2030 2050 2070

What did we learn?

- Single data streams (climate models, ecophysiology, field experiments) are not enough, if not integrated.

- Refine bioclimatic models to include considerations about yield, etc. -> more and better data collection

- Include interactions with climatic conditions for main pests and pathogens

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Thanks to Aaron Dillon &
Deborah Pagliaccia for inviting

and our partners …

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Strategic partnership initiative
GREEN CITIES FUND

NSW GOVERNMENT
Planning, Industry & Environment

Urban Science Lab

MACQUARIE University

WESTERN SYDNEY UNIVERSITY

Questions?

aossola@ucdavis.edu
@lessandrOssola