



# Looking at Bee-Friendly Botanic Garden Design

Guidelines Western Australia



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### Researcher contact details



Professor Dr. Maria Ignatieva  
UWA School of Design  
+61 8 6488 2789  
M433, Perth WA 6009 Australia  
maria.ignatieva@uwa.edu.au

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## Foreword

Botanic Gardens are a haven for all that is exotic. With Western Australia being a biodiversity hotspot, there has been a shift to showcase our indigenous flora and preserve what we are rapidly losing to climate and land-use change. So much of the flora is now confined to remote regions that are difficult to access. Bringing it to easily accessible sites is the approach for the future.

Insects have not been in the scope of Botanic Gardens but, as they are now being threatened by pest and diseases spreading across the world as well as indiscriminate pesticides, their presence is now becoming as interesting and spectacular as the plants within the gardens. The message of this ecological plant-insect interaction for the sustainability of our flora, is becoming a feature of Botanic Gardens.

When bringing together different insect groups with plants, there are biological considerations. For the bees, considerations are non-saline water, plants that produce flowers that provide nutritious nectar and pollen and a nesting place. As this is a public space, for honey bees and their ability to sting, their nesting place needs to be controlled to minimise interaction between the public and the colony.

Achieving the balance offers many rewards, either through enjoyment, products produced from the hive or the reproductive stability of the garden through the pollination services of the honey bee.

Dr Liz Barbour  
CEO

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## About the Authors

### Maria Ignatieva

Maria Ignatieva, Ph.D., is a Professor of landscape architecture and the discipline chair of the Landscape Architecture program at the School of Design, the University of Western Australia. She is the president of the URBIO (Urban Biodiversity and Design International Network). She previously taught and researched in the USA (SUNY ESF, Syracuse, New York), New Zealand (Lincoln University), Sweden (Swedish University of Agricultural Sciences, Uppsala) and in Russia (St. Petersburg State Forest Technical University). Maria's main research interests are urban ecology (with emphasis on urban biodiversity and design), urban green infrastructure, the history of landscape architecture, and the restoration and conservation of historical gardens.

### Yuqi Yang

Yuqi Yang is a landscape architect and a Ph.D. candidate in the School of Design at the University of Western Australia (UWA), funded by UWA and CRC for Honey Bee Products. Her Ph.D. research emphasis on design principles of honey bee botanic gardens under Western Australia's context. Her research interest concentrates on the theory of "Design with Nature" and "Urban Biodiversity" within the context of sustainable cities.

## Acknowledgments

This research is funded and supported by the Cooperative Research Centre for Honey Bee Products (CRCHBP) and the School of Design, University of Western Australia (UWA). Our deep gratitude goes to Dr. Liz Barbour, Mr. Gin Wah Ang, and Yanchep Beach Joint Venture for providing this precious opportunity and the support for the past years from 2019 till now. We would like to thank the 30 interviewees for taking part in and supporting this study.

# EXECUTIVE SUMMARY

## Background

As one of the most important pollinators, both honey bees and native bees play a vital role in providing ecosystem services to different type of landscapes by ensuring stable pollination to agriculture and other plant communities. European honey bees (*Apis mellifera*) were introduced to Australia in the 19th century, foraging mostly on native plants, and playing an essential role in agriculture. However, statistics show that the honey bee populations have experienced serious declines over recent decades worldwide, especially in the Northern Hemisphere. Although the honey bee populations in Australia remain resilient currently, due to climate change, it is suffering a degradation of the foraging flora value, which may further influence the honey bee populations.

Urban green infrastructures (UGIs) are being introduced to the sustainable urban planning framework due to its key position in maintaining and strengthening the relationship between human and nature, between development and conservation. As a crucial part of green infrastructure, botanic gardens are highly recognised for their conservation, educational and recreation values.

Being in one of 35 internationally recognized biodiversity hotspots, the Perth region is experiencing the ongoing destruction of unique native habitats; at the same time, there is an emerging need for city centre development in one of its outer suburbs, Yanchep. In response to the rising attention to healthy human-environment and city-nature relations, particularly ecological design and nature-based solutions, contemporary landscape practitioners and researchers must possess knowledge from different disciplines, in order to integrate them into research and practical applications.

## Objectives and aims

This research aims to explore multi-scale approaches toward green infrastructure design and regional city planning strategy, based on a theoretical framework and a design proposal of a honey bee botanic garden. Specific research foci will be as follows: (1) Exploration of human-nature relations in the Anthropocene from the perspective of bees and habitats in urban landscapes in Western Australia; (2) Design criteria and guidelines for honey bee botanic gardens in the context of sustainable urban development of a new type of settlement; (3) Reflections on designing sustainable botanic garden under urban development context.

## **Outline and Scope of the thesis**

### **PART 1: BACKGROUND**

Chapter 1: General Introduction

Chapter 2: Systematic Review of the Theoretical and Conceptual Context

Chapter 3: Methods

### **PART 2: THEORETICAL RESEARCH**

Chapter 4: Landscape design theories

Chapter 5: Botanic gardens: the past and the future

Chapter 6: Physical environment of WA and Yanchep

Chapter 7: Conservation in the Anthropocene era: Bees, habitats and landscape

### **PART 3: LOCAL INTERPRETATION: HONEY BEE BOTANIC GARDEN DESIGN APPROACH**

Chapter 9: The design experiment in Yanchep, Western Australia

Chapter 10: Criteria and principles of sustainable design and management process

### **PART 4: CONCLUSIONS**

Chapter 11: Discussion: responding to research aims

Chapter 12: Conclusions and limitations

## **Key findings and implications for the honey bee industry**

This research is pioneering in Western Australia. It puts forward a new angle to study the relationship between nature and city and between urban planning and landscape. The findings of this research will:

- Arouse public concerns for both native bees and honey bees' wellbeing in Western Australia
- Provide a design guideline for the creation of bee botanic gardens as a part of a sustainable urban landscape.
- Explore green linkages and their role in the sustainable urban environment and in connecting natural patches (wildlife habitats), increasing and deepening its effectiveness at providing ecosystem services.
- Be valuable guidelines for policymakers on the quality of existing green spaces in urban areas.

## Academic outputs

(2022) Yuqi Yang, Maria Ignatieva & Andrea Gaynor. "Design and Conservation Strategies for Urban Biodiversity in Australian Botanic Garden". *Landscape Architecture*, 29(1), 34-48.

(2019) Seminar presentation: "Botanic Gardens as Unique Urban Bee Habitats and Places for Interaction with Nature", 'Nature City Seminar 2019', Perth.

(2019) Symposium presentation: "Bee Botanic Gardens: places for humans and nature", 'EcoPeoPle Symposium: Environment and Society Now', UWA.

(2019) Poster presentation: "Looking at the Honey Bee-Friendly Botanic Garden Design in Western Australia", 'PhD Colloquium for ECLAS Conference', Oslo.

(2021) Conference presentation: "Honey Bee Friendly Botanic Gardens Design - What does LANDSCAPE ARCHITECTURE bring to BEES?", Australasian Honey Bee Conference 2021, Perth.

Manuscript in preparation describing: "The Ideas of Hybridity in Urban Landscapes: Vision through the Research of Honey bees in Western Australia".

Ph.D. thesis being compiled by Yuqi Yang.

## Industry output

Table 1: Project Activities

	Project Activities	Method	Time Period
1	Yanchep bee-friendly botanic garden concept design	Research by design	2019-2021
2	World Bee Day demonstration design	Design	2021
3	Bee-friendly front verge planting design for "Hive and Wellness"	Design	2021

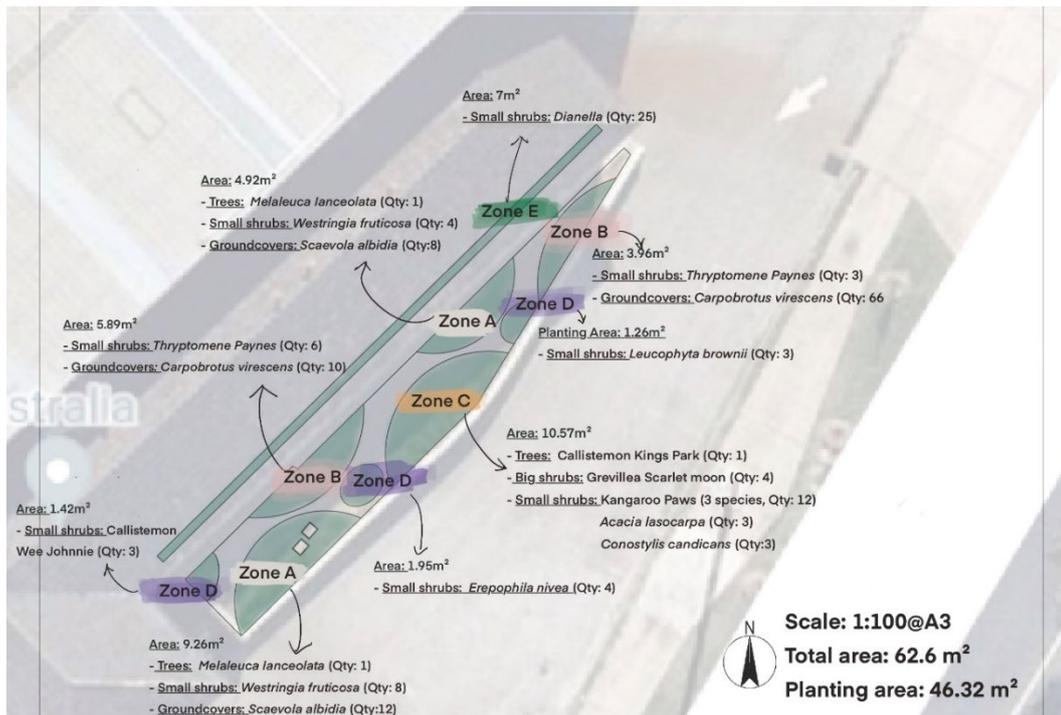


Figure 1: Bee-friendly front verge planting design for “Hive and Wellness”

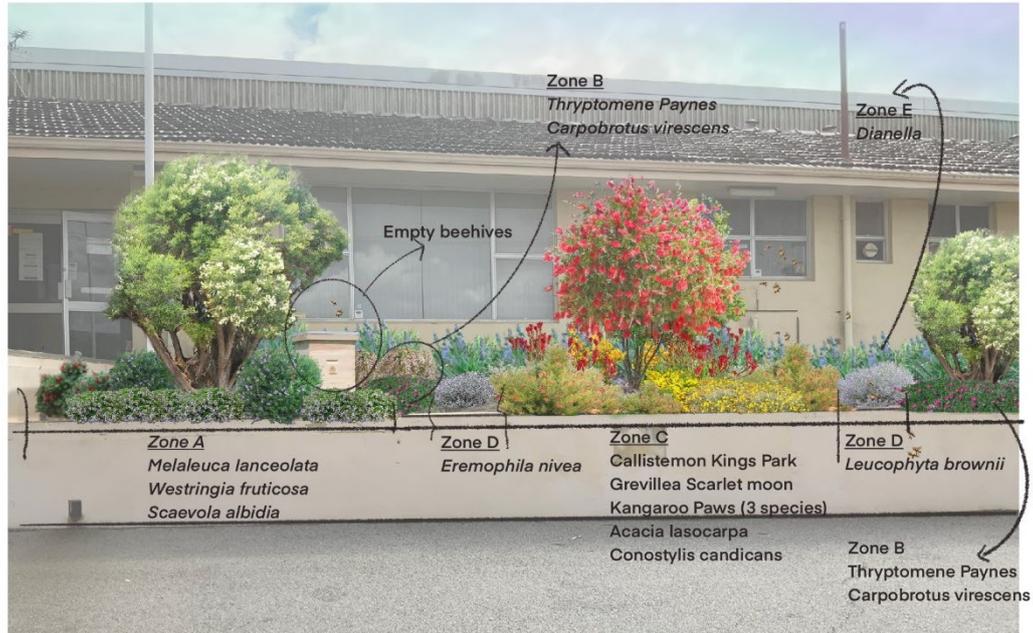


Figure 2: Front Verge Planting Design Perspective 1

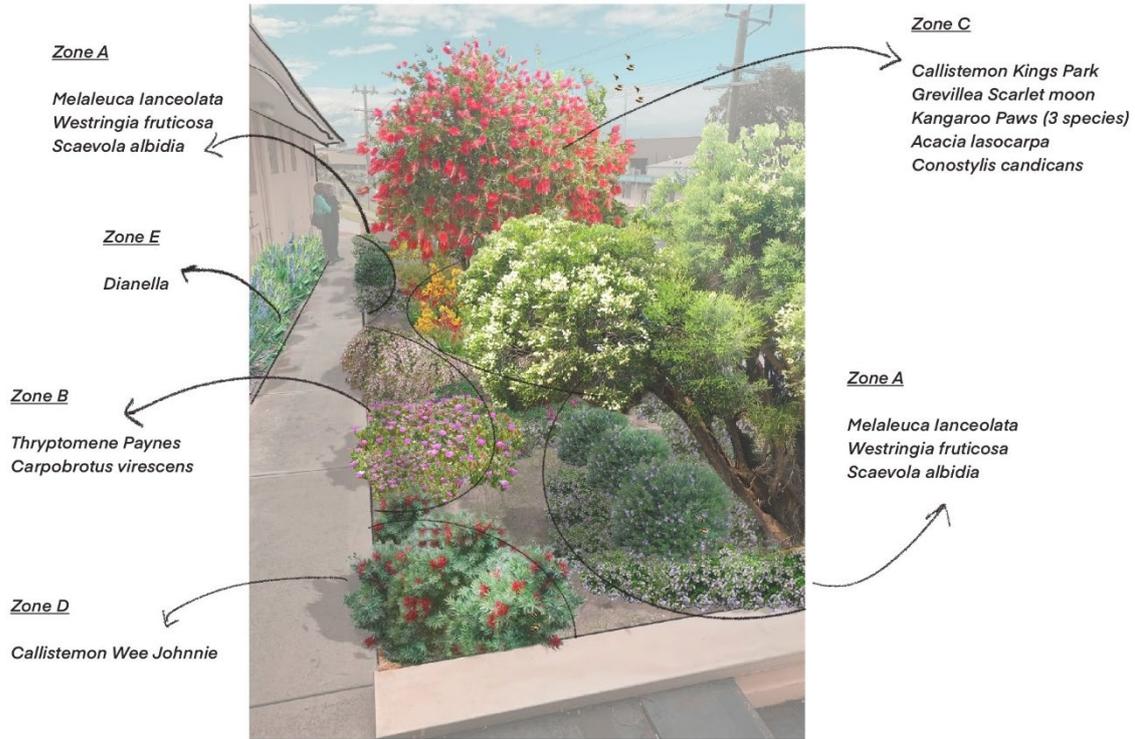


Figure 3: Front Verge Planting Design Perspective 2

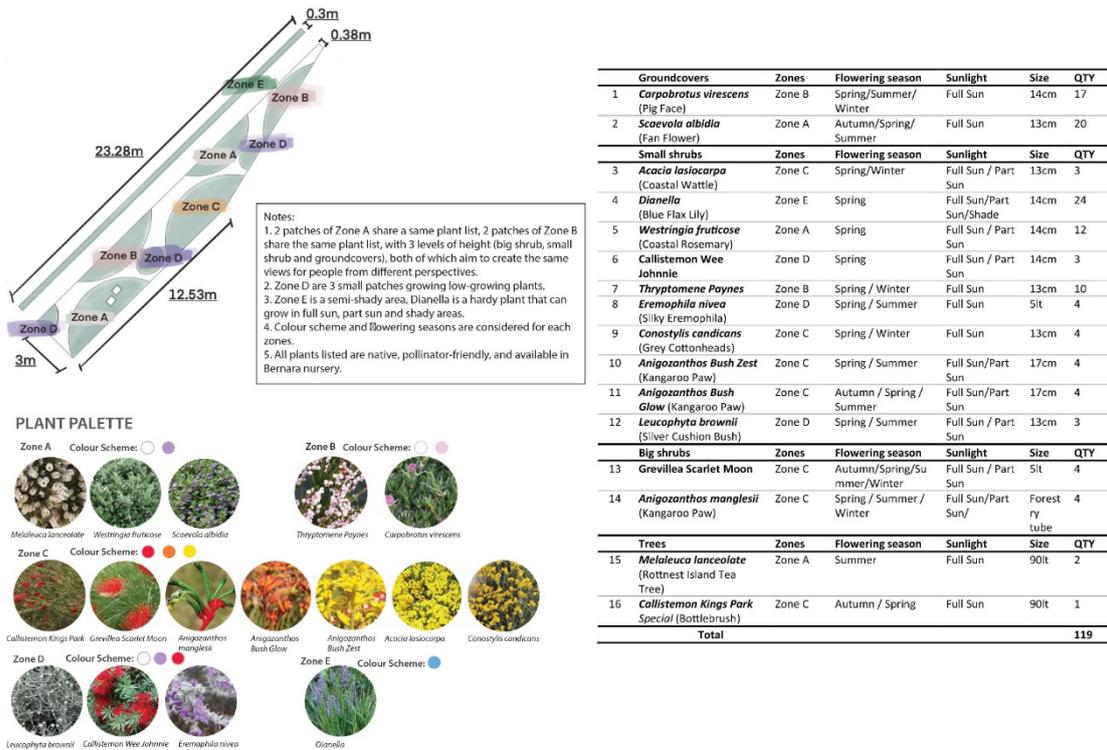


Figure 4: Front Verge Planting Design Plant List

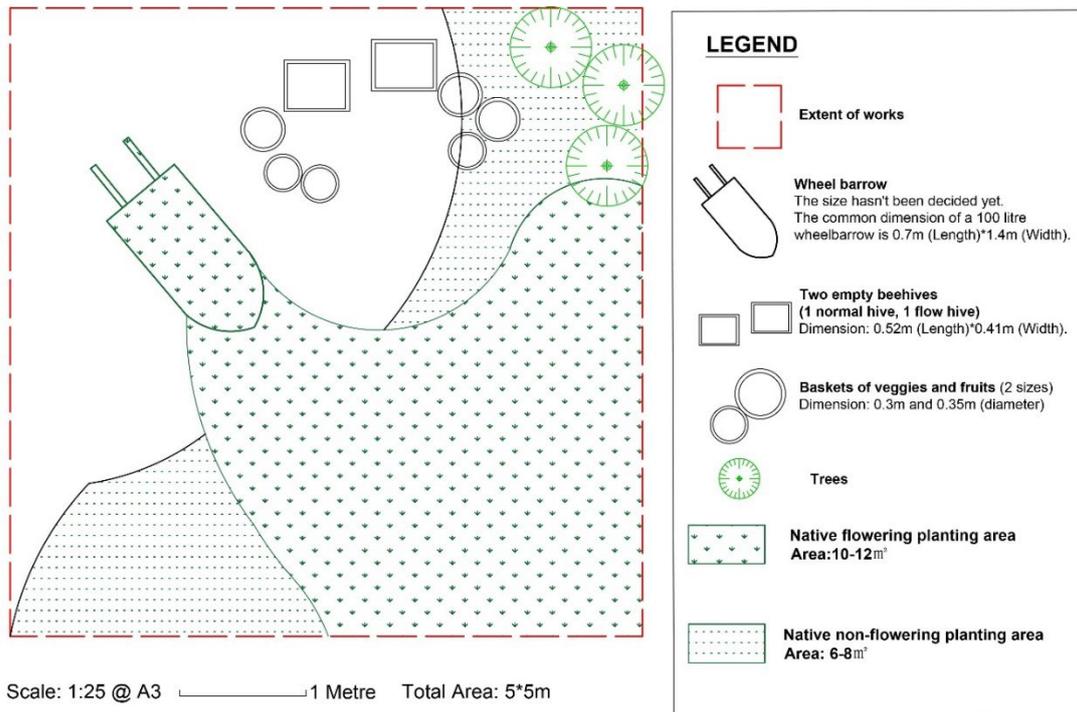


Figure 5: Overall Plan for World Bee Day Exhibition

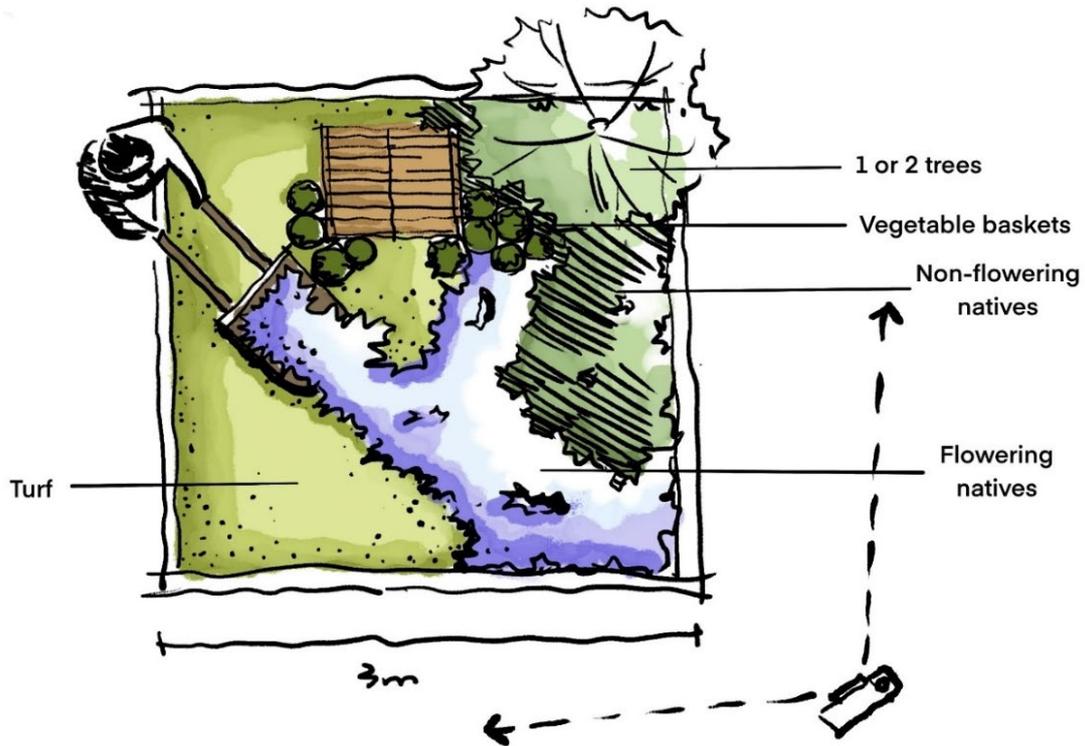


Figure 6: Sketch for World Bee Day Exhibition



Figure 7: World Bee Day Display (1)



Figure 8: World Bee Day Display (2)



Figure 9: World Bee Day Display (3)

# **PART 1: THEORETICAL RESEARCH:**

## **(1) Design and Conservation Strategies for Urban Biodiversity in Australian Botanic Gardens**

## **(2) Conservation in the Anthropocene era: Bees, habitats and landscape**

### **Publication**

Yang, Y., Ignatieva, M., & Gaynor, A. (2022). Design and Conservation Strategies for Urban Biodiversity in Australian Botanic Gardens. *Landscape Architecture*, 29(1), 34-48.

### **Introduction**

#### **- Design and Conservation Strategies for Urban Biodiversity in Australian Botanic Gardens**

This paper reviews the biodiversity benefits of botanic gardens. It discusses the changes in design focus to demonstrate biodiversity, using case studies in Australia. The design history of Australian botanic gardens, Australia's native biodiversity, and biodiversity-focused design solutions are discussed and analysed. This paper offers a framework for understanding local biodiversity and implementation of new conservation design strategies in botanic gardens. The research outcomes of this paper provide a new angle that allows to rethink and reinforce "biodiversity" in designing a botanic garden. (Yang, Ignatieva and Gaynor, 2022)

#### **- Conservation in the Anthropocene era: bees, habitats and landscape**

Rapid environmental changes are challenging designers and their strategical approach to organising green spaces. In this part of the research, the relevant key terminologies are defined and described regarding the research topic. Major issues and key theories related to urban honey bee habitats, botanic gardens, urban green infrastructure, and sustainable urban development are covered, particularly focusing on the ecosystem services of both native bees and honey bees and their urban habitats.

### **Methodology: Literature Review**

#### **- Design and Conservation Strategies for Urban Biodiversity in Australian Botanic Gardens**

Books, Australian nationwide strategies and action plans, peer-review papers, and the official web pages of Australia's botanic gardens were the main sources for this literature review. There are 3

research questions: 1) How has the design of Australian botanic gardens developed throughout time? How the botanic garden design styles are impact the understanding of native biodiversity and its role in society? 2) How has the attitude towards natives and exotics changed Australia's botanic gardens? What are the roles of botanic gardens in preserving biodiversity? 3) What are the solutions to preserving biodiversity in Australia's botanic gardens? (Yang, Ignatieva and Gaynor, 2022)

- **Conservation in the Anthropocene era: bees, habitats and landscape**  
Literature review.

## Key Results

- **Design and Conservation Strategies for Urban Biodiversity in Australian Botanic Gardens**

This paper discusses the conservation of biodiversity in Australia's botanic gardens from three main angles: Its design history (Table 2) and styles' influence on biodiversity (Table 3); the perceptions towards native biodiversity in Australia's botanic gardens; and the solutions for preserving native biodiversity. It offers a framework for understanding local biodiversity and developing designing strategies for demonstration preservation strategies in botanic gardens. This framework needs to include an understanding of the local environmental history and landscape design history, acknowledging changes in perceptions on biodiversity over time, and integrating current local biodiversity conditions. The solutions to preserving the biodiversity in botanic gardens should include different dimensions, from the national-level macro policies, the development and management plan at the botanic garden level, and the detailed design principles within the gardens (Table 4 and 5) (Yang, Ignatieva and Gaynor, 2022).

- **Conservation in the Anthropocene era: bees, habitats and landscape**  
This part of the Project will be reported in the thesis.

Table 2: The changing roles of botanic gardens

Stages	Focus	Examples
<b>16th and 17th century: 'physic' gardens</b>	Growing medicinal plants with educational purposes in universities	The Orto Botanico di Padova in Padua, Italy (1545) The Hortus Botanicus in Leiden, Netherlands (1590) The Jardin des plantes, Paris, France (1635)
<b>18th and 19th century: Victorian colonial botanic gardens</b>	The economic values of plants became an important aspect during the 18th century In the 19th century, gardening became a popular leisure activity, and the scientific and economic role blended with the aesthetic one, reflecting a love of the exotic	The Royal Botanic Gardens, Kew, England (1759) The Royal Botanic Gardens, Sydney, Australia (1816) The Royal Tasmanian Botanical Gardens, Hobart, Australia (1818) The Royal Botanic Gardens Victoria, Melbourne, Australia (1846) Adelaide Botanic Gardens, Australia (1857)
<b>20th and 21st century: conservation gardens</b>	Conservation and education are the two main functions of botanic gardens in response to climate change and the loss of biodiversity.	King's Park and Botanical Gardens, Australia (1965) Australian National Botanic Gardens, Canberra, Australia (1970) The Royal Botanic Gardens Victoria, Cranbourne, Australia (2006)

Table 3: Design features of the Picturesque and the Gardenesque styles

Style	Design features
<b>Picturesque</b>	<ol style="list-style-type: none"> <li>1. Picture-like landscapes, visually navigated vistas</li> <li>2. Creation of an "ideal" nature</li> <li>3. Irregular layout, curvy pathways, rough rockwork, and clumps of trees</li> <li>4. Green colour and preference of native species</li> </ol>
<b>Gardenesque</b>	<ol style="list-style-type: none"> <li>1. A combination of art and botanical science;</li> <li>2. Display trees and shrubs as botanical specimens;</li> <li>3. Mixture of different approaches and styles (eclecticism and revivalism) .Geometric pathways, flowerbeds and flower carpets in combination with some curvy pathways and "free" configuration shrub plantings;</li> <li>4. Bright colours, many variety of plant species.</li> </ol>



Figure 10: Picturesque in the Melbourne Botanic Gardens



Figure 11: Gardenesque in Melbourne Botanic Gardens



Figure 12: The cultivation of groves of palms and tree ferns with “naturalistic grouping” in Royal Botanic Gardens, Sydney



Figure 13: Gardenesque in Adelaide Botanic Gardens

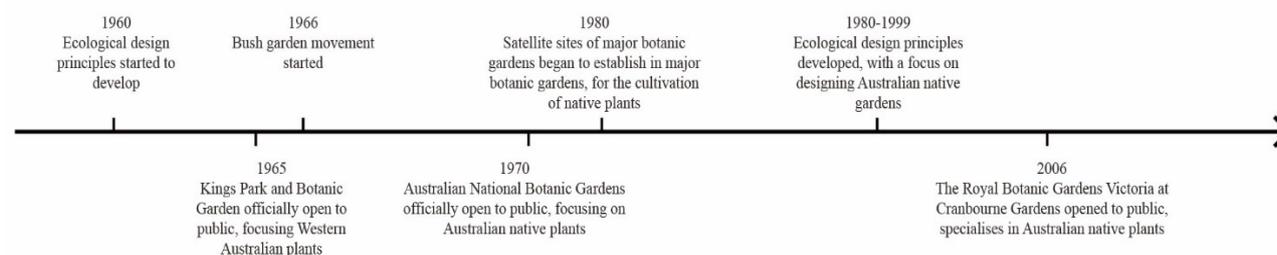


Figure 14: Timeline of the development of the appreciation of native plants used in botanic gardens in Australia, in the 20th and 21st century

Table 4: Major wildlife-friendly solutions in Australia's botanic gardens

	Botanic gardens or organisations	Functions
A predator-proof fence and special gates on fences designed for native fauna	Royal Botanic Gardens Victoria, Cranbourne	Protect the endangered Southern Brown Bandicoot from being predated by cats and foxes, while providing access to fences for native species <sup>1</sup>
A wildlife tunnel	Royal Botanic Gardens Victoria, Cranbourne	Allow safe access for wombats, bandicoots, ducks, and echidnas when crossing the road
Invertebrate Safari - Stage 1	Royal Botanic Garden, Sydney	An educational program for primary school students. It allows students to explore habitats for invertebrates in the Botanic Gardens, and learn to identify their body features and living essentials <sup>2</sup>
Eco Detectives - Stage 2	Royal Botanic Garden, Sydney	An educational program for primary school students to learn the importance of the Cumberland Plain Woodland for native species. It also includes planning adequate habitats for the powerful owl (a native owl species to eastern Australia) <sup>3</sup>
Provide gardening resources for designing bird-friendly gardens	Kings Park and Botanic Gardens, Perth	Some simple design guidelines are provided to the public on Kings Park's website on designing a bird-friendly garden <sup>4</sup>

<sup>1</sup> Gardening Australia. Wild Cranbourne. <https://www.abc.net.au/gardening/factsheets/wild-cranbourne/13172220>.

<sup>2</sup> The Royal Botanic Gardens, Mount Annan. Invertebrate Safari - Stage 1. <https://www.australianbotanicgarden.com.au/Learn/Primary-Programs/Invertebrate-Safari-Stage-1>.

<sup>3</sup> The Royal Botanic Gardens, Mount Annan. Eco Detectives - Stage 2. <https://www.australianbotanicgarden.com.au/Learn/Primary-programs/Eco-Detectives-Stage-2>.

<sup>4</sup> Botanic Gardens & Parks Authority. Bird-attracting Gardens. <https://www.bgpa.wa.gov.au/about-us/horticulture/gardening-resources/384-bird-attracting-gardens>.

Table 5: Major bee-friendly solutions in Australia's botanic gardens

	Botanic gardens or organisations	Functions
Air Bee 'n' Bee	Australian National Botanic Garden, Canberra	A bee hotel offers rooms to solitary native bees, providing native bee habitats <sup>5</sup>
"Backpacks" for European honey bees	Royal Botanic Garden, Sydney	Ultra-tiny RFID tags are placed on individual bee's backs, tracking bees' movements to understand bee behaviours <sup>6</sup>
Plan Bee	Royal Botanic Garden, Sydney	An educational program for primary school students. Face-to-face presentations, workshops, garden walks, and pollinator-related activities are included <sup>7</sup>

<sup>5</sup> TRAVERS P. Bee Hotel to Attract Native Bees to Australian National Botanic Gardens in Canberra.(2016) <https://www.abc.net.au/news/2016-02-11/hotel-attracts-native-bees-to-botanic-gardens-canberra/7159688>.

<sup>6</sup> HORVATH C. The Garden Bees have Backpacks. <https://www.australianbotanicgarden.com.au/Science/Our-work-discoveries/Natural-Areas-Management/Ecology-of-Cumberland-Plain-Woodland/Woodland-ecology/Community-ecology/Interactions-between-native-and-exotic-plants>.

<sup>7</sup> The Royal Botanic Gardens Sydney, Plan Bee - Stage 1, 2 or 3. <https://www.rbg Syd.nsw.gov.au/planbee>.

## **PART 2: IN-DEPTH INTERVIEW:**

### **(1) The Ideas of Hybridity in Urban Landscapes: Vision through the Research of Honey bees in Western Australia**

### **(2) Design Considerations: Bee-friendly Garden Design Strategies, Plant Selections and Management in Western Australia**

Manuscript in preparation. This part of the Project will be reported in the thesis.

#### **Introduction**

Australia has a high floristic richness and endemism. More than 80% of plant and animal species are endemic, with about 90% of vascular plants being endemic. The initial reason for using non-native plants and animals in Australia's landscapes was the absence of traditional agricultural and horticultural crops for European settlers. Native biodiversity has been deeply affected by continuing land clearing, the introduction of non-native species, further causing the invasion of environmental weeds (more than 3,000 species since 1788), and climate change. In Australia, both honey bees and native bees play vital roles in providing ecosystem services to different types of landscapes by ensuring stable pollination for agriculture and other plant communities.

The debate over native vs invasive species has carried on for years in Australia. This study seeks to understand the differences between "native landscape" and "urban landscape" in the eyes of WA-based landscape architecture practitioners, and to analyse the grounds behind such discrepancies. We also explore further on the feasibility of keeping "Hybrid" landscapes in Western Australia, focusing on both plant species and bee species.

#### **Methodology**

This study conducts in-depth interviews with 15 landscape architecture practitioners and 15 beekeepers and native bee scientists in Western Australia (WA) to collect their perceptions on "nature", "wilderness", and "urban biodiversity" in the context of Western Australia. We have also explored their views and applications on the use of native and exotic species in urban landscape practices. Key research questions are: 1. How are "biodiversity" and "nature" expressed in Western Australia's urban landscapes? 2. Do we need to go to "Hybrid" landscapes in WA?

#### **Key Results**

This paper discusses and analyses the perceptions on “honeybee and native pollinator competition”, the importance of beekeeping for the public (targeting on human-nature relationship), pollinations and perspectives on exotic plants (targeting ecological values. There is also discussion of the differences between "appreciation of native vegetation" and "positive attitudes towards exotic plants in urban landscapes."

In Australia, the perception of urban biodiversity is more related to native biodiversity. Preserving biodiversity always refers to the conservation of native species. The use of native species is the priority in landscape plant selections.

14 out of 15 landscape architecture practitioners consider exotic plant species to be part of urban biodiversity and support the notion that exotic plants are appropriate in certain locations, according to one of the interview results. Their preference is for Western Australian natives, however in some cases, natives are inappropriate for urban settings, and tall, wide canopies that provide a great deal of shade and coolness can provide a little more amenity to people. As an expression of commitment to urban biodiversity, the bee-friendly botanic garden should feature both native and exotic collections. Because WA's exotic plants are European honeybees' native habitats. A suitable area containing exotic plants can attract honeybees, thereby reducing the competition between native plants and native bee species. This is one of the main arguments in support of the research findings on hybridity in urban landscapes.

## **PART 3: DESIGN APPROACH:**

### **Local Interpretation of the Bee Botanic Garden Design in Yanchep**

This manuscript is in preparation. This part of the Project will be reported in the thesis.

#### **Introduction**

This research aims to design a bee botanic garden with a range of biological and conservation values in the new city centre area in Yanchep, WA, from the perspective of balancing the relationship between sustainable urban planning and landscape ecological design. Yanchep is a coastal suburb of Perth, located on the coast 56 km north of the Perth metropolitan area, under the jurisdiction of the City of Wanneroo (Figure 15).

The research area in Yanchep is botanically rich with undisturbed vegetation (Figure 16). Most of existing plant species provide nectar and pollen for pollinators. Located in the Quindalup dunes, this remnant plant community is playing an irreplaceable role in providing hydrological, aesthetic and socio-economic services in coastal protection. Along this line of consideration, one of this research's emphases will be finding solutions for retaining well-managed remnant vegetation for bee foraging and conservation considerations in bee botanic gardens, while connecting with other surrounding green spaces to form a united urban green infrastructure network.

This conceptual design proposal incorporates theoretical research on human-nature relationships with regard to bees, natural and human-made habitats and urban landscapes. Design guidelines for creating a new demonstration site of a bee-friendly botanic garden and associated plant communities will be developed. These guidelines focus on the integration of the botanic garden with the city centre area, the connections between the botanic garden and the surrounding green infrastructure (newly created urban green areas and natural bushlands), and the foraging landscape design as an urban bee habitat within the botanic garden.

#### **Method**

This study employs design-based research. It can convert scientific knowledge into design guidelines and visually express and evaluate design outcomes.

#### **Results**

The concept design proposal of the Yanchep Bee Botanic Garden was presented on the 29th of May, 2021.

The design concept is "The symphony of vitality and livelihood". The term "symphony" has two meanings in this context. (1) Communion and union. The vitality and livelihood symphony are actually a communicative relationship between nature and humans. Everything in nature, plants and animals, represents vitality, and livelihood represents the support on which humans rely for survival. It refers to both the means of survival as well as the occupation and source of income. For example, honey bees, as

a type of livestock, not only provide food for humans, but also an occupation and a source of income for commercial beekeepers by producing honey products. This botanic garden's plant collections are based on various livelihood types in order to highlight agriculture (for instance, an edible garden, an herbal garden, a pollinator garden etc.) (2) Construct the soundscape in accordance with its original intent. The buzzing of bees and the calls of birds and insects are integrated into the landscape of the entire site, along with plant collections and installation of art objects. Plant collections can be used to create a variety of habitats for wildlife (refer to the specific insect and bird species in the Yanchep map).

The design drawings (site analysis, design concept and the plan), plant selections, and guideline proposal of Yanchep Bee Botanic Garden will be reported in the thesis.

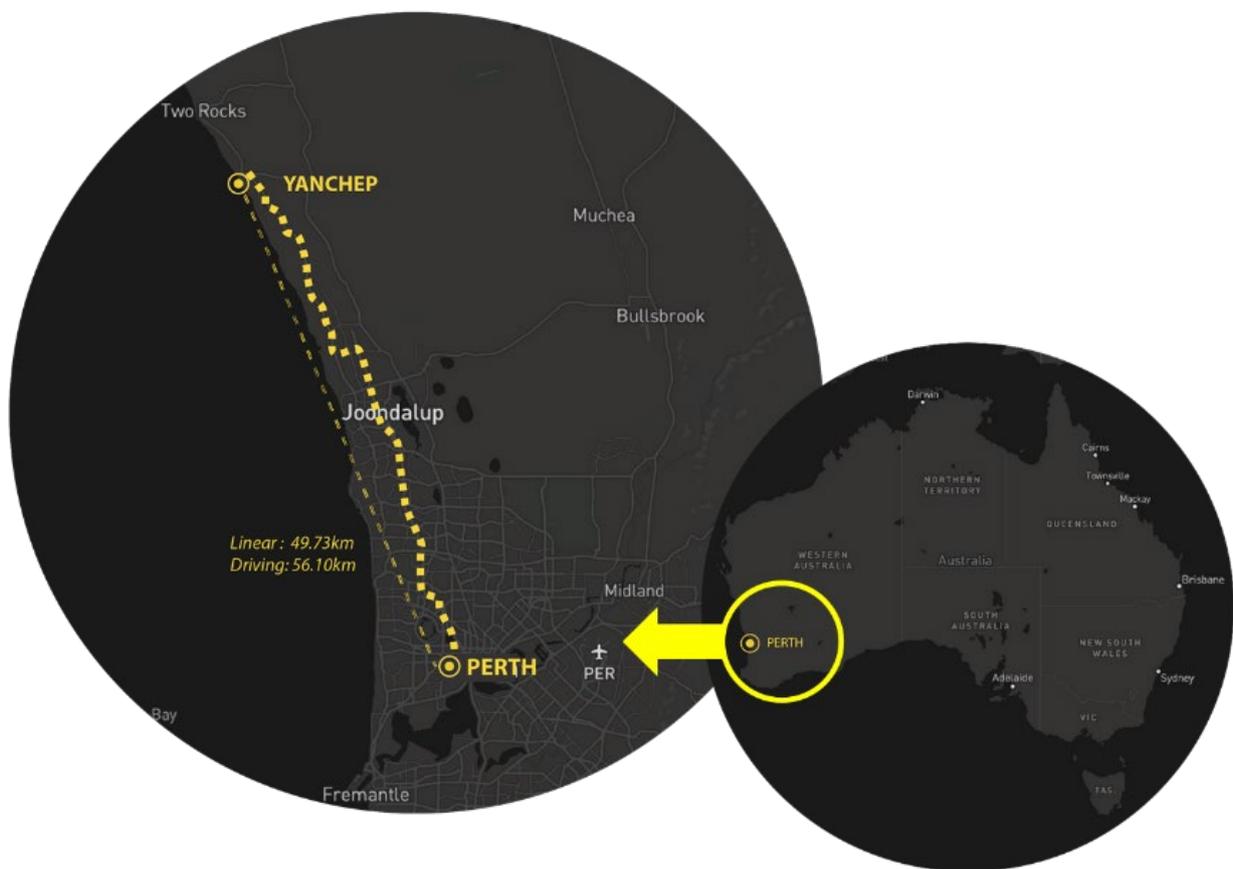


Figure 15: Yanchep Location



Figure 16: "Swan Coastal Plains Shrublands and Woodlands" area



Figure 17: Site Analysis

## IMPLICATIONS

1. Australian Botanic Gardens' primary design focus has shifted from exhibiting exotic plants to conserving and popularisation of native plants. Increasingly, botanic gardens and landscape designs are shifting from entertainment-based functions to ecological conservation functions that take into account wildlife (including insects).
2. The three pillars of landscape architecture are planning, design, and management. The botanic garden's design should reflect the city plan's visions while also incorporating the site's surrounding functions and traffic flow. Bee-friendly botanic gardens should consider not only plant selection and arrangement, but also the "symbiosis between European bees and native bees and other native pollinators and birds." Meanwhile, as part of our interdisciplinary research, the botanic garden's management and maintenance should be developed in collaboration with experts from relevant fields. Management and maintenance plans should aim to protect as much biodiversity for our flora and fauna as possible while requiring careful maintenance schedules.

# APPENDIX: SEMI-STRUCTURED INTERVIEW QUESTION LIST

The questions vary according to the interviewees' experiences and specialities.

## List One: landscape practitioners

### Background Information

Age, gender, education, years of practice, your expertise and experiences (e.g. the scales of the projects), reasons in choosing LA as a career

### Design practices under WA's context

Design preparation: What factors do you consider when preparing site plans and specifications? Please share your experience.

### Understanding WA's cultural identity

Do you have any practical experiences in integrating local culture and history into the design? Or do you know any local projects that could be good examples in this aspect (e.g. six seasons' garden)?

What is your opinion on expressing local culture (e.g. Nyoongar Culture and History) in landscape design process?

Are there any special considerations that we should be aware of the integration of local culture into the project?

### Plant selection

What are the main considerations when you do plant selections? (e.g. from 'ecological benefits' and 'aesthetic pursuit' perspectives)

Do you think exotic species are important for maintaining urban biodiversity? And why?

Have you used exotic species in any of your previous projects? Why (if yes), and what are the species that you most frequently used?

What are the top native species in your mind that you frequently used and could present WA's identity?

What do you think of the relationship between the exotic and native plant species and how do you balance this relationship during your practice?

## **Management**

Do you consider management issues when designing? If yes, what are they? (e.g. Water, fire)

Do you have any water-wise design practices and suggestions?

## **Landscape architect's perceptions on NATURE**

What is your perception on nature?

Are you familiar with the "Design with Nature" concept? How do you think of it?

Based on your experience and WA's unique physical environment, what are the tactics and tips you would suggest as guidelines of the "Design with Nature" concept?

## **Landscape architect's ideas on designing a honey bee-friendly botanic garden**

Are you familiar with honey bees or native bee pollinators? Do you consider pollinator-friendly issues when designing?

If you are assigned with a honey bee friendly design project, what would you consider (e.g. plants, art installations)?

## List Two: beekeepers and native bee experts

Key factors in placing managed honeybees in the botanic garden, and beekeepers' willingness in placing their hives in the botanic garden. (Design related)

1. Ratio: numbers of beehives and garden area
  - How many honeybee hives could you suggest for the botanic garden of 1.6 hectares?
  - What is usually the ratio of the numbers of beehives in a garden area?
2. Safety: honeybee behaviours
  - Are there any special considerations we should be aware of the placement of the honeybee hives in this public botanic garden? (public safety issue)
3. Willingness
  - Will you place your beehives in the Yanchep Bee Botanic Garden? Why (if yes), and what are the main factors that affect your decision?
4. Plant selection
  - What are the particular honey plants you recommend to plant in the Yanchep Bee Botanic Garden, and why? (e.g. honey quality, price, bees' love, education)
  - How many plant species do you think would be beneficial for producing honey and at the same time to be a Bee Garden collections?
5. Management
  - What are the main maintenance operations we should be aware of for the effective functioning of designed bee plant collections?
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### Beekeepers' perceptions.

1. Exotic and native debate: biodiversity
  - What is your opinion on the relationship between managed European honey bees and other native pollinators and native bird species [e.g. native bees and black cockatoo]? Are there any competition between native bees and European honey bees from your experience?
  - Do you suggest to plant exotic species in the botanic garden, and why?
2. How public perceptions on the practice of beekeeping has changed overtime?



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