



Green investment

The social, cultural, and economic contribution of the Royal Botanic Gardens and Domain Trust

2022

Acknowledgement of country

Deloitte is a national firm and we acknowledge the Traditional Custodians of the lands, waters, seas of this Country, and pay our respect to the Elders past and present.

The Royal Botanic Garden and Domain Trust (the Trust) manages land which the Cadigal, Dharawal, Gundungarra and Darug people have cared for the land for tens of thousands of years. For Traditional Custodians, the land has immeasurable value as a place of identity, language, nourishment, shelter, ceremony, trade and gathering.

We as a project team acknowledge this connection and recognise the deep wisdom that comes from an Aboriginal perspective on the value of our natural and cultural assets.



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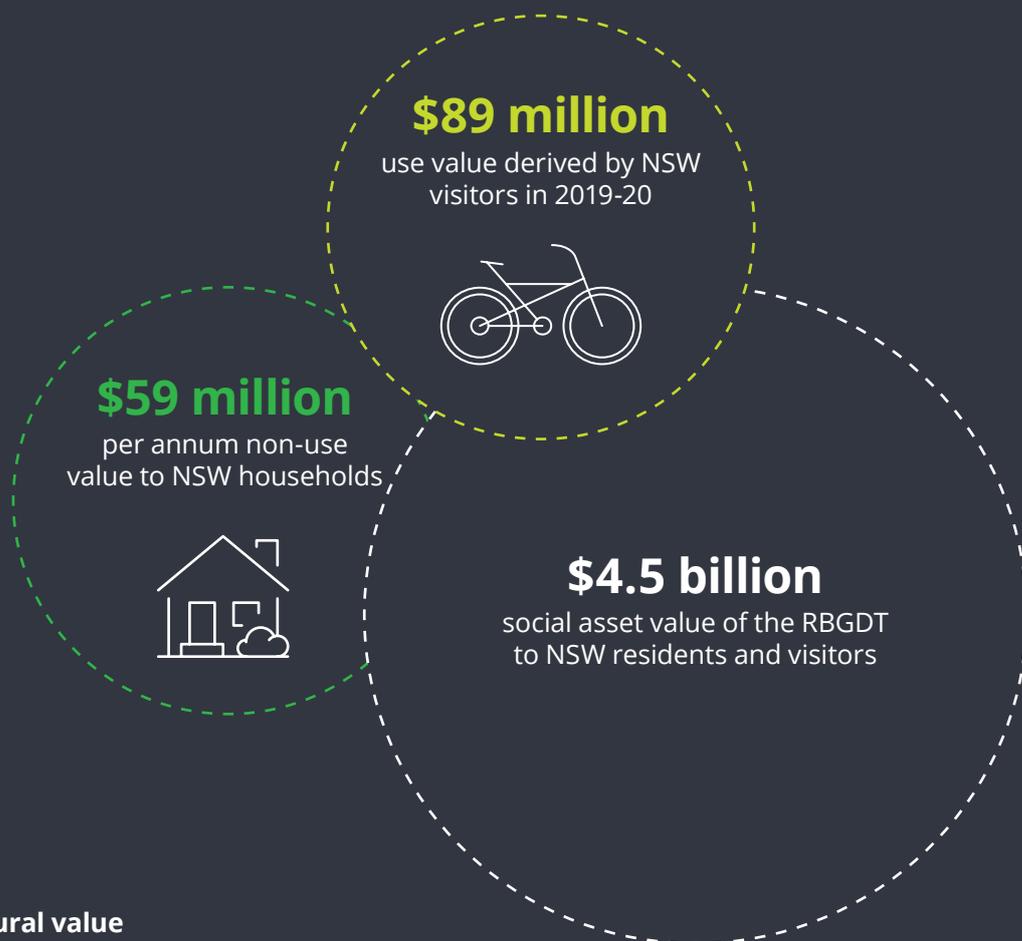
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Glossary

Acronym	Full name
the Institute	Australian Institute of Botanical Science
CG	Community Greening
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DArT	Diversity Arrays Technology
DPIE	Department of Planning, Industry and Environment
EBITDA	Earnings before Interest, Tax, Depreciation and Amortisation
EPA	Environmental Protection Authority
FTE	Full Time Equivalent
GDP	Gross Domestic Product
GOS	Gross Operating Surplus
GSP	Gross State Product
GVA	Gross value added
IO	Input-output
IVS	International Visitor Survey
NVS	National Visitor Survey
RAP	Reconciliation Action Plan
the Trust	Royal Botanic Gardens and Domain Trust
SEEA EA	System of Environmental Economic Accounting Ecosystem Accounting
STEM	Science, Technology, Engineering and Mathematics
TRA	Tourism Research Australia
TSA	Tourism Satellite Accounts
UN	United Nations
UNSW	University of New South Wales
WHO	World Health Organisation
WTP	Willingness to Pay
YCG	Youth Community Greening



Figure i: Key findings



Almost 1,000

full-time equivalent roles supported in NSW in 2019-20



\$61 million

tourism contribution of the RBGDT to NSW in 2019-20



\$110 million

value added to the NSW economy in 2019-20

\$49 million

economic contribution of the RBGDT to NSW in 2019-20



Economic and tourism contribution



Executive summary

The Royal Botanic Garden and Domain Trust (the Trust) manages some of Sydney's most iconic landmarks. It provides 752 hectares of public green space across Greater Sydney and is the oldest continuous scientific institution in Australia, making critical contributions to ecological and conservation research. Sites managed by the Trust are part of the broader tourism ecosystem in Sydney, welcoming more than 4.3 million visitors in 2019-20. The Trust also coordinates important community activities and helps to educate visitors about the native environment.

The land managed by the Trust is Aboriginal land,¹ with the Cadigal, Dharawal, Gundungarra and Darug people living in the region for tens of thousands of years prior to the European invasion in 1788. For Traditional Custodians, the land holds immeasurable value as a source of identity, language, nourishment, shelter, ceremony, trade and gathering.

The relationship of Aboriginal people to these landscapes has been catastrophically affected by European colonisation. Massacres, forced removal and other actions led to the genocide of many of the original communities and the loss of much of the direct knowledge about the pre-colonial landscapes of the three Botanic Gardens and the Domain. We were reminded through this project though that Aboriginal culture is emerging from the shock of European colonisation, and that the land is still alive with culture. Where ceremonies, births, deaths, feasts, celebrations, care, justice and civilisation were once likely practised there is now gardens and buildings and roadways – but the cultural role and value of the landscape still thrums through the soil.

There is increasing recognition of the importance for all Australians of Aboriginal people's historic and continuing connection to the land and the valuable role it might play in determining the economic and social value of these landscapes in the future.

The Trust acknowledges and actively promotes the intrinsic connection Aboriginal communities have to the land of the three Botanic Gardens and the Domain for the benefit of Aboriginal and non-Aboriginal

visitors. The Trust has released its inaugural Innovate Reconciliation Action Plan (RAP) in and its First Nations Engagement Strategy 2021-26 in November 2021. Both of these documents were informed by engaging with local Aboriginal communities and aim to deepen the cultural understanding of the staff working at the Trust and the Australian community through existing and new activities undertaken by the Trust.

To develop a clear understanding of the worth and contribution of the Trust, this report explores its many sources of value – economic, social, cultural, scientific, and environmental – across its four sites for the 2019-20 financial year, including:

- **Royal Botanic Garden Sydney:** covering an area of 30 hectares in Sydney's CBD and housing the National Herbarium of New South Wales and Daniel Solander Library.
- **The Domain, Sydney:** situated adjacent to the Royal Botanic Garden and comprises 34 hectares of urban parkland which plays a central role in Sydney's festivals and cultural events.
- **Australian Botanic Garden Mount Annan:** showcases Australian flora among 416 hectares of gardens, grassland and woodland, located in southwestern Sydney.
- **Blue Mountains Botanic Garden Mount Tomah:** located within a UNESCO World Heritage area, the site includes 28 hectares of public botanic gardens and a further 244 hectares of natural areas.

This report updates and enhances the analysis of a 2018 study by Deloitte Access Economics that assessed the economic and social contribution of the Trust. Three years on, this report provides an opportunity to reflect on the Trust's contributions and significant changes underpinning its operating environment. This edition also includes the results of a bespoke survey of 2,000 Australians which offer insights into use of the sites and attitudes towards the Trust's activities.

The results of the analysis demonstrate the important contribution the Trust makes to the NSW economy and to visitors more broadly (Figure i).

¹ Throughout this report we have deliberately used the term 'Aboriginal' to identify the people of this land. We do this because the lands of Southeast Australia is Aboriginal land. The term 'Indigenous' is often used to describe the national collective groups of First Nations people, including the Torres Strait Islanders.

While we would prefer to attribute the correct individual community identity of Cadigal, Dharawal, Gundungarra and Darug to each discussion, it is also recognised that many other communities of NSW lived, loved and worked on the lands of the gardens, and so for simplicity we have used the term 'Aboriginal'.

Key findings from the citizen survey

1. Three-quarters (74%) of respondents agreed or strongly agreed that the three Botanic Gardens and the Domain contribute to Sydney's brand as an open and green city.
2. The main reasons for visiting the Trust's sites were scenic views (ranked first by 23% of visitors, averaged across sites), to spend time with family and friends (17%), and to see and learn about unique plants and native flora (9%).
3. More than two in five (42%) respondents agreed they now spend more time in public green spaces and 64% said they value green spaces more than they did prior to COVID-19.
4. Close to three-quarters (74%) agreed the Trust undertakes important conservation and restoration work.
5. More than half (56%) of Australian residents indicated that they were aware of the scientific research undertaken by the Trust to conserve and protect Australian plant species.

Economic contribution

In 2018-19, the Trust welcomed more than five million visitors across its sites. Roughly 84% of interstate tourists who responded said the Trust was 'somewhat' or 'very' important in their decision to travel to Sydney.

As a national icon and tourist destination, the Trust supports economic activity. Modelling for this report finds that the Trust contributed \$110 million in value added to the NSW economy in 2019-20, comprised of its economic and tourism contribution, as outlined below.

- In 2019-20, **the Trust's operations** generated \$49 million in value-added to the NSW economy both directly and indirectly. In employment terms, it supported 431 full-time equivalent (FTE) roles.
- In addition to its economic contribution, the Trust also helps to support economic activity in NSW by attracting tourists to Sydney. It is estimated **that tourists visiting the Trust** helped facilitate roughly \$62 million in value added to the NSW economy. The value provided by these tourists also supported 496 FTE roles both directly and indirectly.

This contribution reflects the economic value of the Trust, despite major disruptions over this period including COVID-19 and the Australian Black Summer Bushfires in 2019-20. These events not only dampened the visitor economy but also placed substantial restrictions on movements of local residents. From 2018-19 to 2019-20, visitation to the three Botanic Gardens and the Domain dropped by more than 16%, representing a decline of one million visitors to the sites.

The Trust is more than just a place to see unique plants and a tourist destination. It also contributes to Sydney's brand. In fact, three-quarters (74%) of Australians agreed or strongly agreed that the three Botanic Gardens and the Domain contribute to Sydney's brand as an open and green city. This helps to establish Sydney as an attractive place to live and visit.

Social and cultural contribution

There are many reasons for visiting the Trust's facilities. The top reasons for visiting included the scenic views, to spend with time with family and friends, and to see and learn about unique plants and native flora.

However, the use of these sites started long before with the Traditional Owners of the land. The Cadigal, Dharawal, Gundungarra and Darug have maintained a strong connection with the land of the three Botanic Gardens and the Domain for tens of thousands of years. Even now, many Aboriginal people use and value these sites for the history embedded within the land.

The Trust also plays an important outreach role. Volunteers at the Trust and the Foundation and Friends of the Botanic Gardens donated nearly 40,800 hours of their time in 2019-20 by engaging visitors and supporting in areas such as events and exhibitions, science, conservation and environmental projects. The in-kind value of this time has been estimated by the Trust as worth \$1.5 million. There have been 555 Community Greening projects since the Community Greening (CG) program's inception, with over 10,000 participants in 2019-20. CG and Youth Community Greening involves helping people from disadvantaged backgrounds grow their own gardens, with the aim of enhancing their relationship with the natural environment and contributing to social cohesion, crime reduction and improving public health across NSW. The Master Gardener Volunteer and Leadership Program is another initiative by the Trust that provides training opportunities to improve employment and further education prospects for participants.

The Trust is a social asset that is experienced by some people directly (i.e., by visiting one of the sites) and others value for its very existence. Overall, we estimate that the Trust has a social asset value of \$4.5 billion. This represents the net present value of the annual figures for use and non-use values over the next 30 years.

- The **use value** reflects the value people derive from visiting the Trust's sites and is based on the travel costs of NSW residents to the three Botanic Gardens and the Domain. This includes tangible travel costs (e.g., public transport fares, petrol, etc.) alongside the cost of individuals' leisure time.
- The **non-use** or existence value reflects the value that citizens place on the Trust's natural assets existing and the organisation undertaking its various activities, even if they never intend of using its services. This was estimated using a contingent valuation methodology.

The future stream of benefits attributable to the Trust was discounted to a present value using a discount rate of 3.5%. This discount rate reflects the nature of the three Botanic Gardens and the Domain as natural assets, with long-term environmental effects.

Physical restrictions related to COVID-19 have made the important role the Trust plays even more salient to NSW residents. Results from the survey indicate that use of green spaces has increased since COVID-19, and 64% of Australians agree they value green spaces more as a result.

Scientific and environmental role

The Trust is the oldest continuous scientific institution in Australia and makes critical contributions to ecological and conservation research. The Trust's living collection included 66,700 accessions of flora and an estimated 538,900 trees in their sites in 2019-20. The Trust is the recognised authority of scientific plant names in NSW which are accessible to the community through NSW Flora Online – which is used by more than 28,000 users each month - and holds one of the most important herbaria botanical collections in the Southern Hemisphere. The majority of the Trust's research and scientific assets are publicly available for a wide variety of users, such as the Restore & Renew project which aims to enhance the success of restoration processes by providing land management organisations with an accessible source of information about the genetic suitability of plant species to certain environments. Another example is the Australian PlantBank, which plays an integral role in long-term conservation and safeguarding biodiversity in Australia through its collection and research of threatened and at-risk plant species.

The Black Summer bushfires highlighted the need to safeguard Australia's unique biodiversity. The Trust is working closely with Government and other organisations to support the conservation of threatened species following the bushfires and in response to climate change, including by closely monitoring the populations of plants and collecting seeds and tissues for the seed bank and rewilding.

Close to three-quarters (74%) of Australians agreed the Trust undertakes important conservation and restoration work, while just over half (56%) indicated that they were aware of the scientific research undertaken by the Trust to conserve and protect Australian plant species. While substantial, this suggests there is an opportunity to further increase Australians' awareness of the Trust's role.

Furthermore, the Trust plays a critical environmental role through its conservation research, which is delivered through the Australian Institute of Botanical Science (the Institute). Additionally, broader public and school education programs delivered by the AIBS Education and Engagement Centre helps to raise awareness around environmental issues and sustainability, including the importance of plants to life on Earth, how climate change impacts biodiversity, and what we can do to reduce climate change.

The land managed by the Trust is also an environmental asset in its own right, helping to support and enhance a variety of ecosystem services. Ecosystem services represent the benefits provided to households and businesses through the transformation of environmental assets into goods and services, such as urban cooling, absorbing pollutants, carbon sequestration, reducing glare and noise pollution, among many others. The Trust's sites also provide direct habitat for a wide range of native species and their ecosystems, and the works of Trust to protect, restore and rehabilitate this habitat provide an added service for this biodiversity.

The Trust role in generating value for NSW residents and visitors to the sites is clear. **This value far exceeds that of a green space through the Trust's social and cultural role, as well as the contributions it makes to science, education, the economy and the environment more broadly.** Ongoing investment will be important to enable it to continue to provide these services and growing the value it provides.

Deloitte Access Economics

1. Introduction

The four sites of the Royal Botanic Gardens and Domain Trust (the Trust) provide iconic landmarks across Greater Sydney. The three Botanic Gardens and the Domain provide a total of 752 hectares of public space across the city, and its CBD location, the Royal Botanic Garden Sydney, is considered the 'lungs of the city'. These sites provide important ecosystem services such as urban cooling and natural management of stormwater.

The Trust also undertakes important scientific research that contributes to preserving Australia's unique biodiversity and could assist in mitigating the effects of climate change, in addition to organising a number of community outreach programs that engage disadvantaged communities through community gardens.

These landmarks, and scientific and social activities, are an important part of Australian history that continues to play out. While the Royal Botanic Garden Sydney is recognised as the oldest botanic garden and scientific institution in Australia with a history spanning over 200 years, the use of these sites started long before with the Traditional Owners of the land.

These landmarks, and scientific and social activities, are an important part of Australian history that continues to play out. While the Royal Botanic Garden Sydney is recognised as the oldest botanic garden and scientific institution in Australia with a history spanning over 200 years, Aboriginal peoples have in fact cared for this site and the other Botanic Gardens for tens of thousands of years.

For the Cadigal, Dharawal, Gundungarra and Darug people, these areas have provided a source of identity, language, nourishment, shelter, ceremony, trade and meeting places for tens of thousands of years. While not always immediately visible in the buildings and facilities of the Botanic Gardens, the living culture of the landscape, its purpose and ancient use enriches the value we draw from it today.

Professor Deen Sanders OAM, Worimi man and one of Deloitte Senior Indigenous leaders, reminds us that

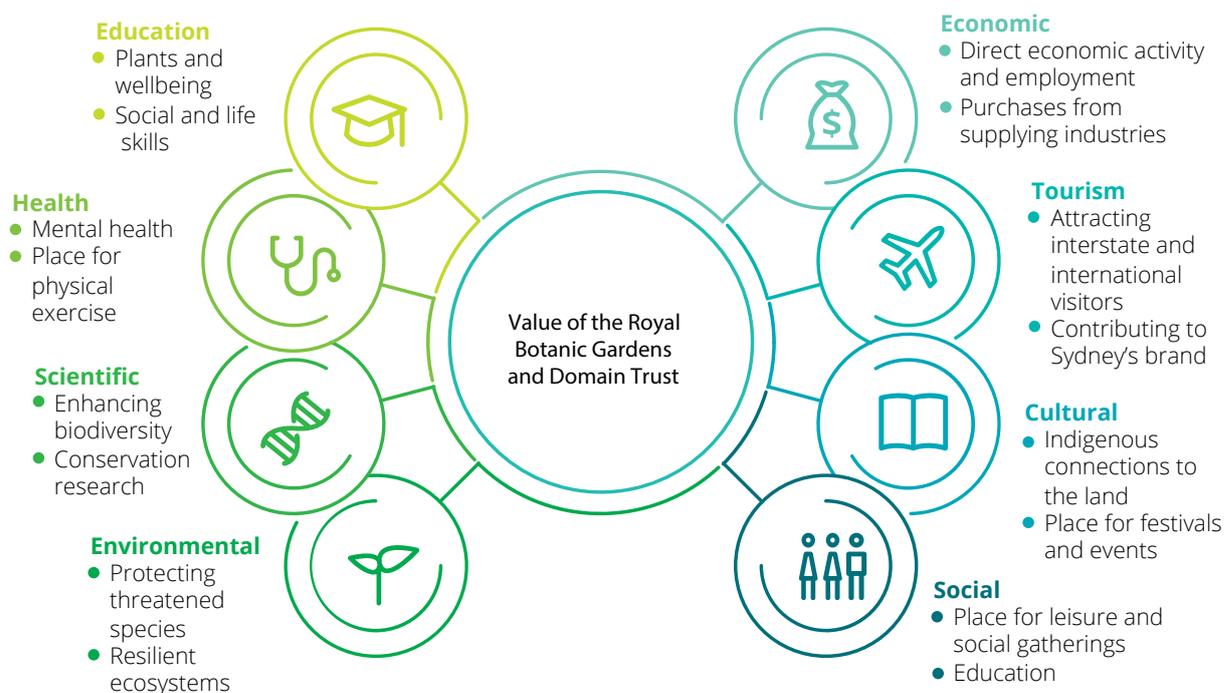
"Aboriginal culture is never lost, our old people shared knowledge across different communities and culture was a relationship with the land as a living being. Knowledge of its value and purpose is still there, held in the land, and shaped by our relationship to it. It waits for new generations to listen and learn from it."

The site of the Royal Botanic Garden Sydney is a landscape of tranquillity and trauma. It is an area that represents the invasion of European settlers and the establishment of colonial structure, that still characterises much of the relationship between Aboriginal and non-Aboriginal people. Where ceremonies, births, deaths, feasts, celebrations, care, justice and civilisation were once likely practised there is now managed landscapes and buildings and roadways, with only passing reference to the knowledge and history that lives in the land. The value of these sites as living places of life, learning and culture has never been captured in economic terms and it remains impossible to do with any great clarity because of the loss of first-hand stories about the role of the land.

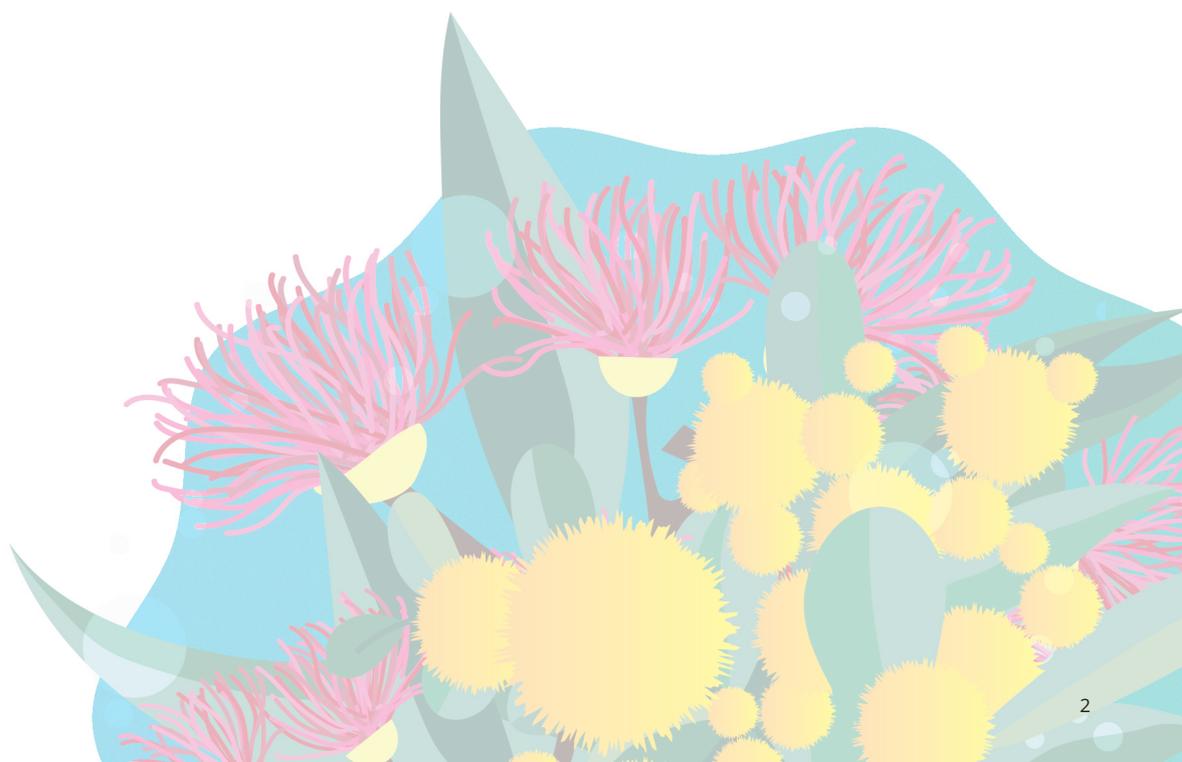
The Trust has sought to recognise this history and the continuing connection to this land of Aboriginal peoples, through visitor education programs and strengthening connections with local Aboriginal community members.

This report seeks to explore the many sources of value – economic, social, cultural and environmental – that comes from the Trust's facilities and activities, as shown in Figure 1.1.

Figure 1.1: Value of the Royal Botanic Gardens and Domain Trust



Source: Deloitte Access Economics (2021).



In exploring the different types of value of the Trust, this research builds on previous work by Deloitte Access Economics from 2018.ⁱ This report enhances the methodology for estimating value of the Trust's activities and natural assets by:

- undertaking a citizen survey of visitors and non-visitors across Australia, to understand use of the sites and attitudes towards the Trust's activities
- incorporating a series of new case studies on the Youth Community Greening (YCG) program, Aboriginal engagement in the Trust, land restoration after the African Olive invasion as well as updating case studies on the Restore and Renew project and seedbanking
- consulting with partners and stakeholders such as the CSIRO, University of NSW, Destination NSW, NSW Environmental Protection Authority (EPA) and Royal Botanic Gardens, Kew
- recognising the important ecosystem services that the Trust's sites provide, by showing how they could be incorporated into an ecosystem services accounting framework
- estimating the social asset value of the Trust, representing the combined discounted value of the Trust's use and non-use values.

About the citizen survey

This report is informed by a survey of more than 2,000 Australians fielded in August 2021.

The survey included 1,007 visitors to the Trust's sites, as well as 1,042 non-visitors. For the purposes of the study, visitors were classified as anyone who had visited one or more of the Trust's sites in the past five years.

The survey was designed to identify the patterns and reasons for using the Trust's facilities in addition to perceptions around the activities undertaken by the Trust.

Fielded during the COVID-19 pandemic, results provide a unique perspective into attitudes towards the Trust's sites and activities, and green spaces more broadly, during the pandemic. For residents in both Sydney and Melbourne, the Delta outbreak has meant that thousands were subject to a number of restrictions including the temporary closure of non-essential business, travel limited to five kilometres or within Local Government Areas (LGA), and limits on exercise and social activity.ⁱⁱ

Further detail on the survey is available in Appendix A.

1.1 Sites managed by the Royal Botanic Gardens and Domain Trust

To understand the value of the Trust requires an understanding of the four unique sites under the Trust's management and the wide variety of activities undertaken within each site.



The Royal Botanic Garden Sydney is home to a collection of more than 8,300 plants from around the world. With a site area of 30 hectares, it's a centre for science and education with assets at the time of writing including the National Herbarium of New South Wales (an institution housing a growing collection of over 1.43 million preserved plant specimens that is soon to be relocated to the Australian Botanic Garden Mount Annan) and the Daniel Solander Library (the oldest botanical research library in Australia). The site also houses various community assets such as the Calyx (an education and exhibition hub, housing a café and one of the largest green walls in the southern hemisphere), restaurants, a plant nursery and retail outlets.



The Domain, Sydney wraps the Royal Botanic Garden Sydney and comprises urban parkland which plays a central role in Sydney's festivals and cultural events. Prominent events held annually include the Field Day outdoor music festival, Handa Opera, Open Air Cinema, and Carols in the Domain.ⁱⁱⁱ In 2021, the Trust also planned an inaugural Winter in the Domain Festival for June-July, however this was cancelled due to the outbreak of the COVID-19 virus in Sydney.^{iv} With an area of 34 hectares, the Domain features community assets including Mrs Macquaries Point (known as Yurong Point to the Cadigal), Tarpeian Way, Fleet Steps, the Domain Crescent Fields, and the Domain Car Park.

The Australian Botanic Garden Mount Annan

showcases Australian flora among 416 hectares of rolling hills, lakes, lawns and gardens. Approximately 3,400 species are displayed via themed gardens as well as a four-hectare intensely cultivated Connections Garden. Other features of the Garden include a restaurant, visitor centre with gift shop, free gas barbeques and remnants of critically endangered Cumberland Plain Woodland. It advances plant science with scientific assets including the Australian PlantBank (an innovative plant conservation and research centre focused on saving flora through conservation activities), and will be the new home of the National Herbarium of New South Wales in a move to ensure the survival of plants and build more resilient ecosystems for future generations.



The Blue Mountains Botanic Garden Mount Tomah

is situated 1,000 metres above sea level in the World Heritage-listed Greater Blue Mountains. This site include 28 hectares of public botanic gardens and an additional 244 hectares of natural areas which are home to endangered Blue Mountains Basalt Cap Forest and more than 5,800 species that can be found in cool climate regions of the world. It features scientific assets in natural areas including native wooded and rainforest areas, Garden areas including Formal Garden, Rock Garden, and Bog Garden. It also is home to various community assets including a restaurant, café, and visitor centre with a gift shop.

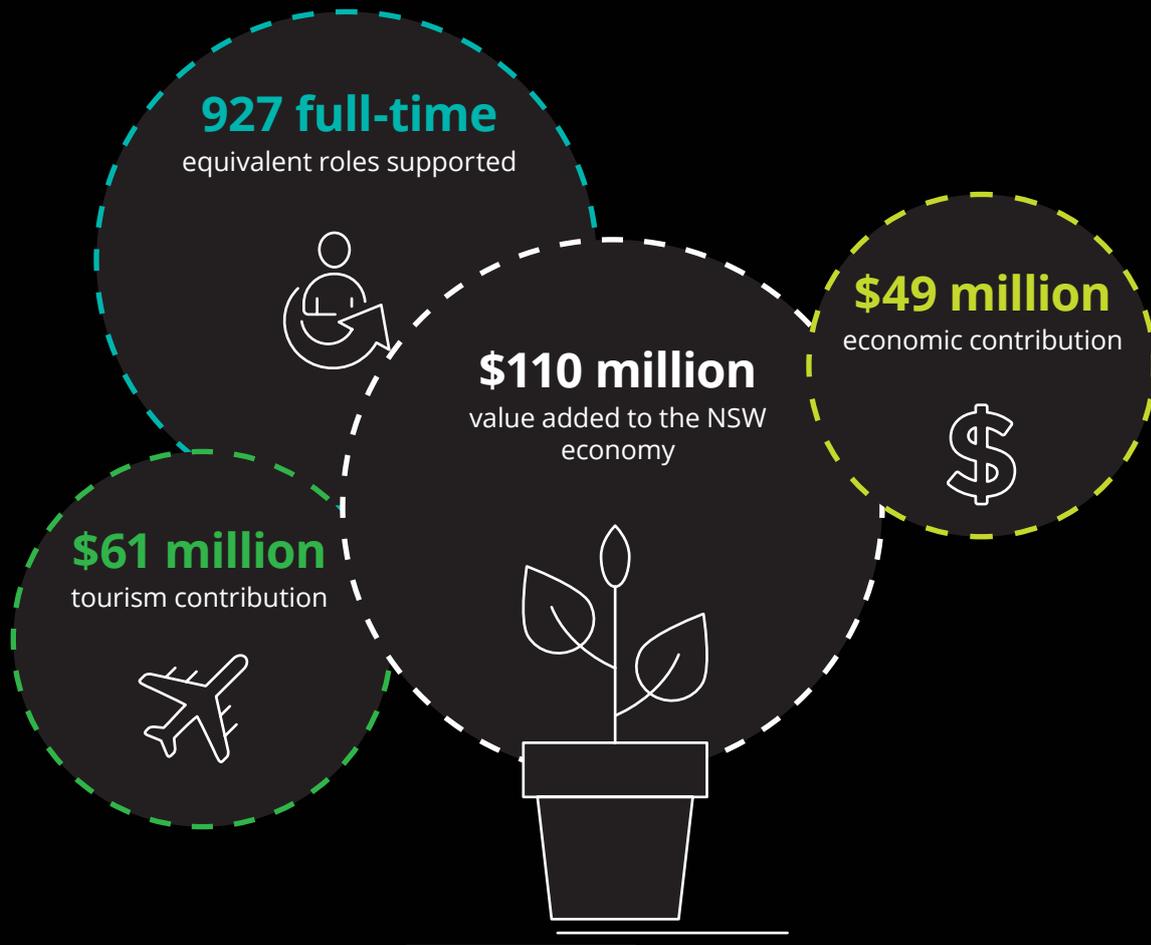
1.2 This report

In order to assess the economic, social and cultural contribution of these four sites, the remainder of this report is structured as follows:

- **Chapter 2** assess the economic and tourism contribution of the Trust's sites for the NSW economy
- **Chapter 3** explores the broader social and cultural contribution that the Trust has on local residents and visitors to the four sites
- **Chapter 4** discusses the value of scientific research undertaken by the Trust
- **Chapter 5** outlines an environmental accounting framework used to identify the ecosystem services provided by the three Botanic Gardens and the Domain.

Appendices provide a more detailed description of the economic contribution modelling, tourism contribution modelling, travel cost methodology, and citizen survey respectively.

2. Economic contribution



2. Economic contribution

The Trust generates significant value for its users and, more broadly, to the NSW economy. This Chapter estimates the market value of economic activity generated and supported by the Trust during the 2019-20 financial year. Specifically, this includes:

- the **direct** economic activity of the Trust
- the **indirect** economic activity that is supported through its activities
- the role of the Trust in facilitating tourism activity and expenditure in NSW.

The 2019-20 financial year was an exceptional year for much of Australia, including the Trust. Clearly, the impact of COVID-19 is significant, in addition to Australian bushfires. The impacts of these events on the Trust's activities are explored in this Chapter.

Despite these disruptions, the Trust still played a critical role in attracting tourists to NSW and in showcasing both Australia's unique flora and Indigenous ties.

2.1 Economic contribution

An economic contribution study provides an estimate of the contribution of an entity to an economy at a given point in time.

The economic contribution of the Trust to the NSW economy includes its value added, as well as the employment it supports, both directly and indirectly.

- **Direct value added** captures returns to capital (gross operating surplus or GOS) and returns to labour (wages).
- **Indirect value added** captures the flow-on economic activity associated with purchases of intermediate inputs made by the Trust.

For the Trust, a key consideration when estimating the economic contribution is the treatment of grants. As a not-for-profit entity, the Trust receives funding from the NSW Government to help support its activities. This funding can vary year-on-year for various reasons. For example, in 2019-20 the Trust received \$5.8 million from a one-off grant to fund its activities during the pandemic.

To provide a more accurate reflection of returns to capital in the economic contribution as opposed to fluctuations in Government funding, grant funding has been averaged for the three years to 2019-20. This differs to the previous Deloitte Access Economics report, which considered grant funding for the year of the study only.²

Importantly, while grant funding varies year-on-year, the NSW Government assumes a certain level of productivity improvements over time, in line with the broader economy.³ This means that funding for the Trust decreases for a given level of services, implying the value for money provided by the Trust improves over time.

Further detail on the economic contribution modelling is provided in Appendix B: Economic contribution modelling.

² In sensitivity testing we look at the impact of averaging grants on the results of the economic contribution, see Appendix B.

³ In addition to grant funding, efficiency dividends are applied to non-cash in-kind donations (e.g. volunteers) and expenses fully recovered from events which generate self-funded revenue for the Trust.

2.1.1 Economic contribution results

In 2019-20, the Trust directly generated \$33 million in value-added to the NSW economy, including \$5 million in GOS and \$28 million in labour income. In employment terms, the Trust supported 307 full-time equivalent (FTE) jobs. Even after accounting for changes in methodology and inflation, the Trust's direct economic contribution has grown by 16% since 2016-17.

In addition to its direct contribution, the Trust generates additional economic activity through purchases of intermediate goods and services. As an example, purchases of garden equipment by the Trust helps to support the agriculture industry. The sum of these flow-on benefits reflects the indirect economic contribution.

Modelling for this report estimates the indirect economic contribution of the Trust was \$16 million in 2019-20, with this activity supporting 124 FTE roles.

In total, the Trust supported \$49 million in direct and indirect value added in 2019-20, and around 431 FTE roles, as shown in Table 2.1. And for every worker employed by the NSW Department of Planning, Industry and Environment (DPIE) to work at the Trust sites, there is another half a worker employed in the supply chain.

Table 2.1: Economic contribution of the Trust, 2019-20 (\$millions)

	Direct contribution	Indirect contribution	Total contribution
GOS	\$5.0	\$6.0	\$11.0
Labour income	\$28.0	\$9.9	\$37.9
Value added	\$32.9	\$15.9	\$48.8
Employment (number of FTEs)	307	124	431

Source: Deloitte Access Economics, the Trust (2021).

Note: The approach to estimating GOS has changed and as such these results are not directly comparable to the 2017 report. See Appendix B: Economic contribution modelling.

2.2 Tourism contribution

In addition to its economic contribution, the Trust also helps to support economic activity in NSW by attracting tourists to Sydney. **In fact, the Royal Botanic Garden Sydney has been named the best major tourist attraction in NSW in 2017.**⁹

Some tourists – from interstate or overseas – will visit Sydney to visit and experience one of the botanic gardens. Based on data from Tourism Research Australia, it was estimated that there were 143,000 interstate tourists to the Trust's sites in 2019-20, and 761,000 international tourists. Roughly 115,400 interstate tourists said the three Botanic Gardens and the Domain were 'somewhat' or 'very' important in their decision to travel to Sydney.

To the extent that the Trust contributes to a tourist's reason to come to Sydney, or spend longer in the city, some of their expenditure can be attributed to the Trust's sites.

2.2.1 Approach and sources

The tourism contribution estimates the value added generated through the spending of tourists that is attributable to the Trust's sites, drawing from the Tourism Satellite Accounts (TSA). Value added can be generated directly by tourists (for example, through spending on transport or dining) but it can also be generated indirectly. The indirect tourism contribution reflects the spending on inputs required to produce the goods and services consumed by tourists (for example, petrol or produce).

Data on visitation collected by Tourism Research Australia through the National Visitor Survey (NVS) and International Visitor Survey (IVS) were also used to estimate the share of international and interstate visitors and their typical expenditure during their trip to Sydney. Importantly, the tourism contribution **does not consider intrastate visits** to the Trust's sites as these visits do not represent net additional expenditure in NSW, but rather a reallocation of funding within the State.

Of course, not all spending by international and interstate visitors to Sydney can be attributed to the Trust's sites. The Royal Botanic Garden Sydney is one of the many tourist attractions that draws visitors to Sydney. The Royal Botanic Garden Sydney, and other iconic landmarks such as the Harbour Bridge, Sydney Opera House and the Sydney Fish Markets, play an important role in showcasing Sydney's unique offering. Situated within a World Heritage site, the Blue Mountains Botanic Garden Mount Tomah is also a key tourist attraction alongside the Three Sisters, Scenic World and Jenolan Caves, that draw visitors to the area. The completion of Western Sydney Airport in 2026 will bring potential to attract greater visitation to the Australian Botanic Garden Mount Annan.

For **interstate visitors**, data from the survey was used to attribute expenditure to the Trust. Results from the survey showed that 15% of visitors said visiting the three Botanic Gardens and the Domain were 'very important' in taking their trip (reflecting more than 21,000 interstate visitors), while a further 66% of visitors said it was 'somewhat important' (reflecting 94,000 interstate visitors). For **international visitors**, we draw on a previous survey by Deloitte Access Economics which found that 19% of international visitors nominated the Royal Botanic Garden Sydney as their most preferred attraction in Sydney.^{vi} For international visitors, this survey also informed the attribution approach in the previous report.

Further information around the approach to calculating the Trust's tourism contribution is provided in Appendix C: Tourism contribution.

2.2.2 Tourism contribution results

Modelling for this report estimates that the Trust facilitated almost \$80 million in tourism expenditure during 2019-20. This expenditure supports businesses and generates value added in the NSW economy. As shown in Table 2.2, it is estimated that tourists to Sydney that visited the three Botanic Gardens and the Domain helped to facilitate around \$62 million in value added to the NSW economy, made up of \$31 in direct value added and \$30 of indirect value added. The Trust also supported 496 FTE roles both directly and indirectly.

Previous research by Deloitte Access Economics estimated that in 2016-17 the tourism contribution of the Trust was \$104 million.^{vii} After adjusting for inflation, this reflects a 56% drop in the Trust's tourism contribution. This decline is mostly attributable to the drop in international visitation, which was estimated at 1.2 million visitors in 2016-17, compared to 761,000 visitors in 2019-20. Further details on the impacts of COVID-19 on the economic and tourism contribution of the Trust is provided in section 2.3.1.

Table 2.2: Tourism contribution, 2019-20 (\$millions)

	Direct	Indirect	Total
Value added	\$31.3	\$30.2	\$61.5
Employment (number of FTEs)	343	153	496

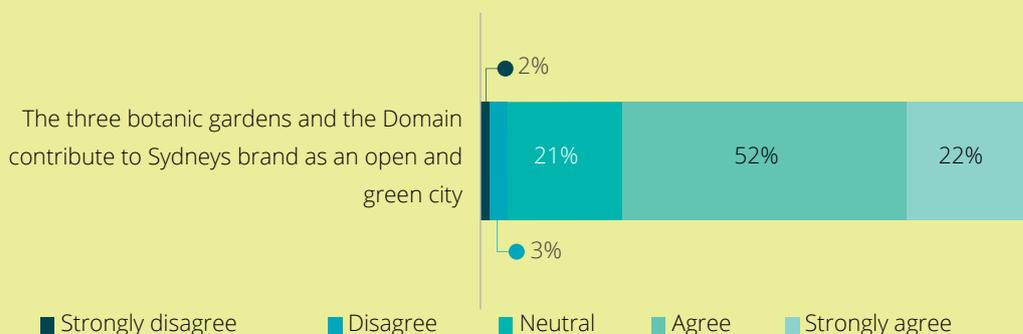
Source: Deloitte Access Economics (2021).

Brand value of Trust

The three Botanic Gardens and the Domain contribute to the brand of Sydney as green and active metropolitan city. Sydney's unique brand includes its beaches, national parks, iconic landmarks and botanic gardens. In addition to its green spaces and contrast to urban surrounds, the three Botanic Gardens and the Domain help tell the story of Sydney's culture and history. The range of Indigenous flora and connections to land provide large opportunities to tell this story that will resonate strongly for visitors to Sydney.

These sites therefore play an important role in Destination NSW's Visitor Economy Strategy 2030, which aims to make NSW the premier visitor economy of the Asia Pacific by 2030. **In fact, nearly three quarters of Australians (74%) agreed or strongly agreed that the three botanic gardens and the Domain contributed to Sydney's brand as an open and green city.**

Chart 2.1: The three Botanic Gardens and the Domain's contribution to Sydney's brand



Source: Deloitte Access Economics (2021)

Located in the heart of the Sydney CBD, the Royal Botanic Garden Sydney is part of a broader ecosystem of tourist attractions and is one of the unique cultural, lifestyle and sporting attractions that draws visitors to Sydney. Situated right on the harbour, it provides green space with scenic views of the city skyline and harbour. The site is also a key linkage to other parts of the city and is within walking distance of iconic landmarks such as the Sydney Harbour Bridge and Sydney Opera House and the NSW Art Gallery. The prime location and unique space offer unique event opportunities for private and public use including major public events such as Carols in the Domain and viewing the New Year's Eve fireworks.

The continued growth of Western Sydney and its visitor attractions has meant destinations such as the Australian Botanic Garden Mount Annan and the Blue Mountains Botanic Garden Mount Tomah have become key attractions for visitors. The Australian Botanic Garden Mount Annan's science facilities along with its natural landscapes and living collections, attract visitors to Sydney's South West while the natural beauty of Blue Mountains Botanic Garden Mount Tomah complements the World Heritage-Listed Blue Mountains. The Australian Botanic Garden Mount Annan and the Blue Mountains Botanic Garden Mount Tomah have also continued to grow their community engagements. This includes the monthly lakeside markets and AnnanROMA, a food, beer and wine festival. The Blue Mountains Botanic Garden Mount Tomah also introduced a new touring route along the Bells Line of Road in 2018, and also hosts family day and community programs including science week and NAIDOC week events. These green spaces and community events offer additional activities to the urban and suburban surrounds of Greater Sydney.

2.3 Total economic contribution of the Trust

Overall, the Trust contributed \$110 million in value-added to the NSW economy in 2019-20. This is comprised of \$49 in terms of its economic contribution and \$61 from facilitated tourism. It also helped to support more than 539 FTE equivalent roles.

To avoid double counting, the tourism contribution does not include expenditure by visitors to the Trust's sites.

To help put these numbers into context, the video game, DVD, and music retailing industry contributed \$241 million in value added to the Australian economy in 2019-20,^{viii} while the economic contribution of Kakadu National Park has previously been estimated to be \$136 million. Meanwhile, in a previous study conducted by Deloitte Access Economics in 2013, the contribution of the Adelaide Botanic Garden to the South Australian economy was valued at \$10.8 million.^x

Table 2.3: Total economic and tourism contribution of the Trust (\$millions)

	Economic contribution	Tourism contribution	Total contribution
Value added	\$48.8	\$61.5	\$110.3
Employment (number of FTEs)	431	496	927

Source: Deloitte Access Economics (2021).

2.3.1 Impacts of COVID-19 and the Australian bushfires

It is important to consider these numbers in the context of 2019-20, which was an exceptional year. Clearly, the impact of COVID-19 is significant, as well as the Australian bushfires over the Summer of that year.

The impact of these events cannot be understated. From January to June 2020, international visitor

numbers to Australia fell by 60% as compared to the same period the prior year, with spend falling by 53%.^x In addition, domestic overnight visitors fell by 43%, while domestic day trip visitors fell by 34%.^{xi} In NSW, the contribution of tourism to Gross State Product (GSP) dropped by 21% from 2018-19 to 2019-20.^{xii} Furthermore, in 2019-20 there was a drop of roughly one million visitors relative to the 2018-19 financial year, which is likely attributable to these events (Table 2.4).

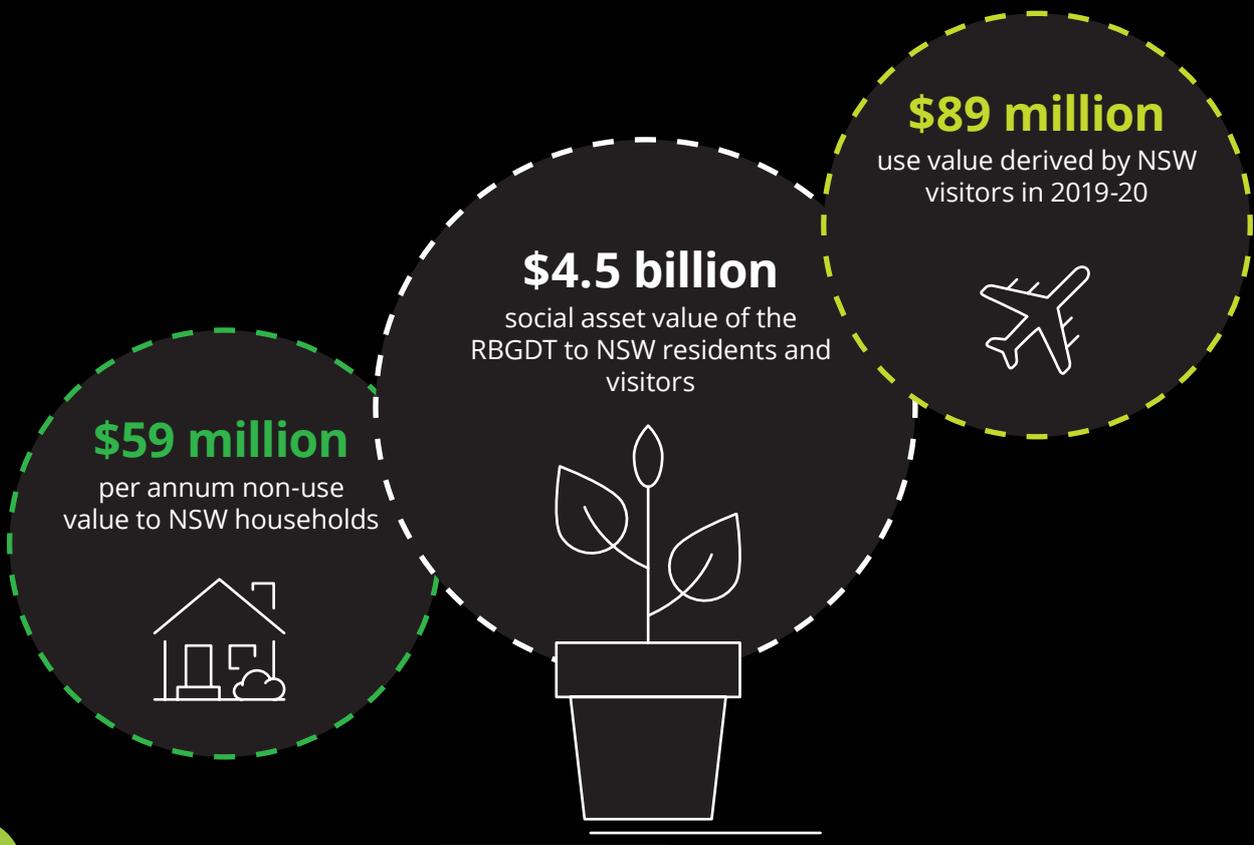
Table 2.4: Visitation by site (millions)

	2019-20	2018-19	Percentage change
Royal Botanic Garden Sydney	4.3	5.4	-20.0%
Australian Botanic Garden Mount Annan	0.6	0.5	18.6%
Blue Mountains Botanic Garden Mount Tomah	0.2	0.2	-4.5%
Total	5.1	6.1	-16.5%

Source: RBGDT 2019-20 Annual Report.

The impact of these events across the Trust's sites has varied. The impact for the Royal Botanic Garden Sydney and the Domain was much more severe compared to its suburban sites. This is likely due to the dependence on international visitors and large public events. Meanwhile, the Australian Botanic Garden Mount Annan recorded an increase in visitation between 2018-19 and 2019-20, which may be explained through an increase in outdoor recreation during the pandemic. This highlights the importance of suburban green space over this period.

3. Social and cultural contribution



3. Social and cultural value

The Trust plays a vital social and cultural role in NSW. It helps to promote Indigenous cultural connections, coordinates important community activities, and helps to educate school students and visitors about the native environment. It also provides green spaces for the public to enjoy, which have important health and wellbeing benefits. In particular, the Royal Botanic Garden Sydney and the Domain provide a green space for CBD workers during their lunchtime breaks.

The various sources of social and cultural value are explored in this Chapter. In addition, this Chapter estimates the social asset value of the Trust.

3.1 Reasons for visiting

There are many reasons for visiting the three Botanic Gardens and the Domain. Table 3.1 shows the most common reasons for visiting these sites, based on survey findings.

The most frequently selected reason for visiting the sites included the **scenic views** (ranked first by 23% of visitors, averaged across sites), **spending time with family and friends** (17%), and **to see and learn about unique plants and native flora** (9%). The top reasons for visiting were consistent across the four sites.

Table 3.1: Top reasons for visiting, averaged across the Trust's sites

Reason for visiting	%
The scenic views	23%
To spend time with family and friends	17%
To see and learn about unique plants and native flora	9%
To do exercise	7%
To take photographs	6%

Source: Deloitte Access Economics (2021).



3.2 Enjoying green space in an urban environment

Australia is one of the most urbanised countries in the world, with 86.2% of the population living in urban cities in 2019.^{xiii} As such, green spaces are becoming increasingly important in urban planning and in helping to promote positive environmental and social outcomes. In this context, the Trust plays a critical role in providing public green space for public use.

The provision of green spaces has important benefits for the visitors to three Botanic Gardens and the Domain. In fact, **more than four in five Australians (83%) agreed or strongly agreed that being in green spaces improves their wellbeing.**

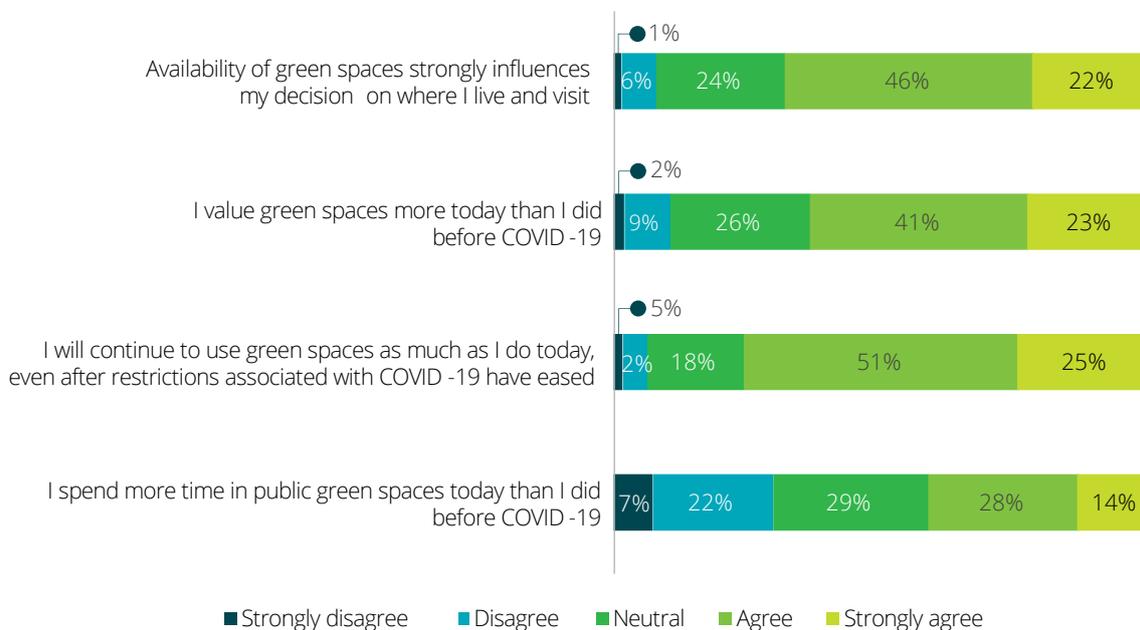
The perception that green space can have positive impacts on mental health is supported in the literature. A review of evidence by the World Health Organisation (WHO) found that green spaces can help to improve mental and physical health, reduce morbidity and mortality, as well as reduce the risk of type two diabetes.^{xiv} Indeed, greener residential areas are associated with lower rates of obesity among children.^{xv}

Recognising the important benefits that public green spaces provide to residents and visitors, the NSW DPIE are developing the first NSW Public Open Space Strategy, which will aim to provide a clear roadmap to deliver more public space in NSW.^{xvi}

Restrictions associated with the COVID-19 pandemic forced many businesses to close, such as gyms and restaurants, which saw many people increase their use of green space. **More than two in five (42%) respondents to the survey agreed they spend more time in public green spaces and 64% said they value green spaces more than they did prior to COVID-19.**

In addition, more than two thirds (68%) also indicated that the availability of green space has a strong influence on where they live and visit. Homes located close to parks, gardens and other publicly available green space are often valued more than those that are not. Indeed, analysis conducted in the UK found that houses and flats within 100 meters of green space had a premium of 1.1% (or £2,500) compared to property that were more than 500 meters away.^{xvii}

Chart 3.1: Green space use and value



Source: Deloitte Access Economics (2021).

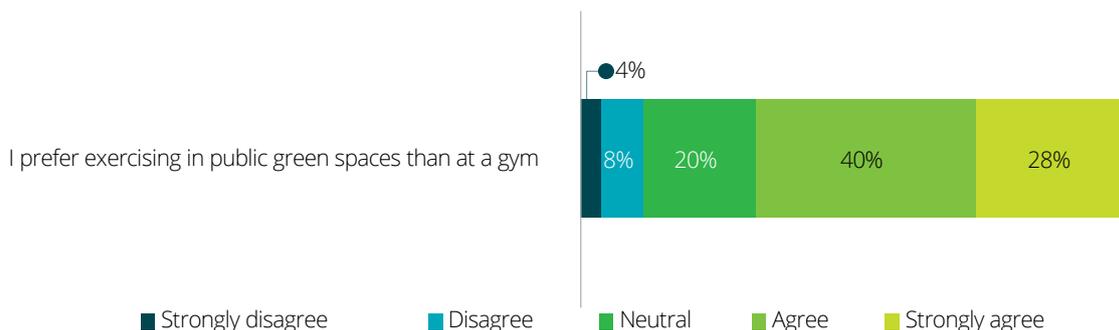
Furthermore, it's likely the premium placed on green space is likely here to stay, with 76% of Australians agreeing they will continue to use green spaces as much as they do today, even after COVID-19 restrictions have eased.

3.3 A place for exercise and recreation

The three Botanic Gardens and the Domain provide spaces for exercise in the CBD and outer suburban areas. There are a number of exercise events that take place at the Royal Botanic Garden Sydney and the Domain, including runs such as Run2Cure and the Mother’s Day Classic.

The Royal Botanic Garden Sydney and the Domain also offer informal areas for exercise including group fitness, personal training, and social sports. Our survey of Australian residents found over two thirds (68%) agreed they prefer exercising in green spaces than going to the gym. These opportunities are expected to have significant flow-on benefits for residents and workers in the CBD.

Chart 3.2: Preferences for exercising in green space compared to gyms



The Trust’s facilities also provide opportunities for recreational activities, including hosting of major events. In 2019-20, more than 240,000 visitors attended public events at the Royal Botanic Garden Sydney and the Domain, including the Handa Opera, Carols in the Domain and viewing the New Year’s Eve Fireworks. In addition, \$3.6 million was raised for charities via special events held at the venues, including fun runs. While substantial, these numbers are lower than previous years due to the cancellation of major

events due to COVID-19 restrictions. For example, in 2018-19 Vivid Sydney attracted over 350,000 visitors.

The Royal Botanic Garden Sydney and the Domain also host various smaller events. In 2019-20 there were more than 579 bookings for private events such as weddings and picnics. Amenities such as the Calyx, which has the largest green walls in the southern hemisphere, as well as cafes, shops and restaurants are available for visitors to enjoy.

3.4 Maintaining and promoting Aboriginal culture

The Cadigal, Dharawal, Gundungarra and Darug people have occupied the land of the three Botanic Gardens the Domain for tens of thousands of years.

Professor Deen Sanders OAM, a Worimi man and one of Deloitte's Senior Indigenous leaders, explains that

"All land is inherently valuable because it is one agentic body and how would we distinguish the value of different parts of our own body?"

For each community, different areas and physical features hold different purpose and significance. This is a complex framework of utility and relationality. Land "value" is not reflected as a simple relationship to food sources but also relates to ceremony or tool making or law practice or care or birth or dying and every aspect of life in between. Each place has its function, chosen not for convenience and real estate aspect but determined by the land itself in agentic relationship with the community.

Only when we use the land in a way aligned with its purpose can the true value of the land be recognised and realised by those living on it. In simple terms, a new hospital built on the site of an Aboriginal place of healing and care would reflect an alignment of past and present. The full depth of place value is lost to us for these sites because of the erasure of public knowledge of the Cadigal, Dharawal, Gundungarra and Darug practice and life.

It is still there, in community and in the landscape, but it will take time to listen and hear it fully."

For this project, we have sought to engage with Aboriginal elders from surrounding areas. Their reflections are provided in this report. Theirs is not a complete retelling of this landscape and it is insufficient for a holistic economic assessment of Aboriginal value for the three Botanic Gardens and the Domain, but it represents an important first step in recognising that economic value is a product of history and present and future. Their stories also remind us that the land itself will likely tell us what its real economic, social and cultural value is, if only we would listen more carefully to the knowledge that cultivated it for tens of thousands of years.

We spoke with Aunty Barbara Simms and Uncle Vic Simms of Bidjigal who both spoke about the Royal Botanic Gardens Sydney while Aunty Kay of the Yorta Yorta spoke about the land around the Australian Botanic Garden Mount Annan. Through their generosity and stories we

know that each of the three Botanic Gardens and the Domain have their own unique significance and purpose, as recognised by their respective Traditional Custodians.

The Dharawal people gave Mount Annan the name of Yandel'ora, meaning 'a place of peace between people', signifying its use as a connecting point for Aboriginal people – including the Cadigal, Gundungarra and Darug - coming from the coast, the plains and the mountains. As a gathering site, we understand the area was also used for celebrations.

Similar to Mount Annan, the Blue Mountains was a connecting site for the Darug people and neighbouring Aboriginal groups. Near to Mount Tomah was also a place where elders gathered to set tribal laws and resolve disputes.

In the Royal Botanic Gardens Sydney and the Domain, the Cadigal have relied on native vegetation such as Guldadya (Grass Trees) for food, tools, medicine, and weapons. Aunty Barbara, recalls that the land acted as their supermarkets, nurseries, hospitals, and even hardware stores. For instance, instead of super glue, the Aboriginal people used tree resin while local herbs and leaves created balms. As Aunty Barbara said, "We only took what was needed. Everything had a reason and purpose". By following nature's seasonal calendar, the Aboriginal people thrived on the land that nurtured them. This connection to the land is summarised by Aunty Barbara as

"The land owns us, we don't own the land."

The Yurong Precinct, the area presently known as Mrs Macquaries Road and Chair, was also a significant trading ground between the numerous groups of the Sydney basin. Aunty Barbara explains that "visitors were always welcome. Our house was always open to other people."

Aunty Barbara Simms of the Bidjigal and Rhiannon Yetsenga



This site is a landscape of both tranquillity and trauma. It is an area that represents the invasion of European settlers and the establishment of colonial structure, that still characterises much of the relationship between Aboriginal and non-Aboriginal people. Where ceremonies, births, deaths, feasts, celebrations, care, justice and civilisation were once likely practised there is now managed landscapes and buildings and roadways, with only passing reference to the knowledge and history that lives in the land. The value of these sites as living places of life, learning and culture has never been captured in economic terms and it remains impossible to do with any great clarity because of the loss of first-hand story about the role of the land.

Massacres, forced removal and other actions led to the genocide of many of the original communities and the loss of much of the direct knowledge about the pre-colonial landscapes of the Three Botanic Gardens and the Domain. European invasion also drastically changed the landscape, both physically in terms of utilisation but also economically as a construct of capital, which introduced concepts of ownership and access that had no basis in Aboriginal culture, and profoundly affected the ability of Aboriginal people to maintain practical and cultural relationships with the landscape. We were reminded through this project though that Aboriginal culture is emerging from the shock of European colonisation. There is increasing call from Aboriginal community for reconnection and consideration of the agentic nature of land, rather than its purely capital one.

There is also increasing call for this amongst non-Aboriginal Australians with the recognition that all Australians would benefit from this restorative work for national healing. While significant pain and damage has been inflicted on Aboriginal people and the land, Uncle Vic Simms, believes there is reason for optimism, saying

“What has been done in the past can be revived. But this can only be achieved if we acknowledge and understand the truth of what has happened here. History needs to be rewritten.”

This history – Aboriginal connection to both past and present events embedded in land – is now actively promoted by the Trust for the benefit of all visitors and builds on Aboriginal education and engagement experiences and events offered by the Trust. This has culminated with the development of the Trust’s First Nations Australian’s Engagement Strategy and RAP, which were both released in late 2021 (see case study below).

The three Botanic Gardens and the Domain are still being actively used by Aboriginal Australians, even if only as ordinary citizens, rather than with the recognition they should be afforded. Aunty Kay tells us that she walks with other local women around the Australian Botanic Garden Mount Annan. They gather quietly and spend time in the gardens just walking. She explains that these walks provide a great sense of connection to Country and her community.

“We get everyone together [at the Australian Botanic Garden Mount Annan] and walk around the gardens, seeing the plants and breathing in their natural perfume. It gets the heart pumping... then when you hear the water, everything becomes so peaceful. In there, you can truly connect with Country.”

By using the land in a way that aligns with the purpose of the environment, Aboriginal Australians are not only able to access the greatest possible value from the land, they are also restoring the human relationship with the land in a way that translates to improved social and economic value for all.

Professor Sanders tells us that spending time on country is not only a personally restorative function, it is a restorative relationship for the land. We are taught in culture that the land is waiting for us to love it, and it responds to our attention and presence. There is a genuine physical consequence for people (non-Aboriginal included) walking through a loved landscape. This isn’t a measure defined by manicured landscaping but by the proper purpose of the land being realised and celebrated.

Uncle Vic Simms of the Bidjigal



Promoting an Aboriginal perspective within the Trust

The land of the Trust holds great beauty and cultural significance but also reflects past and present trauma for Aboriginal people. The Trust has developed its First Nations Australian's Engagement Strategy 2021-26 and its inaugural Innovate RAP to strengthen connections of Traditional Custodians to the three Botanic Gardens and the Domain while improving the general community's understanding of Aboriginal culture.

Josh Brown, Manager Aboriginal Strategy and Development at the Trust, recognises the important responsibility that the Trust has in the community. Josh explains that "we want to avoid using Aboriginal culture as a marketing exercise. The Trust has a role in helping to keep Aboriginal culture alive and make sure visitors come away with a greater understanding of that culture." This is also the aim underlying the initiation of the National Sorry Day event at the Australian Botanic Garden Mount Annan in 2018, which, according to Josh, has become "a key factor in our Aboriginal community relationships and engagement."

There are a number of physical features in the three Botanic Gardens and the Domain that connect all visitors to Aboriginal culture, including:

- The award-winning garden display Cadi Jam Ora: First Encounters, which features a 52 metre sculptural 'storyline' of Aboriginal history in Sydney, including names of people, animals, tools, and stories from Aboriginal people in the Sydney region. The imagery used is based on 40 interviews with local Aboriginal people and offers differing perspectives into the lives of the custodians of the Royal Botanic Garden Sydney.
- The Australian Botanic Garden Mount Annan is the home to the Stolen Generations Memorial. Featuring a sandstone sculptural centrepiece crafted by the renowned Uncle Badger Bates, the Stolen Generations Memorial offers a place of healing and reflection in the natural and tranquil landscape. By recognising the past and current trauma of the Stolen Generations, the Memorial seeks to unite different cultures in the peaceful Cumberland Plain Woodland.
- In the Blue Mountains Botanic Garden Mount Tomah, Darug artists leave their interpretive art celebrating the past, present, and future – an important sign of the connection between Indigenous people and this land.

Language revitalisation is a key part of Trust's engagement with Traditional Custodians. For example, a recent program involving Aboriginal children enabled them to learn about the local Cadigal language, poetry and produce works themselves. In a unique display in the Royal Botanic Garden Sydney, the poems of children were recorded into a soundscape and played through the submerged underwater speakers, with eucalyptus gum tree branches used to allow the sound to flow straight from the wood into the listener's ear.

The Trust also seeks to promote Aboriginal culture with visitors to the sites. At each of the three botanic gardens, lessons with Aboriginal cultural themes have been developed for student visitors aged from primary to tertiary level. These lessons are linked to NSW and Australian curriculum requirements and syllabus outcomes and can equip teachers with the necessary skills to achieve Aboriginal learning outcomes and foster a deeper understanding among students about the Aboriginal heritage of the three Botanic Gardens and the Domain. In addition, Aboriginal heritage tours encourage visitors to learn about the way plants are used by Cadigal people, along with a variety of historical impacts of First Contact between Europeans and the Cadigal. More than 5,000 domestic and international tourists engaged in Aboriginal culture programs during 2019-20. Both the heritage tours and lessons allow visitors to the three Botanic Gardens Sydney to gain an immersive first-hand experience of the richness of Aboriginal culture.

Undertaking this role of promoting Indigenous culture authentically has required internal changes to the Trust. Josh recognises that the Trust has experienced a shift in mindset as "the Aboriginal perspective and engagement with community has become increasingly recognised and celebrated throughout the entire organisation. This is set to continue with the launch of our First Nations Australian's Engagement Strategy and RAP."

3.5 Community involvement and outreach

The Trust has a long history of being embedded in the local community.

Over 630 volunteers at the Trust and the Foundation and Friends of the Botanic Gardens donated nearly 40,800 hours of their time in 2019-20 by engaging visitor and supporting in areas such as events and exhibitions, science, conservation and environmental projects. The in-kind value of this time has been estimated by the Trust as worth \$1.5 million.⁴

The Community Greening program that started over 20 years ago involves helping communities grow their own gardens with the aim of improving outcomes for individuals and groups from disadvantaged backgrounds by enhancing their relationship with the natural environment.^{xxiii} Developing these community gardens has been found to contribute to social cohesion, crime reduction and public health across NSW.

There have been 555 Community Greening projects since the program's inception, with over 10,000 participants in 2019-20. This represents a 21% increase in participants despite the programs being suspended in March 2020 due to COVID-19. The disruption caused by the pandemic led the Community Greening team to transition to the delivery of virtual tasks, seedling sharing challenges, online workshops and resource delivery to groups.

The Master Gardener Volunteer and Leadership Program is another initiative by the Trust that provides training opportunities to improve employment and

further education prospects for participants. In 2019-20, 142 participants completed the two-year program and gained a qualification and statement of attainment in Community Engagement.^{xxiv}

A third program offered by the Trust is the Youth Community Greening (YCG) program, which has delivered over 487 garden projects in its 12-year history. This program is explored further in the case study box below.

Across these three programs, the positive social outcomes are measured through indices such as a personal wellbeing index and biannual follow-ups. Since its inception, the Trust has delivered approximately 1,042 youth and community gardens involving over 200,000 participants, with 70% of these gardens still active in the community. In pre- and post-program questionnaires, Community Greening participants reported significant improvements in their sense of emotional connection with the community. According to one participant, "... I feel like I'm part of the community now, and I didn't feel like I was a part of it until now."^{xxv}

Philip Pettitt, Community Greening Manager, believes the success of the program comes from being led or designed by the communities themselves. Philip notes that "We always love it when people contact us about a new idea for a project and lead those projects. We aim to provide a supporting role to let these communities achieve their goals." In providing this support for local communities, the Trust has partnered with over 100 stakeholders, including organisations such as Mission Australia and NSW Health.

⁴ These aggregate figures also include corporate volunteers

Delivering positive social outcomes through the Youth Community Greening Program

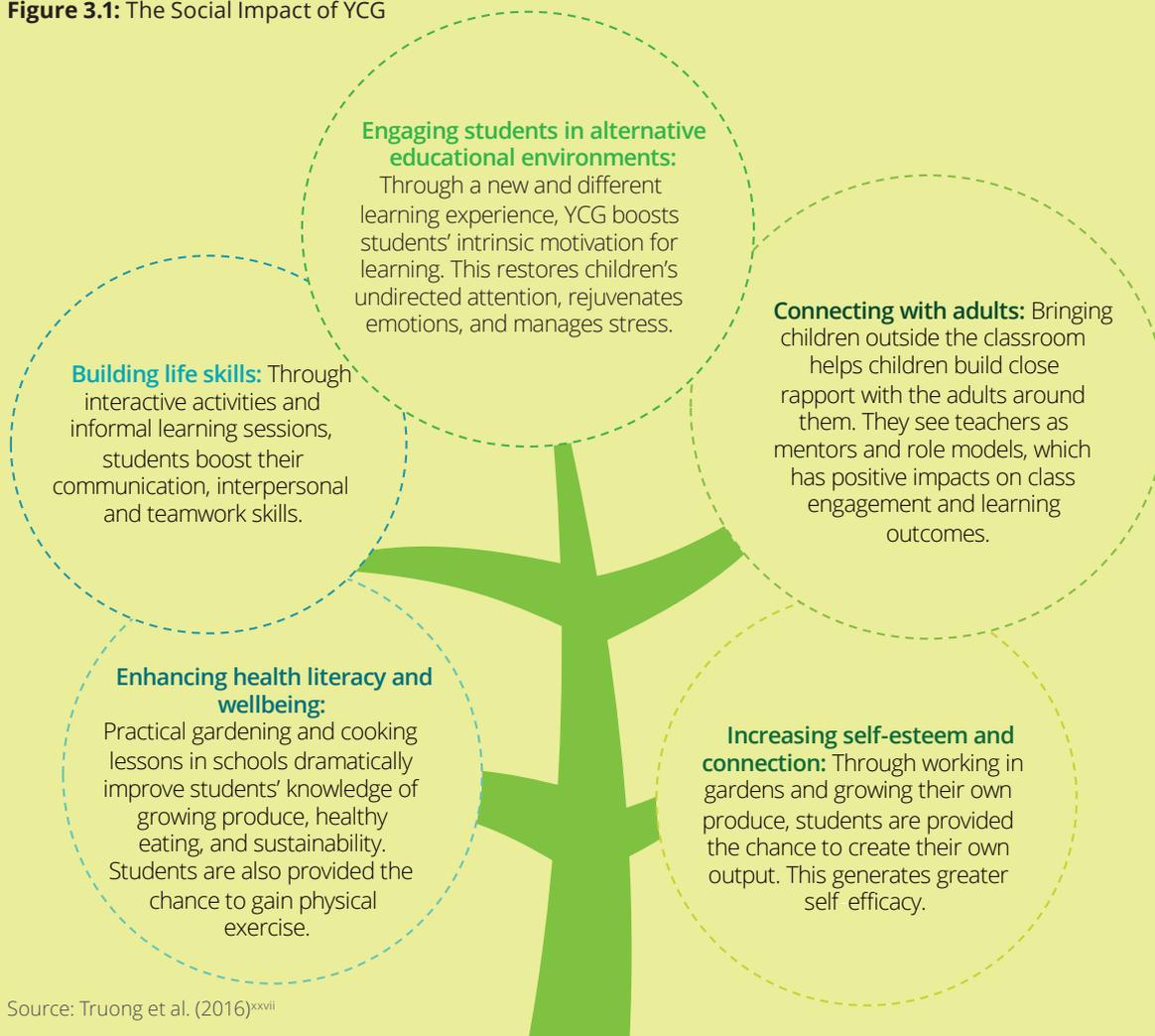
The YCG program seeks to engage children and youth from disadvantaged backgrounds by seeking to provide them greater opportunities to interact with nature in gardening projects at school. Over 106,000 students have engaged with the YCG program since its launch. Participation in the program helps improve children's physical and mental wellbeing, equipping them with the skills necessary to navigate social, employment, and financial challenges faced in adolescence.^{xxvi}

As part of YCG, the Trust works with Department of Education and TAFE teachers to ensure Trust staff have the necessary skills to foster youth development.

From its inception, the YCG team has sought to identify the social benefits of the program to promote its value and continuously improve its design. A wide variety of social benefits for participants of YCG has been measured by researchers at Western Sydney University in 2016 and are displayed in Figure 3.1. Providing evidence of the benefits from YCG has assisted in attracting interest among partner groups and sponsors.

Yvette Pratt, Head of the Education and Engagement Centre, recognises the importance of measuring outcomes, stating that "we continue to support and monitor 90% of the YCG gardens, scheduling repeat visits throughout the year to see how the groups are going. Doing this helps us understand what works, and better provide lessons for future projects."

Figure 3.1: The Social Impact of YCG



The YCG program at Cobargo Public School provides an example of its profound impact. Following the devastating impacts of the 2019-20 Black Summer bushfires, the YCG team worked with Cobargo Public School to create a bush tucker garden in the front of the school. Students had the opportunity to hear about native plants from Aboriginal Community Greening Officer, Brendan Moore, and work with Indigenous Yuin artist, Natalie Bateman, to paint and install totem poles in the garden. With many children at the school suffering from the traumatic effects of the Black Summer bushfires, the process of making designs, planting seeds and watering the garden enabled them to feel a sense of connection to the land and improve their resilience.^{xviii} Philip recalls that “the program brought the whole school together, creating a special memory for both the children and the community.”

Another example of the impact of participating in YCG has come from a project at Macquarie Fields High School. During the YCG program at their school, two participants enjoyed working in the garden so much that they undertook their Year 10 work experience at the Royal Botanic Garden Sydney. During this week, they undertook tasks such as leading Heritage tours for visitors, sharing their knowledge of native plants, assisting staff in the construction of the Wildflower

Meadows and presenting workshops to other students at the Youth Eco Summit. This program enabled the boys to develop both their horticulture and leadership skills.^{xxix}

Following the success of these students’ experiences, the YCG team is looking to provide this opportunity to more students in the future. Currently, the team is working on one such program called ‘Embrace the Wild’ in collaboration with the Jane Goodall Institute Australia and Taronga Zoo. In this first-worldwide initiative, students from the YCG program who have shown an interest in horticulture, education, or zookeeping will be provided the chance to embark on a targeted work experience program aimed at showcasing pathways outside of school. With a focus on retention, the experience will enable students to follow their interests and undertake further studies in tourism and horticulture combined with an accredited TAFE course. The program is expected to be rolled out in 2022.

The YCG program is set to expand in 2022 with the recruitment of two YCG identified roles. This expansion will provide greater opportunities for Indigenous young people to connect with their culture through caring for country and working with local Elders and community organisations.



3.6 Educating visitors on native environment

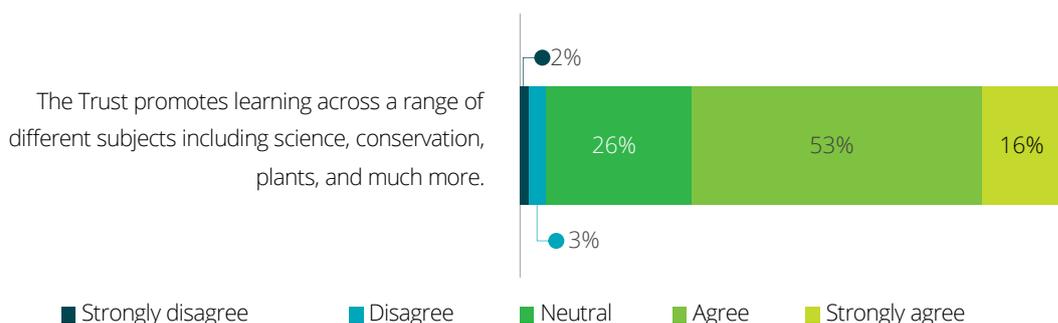
The Trust offers a wide range of educational programs on nature, science, culture and community. These programs are available to students, visitors and residents and aim to encourage curiosity about the environment unique to Australia and demonstrate the value that botanic gardens bring to our planet.

Over 1,000 learning programs were delivered across the three Botanic Gardens in 2019-20, which attracted over 69,000 visitors. This included formal school children through to retirees who participated in formal, community or Aboriginal programs. The number of participants would have been higher, except for the Black Summer bushfires and COVID-19 restrictions resulting in all programs being ceased in March 2020.

One educational program was the newly developed Seedlings Nature School at the Royal Botanic Garden Sydney, which encourages children under five years old to play in an 'outdoor classroom'. Education programs offered are aligned with syllabus outcomes and 23,365 science students participated in STEM (Science, technology, engineering and mathematics)-based programs across the three Botanic Gardens in FY21.

The important educational role of the Trust is recognised by Australian residents, with over two thirds (69%) of Australian residents believing the Trust promotes learning across a range of different subjects including science, conservation, plants and more.

Chart 3.3: Promotion of learning



Source: Deloitte Access Economics (2021).

The Trust contributes to broader learning and education programs such as National Science Week, Living Laboratory science festival and Science in the Wild. More than 48,000 visitors participated in the Sydney Science Trail: Education as part of National Science Week 2020. The Sydney Science Trail program is a free, weeklong education program for schools and community which involved panel discussions, keynote speakers and workshops. Other events hosted include the Living Laboratory Science festival at the Royal Botanic Garden Sydney and Science in the Wild at the Australian Botanic Garden Mount Annan.

COVID-19 has meant that education programs offered by the Trust have transitioned online. One example is Living Learning, which aims to encourage continuity of learning at home and at school through virtual tours, 'how-to' videos and other educational materials. An average of 26,206 users accessed the Living Learning pages.

3.7 Estimating the social and cultural value of the Trust

There are a number of reasons that an economic contribution may understate the value of an asset to a broader community. For example, if sites are free to access then the value visitors derive from visiting would not be captured in an economic contribution.

To help understand and quantify the various components of value the Trust produces, this report has modelled the use and non-use values of the Trust. Use value includes the value derived from visiting the three Botanic Gardens and the Domain, for example to learn about native flora, to attend cultural events, to enjoy green space, among many other reasons. But it also captures the non-use or existence value of the Trust. The non-use value reflects the value that people who do not use the three Botanic Gardens and the Domain, place on their existence.

To help estimate the use and non-use value, bespoke inputs were drawn from the citizen survey to understand the value Australians places on the Trust's sites. It is noted that there is some overlap between the social asset value and the economic value and as such these figures are not additive.

3.7.1 Use value

Use values represent benefits that accrue from actual use of some good. For the three Botanic Gardens (and the Domain?), this is the value that visitors derive while at the sites. This can be from the enjoyment of green space, exercise and recreation, observing flora and fauna and attendance to private and public events.

The travel-cost method was used to assess the value of the three Botanic Gardens (and the Domain?). Inputs were drawn from the citizen survey, which collected information about visitor's travel each of the Trust's sites such as reason for visiting, travel costs, travel time and time spent at each site (see Appendix D: Travel cost methodology).

The travel cost method is a revealed preference approach to estimating the value that visitors place on visiting the three Botanic Gardens (and the Domain?). It is based on the idea that travelling to visit an attraction involves costs other than a formal entry fee. A visitor to the site will incur costs such as fuel or public transport fares as well as the opportunity cost of their time to travel.

When using the travel-cost methodology, it is important to note that individuals often visit multiple venues in a single trip. The use value for individuals visiting multiple sites must be shared across the multiple locations. This is especially true for the Royal Botanic Garden Sydney, where multiple attractions are in the same vicinity such as the Sydney Opera House and the Sydney Harbour Bridge.

Findings from the survey reveal that on average across each of the Trust's sites, the average cost of travel was \$21.33 per person. This includes tangible travel costs (e.g., public transport fares, petrol, etc.) alongside the cost of an individual's leisure time.⁵

The per person use value was highest for the Blue Mountains Botanic Garden Mount Tomah, at roughly \$39 per person on average, and lowest for the Royal Botanic Garden Sydney, at \$20 per person on average. These differences likely reflect the longer distances people travel to get to the Blue Mountains site.

Average visitor use values were applied to the total number of visits undertaken by NSW residents at each site. Visitor number were provided by the Trust, while the proportion of visits undertaken by domestic visitors (as opposed to interstate or international visitors) was derived using Tourism Research Australia's NVS. The total use value across each site was then summed to derive the total use value attributable to the Trust.

⁵ Leisure time was valued at 50% of an individual's income, as per Queensland Treasury (2016). Where individuals were unemployed or not in the labour force, their leisure time was assumed to be 50% of the minimum wage in Australia.

The total use value of the Trust was estimated at \$89 million for 2019-20. The majority (80%) of this value associated with the Royal Botanic Garden Sydney, while the Australian Botanic Garden Mount Annan and the Blue Mountains Botanic Garden Mount Tomah comprised a smaller proportion of the total use value (13% and 7% respectively).

Table 3.4: Use value of the Trust's sites

	Per person use value	Intrastate visitors (000s)	Total annual use value (millions)
The Royal Botanic Garden Sydney	\$20.00	3,559	\$71.2
The Australian Botanic Garden Mount Annan	\$25.65	456	\$11.7
The Blue Mountains Botanic Garden Mount Tomah	\$38.59	161	\$6.2
Total	\$21.33	4,176	\$89.1

Source: Deloitte Access Economics (2021).

This is just one of the many ways use value can be measured. To help benchmark these results, the use value was also modelled using a stated preference technique. This involved asking visitors in the survey hypothetically how much they would be willing to pay to support the Trust through paying entry fees to visit the three Botanic Gardens (and the Domain?). Under this approach, the per person use value was just marginally higher at \$21.83 and the total use value attributable to the Trust was \$91.2 million, suggesting the estimated use value is consistent despite different estimation approaches.

3.7.2 Non-use value

Another important element of the Trust's social and cultural value is its existence or icon value. This reflects the value that citizens place on the Trust's natural assets existing, and the organisation undertaking its various activities, even if they never intend on using its services.

In the survey, Australian residents emphasised the importance of the Trust's sites as a landmark. For example, **74% of Australians said they agreed or strongly agreed that the three Botanic Gardens and the Domain contribute to Sydney's brand as an open and green city.**

To estimate the non-use value of the Trust, a contingent valuation methodology was used. This methodology asks survey respondents how much they would be willing to pay to support an entity or program (in this case, the Trust) through Government funding. The survey included information about the current level of Government funding that the Trust receives to provide a relevant benchmark.

The average non-use value of the Trust was derived based on responses from NSW residents who had not visited the three Botanic Gardens or the Domain. On average, NSW residents suggested the Trust should receive \$19.16 per household. When applied to the total number of households in NSW, this equates to a total non-use value of \$59.31 million per annum.

To help put these figures into context, a previous study looking at the value of the Sydney Opera House found that the NSW per household funding level was \$18.83 in 2020 dollars, suggesting the non-use value of the Trust is on par with some of Australia's biggest icons.

It is further noted that the non-use value was previously estimated for the Trust in 2016-17, using a study based on Botanic Gardens of South Australia. In that study the non-use value was estimated to be \$11 per person, equivalent to \$29 per household (adjusted for inflation). While this is higher than the present study, these figures are not directly comparable due to differences in approach and it being specific to the South Australian site.

Table 3.5: Non-use value of the Trust in NSW

	Per household non-use value	NSW households (millions)	Total non-use value (millions)
Royal Botanic Gardens and Domain Trust	\$19.16	3.09	\$59.31

Source: Deloitte Access Economics (2021).

Australian non-use value

The Trust is not only well-known by NSW residents but many Australians living outside of NSW feel it contributes to Sydney's brand. Seven in ten (71%) non-NSW residents agreed that the three Botanic Gardens and the Domain contribute to Sydney's brand as an open and green city.

On average, interstate respondents said that the Trust should receive \$15.68 on average each year in Government funding, which is slightly lower than the average value of \$19.16 provided by NSW residents.

When combined with the estimated number of interstate visitors to the Trust's sites, and added to the estimated non-use value for NSW, this suggests the **total Australian non-use value of the Trust was \$162 million in 2019-20**.

3.7.3 Total social asset value

The Trust is a social asset that is experienced by some people directly (i.e., by visiting one of its sites) and others who may not visit the site but value the Trust's existence and activities it undertakes. Overall, **we estimate that the Trust has a social asset value of \$4.5 billion** (see Table 3.8). This represents the net present value of the annual use and non-use values over the next 30 years.⁶ The largest component of this value is from the use value of the Trust, which makes up \$3.2 billion or 71% of the total social asset value of the Trust.

Table 3.6: Total social asset value of the Trust in 2019-20 (\$millions)

	Social asset value
Use value	\$3,176
Non-use value	\$1,276
Total	\$4,453

Source: Deloitte Access Economics (2021).

The future stream of benefits attributable to the Trust was discounted to a present value using a discount rate of 3.5%. This is in line with recommendations by the Victoria Institute of Strategic Economic Studies when valuing green spaces,^{xxx} and reflects the nature of the Trust as a natural asset, with long-term environmental effects. Appendix E provides further detail around discount rates and shows the sensitivity of results to different discount rates.

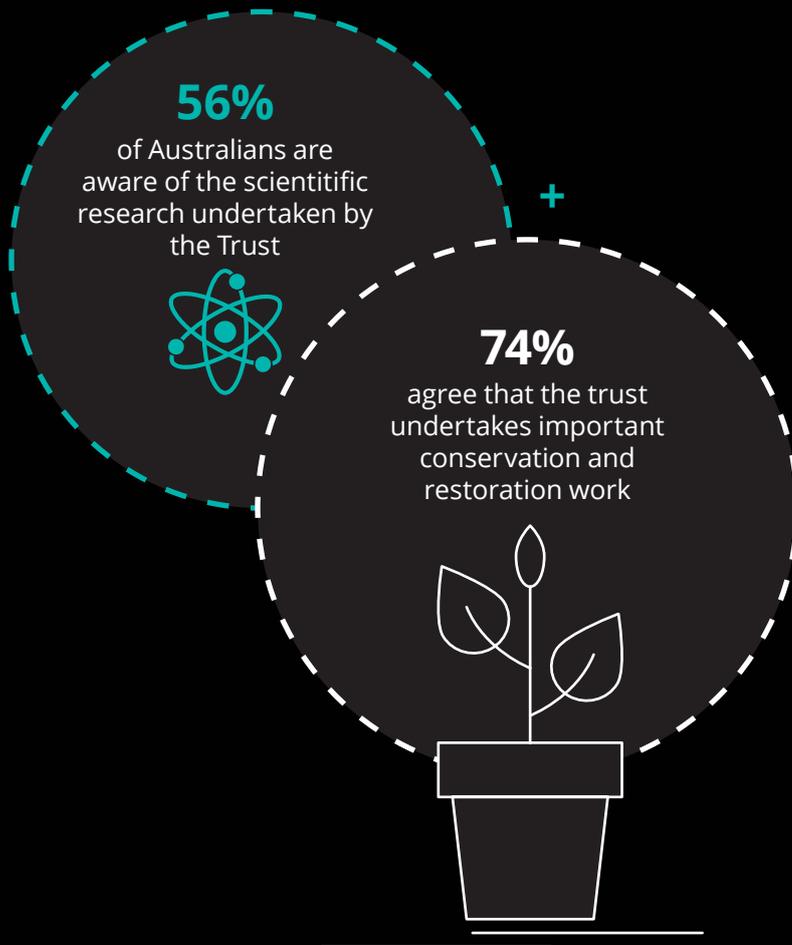
The future use value of the Trust is likely to grow over time. In part, this is due to the impacts of COVID-19 and the Black Summer bushfires impacting use in 2019-20 as well as expected longer-term growth in visitation to the Trust's sites.

To account for this forecasted growth, when estimating the future flow of benefits a growth rate of 5.4% per annum is applied, reflecting the average growth in visitation to the Trust's sites between 2008-09 and 2018-19.^{xxxi} However, growth is held constant for the first three years (between 2019-20 and 2021-22), reflecting the expected ongoing impacts of COVID-19 on visitation to the sites during this time.

Similarly, the non-use value is adjusted over time by considering the expected growth in NSW households, based on ABS household projections.^{xxxi}

⁶ In sensitivity analysis, we estimate the social asset value of the Trust over a period of 20 and 50 years respectively, see Appendix E.

4. Scientific contribution



4. Scientific contribution

Beyond its economic and social contributions, the Trust is the oldest continuous scientific institution in Australia and makes critical contributions to ecological and conservation research.

The Trust's strong focus on scientific research generates outcomes which have both intrinsic value as well as commercial benefits. Established by the Trust, the Australian Institute of Botanical Science (the Institute) is a premier botanical research organisation. The Institute brings together the people, with the physical and virtual scientific collections, research, services and facilities of the Royal Botanic Gardens and Domain Trust. These are outlined below.^{xxxiii}

- The **National Herbarium of New South Wales** houses more than 1.4 million plant specimens and is one of the largest botanical resources in the Southern Hemisphere. Through studying the relationships between plants and the evolution of species, researchers at the Institute and other partner organisations gain important insights that can improve the processes of conservation and management. The collection data is freely available through BioNET and Atlas of Living Australia. Discovering, understanding and documenting native plants is a fundamental role of the Trust, who is the recognised authority for scientific plant names in NSW. This knowledge is shared with the business and community through NSW Flora Online.
- Located at Australian Botanic Garden Mount Annan, the **Australian PlantBank** is the largest native plant conservation seedbank in the country, housing more than 5,242 Australian plant species, including about 69% of NSW Biodiversity Conservation Act species. It supports long-term conservation through ex situ conservation including tissue and seed collections and seed and germplasm research. It provides an insurance policy for future generations to prevent plant species going extinct, and supports propagation and cultivation research of native species. The Australian PlantBank also contributes to domestic and international conservation programs through initiatives such as the Millennium Seed Bank Partnership with the Royal Botanic Gardens, Kew.
- The new **Research Centre for Ecosystem Resilience (ReCER)** aims to restore, repair, and protect native ecosystems threatened by challenges such as climate change, environmental degradation and invasive pathogens. Its initiatives include programs that study the genetics of threatened species.
- Established in 1852, the **Daniel Solander Library** is the oldest botanical research library in Australia and houses more than 250,000 collections, including important books, journals, botanical illustrations, and archaeological artefacts.
- The **PlantClinic** conducts world-class research into plant disease and provides a service to diagnose disease and other plant health issues for a range of clients ranging from home gardeners, local government and land management agencies, which has important implications for these stakeholders particularly with respect to biosecurity.
- With the **Living Collection**, which is comprised of more than 17,500 individual species, the Trust offers the public a glimpse into scientists' insights in horticulture, medicine, and conservation, as well as a better understanding of First Nations culture and bush foods.
- The **Centre for Education and Engagement (CEE)** provides transformative learning experiences through volunteer and community engagement programs, First Nation Cultural Knowledge and inquiry based primary and secondary school programs with a focus on STEM content, inspiring the next generation of talent. The Centre also leads community outreach and volunteering for the Trust.
- Three **nurseries** (one at each Garden) which contribute to the propagation and conservation of threatened and at-risk flora. As part of the Institute, these nurseries help ensure the survival of plants and find solutions to biodiversity issues by propagating and researching plants under threat from climate change and key threatening processes.

The majority of the Trust's research and scientific assets are publicly and freely available for a wide variety of users throughout Australia and internationally. One example is the Restore & Renew project (see case study below).

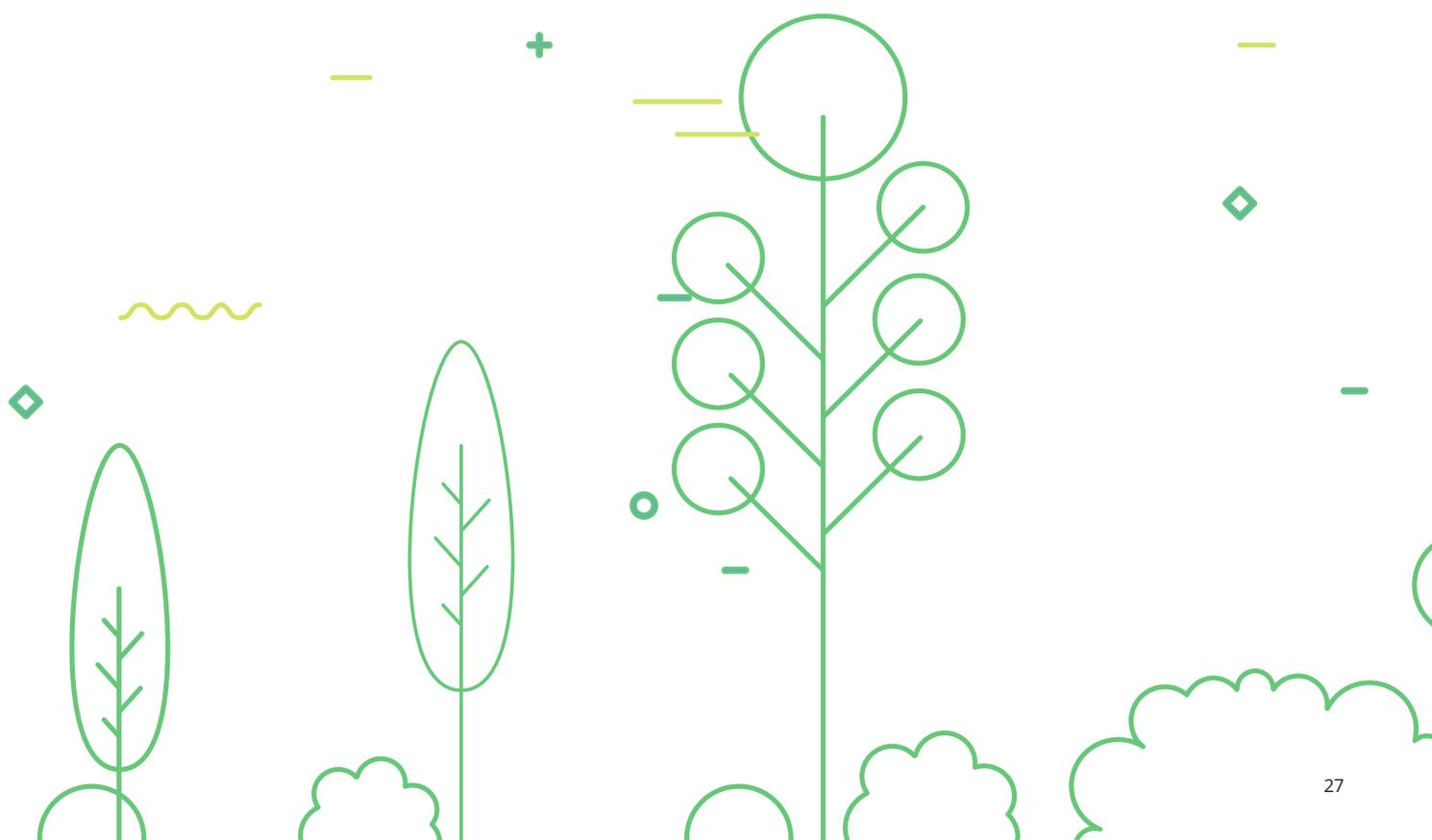
The expertise of the Trust's staff and its valuable scientific assets has meant that the Trust is a sought-after partner organisation for scientific research including organisations such as universities in Greater Sydney, interstate and internationally the CSIRO, Australasian herbaria and other Botanic Gardens located in other states and territories. These partnerships have the benefit of attracting public funding for research projects, beyond what would have been attained by a single organisation and fostering collaboration in producing scientific knowledge.

Numerous universities frequently collaborate with the Trust. These include universities in the Sydney region (Macquarie University, University of New South Wales, University of Sydney and Western Sydney University), in other states (e.g. University of Queensland, University of Melbourne, Curtin University, Murdoch University) and internationally in Europe, North America, Asia and Africa.. These partnerships benefit from the long-term datasets developed by the Trust which help to inform analysis around changes in plant ecology over time and from the specific high quality expertise that the Trust scientists can provide.

Students from these universities also gain invaluable scientific experience at the Trust by assisting with research and collection tasks. This provides students with greater experience in roles they may attain in the future and builds their capability and interest in the area and in their contribution they provide to society in understanding plants, fungi and natural ecosystems.

The National Herbarium of New South Wales also contains well-documented records of native flora which can be used to obtain information about plant diversity and distribution in regions across NSW, to help with restoration and conservation. The Trust is working closely with the NSW and Federal Governments and other organisations to discover, understand and document native plants. The work supports the conservation of threatened species and provides fundamental and authoritative information. The Flora of NSW is available electronically through NSW Flora Online and contains keys, descriptions and images of plants found in NSW. This information is used by government, industry, consultants and the public to identify plants, with over 28,000 users per month.

The Trust provide a Botanical Information Service including plant identification and botanical information, including current scientific names and details of the distribution. This information helps in areas such as threatened species assessments, environmental impact statements, weed identification and where plants have caused poisoning of animals.



Using science to inform land restoration projects through Restore & Renew

The Restore & Renew project aims to provide land management organisations with an accessible source of information about the genetic suitability of plant species to certain environments.

Using Diversity Arrays Technology (DArT) genomic sequencing and environmental modelling, the Restore & Renew project is producing comprehensive information on how plants evolve over time. This information can be used to enhance the success of restoration processes that aim to recreate healthy and resilient ecosystems.^{xxxiv} In a world-first, this genomic sequencing is being conducted on a systemic level rather than being focused on a particular species.

Since its launch in 2017, the Restore & Renew project has expanded significantly. According to Dr Maurizio Rossetto, Head of the Research Centre for Ecosystem Resilience, “we have collected data on more than 120 species so far. This is very exciting as now we are starting to see practical outcomes and decisions based on our research.”

One example is the direct support that the Trust provides to local non-governmental organisations (NGOs) involved in restoration projects in the northern NSW rainforests by providing information on safe areas for rare species and identifying seed sources that will provide greater biodiversity or climate resistance to the area. With numerous community and industry groups seeking to restore species but lacking the expert knowledge on how to do so, the Trust offers specialised advice to support land restoration.

The insights gained from Restore & Renew are available on a user-friendly Restore & Renew webtool that provides maps of where seeds can be sourced for ecological restoration projects to maximise their health and longevity. In 2020, a second site-matching webtool was added, which identifies areas that reflect current and future climatic conditions for a selected site.^{xxxv} Maurizio explains how this information will be increasingly important as “the impacts of climate change, land degradation, natural disasters, and urban development all influence the local environment’s ability to sustain particular species.”

On an international scale, the Trust is forging partnerships with countries such as Madagascar and Malaysia to share best practices for genomic sampling. While these collaborations are currently at the theoretical level due to the difficulties posed by COVID-19, Maurizio hopes to initiate work together on a more practical level soon.



4.1 Valuing scientific research

The value of Trust’s scientific assets and its research is difficult to quantify due to its unique nature and numerous potential applications both now and in the future. While some of this value will be captured in the economic contribution through research grants and wages to scientists, the economic contribution does not capture the outputs of the scientific research. The research undertaken by Trust into land management and ecological restoration practices can also lead to substantial financial savings through avoided costs, such as stopping the spread of a pathogen in Australian crops. Indeed, there has been major investment by various State and Commonwealth Governments into scientific research led by the Trust.

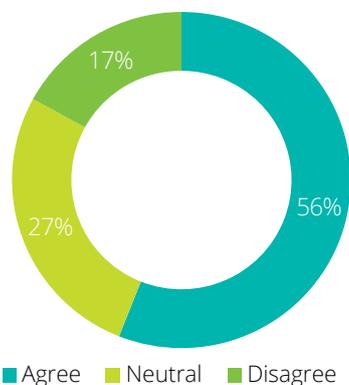
The return on scientific research more broadly has been quantified in previous studies. A number found that publicly funded research and innovation generates approximately a 20% annual return.^{xxxvi, xxxvii} Another study focused on the impact of public expenditures

on agricultural research estimated a 45% social rate of return per year.^{xxxviii} The 20% estimated rate of return has been used by Oxford Economics to estimate the total value of the Royal Botanic Gardens Kew’s scientific research to the UK economy, which was valued at £56.2 million.^{xxxix} Other research has found that an individual’s willingness to pay (WTP) for the conservation of endangered flora and fauna is \$182 per year.^{xl}

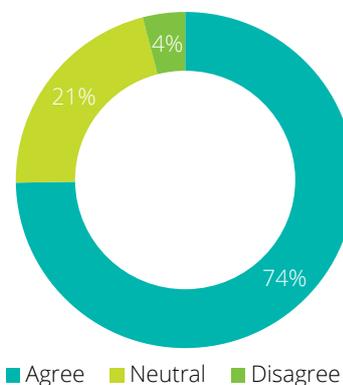
The survey of Australian residents suggests that the value of scientific research of the Trust is only partially recognised. More than half (56%) of Australian residents indicated that they were aware of the scientific research undertaken by the Trust to conserve and protect Australian plant species. Meanwhile, the important conservation and restoration work undertaken by the Trust is well-recognised by the Australian community, with just under three-quarters (74%) of Australians stating they are aware of these activities (see **Chart 4.1** and **Chart 4.2**).

Chart 4.1 and Chart 4.2: Proportion of respondents that agreed with the following statements:

I am aware of the scientific research undertaken by the Trust to conserve and protect Australia’s plant species



The Trust undertakes important conservation and restoration work



Source: Deloitte Access Economics (2021)

One potential contributor to the awareness of Trust’s conservation work could be the role the organisation played to safeguard Australia’s unique biodiversity following the Australian Black Summer Bushfires in 2019-20.

Between July 2019 and March 2020, over 24 million hectares of land was burnt across Australia, including areas at the Blue Mountains Botanic Garden Mount Tomah. Dr. Brett Summerell, Director of Research and Chief Botanist at the Trust estimated that 7 billion trees were burnt during the event, with more recent information indicating the number is likely to be even higher. The scale of the bushfires meant areas that were typically not exposed to bushfire and therefore less resilient to fire – such as rainforests – were impacted.

The Trust has promoted a scientific response to the ecological damage caused by the Black Summer Bushfires 2019-20 to ensure any recovery efforts are effective in the long term. Again, the long-term data sets were useful in informing the response. The National Herbarium of NSW provides detailed records of species of plants that previously existed within affected regions so that regions could be restored to their former states.

Research on the genetics of plants is being used to ensure both species and genetic diversity of plants used for restoration is conserved and enhanced. The Trust is working with bush regeneration groups at affected sites to share this information. This has

involved increasing the awareness of the scientific research for land management as this approach may take longer initially to rollout but can be more effective over the longer term.

In addition to the immediate recovery following the bushfire, the Trust has sought to increase the collection rate of the Australian PlantBank for those species that have become recently endangered. The Australian Seed Bank Partnership, of which the Trust is a member has received \$3.3 million in funding from national and international sources, as well as corporations, over the next year and a half for collecting seed and plant specimens and monitoring plant populations.

Seedbanking to safeguard Australian biodiversity

The Australian PlantBank plays an integral role in safeguarding biodiversity in Australia through its collections of threatened plant species. These species are chiefly preserved using seed banking, but alternative methods such as tissue culture and potted collections are used when seed banking is not possible. To store seeds, PlantBank dries the seeds to around 5% moisture content, then freezes them at -20°C. If required, the seeds can be withdrawn from storage at a later date and reestablished in a suitable area. Currently, 10% of Australian plant species are threatened with extinction, making the need for preservation ever more pressing.^{xii}

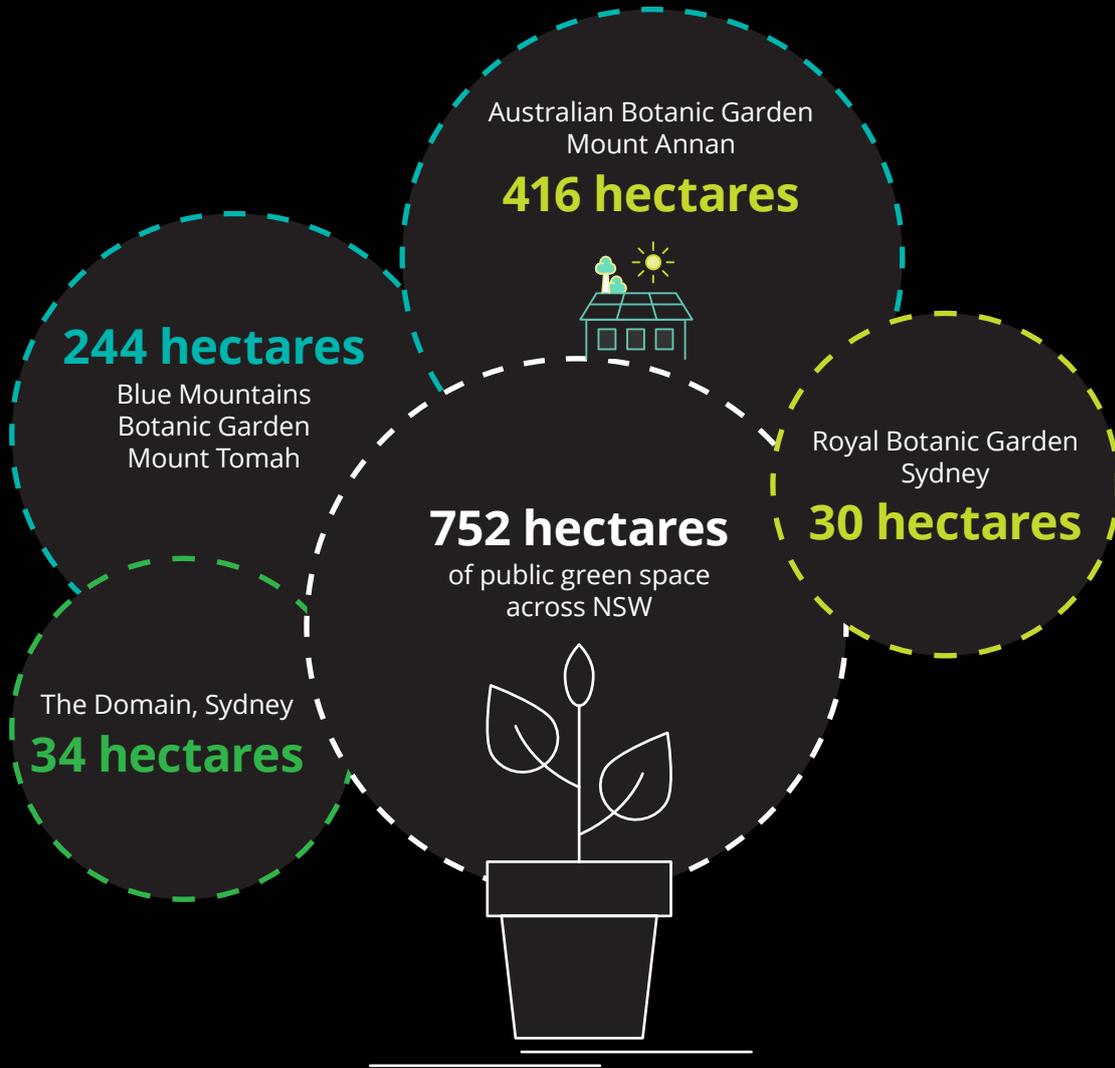
However, not all species are amenable to the drying and freezing process required for standard seed banking, particularly those from rainforest regions. For example, of the 162 rainforest species assessed through the Rainforest Seed Conservation Project, 22% were sensitive to the drying required and not suitable for seed banking at all. Of the 74% potentially suitable for seed banking, 10% were only partially tolerant of drying to 5% moisture content and 16% were sensitive to freezing at -20°C.

Research Scientist, Dr Karen Sommerville and fellow researchers under the Rainforest Seed Conservation Project seek to develop innovative storage techniques for these more difficult species. Notable examples are the four macadamia species that are all currently threatened in their natural environment and are endemic to Australia. Karen describes how her team is working to preserve macadamia species by cracking the seed open and extracting the embryonic axis rather than preserving the whole seed. This investigation delivers important insights into seed conservation for PlantBank, and also benefits the macadamia production industry.

Another prominent example that required an innovative alternative to seed banking was native guava. Native guava populations have been substantially reduced due to pervasive myrtle rust, and the species is now listed as critically endangered. One method that researchers at PlantBank have deployed to preserve this species is to collect cuttings from as many individual plants as possible, using those cuttings to produce a collection of potted plants, and then using the potted plants to establish the species in tissue culture.^{xiii}

The Trust team often works with other organisations to ensure the preservation of a number of threatened species. For example, the Trust, the Australia Tropical Herbarium, and other botanic gardens have been engaged in the conservation of 70 species endemic to tropical mountaintops in Queensland that are threatened by climate change. Internationally, the Trust is in the process of developing a memorandum of understanding with Singapore Botanic Garden, where information on rainforest preservation methods will be shared to foster better protection of threatened species.

5. Environmental role



5. Environmental role

The Trust plays a critical environmental role in helping to safeguard the world's plant diversity and native fauna, contributing to research and conservation efforts, and helping to educate the public about environmental issues and sustainability. The Trust also has a positive impact on visitors' environmental attitudes.^{xliii}

The three Botanic Gardens and the Domain are environmental assets in and of their right, providing 752 hectares of public green space across NSW. These areas are also home to a range of native fauna, such as microbats, grey-headed flying foxes, parrots, and migratory birds. They support and enhance ecosystem services, **helping to preserve Australia's unique biodiversity and mitigating the effects of climate change**. These services help to produce benefits for businesses and households, such as urban cooling, absorbing harmful pollutants, and counteracting carbon emissions by acting as a natural carbon sink.

This Chapter provides a suggested framework for understanding the environmental contributions of the Trust, drawing on the System of Environmental Economic Accounting Ecosystem Accounting (SEEA EA) framework.

5.1 Ecosystem services accounting

Environmental accounting, for which Australia has a national strategy,^{xliv} integrates environmental and economic data to help enable sustainable decision-making. The SEEA framework reflects the first international standard of environmental accounting and was adopted by the United Nations in 2012. However, it was not until March 2021 that the framework was extended to include ecosystem accounting (SEEA EA).

Ecosystem accounting provides a way to understand and quantify the services provided by ecosystem assets. Examples of ecosystem assets include forests, rivers, and oceans.⁷

Ecosystem accounting typically follows a spatial approach, which involves identifying the location and size of ecosystem assets, the services they provide, the location of beneficiaries (including households, businesses, and governments), and their state of health or condition.

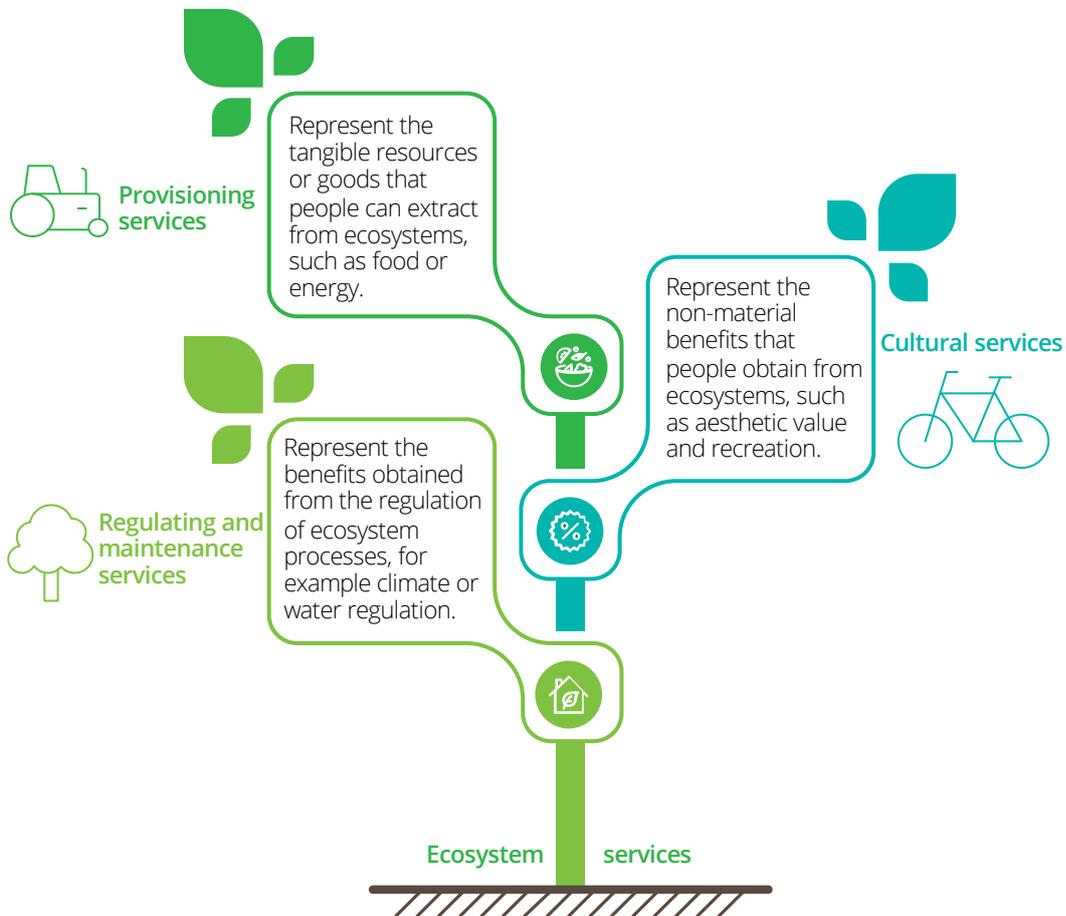
There are a number of core accounts under SEEA EA,^{xlv} including:

- **Ecosystem extent account:** records the total area of each ecosystem within a specific area and are usually classified by type.
- **Ecosystem condition account:** records the condition of ecosystem assets based on their quality.
- **Ecosystem services flow account (physical and monetary):** records the supply of ecosystem services by ecosystem assets, and the use of these services by economic units.
- **Monetary ecosystem account:** records changes in stocks (additions and reductions) of ecosystem assets.

The SEEA EA recognises three broad categories of ecosystem services produced by ecosystem assets. These are outlined in the Figure overleaf.

⁷ Ecosystems are typically classified using the IUCN Global Ecosystem Typology. A single ecosystem could be made up of various types e.g., artificial surfaces, woody crops, grasslands, etc.

Figure 5.1: Overview of ecosystem services.



Source: Deloitte Access Economics based on SEEA UN Technical Recommendations (2012).

Note: The Millennium Ecosystem Assessment also considers supporting services, which are services necessary for the production of all other ecosystem services.

Under the SEEA EA framework, only when there is a beneficiary (or a user) of the service, is there a 'transaction'. This transaction can be categorised in physical or monetary units and forms the basis of valuation.

While it is still a relatively new field, SEEA EA has already been used for a wide range of applications around the world. For example:

- In Uganda, species accounts helped to demonstrate the economic value of the Shea tree.^{xlvi}
- In South Africa, ecosystem extent and condition accounts for rivers helped to inform their National Water and Sanitation Plan.^{xlvii}
- In August 2017, the ABS released experimental environmental-economic accounts for the Great Barrier Reef, including ecosystem extent, condition and service accounts.^{xlviii}

5.2 Application to the Trust

The SEEA EA framework could be used to understand the ecosystem services and benefits derived from the Trust's sites.

A high-level example of the application of the SEEA EA framework to the Trust's sites, and the ecosystem services they produce, is outlined below.

#	Step		Application to the Trust
1	Asset E.g. botanical gardens		The model starts with identifying an ecosystem asset and measuring their extent (in this case, the three Botanic Gardens and the Domain cover 752 hectares of public green space across NSW). This step would also define the ecosystem type, including grassland, wetlands and forests, that make-up the asset.
2	Condition E.g. plant diversity		The ecosystem asset can be further described in terms of its condition, through indicators that reflect its overall quality. As an example, this could include habitat cover, soil depth, or plant diversity.
3	Service E.g. carbon sequestration		One example ecosystem service provided by the Trust is its role in carbon storage. The ability for trees to act as a carbon sink is well documented, and previous research by Deloitte Access Economics estimated that the Trust provides approximately 8,905 tonnes of carbon storage. ^{xlix} Carbon sequestration is one example of a regulating service.
4	Benefit E.g. improve air quality		There are many benefits of carbon sequestration. As an example, it can help to reduce air pollution and improve air quality, which can lead to health benefits. In fact, previous research estimates that about 3,000 deaths are attributable to urban air pollution in Australia each year. ¹
5	Beneficiaries E.g. households and businesses		These benefits accrue to economic agents – such as households and businesses. Economic valuation techniques can be used to model the value of these benefits. For example, it is estimated that air pollution costs the Australian economy \$24.3 billion in health expenditure each year. ⁱⁱ Through its gas regulation services, the Trust helps to prevent additional health costs from being incurred.

Source: United Nations (2021).

Of course, this example reflects just one of the many benefits attributable to the ecosystem services provided by the Trust. Some other benefits noted in the literature include counteracting the urban heat island effect, improving hydrological process, absorbing harmful pollutants, providing shelter and restoring biodiversity, reducing glare and noise pollution, among many others.ⁱⁱⁱ

The ecosystem services provided by the three Botanic Gardens and the Domain reflect the long-term custodianship of the three Gardens and Domain, as well as the conservation activities, enhancements and investments made by the Trust over that time. For example, increasing diversity within the Trust's living collection could be achieved through the removal of an invasive species (see case study below), while increasing carbon sequestration above base levels may also require additional plantings.

5.3 A way to go

Ecosystem accounting provides a clear opportunity to demonstrate the multiple values of the Trust and support effective decision-making and management. Such explicit consideration and valuation of ecosystem services along with the economic, social and cultural value will help to improve outcomes for both people and nature. But there is still a way to go.

Above all, new approaches to data are needed. Understanding the stocks and flows of environmental assets and a consistent way to quantify condition of services will be critical to understanding their value over time. While there has been some momentum in this area, there is still much more to be done. Building our understanding of ecosystem services and integrating this into the policy discussion will play a key role in informing the decisions we make moving forward.

Reducing costs of conservation through proactive land management of the African Olive

Originally introduced to Australia in the early-mid nineteenth century, the African Olive has caused widespread ecological damage to the Australian landscape. John Siemon, Director of Horticulture, ascribes this primarily to the aggressive colonising behaviour and the dense canopy that the African Olive plant forms, blocking out sunlight and preventing native grasses and herbs establishing.

In the Australian Botanic Garden Mount Annan, a dense African Olive canopy resulted in a 77% reduction in native understorey species in affected areas. The photos below show the extent of the African Olive expansion, from merely background in 1984 to dominating the landscape in 2014. John explains that “African Olive has become a key threatening process significantly reducing biodiversity smothering native vegetation and limiting fauna to bird species and shade for kangaroos under the canopy.”

Figure 4.1: Mount Annan Summit in 1984 versus 2014



Source: Peter Cuneo (1984) and Scott (2019)

Removing the African Olive requires fast and timely action to prevent further spread. At maturity, an African Olive tree can produce up to 25,000 seeds per annum. This is exacerbated by birds carrying seeds to neighbouring areas. John estimates that more than \$2 million has been invested in removing 85% of a 80-hectare incursion in the Australian Botanic Garden Mount Annan, which would increase to more than \$12 million if the weed had spread to the entire 416 hectares of the site.

Once the area has been cleared of the African Olive, the next step in the restoration journey is to regrow native flora at the Australian Botanic Garden Mount Annan site in an effort to restore the critically endangered Western Sydney Dry Rainforest and Cumberland Plain Woodland biodiversity that once thrived onsite.

Appendix A: Citizen survey

To better understand the use of the three Botanic Gardens and the Domain, as well as social attitudes toward activities held by the Trust, Deloitte Access Economics has conducted a citizen survey of more than 2,000 Australians.

The survey included responses from 1,007 visitors (anyone who had visited one or more of the Trust's sites in the past five years) and 1,042 respondents who are either historic visitors (anyone who had visited one or more of the Trust's sites but not in the past five years) or have never visited any of the Trust's sites.

Fielded during the COVID-19 pandemic in August 2021, results provide a unique perspective into attitudes towards Trust's sites and activities as well as green spaces in general during the crisis.

Demographic profiles of survey respondents, including information on their previous visits to the three Botanic Gardens and the Domain, State of residence, gender, age, employment status, and income levels are summarised in the Tables below.

Table 6.1: Visitor composition of survey respondents by site

	Royal Botanic Garden Sydney	Australian Botanic Garden Mount Annan	Blue Mountains Botanic Garden Mount Tomah	The Domain, Sydney
Visitor	37%	18%	21%	33%
Historic or non-visitors	32%	19%	25%	32%
Never visited	31%	63%	54%	34%
Total	100%	100%	100%	100%

Source: Deloitte Access Economics (2021).

Table 6.2: Visitor composition of survey respondents by state

State	Visited in the past five years	Did not visit in the past five years
NSW	58%	42%
VIC	37%	43%
QLD	35%	65%
SA	32%	32%
WA	20%	80%
TAS	29%	71%
ACT	50%	50%
NT	0.0%	100%

Source: Deloitte Access Economics (2021).

Table 6.3: Gender composition of survey respondents

Gender	Percentage
Male	48%
Female	52%
Other/Prefer not to say	0.4%
Total	100%

Source: Deloitte Access Economics (2021).

Table 6.4: Age composition of survey respondents

Age	Percentage
18-24	11%
25-34	19%
35-44	19%
45-54	17%
55-64	15%
65-74	12%
75+	7%
Total	100%

Source: Deloitte Access Economics (2021).

Table 6.5: State of residence of survey respondents

State	Percentage
NSW	63%
VIC	15%
QLD	12%
SA	4%
WA	4%
TAS	1%
ACT	0.7%
NT	0.1%
Total	100%

Source: Deloitte Access Economics (2021).

Table 6.6: Employment status of survey respondents

Employment Status	Percentage
Employed full-time	42%
Employed part-time	17%
Employed casually	7%
Not in labour force	22%
Unemployed	8%
Student	4%
Total	100%

Source: Deloitte Access Economics (2021).

Table 6.7: Income profiles of survey respondents

Annual Income	Percentage
Less than \$20,000	11%
\$20,000-\$49,999	20%
\$50,000-\$99,999	33%
\$100,000-\$199,999	27%
\$200,000-\$499,999	3%
\$500,000 or more	1%
Did not receive income this year	3%
Total	100%

Source: Deloitte Access Economics (2021).

Appendix B: Economic contribution modelling

Economic contribution studies are intended to quantify measures such as value added, exports, imports and employment associated with a given industry or firm, in a historical reference year. The economic contribution is a measure of the value of production by a firm or industry.

7.1.1 Value added

Value added is the most appropriate measure of an industry's economic contribution to gross domestic product (GDP) at the national level, or gross state product (GSP) at the State level.

The value added of each industry in the value chain can be added without the risk of double counting across industries caused by including the value added by other industries earlier in the production chain.

Other measures, such as total revenue or total exports, may be easier to estimate than value added, but they 'double count'. That is, they overstate the contribution of a company to economic activity because they include, for example, the value added by external firms supplying inputs or the value added by other industries.

7.1.2 Measuring the economic contribution

There are several commonly used measures of economic activity, each of which describes a different aspect of an industry's economic contribution.

- Value added measures the value of output (i.e. goods and services) generated by the entity's factors of production (i.e. labour and capital) as measured in the income to those factors of production. The sum of value added across all entities in the economy equals GDP. Given the relationship to GDP, the value-added measure can be thought of as the increased contribution to welfare.

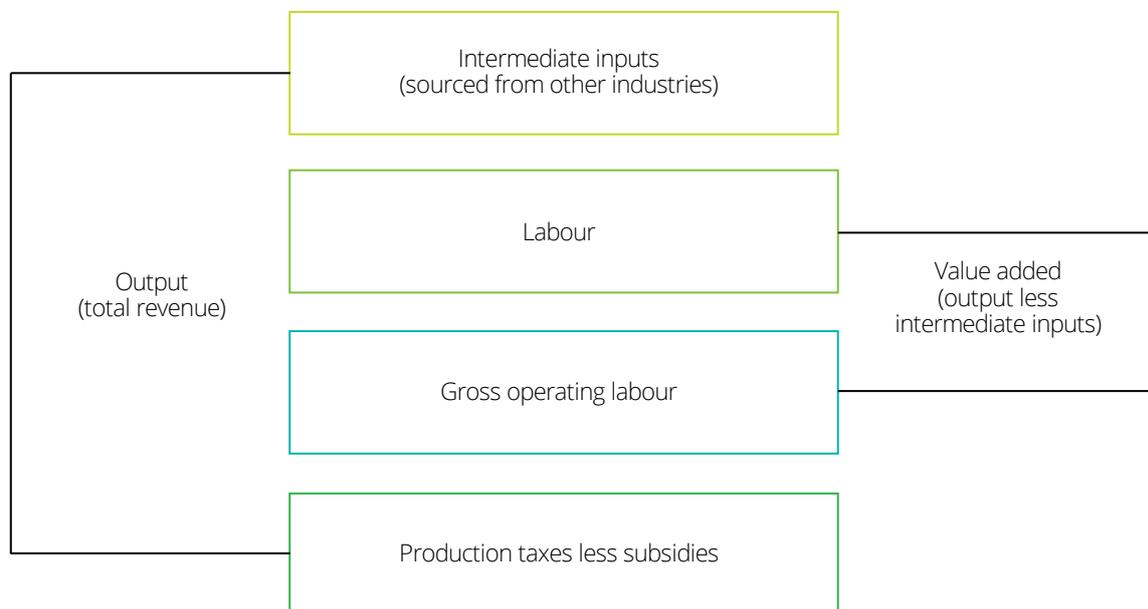
- Value added is the sum of:

- Gross operating surplus (GOS), which represents the value of income generated by the entity's direct capital inputs, generally measured as earnings before interest, tax, depreciation and amortisation (EBITDA).
- Labour income, which represents the value of output generated by the entity's direct labour inputs, as measured by the income to labour.
- Tax on production less subsidy provided for production, which generally includes company taxes and taxes on employment (given the returns to capital before tax (EBITDA) are calculated, company tax is not included, or this would double count that tax).

- Gross output measures the total value of the goods and services supplied by the entity. This is a broader measure than value added because it is an addition to the value added generated by the entity. It also includes the value of intermediate inputs used by the entity that flow from value added generated by other entities.
- Employment is a fundamentally different measure of activity to those above. It measures the number of workers that are employed by the entity, rather than the value of the workers' output.

Figure 7.1 shows the accounting framework used to evaluate economic activity, along with the components that make up gross output. Gross output is the sum of value added and the value of intermediate inputs. Value added can be calculated directly by summing the payments to the primary factors of production, labour (i.e. salaries) and capital (i.e. GOS, or profit), as well as production taxes less subsidies. The value of intermediate inputs can also be calculated directly by summing up expenses related to non-primary factor inputs.

Figure 7.1: Economic activity accounting framework



Source: Deloitte Access Economics (2021).

7.1.3 Direct and indirect contributions

The **direct economic contribution** is a representation of the flow from labour and capital within the sector of the economy in question.

The **indirect contribution** is a measure of the demand for goods and services produced in other sectors as a result of demand generated by the sector in question. Estimation of the indirect economic contribution is undertaken in an input-output (IO) framework using Australian Bureau of Statistics input-output tables, which report the inputs and outputs of specific sectors of the economy (ABS 2010).

The total economic contribution is the sum of the direct and indirect economic contributions.

7.1.4 Limitations of economic contribution studies

While describing the geographic origin of production inputs may be a guide to a firm's linkages with the local economy, it should be recognised that these are the type of normal industry linkages that characterise all economic activities.

Unless there is significant unused capacity in the economy (such as unemployed labour) there is only a weak relationship between a firm's economic contribution as measured by value added (or other

static aggregates) and the welfare or living standard of the community. Indeed, the use of labour and capital by demand created from the industry comes at an opportunity cost as it may reduce the amount of resources available to spend on other economic activities.

This is not to say that the economic contribution, including employment, is not important. As stated by the Productivity Commission in the context of Australia's gambling industries:

"Value added, trade and job creation arguments need to be considered in the context of the economy as a whole ... income from trade uses real resources, which could have been employed to generate benefits elsewhere. These arguments do not mean that jobs, trade and activity are unimportant in an economy. To the contrary they are critical to people's wellbeing. However, any particular industry's contribution to these benefits is much smaller than might at first be thought, because substitute industries could produce similar, though not equal gains."

In a fundamental sense, economic contribution studies are simply historical accounting exercises. No 'what-if', or counterfactual inferences — such as 'what would happen to living standards if the firm disappeared?' — should be drawn from them.

The analysis — relies on a national input-output table modelling framework and there are some limitations to this modelling framework. The analysis assumes that goods and services provided to the sector are produced by factors of production that are located completely within the State or region defined and that income flows do not leak to other states.

The IO framework and the derivation of the multipliers also assume that the relevant economic activity takes place within an unconstrained environment. That is, an increase in economic activity in one area of the economy does not increase prices and subsequently crowd out economic activity in another area. As a result, the modelled total and indirect contribution can be regarded as an upper-bound estimate of the contribution made by the supply of intermediate inputs.

Similarly, the IO framework does not account for further flow-on benefits as captured in a more dynamic modelling environment like a Computable General Equilibrium model.

7.2 Sensitivity testing

To estimate the economic contribution for this report, grant funding was averaged over the three years to 2019-20. This differs to the previous report, which considered grant funding in the 2016-17 financial year only.

To determine the sensitivity of results to this change in methodology, the direct economic contribution of the Trust was estimated for 2018-19, keeping the approach consistent with the previous report. The results of this analysis are shown below.

Table 7.1: Sensitivity testing, economic contribution

State	Direct contribution, main results	Direct contribution, 2016-17 approach
GOS	\$5.0	\$21.7
Labour income	\$28.0	\$28.0
Value added	\$32.9	\$49.6

Source: Deloitte Access Economics, RBGDT (2021).

7.1.5 Input-output analysis

IO tables are required to account for the intermediate flows between sectors. These tables measure the direct economic activity of every sector in the economy at the national level. Importantly, these tables allow intermediate inputs to be further broken down by source. These detailed intermediate flows can be used to derive the total change in economic activity for a given sector.

A widely used measure of the spill over of activity from one sector to another is captured by the ratio of the total to direct change in economic activity. The resulting estimate is typically referred to as 'the multiplier'. A multiplier greater than one implies some indirect activity, with higher multipliers indicating relatively larger indirect and total activity flowing from a given level of direct activity.

The IO matrix used for Australia is derived from the ABS IO tables. The industry classification used for input output tables is based on ANZSIC, with 111 sectors in the modelling framework.

Appendix C: Tourism contribution

The Trust visitor data does not break down the visitors into demographics (e.g. international visitors or locals). However, the National Visitor Survey (NVS) and International Visitor Survey (IVS) does provide a breakdown of tourists who visited the botanic gardens. This provides an estimate of international and interstate tourists who visited the botanic gardens in 2019-20.

This breakdown was applied to the numbers of visitors to the three Botanic Gardens and the Domain in 2019-20, based on the Trust annual report. Under this approach it was estimated that there were 143,000 interstate tourists to the three Botanic Gardens and the Domain in 2019-20, and 761,000 international tourists.

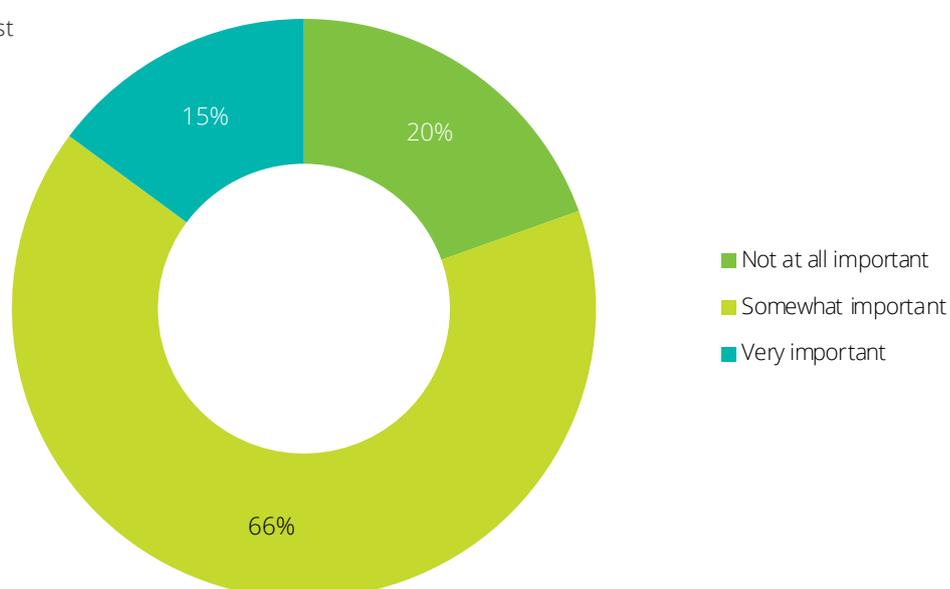
Importantly, the tourism contribution **does not take into account intrastate visits** to the three Botanic Gardens and the Domain. This is because these visits do not represent net additional expenditure in NSW, but rather a reallocation of funding within the State.

The NVS and IVS were then used to estimate the typical daily spending of such tourists by product type. On average it was estimated that a typical interstate tourist to the botanic gardens spends \$273 per day in Sydney, while an international tourist spends \$153 on average each day.

However, not all spending by international and interstate visitors to Sydney can be attributed to the Trust's sites.

Data from the survey was used to determine how much expenditure could be attributed to the Trust as opposed to other sites. Interstate visitors to the three Botanic Gardens and the Domain were asked how important visiting the Trust's sites were in driving their decision to come to Sydney. One in five (20%) said it was not at all important, 66% said it was somewhat important, and 15% said it was very important in their decision to come to Sydney.

Chart 8.1: Importance of the Trust



Source: Deloitte Access Economics (2021).

Based on these findings, we conservatively attributed half a day's worth of expenditure to the Trust for the 66% of visitors who said it was somewhat important in their decision to come to Sydney. A further 15% said it was 'very important' in taking their trip and as such a full day's worth of expenditure was attributed to this group.

For **international visitors**, we drew on a previous survey by Deloitte Access Economics which found that 19% of international visitors nominated the Royal Botanic Garden Sydney as their most preferred attraction in Sydney.^{liii} As such, we attributed one day of their expenditure to the Trust. For the remaining 81% of international visitors, we conservatively attribute half a day's worth of expenditure to the Trust.

8.1 Estimating value added and FTE employment

Value added and FTE employment estimates based on visitor expenditure were calculated using the Tourism Satellite Accounting (TSA) framework, adjusted to NSW.

This framework is the internationally recognised, best practice approach to estimating the economic contribution of tourism. It adapts the concepts and methods of the Australian Bureau of Statistics' national accounting framework in a way that is useful to measuring tourism and comparable to traditional industries.

While conventional IO modelling can be applied to any sector of the economy (including tourism by using an appropriate sector-specific definition of the tourism sector), the TSA approach is Deloitte Access Economics' preferred approach to measuring the economic contribution of the tourism sector. This is because it ensures that the analysis is consistent with international guidelines for measuring and reporting on the economic activity of the tourism sector.

Similar to IO modelling, TSA measures economic value using headline Gross Value Added (GVA) and employment metrics. In the context of the tourism sector, the GVA specifically isolates the value tourism facing industries create as part of a supply chain.

Appendix D: Travel cost methodology

The travel-cost method was used to assess the use value of the Trust. This is a revealed preference technique which aims to estimate the monetary value that people pay to gain access to recreational facilities and other non-market goods such as botanic gardens.^{lv} The costs incurred by visitors to the site are used to determine the recreational value they place on that site. Costs incurred includes fuel and public transport fares as well as the opportunity cost of their travel time is used as a proxy for the value they place on the amenity.

Inputs for the modelling were drawn from the citizen survey, which collected detailed information around visitors' travel to each of the three Botanic Gardens (and the Domain?). Key variables include visitors' reason for visiting, travel costs, travel time and time spent across each of three Botanic Gardens (and the Domain?) (see Table 9.1). Only NSW residents and those who had visited in the last five years were included in the analysis in order to determine a NSW specific use value.

To estimate use value, median expenditure on travel for each site was added to the average cost of leisure time, to get an estimate of the average total cost of

travel per visitor. Leisure time was valued at 50% of an individual's income, as per Queensland Treasury guidelines (2016).^{lv} Income was calculated by deriving the median income reported through the citizen survey for each employment type. For visitors who were unemployed or not in the labour force, the minimum wage in Australia was used. The average Australian income tax rate of 24.1%, measured by the OECD^{lvi}, was adjusted for before deriving the average hourly wage using ABS data on work hours.^{lvii} The weighted hourly wage by employment distribution was calculated for each site to measure average value of leisure time.

Average visitor use values were applied to the total number of visits undertaken by NSW residents at each site. Visitor numbers were drawn from the Trust's annual report, while the proportion of visits undertaken by domestic visitors (as opposed to interstate or international visitors) was derived using Tourism Research Australia's NVS. The total use value across each site was then summed to derive the total use value attributable to the Trust.

Table 9.1: Profile of NSW visitors to the RBGDT sites.

Parameters	Royal Botanic Garden, Sydney	Australian Botanic Garden Mount Annan	Blue Mountains Botanic Garden Mount Tomah
Travel cost (\$, median)	\$6.67	\$10.00	\$13.20
Travel time (hours)	0.54	0.56	0.89
Length of time spent at site (hours)	2.14	2.21	2.88
Primary reason for trip (% of trips)	58%	55%	55%
Use value (average, \$ per person)	\$20.00	\$25.65	\$38.59
Sample size (n)	570	280	331

Source: Deloitte Access Economics (2021).

Appendix E: Social asset value sensitivity analysis

Discount rates are a key determinant in the estimation of social asset values. Discounting reflects how much value is assigned to the future benefits rather than today, otherwise known as time preference.

Typically, in NSW a rate of 7% is used, in line with NSW Treasury Guidelines.^{lviii} However, many economists argue that a lower discount rate should be used. For example, the UK HM Treasury Green Book recommends a standard rate of 3.5%.^{lix}

Discounting is particularly relevant to environmental effects, which are often long-term and exponential in nature. In fact, the HM Treasury recommends a rate of 1.5% where policies affecting environmental outcomes have other health or life impacts.^{lx}

To help account for this uncertainty, sensitivity was done on the results using a discount rate of 1.5% and 7% respectively. These results are shown in the Table below.

Table 10.1: Social asset value of the Trust using different discount rates (\$millions)

Discount rate	Social asset value
3.5% (Main results)	\$4,485
1.5%	\$6,166
7%	\$2,731

Source: Deloitte Access Economics (2021).

Results were also tested over different time horizons. While the main results discounted benefits over a 30-year time period, sensitivity testing looked at the impact of estimating benefits over a 20-year and 50-year time span, as shown below.

Results were also tested over different time horizons. While the main results discounted benefits over a 30-year time period, sensitivity testing looked at the impact of estimating benefits over a 20-year and 50-year time span, as shown below.

Table 10.2: Social asset value of the Trust over different time periods (\$millions)

Time period	Social asset value
30 years (Main results)	\$4,453
20 years	\$2,869
50 years	\$8,215

Source: Deloitte Access Economics (2021).

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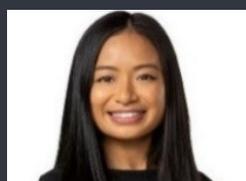
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