Hort Innovation

Final Report

Economic impact assessment for Hort Frontiers: An evaluation of *Which plant where, when and why database for growing urban green space* (GC15002)

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Delivery partner:

AgEconPlus

Project code:

HA20000

Project:

Economic impact assessment for Hort Frontiers (HA20000)

Disclaimer:

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Hort Frontiers invests funds from a wide range of co-investors including businesses, research agencies, government departments, education institutions, the Australian Government and horticulture levies. Economic impact assessment of these investments is required to meet Hort Innovation obligations under its Organisational Evaluation Framework, its Statutory Funding Agreement, and to demonstrate a return to a diverse set of co-investors and other stakeholders.

This economic impact assessment of the Hort Frontiers program addresses these requirements through the completion of a series of project-specific, ex-post, independent impact assessments of the program. The economic impact assessment was completed using guidelines prepared by the Council of Rural Research and Development Corporations (CRRDC 2018).

The project assessed in this impact assessment *was GC15002: Which plant, where, when and why database for growing urban green space*. The Hort Frontiers project has delivered exceptional bio-climatic modelling, a solid and rigorous database, and an easy-to-use online tool for making planting decisions in urban areas. Stakeholders who participated in the project and who make use of the online tool (and project generated best practice guides and factsheets) will be more informed about what to plant where, and more likely to successfully establish diverse and resilient urban green spaces.

Technical summary

This report presents the results of an impact assessment of a Hort Frontiers Green Cities Fund project *GC15002: Which plant where, when and why database for growing urban green space*. The project was funded by Hort Innovation over the period July 2017 to March 2022.

The investment was first analysed qualitatively within a logical framework that included activities and outputs, outcomes, and impacts. Actual and/or potential impacts then were categorised into a triple bottom line framework. Principal impacts identified were then considered for valuation in monetary terms (quantitative assessment). Past and future cash flows were expressed in 2021/22-dollar terms and were discounted to the year 2022/23 using a discount rate of 5% to estimate the investment criteria and a 5% reinvestment rate to estimate the modified internal rate of return (MIRR).

The project (GC15002) has delivered exceptional bio-climatic modelling, a solid and rigorous database, and an easy-to-use online tool for making planting decisions in urban areas. Stakeholders who participated in the project and who make use of the online tool (and project generated best practice guides and factsheets) will be more informed about what to plant where, and more likely to successfully establish diverse and resilient urban green spaces. Successful, climate adapted plantings will establish a virtuous circle, that encourages additional urban planting.

Total funding from all sources for the project was $14.97 million (present value terms). The investment produced estimated total expected benefits of $46.43 million (present value terms). This gave a net present value of $31.46 million, an estimated benefit-cost ratio of 3.1 to 1, an internal rate of return of 13.2% and a modified internal rate of return of 8.9%.

Keywords

Impact assessment, cost-benefit analysis, nursery, landscaping, urban forest, species selection, climate change, heat tolerance, drought tolerance, urban greening.

Introduction

The Hort Frontiers program facilitates collaborative cross-industry investments that are focused on high-risk, transformative research, development, and extension (RD&E) with the potential for significant impact. Investments are longer-term, complex, and focus on traditionally underinvested themes.

Hort Frontiers invests funds from a wide range of co-investors including businesses, research agencies, government departments, education institutions, the Australian Government and horticulture levies. Economic impact assessment of these investments is required to meet Hort Innovation obligations under its Organisational Evaluation Framework, its Statutory Funding Agreement, and to demonstrate a return to a diverse set of co-investors and other stakeholders.

This economic impact assessment of the Hort Frontiers program addresses these requirements through the completion of a series of project-specific, ex-post, independent impact assessments of the program. A total of eight (8) RD&E investments (projects) were selected through a stratified, random sampling process. The projects, and the total life-of-project (LOP) value of their Hort Innovation managed investment in nominal terms are described in Table 1.

Table 1: Hort Frontiers Project Sample for Impact Assessment

Hort Frontiers Fund	Project Code	Project Title	Total LOP Investment[(a)] (nominal $)
Advanced Production Systems	AS19005	Australian Protected Cropping RD&E Strategy 2030	140,322
Fruit Fly	HG14033	SITplus: Raising Qfly Sterile Insect Technique to World Standard	20,502,806
Green Cities	GC15002	Which plant where when and why database	10,572,393
Health, Nutrition & Food Safety	HN15000	Innovative Cold Plasma for Horticultural Industries	5,080,321
International Markets	AM15007	Market Development Program - Almonds	925,499
International Markets	AM17001	Developing a national systems approach for meeting bio-security requirements to access key Asian markets	4,830,614
Leadership	LP15001	Global Masterclass Horticulture	3,235,805
Pollination	PH16004	Securing pollination for productive agriculture: guidelines for effective pollinator management and stakeholder adoption	2,182,967

(a) Hort Innovation managed investment

The project population for each fund from which the random sample was selected included completed projects where a final deliverable had been submitted and accepted in the three-year period from 1 July 2019 to 30 June 2022.

The projects in the random sample were selected such that:

(1) The total LOP sample value (in nominal dollar terms) represented at least 10% of the total Hort Innovation managed investment in the overall Hort Frontiers project population, and
(2) The total Hort Innovation managed investment in each project was greater than, or equal to, $100,000 (to exclude 'trivial' projects).

Further, the random sample was stratified first by Hort Frontiers Fund, to ensure all relevant Funds were represented, and then by LOP value range.

The final stratified random sample shown in Table 1 included the required eight (8) projects. At least one project from each Hort Frontiers Fund was selected and at least one project from each LOP range (as defined by Hort Innovation). The final random sample had a total nominal LOP value of $47.47 million (Hort Managed investment) equivalent to approximately 51.6% of the overall total nominal LOP value in the population. Also, the final random sample included one project completed in 2019/20, two completed in 2020/21, and five completed in 2021/22 (all relevant years represented).

Project GC15002: *Which plant where, when and why database for growing urban green space* was one of the investments randomly selected and is analysed in this report.

Methodology

The impact assessments followed general evaluation guidelines that are now well entrenched within the Australian primary industry research sector including Research and Development Corporations, Cooperative Research Centres, State Departments of Agriculture, and some universities. The approach includes both qualitative and quantitative assessment components that are in accord with the impact assessment guidelines of the Council of Rural Research and Development Corporations (CRRDC) (CRRDC, 2018).

The evaluation process followed an input to impact continuum and involved identifying and briefly describing project objectives, activities, outputs, actual and expected outcomes, and any actual and/or potential impacts associated with project outcomes. The principal economic, environmental, and social impacts then were summarised in a triple bottom line framework.

Some, but not all, of the impacts identified were then valued in monetary terms. The decision to value an impact identified was based on:

- Data availability and information necessary to form credible valuation assumptions,
- The complexity of the relevant valuation methods applicable given project resources,
- The likely magnitude of the impact and/or the expected relative value of the impact compared to other impacts identified, and
- The strength of the linkages between the RD&E investment and the impact identified.

Where impact valuation was exercised, the impact assessment used cost-benefit analysis (CBA) as a principal tool. The impacts valued are therefore deemed to represent the principal benefits delivered by the project. However, as not all impacts were valued, the investment criteria reported for the individual investment evaluated are likely to represent an underestimate of the true performance of the investment.

Background and Rationale

Australia is a highly urbanised nation and the share of people living in urban areas is forecast to increase over time. Urban areas face significant environmental challenges, including urban heat and extreme climate events, poor water and soil management, air pollution, and loss of biodiversity. In addition to the urban heat island effect, climate change predictions are that Australian cities will face hotter temperatures, more intense and more frequent storms, bushfires, and potentially new pests and pathogens.

Urban green areas can provide nature-based solutions to these challenges and deliver a broad range of benefits including climate change mitigation through carbon uptake and storage, adaptation through urban cooling and better stormwater management, air pollution mitigation, enhanced biodiversity, and even improved human health and wellbeing.

To reap the benefits from urban green areas, Australians need to ensure that their urban plant species are resilient to climate change and that urban green spaces are planned, planted, and managed so that they can thrive and deliver the desired benefits. There are many components of building this resilience, ranging from the individual plant level to the precinct and city-scale.

The Which Plant Where project was initially developed out of earlier urban greening initiatives including the South Australian Botanic Garden's plant selector tool, the City of Melbourne's Urban Forest Strategy, and the 202020 Vision Plan. The 202020 Vision was a cross sector, multi-stakeholder initiative designed to build the support, collaboration, inspiration, tools, and framework needed to make Australian urban areas 20% greener by 2020.

Rationale

In recent years there has been an increase in the development of urban forest strategies at both local and state government level. However, while these strategies have focused on building resilience through urban green initiatives, there has been a lack of evidence to guide green space investment. The Which Plant Where project was to build the evidence base to 1) reduce vulnerability and risk to urban and peri-urban plantings from harsh environmental conditions; 2) improve the resilience and tolerance of green spaces to extreme heat and drought; 3) increase the diversity of species used in urban green spaces; and 4) support biodiversity values of urban plantings.

Findings from the project were to be relevant to a wide variety of stakeholders including plant growers and the nursery trade, plant specifiers and practitioners in government and industry, urban forest managers, arborists, landscape architects, and urban planners. To ensure project success, a "user-centred approach" was required – researchers were to work closely with stakeholders to co-design research and development tools and resources. The project was to produce a series of tools and processes to support urban greening, including planning, stakeholder engagement, climate-ready species selection, site condition evaluation and preparation, and ongoing maintenance and monitoring regimes.

Project Details

Summary

Project Code: GC15002.

Title: Which plant where, when and why database for growing urban green space.

Research: Macquarie University.

Project Leader: Professor Michelle Leishman.

Period of Funding: July 2017 to March 2022.

Objectives

The project was developed to facilitate sustainable green cities by unlocking opportunities to develop resilient urban green spaces and drive sustainable market growth for the horticultural industry. Specifically, the overall aims of the five-year program of work were to:

- Identify plant species that will be suitable in Australian cities under climate change.
- Increase the diversity of species planted in Australian urban landscapes.
- Drive market growth for the horticultural industry.
- Facilitate sustainable and resilient green spaces.
- Develop tools and resources to be used by a wide range of stakeholders.

Logical Framework

Table 2 provides a detailed description of project GC15002 in a logical framework.

Table 2: Logical Framework for Project GC15002

Activities	The research program consisted of four interrelated modules: • Module 1 – Species attributes and climatic tolerance – collation of a database of over 2,500 species, hybrids and cultivars including traits on plant form, environmental tolerances, co-benefits (shade, carbon sequestration, biodiversity) and risks. Bioclimatic modelling was undertaken for all species for which sufficient occurrence data were available, resulting in the development of national-level maps of climatic suitability for each species. • Module 2 – Successes and failures – 12 "Living Labs" were developed in collaboration with local councils in QLD, NSW, and VIC, information on urban forest inventories and on successes and failures of urban plantings was compiled, biodiversity and cooling benefits of urban plants were assessed, and an Urban Forest demonstration site was developed. • Module 3 – Heat and drought tolerant species – a protocol for assessing heat and drought tolerance of species was developed. A total of 113 plant species were grown in common glasshouse environments and subjected to an experimental heatwave and/or drought. • Module 4 – Species selection online tool – a world first online climate-ready plant selector tool was developed. Research outcomes from Modules 1-3 were integrated and translated into the online plant selector tool as well as best practice guidelines and articles that are easy to understand by industry stakeholders. The tool provided unique evidence-based support for urban greening initiatives and was supported with a fully developed business plan. The business plan was presented to Hort Innovation. • To deliver the four modules more than 1,000 industry stakeholders were consulted. Stakeholders were engaged through National Roadshows, national industry events, substantial media coverage, state industry events, research outcome webinars, as well as workshops and focus groups for the development of the online selector tool. • Project presentations were made in a wide variety of forums, including for example, Dr. Renee Prokopavicius talk entitled "Finding species that can tolerate heat and drought in Australian cities" a

	presentation to the Ecological Society of America, New Orleans, USA. Professor Leishman was interviewed by Robin Powell, Sydney Morning Herald (SMH) to discuss the Which Plant Where project and the project was featured on the ABC's Gardening Australia 30th Anniversary Special. • The "Which Plant Where" tool was released in May 2022. The tool was designed to be self-sustaining, via subscription funding, and enable regular updates and expansion. • Recommended next steps for the tool include a national promotional campaign and exploration of extensions to enable integration with other urban planning and nursery industry tools, input of data from practitioners to improve modelling outputs and recommendations, and a discussion forum to enable communication and sharing of knowledge within the urban greening industry. Macquarie University was to support promotion of the "Which Plant Where" tool throughout 2022 including salary support for a Business Development Manager. The vision is for the "Which Plant Where" tool to become the "go to" website for the urban greening industry and a collaborative hub for the exchange of information.
Outputs	• Project documents included milestone reports, a stakeholder engagement report, a Climate Suitability Model report, A Plant Selection Tool report, a Heat and Drought Tolerance Index, a Successes and Failures analysis, a Which Plant Where Living Lab brochure, a Thrive and Survive report, and a 2022 comprehensive final report. • Project materials targeting industry stakeholders included factsheets, best practice guidelines, technical reports, and materials. Extension materials included presentations and webinars. Articles were prepared and published in industry media including the Nursery Papers. The project produced 16 referenced articles and scientific publications. • The project/tool website is Home | Which Plant Where. During the project the website provided a portal for hosting media interviews, research updates, team profiles, and social media links. • Post project completion the website tool is available as both a public resource and a subscription-based service. It is anticipated that a subscription service will provide a revenue stream to ensure the tool is regularly updated and self-sustaining. In August 2022 the tool had less than twenty subscribers. A target of 50 to 100 subscribers has been set for the first year. • The website allows selection across more than 2,500 plant species, cultivars, and hybrids for suitability by postcode, growth form, urban space type, height/spread, shade tolerance, leaf loss, origin (native/exotic), soil type, carbon sequestration, and biodiversity. Suitability in any given location in Australia is given for three future climatic scenarios – 2030, 2050, and 2070. Subscribers can access up-to-date scientific climate modelling and mapping as well as functionality such as co-benefits calculator, canopy cover estimator, and a landscape palette creator. • At the beginning of 2022 the website had received 21,000 unique user visits with most visits coming directly to the site or through search engines, and 25% from other referrals such as media links on ABC, The Conversation, and SMH. Most social media came from Facebook (68%), LinkedIn (12%), and Twitter (12%). • The project website operates under the tagline "Future proof urban landscape projects with climate-ready species".
Outcomes	• Stakeholders who participated in the project and who make use of the website (and project generated best practice guides and factsheets) will be more informed about what to plant where, and more likely to successfully establish diverse and resilient urban green spaces. Successful, climate adapted plantings will establish a virtuous circle, that encourages additional urban planting.
Potential Impacts	• A potential increase in sales and profit for green life growers (trees, shrubs, groundcover plants, turf) supplying additional demand in urban areas. The tool also helps nurseries make more informed planning and investment decisions with improved information about future plant demand. • An increase in quality of life and health benefits for people in urban areas including improved mental and physical wellbeing with an improved environment, less heat exhaustion, increased willingness to participate in physical exercise, psychological relaxation, and alleviation of stress.

	• Environmental gain in urban areas e.g., mitigation of extreme heat caused by heat islands and a warmer climate, air pollution mitigation, reduction in stormwater damage with vegetation slowing/ absorbing runoff, carbon sequestration, and improved urban biodiversity. • Increased public and industry awareness of the value of urban green spaces and trees as well as the likely impacts of climate change. • Capacity – additional researcher skills in managing complex projects, understanding flora, the impacts of climate change on flora, and developing online databases of benefit to experts and the public. • Capacity – those who work with green life will have additional skills in creating and sustaining resilient urban green spaces. Nursery owners will have additional skills in long-term planning. • Regional spill-over benefits including income, employment, and longevity associated with a more vibrant horticultural industry (nursery, turf, etc.).

Project Investment

Nominal Investment

Table 3 shows the annual investment made in Project GC15002. Hort Frontiers managed funds included financial contributions to the project by Macquarie University.

Table 3: Annual Investment in Project GC15002 (nominal $)

Year (ended 30 June)	HORT FRONTIERS ($)	OTHERS ($)	TOTAL ($)
2018	1,882,105	0	1,882,105
2019	2,117,951	0	2,117,951
2020	2,340,427	0	2,340,427
2021	2,190,853	0	2,190,853
2022	2,041,057	0	2,041,057
Total	**10,572,393**	**0**	**10,572,393**

Source: Hort Innovation executed variation agreement, 26 August 2022

Program Management Costs

For the Hort Frontiers investment the cost of managing the Hort Innovation funding was added to the Hort Innovation contribution for the project via a management cost multiplier (1.143). This multiplier was estimated based on the share of 'payments to suppliers and employees' in total Hort Innovation expenditure (3-year average) reported in the Hort Innovation's Statement of Cash Flows (Hort Innovation Annual Report, various years). This multiplier was then applied to the nominal investment by Hort Innovation shown in Table 3.

Real Investment and Extension Costs

For the purposes of the investment analysis, the investment costs of all parties were expressed in 2021/22-dollar terms using the Implicit Price Deflator for Gross Domestic Product (ABS, 2022). The GC15002 project will require a second project focused on development and extension if "Which Plant Where" is to fulfil its vision of becoming the "go to" website for the urban greening industry and a collaborative hub for the exchange of information.

Impacts

Table 4 provides a summary of the principal types of impacts delivered by the project, based on the logical framework (Table 2). Impacts have been categorised into economic, environmental, and social impacts.

Table 4: Triple Bottom Line Categories of Principal Impacts from Project GC15002

Economic	• A potential increase in sales and profit for green life growers (trees, shrubs, groundcover plants, turf) supplying additional demand in urban areas. The tool also helps nurseries make more informed planning and investment decisions with improved information about future plant demand.
Environmental	• Environmental gain in urban areas e.g., mitigation of extreme heat caused by heat islands and a warmer climate, air pollution mitigation, reduction in stormwater damage with vegetation slowing/ absorbing runoff, carbon sequestration, and improved urban biodiversity.
Social	• An increase in quality of life and health benefits for people in urban areas including improved mental and physical wellbeing with an improved environment, less heat exhaustion, increased willingness to participate in physical exercise, psychological relaxation, and alleviation of stress. • Increased public and industry awareness of the value of urban green spaces and trees as well as the likely impacts of climate change. • Capacity – additional researcher skills in managing complex projects, understanding flora, the impacts of climate change on flora, and developing online databases of benefit to experts and the public. • Capacity – those who work with green life will have additional skills in creating and sustaining urban green spaces. Nursery owners will have additional skills in long-term planning. • Regional spill-over benefits including income, employment, and longevity associated with a more vibrant horticultural industry (nursery, turf, etc.).

Public versus Private Impacts

The impacts identified from the investment are both private and public in nature. Private impacts mostly accrue to green life growers - increased sales and profit. Public impacts include increased health and wellbeing in urban areas, environmental gain in urban areas, increased research capacity, increased capacity in establishing and maintaining urban areas, and spill-overs to regional communities from a more profitable green life industry.

Distribution of Private Impacts

In the first instance, private impacts will be captured by green life growers through additional sales and profit. Over time, benefits will also be realised by other participants in the green life industry including plant specifiers and practitioners in government and industry, urban forest managers, arborists, landscape architects, and urban planners.

Impacts on Other Australian Industries

Project outputs are tailored to the establishment and retention of urban green life through changing climatic conditions. However, the principles employed may also be relevant to other Australian plant industries including tree crops (e.g., apple, pear, almond, macadamia). Tree crop planting guides may benefit from a reworking with climate change forecasts and the results presented as an interactive tool.

Impacts Overseas

GC15002 outputs are tailored for the Australian situation. However, general principles (an interactive tool for determining which plant where for climate change adapted, successful urban green spaces) will be relevant to a wide range of overseas countries. Overseas countries most likely to benefit from a similar tool will be wealthy (can afford to invest in urban green space), and more likely to experience extreme heat in the future (and benefit from cooling shade).

Match with National Priorities

The Australian Government's National Science and Research Priorities and National Agricultural Innovation Priorities are reproduced in Table 5. The project outcomes and related impacts will contribute to National Science and Research Priority 7 as well as priorities 2 and 8. The project will contribute to National Agricultural Innovation Priority 2 – in this case agriculture is broadly defined to include production nurseries.

Table 5: Australian Government Research Priorities

Australian Government Strategies and Priorities	
National Science and Research Priorities[1]	**National Agricultural Innovation Priorities[2]**
1. Food – optimising food and fibre production and processing; agricultural productivity and supply chains within Australia and global markets. **2. Soil and Water** – improving the use of soils and water resources, both terrestrial and marine. **3. Transport** – boosting Australian transportation: securing capability and capacity to move essential commodities; alternative fuels; lowering emissions. **4. Cybersecurity** – improving cybersecurity for individuals, businesses, government and national infrastructure. **5. Energy and Resources** – supporting the development of reliable, low cost, sustainable energy supplies and enhancing the long-term viability of Australia's resources industries. **6. Manufacturing** – supporting the development of high value and innovative manufacturing industries in Australia. **7. Environmental Change** – mitigating, managing or adapting to changes in the environment. **8. Health** – improving the health outcomes for all Australians.	On 11 October 2021, the National Agricultural Innovation Policy Statement was released. It highlights four long-term priorities for Australia's agricultural innovation system to address by 2030. These priorities replace the Australian Government's Rural Research, Development and Extension Priorities which were published in the 2015 Agricultural Competitiveness White Paper. **1.** Australia is a trusted exporter of premium food and agricultural products by 2030 **2.** Australia will champion climate resilience to increase the productivity, profitability and sustainability of the agricultural sector by 2030 **3.** Australia is a world leader in preventing and rapidly responding to significant incursions of pests and diseases through futureproofing our biosecurity system by 2030 **4.** Australia is a mature adopter, developer and exporter of digital agriculture by 2030

Alignment with the Hort Frontiers Green Cities Fund Themes

The Hort Frontiers Green Cities Fund targets four themes (Hort Innovation, 2018):

1) Climate and environment.
2) Metrics and measurement.
3) Culture and community.
4) Knowledge and information.

This project delivers against the first and fourth investment themes.

[1] See: 2015 Australian Government Science and Research Priorities. https://www.industry.gov.au/data-and-publications/science-and-research-priorities
[2] See: 2021 National Agriculture Innovation Policy Statement. https://www.awe.gov.au/agriculture-land/farm-food-drought/innovation/research_and_development_corporations_and_companies#government-priorities-for-investment

Case Study

The following section provides real world feedback on how the outputs of the investment will benefit growers and the nursery industry supply chain.

R&D CASE STUDY: FUTURE PROOFING URBAN LANDSCAPE PROJECTS WITH CLIMATE READY SPECIES

THE CHALLENGE

Establishing long-lasting urban green spaces to mitigate the current and future impacts of climate extremes is a priority for individuals, precinct managers, and government. But how do we know what will thrive and provide urban-area benefits in 2030, 2050 or 2070?

"Which Plant Where" has mapped the climate potential of commonly grown trees, shrubs, and turf. "Which Plant Where" has delivered exceptional bio-climatic modelling, and a solid and rigorous database. The online database is easily interrogated by the public and urban green space professionals.

MEET HAMISH

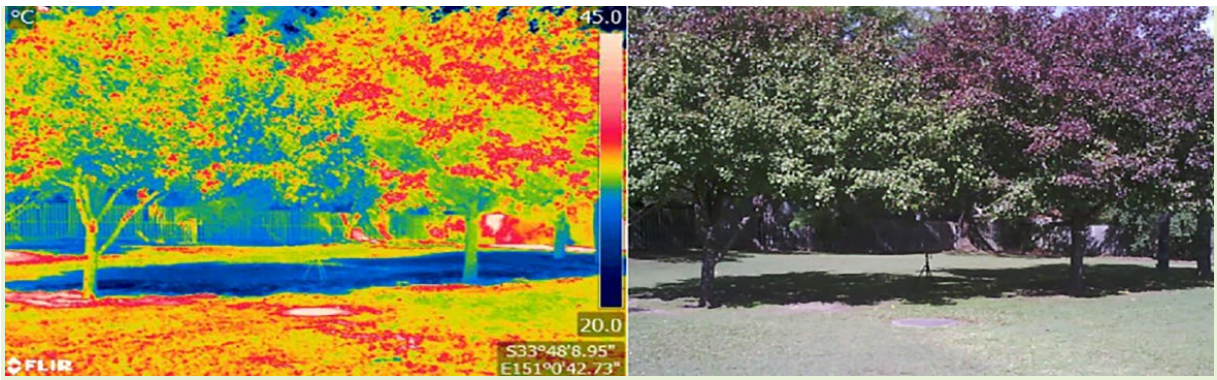
Hamish Mitchell is the Managing Director of Speciality Trees, Narre Warren East, Victoria. Speciality Trees is a wholesale plant nursery that focusses on production of premium quality containerised landscaping trees. The company was established in 1977. Speciality Trees supplies local government, the landscaping industry, and retailers. Hamish notes "Our climate is changing faster than at any time in history. Climate change poses the greatest risk to humanity. Global research states that green life makes a significant contribution to community health and wellbeing. It is linked to increased productivity, improved learning, and improved physical and mental health due to its effect on reducing stress and pollution while improving the air we breathe. It assists to mitigate wind and flood and it cools our cities" (GIA 2022). In relation to "Which Plant Where" Hamish concludes "The importance of planting the right tree in the right position is critical if we are going to have trees in place in 50 years' time."

Hamish Mitchell, top left with the Speciality Trees team in front of OZBREED varieties grown under licence by Speciality Trees (photo credit Speciality Trees)

MEET CAROLE

Carole Fudge is the Sales and Marketing Manager of Benara Nurseries, Forestdale, Western Australia. Benara Nurseries is a leading source of trade and wholesale plant supplies for garden retailers, revegetation projects, and the wider landscaping industry throughout Australia. Benara Nurseries was established in 1963. Carole was part of the nursery industry Strategic Investment Advisory Panel (SIAP) when investment in "Which Plant Where" was under consideration. "We need to plan green spaces for our generations to come. The research coming from the "Which Plant Where" project has been integrated into an online tool and has been designed to identify plant species' ability to handle conditions now and in the future".

"The nursery industry needed facts to support investment in the creation of green cities, data to support the development of long lasting urban green spaces and green spaces that offset the effects of climate change. "Which Plant Where" has done this. Green spaces have been shown to lower the temperature of urban areas by between 2º and 3ºC and even up to 7 º C. This makes a big difference to residents' quality of life. Old suburban Australian areas with a single house and garden are being redeveloped to accommodate four houses without green space. Some 70% of the world's population lives in urban areas and this will only increase over time. The "Which Plant Where" project approach has both national and international application". Carole went on to say that while "Which Plant Where" will benefit the community, government, and landscape planners, it is also advantageous to the production nursery sector. ""Which Plant Where" informs Benara Nurseries planting decisions. If we can understand what plants will do well where in Western Australia under likely climate change scenarios, we can invest in more of these species, and less in other plants. Benara Nurseries subscribes to the online "Which Plant Where tool"."



Thermal image showing the cooling benefits of shade (photo credit "Which Plant Where" final report, 2022)

MEET JON

Jon Hazelwood, Principal/Public Realm Sector Leader, Hassell, Greater Sydney Area. Hassell is a global planning and urban design consultancy committed to sustainability and carbon neutrality. Jon noted in relation to the online "Which Plant Where" tool "As designers of public domains and landscapes, the ability to select species based on their traits and response to climate change, rather than geographic origin, will be invaluable to ourselves and our clients."

THE IMPACT

In mid-2022, the "Which Plant Where" online database has only recently been launched and further investment is required to increase the tools profile and use. Those who have been exposed to the tool, including nursery growers and landscape planners, are enthusiastic about its potential future role.

Valuation of Impacts

Impacts Not Valued

Not all the impacts identified in Table 4 could be valued in the assessment. Those not valued included:

- Environmental gain and community awareness from sustainable planting of urban green spaces.
- Capacity created – additional researcher, landscape professional, and nursery grower skills.
- Contribution to improved regional community wellbeing from spill-over income and employment benefits.

These impacts were not valued due to lack of data to support credible assumptions. Furthermore, it is worth noting that the analysis values impacts over thirty years and a number of potential impacts, especially environmental gain from sustainable planting of urban green spaces, have long term benefits, possibly in excess of fifty years.

Impacts Valued

Analyses were undertaken for total benefits that included future expected benefits. A degree of conservatism was used when finalising assumptions, particularly when some uncertainty was involved. Sensitivity analyses were undertaken for those variables where there was greatest uncertainty or for those that were identified as key drivers of the investment criteria.

Two impacts were valued:

- Increased profit for green life growers.
- Improved health and wellbeing in urban areas.

Impact 1: Increased Profit for Green Life Growers

Urban landscape planners who make use of the "Which Plant Where" online tool are more likely to successfully establish resilient green spaces, encourage additional urban planting and boost green life sales and profit. This benefit will be realised by both production nurseries and turf growers in the longer term after promotion of the "Which Plant Where" tool and feedback on subsequent planting success. This analysis assumes a five-year lag between the end of the project, promotion of the online tool, change in purchasing behaviour and the realisation of additional profit for green life growers. Furthermore, a 5% increase in profit (after allowing for "Which Plant Where" subscription costs) over 20% of industry output is assumed.

Impact 2: Improved Health and Wellbeing in Urban Areas

An accepted method for valuation of improved health and wellbeing can be based on an estimate of the value of a statistical life (VSL) from which in turn can be derived the value of a statistical life year (VSLY). Reduced morbidity and/or increased well-being can be valued through the VSLY by adjusting subjectively for the reduced severity or the health severity and period of the injury/ailment.

VSL is usually assumed to be the life of a young adult with at least 40 years of life ahead (Abelson, 2008). The VSL is the willingness to pay for avoiding an immediate death of a healthy individual in middle age. International research using willingness to pay studies usually place the value of life at somewhere between $AUD1.8 and $AUD4.3 million. The Abelson (2008) figure of $2.5 million for a VSL has been used as a standard value in impact assessment for RDCs by Agtrans Research and others (e.g., Economic Evaluation of NY16005: Where Should All the Trees Go?).

Improvements in health or increases in wellbeing can be valued through a VSLY adjusted by a quality-of-life year (QALY) index (a well-being index covering a scale of 0 to 1 where 0 = death and 1 = a year of perfect health). Alternatively, the value of a statistical life year can be adjusted by disability weights to give a disability adjusted life year (DALY) index, covering a scale of 0 to 1 where 0 is perfect health and 1 is death. Reduced health and wellbeing, mental illness, stress, and anxiety can also be valued via QALY or DALY indices.

To quantify improved health and wellbeing in urban areas the following assumptions were required:

- The VSL value of $2.5 million can be used as a standard value. This is the Willingness to Pay for avoiding an immediate death of a healthy individual in middle age (life expectancy of 40 additional years). Given a discount rate of 5%, this equates to a statistical life year (VSLY) of $150,000.

- Using the QALY index, it is assumed that on average, the index increases from 0.20 to 0.21 due to the GC15002 project for each individual affected. Assuming the VSLY is $150,000 per annum, the value of improvement gained by each individual affected would be $1,500 per person per annum.
- The number of people benefiting, is at maximum, the urban population of Australia, i.e., 70% of the total population of 25 million which live in urban areas. However, it is assumed that only 10% of plantings are impacted and only 1% of the population in impacted areas experiences some form of health and wellbeing improvement.

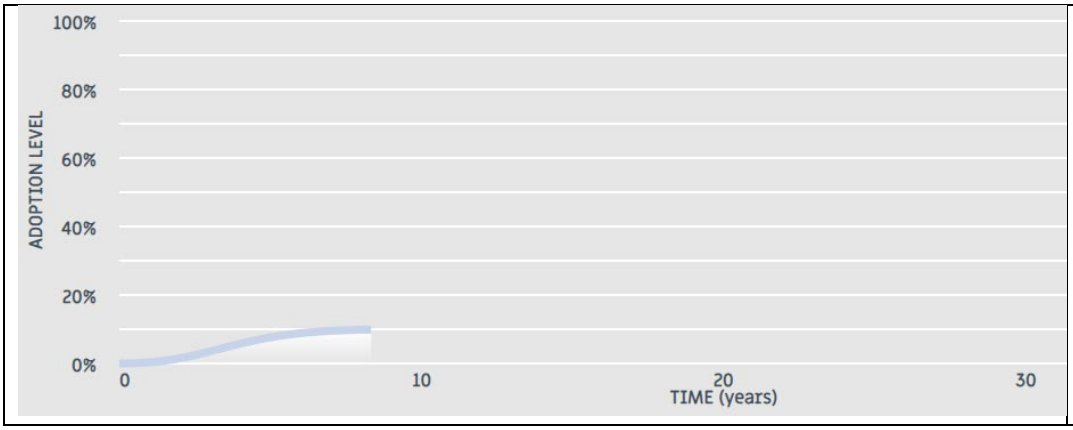
CSIRO Adopt Model Insights

Project parameters were entered into the CSIRO Adopt Model. Assumptions, inputs and outputs used are detailed in Appendix 1. Adopt Model results were:

- Time to peak adoption: 8 years.
- Peak adoption level: 10%.

The adoption profile and levels modelled using the CSIRO Adopt Tool are shown in Figure 1 below. These insights were considered when preparing valuation assumptions.

Figure 1: CSIRO Adopt Model, Adoption Level S-Curve for GC15002



Year	Adoption %
1	0
2	2
3	4
4	6
5	8
6	9
7	10
8	10

(Peak Adoption)

Summary of Assumptions

Table 6 contains a summary of assumptions required for estimation of both quantified impacts.

Table 6: Summary of Assumptions for Impact Valuation

Variable	Assumption/Value	Source/Comment
Impact 1: Increased Profit for Green Life Growers		
Value of nursery green life.	$2.8 billion/year.	Hort Innovation 2022. Estimate includes farmgate value of both nursery and turf.
Profit on green life sales.	15%	Long term horticulture industry average estimated from the Australian National Accounts: Input-Output Tables 2020-21 (ABS 2023).
Increase in profit on sales generated from adoption of the "Which Plant Where" online tool by urban planning professionals.	5%	Analysts' assumption.
Share of green life sales that will benefit from adoption of the "Which Plant Where" online tool by urban planning professionals.	20%	Analysts' assumption.
Impact 2: Improved Health and Wellbeing in Urban Areas		
Value of a statistical life (VSL).	$2.5 million	Abelson 2008.
Value of a Statistical Life Year (VSLY).	$150,000	VSL, discount rate 5%, 40 years.
Average QLFY before change.	0.20	Analysts' assumption.
Average QLFY after canopy increase.	0.21	Analysts' assumption.
Increase in QLFY	0.01	0.21-0.20.
Value of increase per person.	$1,500	0.01 x $150,000.
Australian population in urban areas.	17,500,000	Australian population is 25 million and 70% live in urban areas.
Share of urban population impacted by GC15002 "Which Plant Where"	10%	Analysts' assumption.
People in GC15002 impacted areas experiencing improved health and wellbeing.	1%	Analysts' assumption.
Assumptions Common to Quantification of Both Impacts		
Year of first impact.	2026/27.	Assumes a five-year lag from completion of GC15002, subsequent investment in online tool promotion and realisation of profit and wellbeing benefits.
Year of maximum impact.	2031/32	Five years required to achieve maximum adoption. NB: Adopt tool assumes 9 years but a more optimistic 5 years has been used in the assessment after receipt of favorable feedback from via the impact assessment case study.
Attribution of impacts to this project.	75%	Further investment will be required to promote the "Which Plant Where" online tool.

Probability of the project generating useful outputs.	100%	Outputs have been delivered – "Which Plant Where" tool is online and being used by industry.
Probability of valuable outcomes.	75%	There is risk that further investment will not occur.
Probability of impact (assuming successful outcome)	50%	There is some risk that use of the tool will not increase green life grower profit or health and wellbeing in urban areas.
Counterfactual.	50%	In the absence of GC15002 research, it is possible that an alternative tool would have been produced.

Results

All costs and benefits were discounted to 2022/23 using a discount rate of 5%. A reinvestment rate of 5% was used for estimating the Modified Internal Rate of Return (MIRR). The base analysis used the best available estimates for each variable, notwithstanding a level of uncertainty for many of the estimates. All analyses ran for the length of the project investment period plus 30 years from the last year of investment (2021/22) as per the CRRDC Impact Assessment Guidelines (CRRDC, 2018).

Investment Criteria

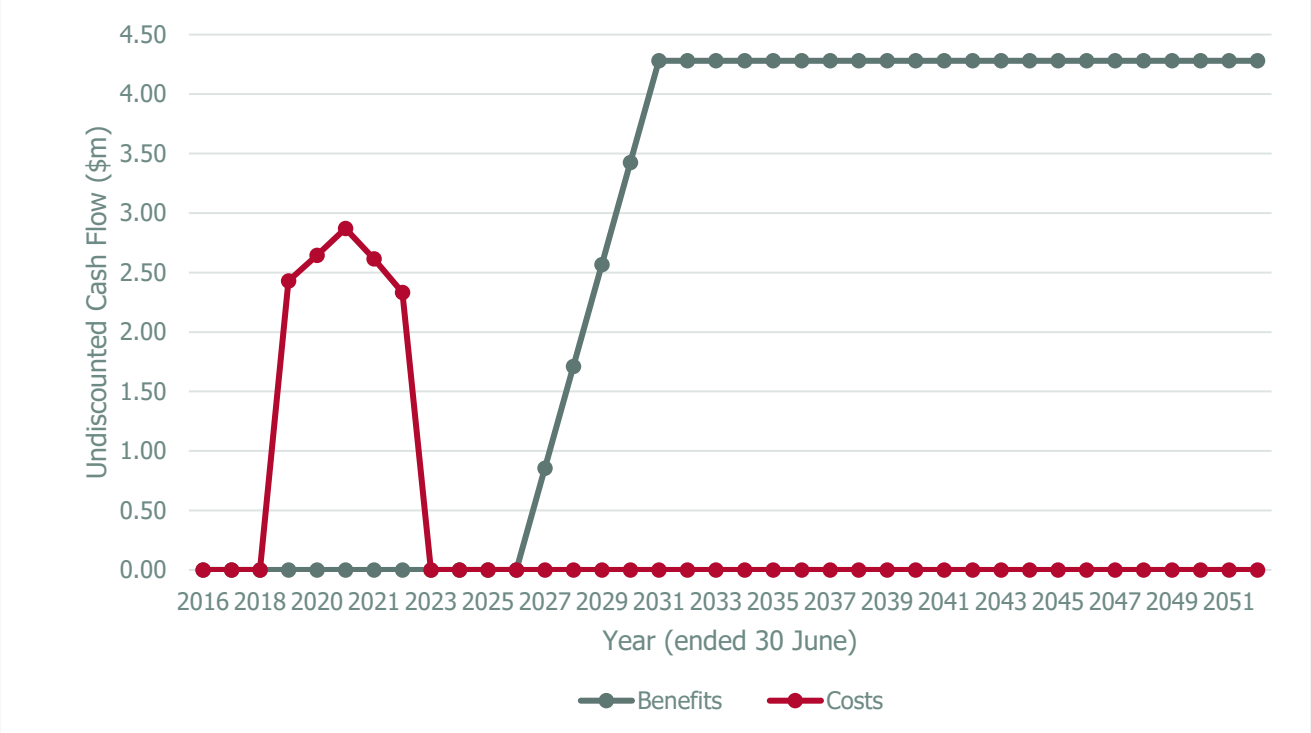
Table 7 show the investment criteria estimated for different periods of benefits for the total investment. Hort Frontiers was the only investor in the project.

Table 7: Investment Criteria for Total Investment in Project GC15002

Investment Criteria	Years after Last Year of Investment						
	0	5	10	15	20	25	30
Present Value of Benefits ($m)	0.00	0.70	12.05	23.99	33.35	40.69	46.43
Present Value of Costs ($m)	14.97	14.97	14.97	14.97	14.97	14.97	14.97
Net Present Value ($m)	-14.97	-14.27	-2.92	9.02	18.38	25.72	31.46
Benefit-Cost Ratio	0.00	0.05	0.80	1.60	2.23	2.72	3.10
Internal Rate of Return (%)	Negative	Negative	1.7	9.5	11.8	12.8	13.2
MIRR (%)	Negative	Negative	2.3	8.1	9.1	9.1	8.9

The annual undiscounted benefit and cost cash flows for the total investment for the duration of the GC15002 investment plus 30 years from the last year of investment are shown in Figure 2.

Figure 2: Annual Cash Flow of Undiscounted Total Benefits and Total Investment Costs



Source of benefits

Table 8 shows the contribution to total benefits from each of the two benefits valued. Improved health and wellbeing was the principal contributor.

Table 8: Source of Total Benefits
(Total investment, 30 years)

Impact	Contribution to PVB ($m)	Share of Total Benefits (%)
Impact 1: Increased profit for green life growers	6.38	13.7
Impact 2: Improved health and wellbeing in urban areas	40.05	86.3
Total	**46.43**	**100.0**

Sensitivity Analyses

A sensitivity analysis was carried out on the discount rate. The analysis was performed for the total investment and with benefits taken over the life of the investment plus 30 years from the last year of investment. All other parameters were held at their base values. Table 9 presents the results. The results are sensitive to the discount rate.

Table 9: Sensitivity to Discount Rate
(Total investment, 30 years)

Investment Criteria	Discount Rate		
	0%	5% (base)	10%
Present Value of Benefits ($m)	102.72	46.43	24.12
Present Value of Costs ($m)	12.89	14.97	17.34
Net Present Value ($m)	89.82	31.46	6.78
Benefit-cost ratio	7.97	3.10	1.39

A sensitivity analysis was then undertaken on the share of Australia's urban population impacted by "Which Plant Where" adoption. Results are provided in Table 10. Share of population impacted would need to fall to 2% before project benefits approximately equate to project costs i.e., the project breaks even.

Table 10: Sensitivity to Share of Urban Population Impacted by GC15002 Adoption
(Total investment, 30 years)

Investment Criteria	Share of Urban Population Impacted by "Which Plant Where" Planting		
	2%	5%	10% (base)
Present Value of Benefits ($m)	14.39	26.41	46.43
Present Value of Costs ($m)	14.97	14.97	14.97
Net Present Value ($m)	-0.58	11.44	31.46
Benefit-cost ratio	0.96	1.76	3.10

A final sensitivity analysis tested assumed increase in profitability of green life producers supplying "Which Plant Where" influenced urban plantings. The results (Table 11) show that if assumed increase in profitability is reduced to zero, and all other assumptions are held constant, the project continues to generate a favourable return on investment.

Table 11: Sensitivity to Increase in Profitability of Green Life Producers with GC15002 Adoption (Total investment, 30 years)

Investment Criteria	Increase in Profitability		
	0%	2.5%	5% (base)
Present Value of Benefits ($m)	40.05	43.24	46.43
Present Value of Costs ($m)	14.97	14.97	14.97
Net Present Value ($m)	25.08	28.27	31.46
Benefit-cost ratio	2.68	2.89	3.10

Confidence Rating

The results produced are highly dependent on the assumptions made, some of which are uncertain. There are two factors that warrant recognition. The first factor is the coverage of benefits. Where there are multiple types of benefits it is often not possible to quantify all the benefits that may be linked to the investment. The second factor involves uncertainty regarding the assumptions made, including the linkage between the research and the assumed outcomes.

A confidence rating based on these two factors has been given to the results of the investment analysis (Table 12). The rating categories used are High, Medium, and Low, where:

High: denotes a good coverage of benefits or reasonable confidence in the assumptions made

Medium: denotes only a reasonable coverage of benefits or some uncertainties in assumptions made

Low: denotes a poor coverage of benefits or many uncertainties in assumptions made

Table 12: Confidence in Analysis of Project

Coverage of Benefits	Confidence in Assumptions
High	Medium

Coverage of benefits valued was assessed as High, two key impacts (Increase in profit for green life growers and Improved health and wellbeing in urban areas) were valued. Confidence in assumptions was rated as Medium, some data were estimated by the analyst.

Conclusions

The project (GC15002) has delivered exceptional bio-climatic modelling, a solid and rigorous database, and an easy-to-use online tool for making planting decisions in urban areas. Stakeholders who participated in the project and who make use of the online tool (and project generated best practice guides and factsheets) will be more informed about what to plant where, and more likely to successfully establish diverse and resilient urban green spaces. Successful, climate adapted plantings will establish a virtuous circle, that encourages additional urban planting.

Total funding from all sources for the project was $14.97 million (present value terms). The investment produced estimated total expected benefits of $46.43 million (present value terms). This gave a net present value of $31.46 million, an estimated benefit-cost ratio of 3.1 to 1, an internal rate of return of 13.2% and a modified internal rate of return of 8.9%.

Recommendations

Impact assessment is now a mature process within Hort Innovation. No recommendations are made for further refinement.

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Abbreviations and Acronyms

ABC	Australian Broadcasting Corporation
ABS	Australian Bureau of Statistics
CBA	Cost Benefit Analysis
CRRDC	Council of Research and Development Corporations
DALY	Disability Adjusted Life Year
DAWR	Department of Agriculture and Water Resources (Australian Government)
GDP	Gross Domestic Product
GIA	Green-life Industry Australia
GVP	Gross Value of Production
IRR	Internal Rate of Return
LOP	Life of Project
MIRR	Modified Internal Rate of Return
PVB	Present Value of Benefits
R&D	Research and Development
QALY	Quality of Life Year
RD&E	Research, Development and Extension
SMH	Sydney Morning Herald
VSL	Value of a Statistical Life
VSLY	Value of a Statistical Life Year

Glossary of Economic Terms

Cost-benefit analysis:	A conceptual framework for the economic evaluation of projects and programs in the public sector. It differs from a financial appraisal or evaluation in that it considers all gains (benefits) and losses (costs), regardless of to whom they accrue.
Benefit-cost ratio:	The ratio of the present value of investment benefits to the present value of investment costs.
Discounting:	The process of relating the costs and benefits of an investment to a base year using a stated discount rate.
Internal rate of return:	The discount rate at which an investment has a net present value of zero, i.e. where present value of benefits = present value of costs.
Investment criteria:	Measures of the economic worth of an investment such as Net Present Value, Benefit-Cost Ratio, and Internal Rate of Return.
Modified internal rate of return:	The internal rate of return of an investment that is modified so that the cash inflows from an investment are re-invested at the rate of the cost of capital (the re-investment rate).
Net present value:	The discounted value of the benefits of an investment less the discounted value of the costs, i.e. present value of benefits - present value of costs.
Present value of benefits:	The discounted value of benefits.
Present value of costs:	The discounted value of investment costs.

Appendix 1: CSIRO Adopt Model Detailed Assumptions, Inputs, and Outputs

Assumptions, inputs and outputs used to develop an adoption profile for GC15002 – Which plant where, when and why database are reproduced in this appendix.

Model to Run

Standard ADOPT model

Which model should be used for evaluation? The Smallholder ADOPT model works best for innovations in a developing country smallholder context. For all other innovations, select the Standard ADOPT model.

Project Title (required)

Increased profit for green life growers

What innovation or practice change is being considered?

Project Author/s

Michael Clarke

Who has contributed to the answers given in this project?

Description of the Innovation

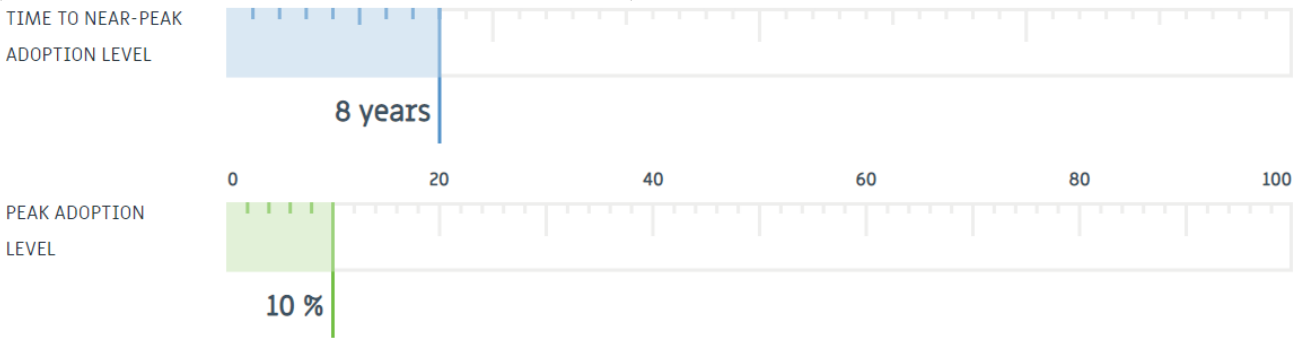
Online tool, best practice guidelines and factsheets to help landscape professionals make more informed decisions about what to plant where and when.

Why is this innovation or practice change being considered?

Description of the Target Population

The target population will include plant growers and the nursery trade, plant specifiers and practitioners in government and industry, urban forest managers, arborists, landscape architects, and urban planners.

Who is the innovation or practice change relevant to?



Increased profit for green life growers

Edit Project Settings >

RELATIVE ADVANTAGE FOR THE POPULATION

1. Profit orientation
2. Environmental orientation
3. Risk orientation
4. Enterprise scale
5. Management horizon

1 Profit orientation

What proportion of the target population has maximising profit as a strong motivation?

- Almost none have maximising profit as a strong motivation
- A minority have maximising profit as a strong motivation
- About half have maximising profit as a strong motivation
- A majority have maximising profit as a strong motivation
- Almost all have maximising profit as a strong motivation

Increased profit for green life growers

Edit Project Settings >

RELATIVE ADVANTAGE FOR THE POPULATION

- Profit orientation
- 2 Environmental orientation
- Risk orientation
- Enterprise scale
- Management horizon
- Short term constraints
- LEARNABILITY CHARACTERISTICS OF THE INNOVATION
- LEARNABILITY OF POPULATION
- RELATIVE ADVANTAGE OF THE INNOVATION

2 Environmental orientation

What proportion of the target population has protecting the natural environment as a strong motivation?

- Almost none have protection of the environment as a strong motivation
- A minority have protection of the environment as a strong motivation
- (•) About half have protection of the environment as a strong motivation
- A majority have protection of the environment as a strong motivation
- Almost all have protection of the environment as a strong motivation

What is your reasoning for this answer? (Optional)

Target population is likely to be aware of climate change and motivated to make informed environmental decisions.

Increased profit for green life growers

Edit Project Settings >

RELATIVE ADVANTAGE FOR THE POPULATION

- Profit orientation
- Environmental orientation
- 3 Risk orientation
- Enterprise scale
- Management horizon
- Short term constraints
- LEARNABILITY CHARACTERISTICS OF THE INNOVATION

3 Risk orientation

What proportion of the target population has risk minimisation as a strong motivation?

- Almost none have risk minimisation as a strong motivation (risk takers)
- A minority have risk minimisation as a strong motivation
- (•) About half have risk minimisation as a strong motivation
- A majority have risk minimisation as a strong motivation
- Almost all have risk minimisation as a strong motivation (risk averse)

What is your reasoning for this answer? (Optional)

Increased profit for green life growers

Edit Project Settings >

RELATIVE ADVANTAGE FOR THE POPULATION

- Profit orientation
- Environmental orientation
- Risk orientation
- 4 Enterprise scale
- Management horizon
- Short term constraints
- LEARNABILITY CHARACTERISTICS OF THE INNOVATION

4 Enterprise scale

On what proportion of the target farms is there a major enterprise that could benefit from the innovation?

- Almost none of the target farms have a major enterprise that could benefit
- A minority of the target farms have a major enterprise that could benefit
- About half of the target farms have a major enterprise that could benefit
- (•) A majority of the target farms have a major enterprise that could benefit
- Almost all of the target farms have a major enterprise that could benefit

What is your reasoning for this answer? (Optional)

Increased profit for green life growers

Edit Project Settings >

RELATIVE ADVANTAGE FOR THE POPULATION

- Profit orientation
- Environmental orientation
- Risk orientation
- Enterprise scale
- 5 Management horizon
- Short term constraints

5 Management horizon

What proportion of the target population has a long-term (greater than 10 years) management horizon for their farm?

- Almost none have a long-term management horizon
- A minority have a long-term management horizon
- About half have a long-term management horizon
- A majority have a long-term management horizon
- Almost all have a long-term management horizon

Increased profit for green life growers

Edit Project Settings >

RELATIVE ADVANTAGE FOR THE POPULATION

- Profit orientation
- Environmental orientation
- Risk orientation
- Enterprise scale
- Management horizon
- 6 Short term constraints

6 Short term constraints

What proportion of the target population is under conditions of severe short-term financial constraints?

- Almost all currently have a severe short-term financial constraint
- A majority currently have a severe short-term financial constraint
- About half currently have a severe short-term financial constraint
- A minority currently have a severe short-term financial constraint
- Almost none currently have a severe short-term financial constraint

Increased profit for green life growers

Edit Project Settings >

RELATIVE ADVANTAGE FOR THE POPULATION

LEARNABILITY CHARACTERISTICS OF THE INNOVATION

- 7 Trialable
- Innovation complexity
- Observability

LEARNABILITY OF POPULATION

RELATIVE ADVANTAGE OF THE INNOVATION

7 Trialable

How easily can the innovation (or significant components of it) be trialled on a limited basis before a decision is made to adopt it on a larger scale?

- Not trialable at all
- Difficult to trial
- Moderately trialable
- Easily trialable
- Very easily trialable

Increased profit for green life growers

Edit Project Settings >

RELATIVE ADVANTAGE FOR THE POPULATION

LEARNABILITY CHARACTERISTICS OF THE INNOVATION

Trialable

8 Innovation complexity

Observability

LEARNABILITY OF POPULATION

RELATIVE ADVANTAGE OF THE INNOVATION

8 Innovation complexity

Does the complexity of the innovation allow the effects of its use to be easily evaluated when it is used?

- Very difficult to evaluate effects of use due to complexity
- Difficult to evaluate effects of use due to complexity
- Moderately difficult to evaluate effects of use due to complexity
- (•) Slightly difficult to evaluate effects of use due to complexity
- Not at all difficult to evaluate effects of use due to complexity

What is your reasoning for this answer? (Optional)

Increased profit for green life growers

Edit Project Settings >

RELATIVE ADVANTAGE FOR THE POPULATION

LEARNABILITY CHARACTERISTICS OF THE INNOVATION

Trialable

Innovation complexity

9 Observability

LEARNABILITY OF POPULATION

9 Observability

To what extent would the innovation be observable to farmers who are yet to adopt it when it is used in their district?

- Not observable at all
- (•) Difficult to observe
- Moderately observable
- Easily observable
- Very easily observabley

Increased profit for green life growers

Edit Project Settings >

RELATIVE ADVANTAGE FOR THE POPULATION

LEARNABILITY CHARACTERISTICS OF THE INNOVATION

LEARNABILITY OF POPULATION

10 Advisory support

Group involvement

Relevant existing skills & knowledge

10 Advisory support

What proportion of the target population uses paid advisors capable of providing advice relevant to the project?

- Almost none use a relevant advisor
- (•) A minority use a relevant advisor
- About half use a relevant advisor
- A majority use a relevant advisor
- Almost all use a relevant advisor

Increased profit for green life growers

Edit Project Settings >

RELATIVE ADVANTAGE FOR THE POPULATION

LEARNABILITY CHARACTERISTICS OF THE INNOVATION

LEARNABILITY OF POPULATION

Advisory support

11 Group involvement

Relevant existing skills & knowledge

11 Group involvement

What proportion of the target population participates in farmer-based groups that discuss farming?

- Almost none are involved with a group that discusses farming
- (•) A minority are involved with a group that discusses farming
- About half are involved with a group that discusses farming
- A majority are involved with a group that discusses farming
- Almost all are involved with a group that discusses farming

Increased profit for green life growers

Edit Project Settings >

RELATIVE ADVANTAGE FOR THE POPULATION

LEARNABILITY CHARACTERISTICS OF THE INNOVATION

LEARNABILITY OF POPULATION

Advisory support

Group involvement

12 Relevant existing skills & knowledge

Innovation awareness

12 Relevant existing skills & knowledge

What proportion of the target population will need to develop substantial new skills and knowledge to use the innovation?

- Almost all need new skills and knowledge
- A majority will need new skills and knowledge
- About half will need new skills and knowledge
- (•) A minority will need new skills and knowledge
- Almost none will need new skills or knowledge

Increased profit for green life growers

Edit Project Settings >

RELATIVE ADVANTAGE FOR THE POPULATION

LEARNABILITY CHARACTERISTICS OF THE INNOVATION

LEARNABILITY OF POPULATION

Advisory support

Group involvement

Relevant existing skills & knowledge

13 Innovation awareness

RELATIVE ADVANTAGE OF THE INNOVATION

13 Innovation awareness

What proportion of the target population would be aware of the use or trialing of the innovation in their district?

- It has never been used or trialed in their district(s)
- A minority are aware that it has been used or trialed in their district
- (•) About half are aware that it has been used or trialed in their district
- A majority are aware that it has been used or trialed in their district
- Almost all are aware that it has been used or trialed in their district

What is your reasoning for this answer? (Optional)

Increased profit for green life growers

Edit Project Settings >

- RELATIVE ADVANTAGE FOR THE POPULATION
- LEARNABILITY CHARACTERISTICS OF THE INNOVATION
- LEARNABILITY OF POPULATION

RELATIVE ADVANTAGE OF THE INNOVATION

14 Relative upfront cost of the project

Reversibility of the innovation

Profit benefit in years that it is used

14 Relative upfront cost of the innovation

What is the size of the up-front cost of the investment relative to the potential annual benefit from using the innovation?

- ○ Very large initial investment
- ○ Large initial investment
- ○ Moderate initial investment
- ◉ Minor initial investment
- ○ No initial investment required

Increased profit for green life growers

Edit Project Settings >

- RELATIVE ADVANTAGE FOR THE POPULATION
- LEARNABILITY CHARACTERISTICS OF THE INNOVATION
- LEARNABILITY OF POPULATION

RELATIVE ADVANTAGE OF THE INNOVATION

Relative upfront cost of the project

15 Reversibility of the innovation

15 Reversibility of the innovation

To what extent is the adoption of the innovation able to be reversed?

- ○ Not reversible at all
- ○ Difficult to reverse
- ○ Moderately difficult to reverse
- ○ Easily reversed
- ◉ Very easily reversed

Increased profit for green life growers

Edit Project Settings >

- RELATIVE ADVANTAGE FOR THE POPULATION
- LEARNABILITY CHARACTERISTICS OF THE INNOVATION
- LEARNABILITY OF POPULATION

RELATIVE ADVANTAGE OF THE INNOVATION

Relative upfront cost of the project

Reversibility of the innovation

16 Profit benefit in years that it is used

Future profit benefit

16 Profit benefit in years that it is used

To what extent is the use of the innovation likely to affect the profitability of the farm business in the years that it is used?

- ○ Large profit disadvantage in years that it is used
- ○ Moderate profit disadvantage in years that it is used
- ◉ Small profit disadvantage in years that it is used
- ○ No profit advantage or disadvantage in years that it is used
- ○ Small profit advantage in years that it is used
- ○ Moderate profit advantage in years that it is used
- ○ Large profit advantage in years that it is used
- ○ Very large profit advantage in years that it is used

Increased profit for green life growers

Edit Project Settings >

- RELATIVE ADVANTAGE FOR THE POPULATION
- LEARNABILITY CHARACTERISTICS OF THE INNOVATION
- LEARNABILITY OF POPULATION

RELATIVE ADVANTAGE OF THE INNOVATION

- Relative upfront cost of the project
- Reversibility of the innovation
- Profit benefit in years that it is used
- 17 Future profit benefit

17 Future profit benefit

To what extent is the use of the innovation likely to have additional effects on the future profitability of the farm business?

- ○ Large profit disadvantage in the future
- ○ Moderate profit disadvantage in the future
- ◉ Small profit disadvantage in the future
- ○ No profit advantage or disadvantage in the future
- ○ Small profit advantage in the future
- ○ Moderate profit advantage in the future
- ○ Large profit advantage in the future
- ○ Very large profit advantage in the future

Increased profit for green life growers

Edit Project Settings >

- RELATIVE ADVANTAGE FOR THE POPULATION
- LEARNABILITY CHARACTERISTICS OF THE INNOVATION
- LEARNABILITY OF POPULATION

RELATIVE ADVANTAGE OF THE INNOVATION

- Relative upfront cost of the project
- Reversibility of the innovation
- Profit benefit in years that it is used
- Future profit benefit
- 18 Time until any future profit benefits are likely to be realised

18 Time until any future profit benefits are likely to be realised

How long after the innovation is first adopted would it take for effects on future profitability to be realised?

- ◉ More than 10 years
- ○ 6 - 10 years
- ○ 3 - 5 years
- ○ 1 - 2 years
- ○ Immediately
- ○ Not Applicable

What is your reasoning for this answer? (Optional)

Increased profit for green life growers

Edit Project Settings >

- RELATIVE ADVANTAGE FOR THE POPULATION
- LEARNABILITY CHARACTERISTICS OF THE INNOVATION
- LEARNABILITY OF POPULATION

RELATIVE ADVANTAGE OF THE INNOVATION

- Relative upfront cost of the project
- Reversibility of the innovation
- Profit benefit in years that it is used

19 Environmental costs & benefits

To what extent would the use of the innovation have net environmental benefits or costs?

- ○ Large environmental disadvantage
- ○ Moderate environmental disadvantage
- ○ Small environmental disadvantage
- ○ No net environmental effects
- ○ Small environmental advantage
- ○ Moderate environmental advantage
- ◉ Large environmental advantage
- ○ Very Large environmental advantage

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Edit Project Settings >

- RELATIVE ADVANTAGE FOR THE POPULATION
- LEARNABILITY CHARACTERISTICS OF THE INNOVATION
- LEARNABILITY OF POPULATION

RELATIVE ADVANTAGE OF THE INNOVATION

- Relative upfront cost of the project
- Reversibility of the innovation
- Profit benefit in years that it is used

Increased profit for green life growers

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RELATIVE ADVANTAGE OF THE INNOVATION

- Relative upfront cost of the project
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- Profit benefit in years that it is used

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RELATIVE ADVANTAGE OF THE INNOVATION

- Relative upfront cost of the project
- Reversibility of the innovation
- Profit benefit in years that it is used

20 Time to environmental benefit

How long after the innovation is first adopted would it take for the expected environmental benefits or costs to be realised?

- [x] More than 10 years
- [ ] 6 - 10 years
- [ ] 3 - 5 years
- [ ] 1 - 2 years
- [ ] Immediately
- [ ] Not Applicable

21 Risk exposure

To what extent would the use of the innovation affect the net exposure of the farm business to risk?

- [ ] Large increase in risk
- [ ] Moderate increase in risk
- [ ] Small increase in risk
- [ ] No increase in risk
- [x] Small reduction in risk
- [ ] Moderate reduction in risk
- [ ] Large reduction in risk

22 Ease and convenience

To what extent would the use of the innovation affect the ease and convenience of the management of the farm in the years that it is used?

- [ ] Large decrease in ease and convenience
- [ ] Moderate decrease in ease and convenience
- [ ] Small decrease in ease and convenience
- [ ] No change in ease and convenience
- [x] Small increase in ease and convenience
- [ ] Moderate increase in ease and convenience

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PREDICT. INFORM. ENGAGE.

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Project Details

PROJECT TITLE

Increased profit for green life growers

MODEL

Standard

YOUR INNOVATION

Online tool, best practice guidelines and factsheets to help landscape professionals make more informed decisions about what to plant where and when.

YOUR POPULATION

The target population will include plant growers and the nursery trade, plant specifiers and practitioners in government and industry, urban forest managers, arborists, landscape architects, and urban planners.

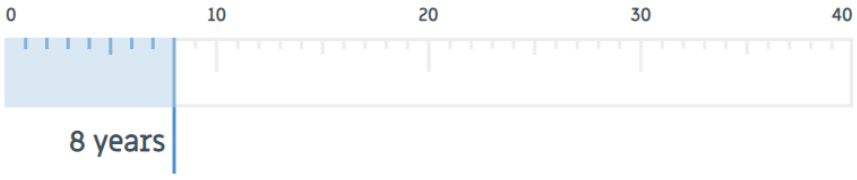
Results

Based on the data entered, the ADOPT model predicts the following:

Adoption Level

TIME TO NEAR-PEAK ADOPTION LEVEL

(years)



PEAK ADOPTION LEVEL

(percent %)