



Darwin Living Lab Snapshot

2019-2020

The Darwin Living Lab: Science and collaboration to support the liveability, sustainability and resilience of Darwin.



Citation

Muster, T., Barnett, G., Horner, N., Williams, R., Meharg, S., Meyers, J., and Cook, S. (2021) Darwin Living Lab Snapshot 2019-2020. CSIRO, Australia.

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Foreword

This report was delivered as part of the work of the Darwin Living Lab. The Darwin Living Lab was established to foster improvements in the liveability, sustainability and resilience of the city.

The Darwin Living Lab is an initiative under the Darwin City Deal and is a 10-year collaboration between CSIRO and the partners of the Darwin City Deal: Australian Government and Northern Territory Government and the City of Darwin. The City Deal was signed by the Prime Minister of Australia, Chief Minister of the Northern Territory and Lord Mayor of the City of Darwin in November 2018.

Messages from our Partners

Commonwealth Department of Infrastructure, Transport, Regional Development and Communications

The Department of Infrastructure, Transport, Regional Development and Communications recognises the valuable work of the Darwin Living Lab over the course of 2019-20, in contributing to the Darwin City Deal vision of Darwin as a vibrant, connected and liveable tropical city. The Department looks forward to continued collaboration and engagement with the Darwin Living Lab, including opportunities to leverage off projects and outcomes to support a broader range of Australian Government priorities.

Northern Territory Government

The Northern Territory Government values its role as a partner in the Darwin Living Lab through the Darwin City Deal. By monitoring and analysing Darwin's heat resilience and sustainability, the Living Lab is playing a crucial role improving the liveability of our tropical city and cementing Darwin's place as the thriving, cool capital of Northern Australia.

In 2020, we worked closely with the Darwin Living Lab to progress a range of strategic projects, including the development of the Darwin Heat Mitigation and Adaptation Strategy; providing input into the Living Lab monitoring and evaluation processes; and partnering on various research and science communication initiatives to build public knowledge of the Living Lab's work.

The Northern Territory Government looks forward to an ongoing partnership with the Darwin Living Lab as we deliver projects designed to cool the city and foster improved tropical living.

City of Darwin

The City of Darwin is working with the Darwin Living Lab as Council seeks to develop and implement strategies that will guide the actions and targets to achieve the vision by 2030 of Darwin as a cool, clean and green city.

In 2020 and 2021, we worked alongside the Darwin Living Lab as we progressed several strategies with their input particularly important in supporting the development of the *Climate Emergency Strategy* and *Greening Darwin Strategy*. The City of Darwin looks forward to continuing to work with the Darwin Living Lab to develop the evidence base that can be used to guide actions and measure progress to achieve the objectives of these strategies.

Executive Summary

The Darwin Living Lab was established to foster improvements in the liveability, sustainability and resilience of Darwin City. It is an initiative under the Darwin City Deal and is a 10-year collaboration between CSIRO and the partners of the Darwin City Deal: Australian Government, Northern Territory Government and the City of Darwin. The City Deal was signed by the Prime Minister of Australia, Chief Minister of the Northern Territory and Lord Mayor of the City of Darwin in November 2018.

Australian cities are powerhouses of productivity and are viewed as being highly liveable against many international metrics¹, yet the future is placing increased pressure on the way that we live. Our climate is changing and there is pressure to reduce greenhouse gas emissions and move to cleaner and healthier, lower consumption society. We are also learning how to increase our resilience against shocks, disruption and natural disasters. Our cities are complex.

Darwin is the northern-most capital city in Australia and strategically important for its proximity to Asia. Darwin is changing; renewing after 2018's Cyclone Marcus, and growing into a smart and sophisticated city. Darwin also a hot place and climate change models project that in the future Darwin is likely to experience more hot days and heat waves. This creates the impetus for Darwin to act and adapt, to do things in a different way to maintain and grow Darwin as a vibrant, connected and liveable tropical city.

These complex and inter-related challenges are not solved by one government or industry sector alone.

CSIRO has progressed the concept of Urban Living Labs as places where multiple stakeholders come together in the interests of changing from business-as-usual, to a new long-term urban system configuration and operation; to seek to tackle wicked problems that require multiple jurisdictions and sectors to solve.

The Darwin Living Lab was borne out of a co-developed vision for Darwin to be the *'Thriving, cool capital of Northern Australia'*. It brings together researchers, government, industry and the community to co-create solutions to local urban challenges. It also seeks to maximise opportunities for innovation and learning, growing tropical city knowledge and expertise.

In its first eighteen months (2019-2020), the Darwin Living Lab fostered collaboration and focused effort in five areas:

1. Provided science to inform the development of the Northern Territory Government's Heat Mitigation Strategy for Darwin.
2. Developed a website and content to provide an accessible forum where the latest innovations in tropical design can be showcased and better understood in order to progress Darwin's urban character and vibrant lifestyle with climate-appropriate responses.
3. Convened forums that brought together local knowledge and national/international expertise to progress heat mitigation and liveability priorities for Darwin. This included: the inaugural science symposium, inviting new partners to collaborate via an Expression of Interest process, and initiating a webinar series.
4. Developed a framework to track the impact of the Darwin Living Lab and changes in the liveability, sustainability and resilience of Darwin during the lifetime of the Darwin City Deal.

¹ Building Up & Moving Out: Inquiry into the Australian Government's role in the development of cities. House of Representatives Standing Committee on Infrastructure, Transport and Cities. Sept 2018. Commonwealth of Australia.

5. Expanded networks through expressions of interest to engage with the Darwin Living Lab to establish and undertake new projects in the areas of: (i) heat mitigation, liveability and tropical design, and (ii) Tracking Darwin baseline and implementation.

These focus areas were supported by communications and engagement activities that have expanded the awareness and the collaborative network of the Darwin Living Lab, which included: presentations to industry groups and scientific forums, newsletters and blog posts. The release of reports was supported by media releases which generated significant interest in print, online and broadcast media with several interviews and reports on Darwin Living Lab activities.

In time the Darwin Living Lab will report on observed changes in Darwin and its role in progressing the city to be a *'thriving, cool capital of the North'*. We plan to expand the network of partners that are willing to invest in collaborative opportunities that can establish Darwin as a global leader in heat mitigation research and wet/dry tropical design.



Find out more at: research.csiro.au/darwinlivinglab

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Overview of the Darwin Living Lab

Vision: Who we are

The CSIRO-led Darwin Living Lab builds on City Deal investments by bringing together collaborators within the Vision of progressing Darwin as a *'thriving, cool capital of the North'*. The initiative aims to co-create solutions to local urban challenges, maximising opportunities for innovation and learning, growing tropical city knowledge and expertise. The Darwin Living Lab will:

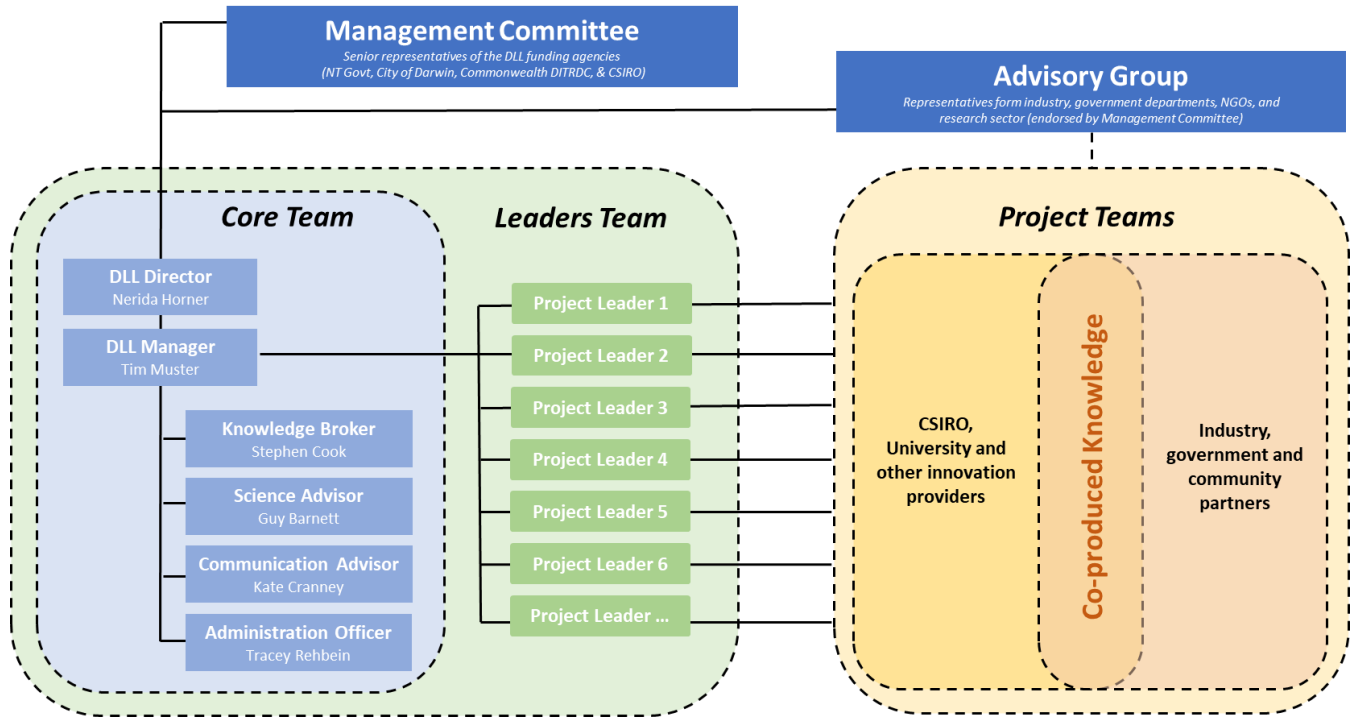
- Support innovation in urban heat mitigation by providing research evidence and expertise to inform Darwin's heat mitigation strategy, including identification and development of future trial initiatives and evaluations of their effectiveness;
- Develop the evidence-base for innovative, performance-based approaches to improve the energy efficiency of buildings in Darwin and the heat-related health outcomes of occupants, for incorporation in urban design guidelines and building regulations; build local tropical city knowledge and expertise that can be translated into products and services for application in other tropical cities in Australia and the ASEAN region; and
- Monitor and evaluate Darwin Living Lab contributions to the liveability, sustainability and resilience of Darwin.

Darwin Living Lab Principles

- **Shared Values** aligned to the ideals of 'liveability', 'sustainability', 'resilience' and 'innovative urban development'.
- **Value Creation** through creating monetary and non-monetary value for communities, stakeholders, and research partners.
- **Long-term Commitment** through the Darwin City Deal and partner agreements.
- **Ethical** experimental plans comply with national specifications for values, governance and review processes, including: voluntary participation, informed consent, confidentiality and anonymity.
- **Inclusion** through the welcoming of skills and competencies, and passion of partners and communities to deliver mutually beneficial outcomes.
- **Systems Focus** by combining the knowledge and skills of a range of disciplines and groups, seeking to avoid failures and difficulties across sectors.
- **Innovation** through exploring and experiencing new ways of working together, rather than replicating, or competing with, current practice and provision.
- **Transformation** over time through bold trials and demonstrations which test urban living options way beyond the current accepted "norm".
- **Knowledge** is created by new partnerships across sectors and jurisdictions and shared transparently to make evidence-based decisions and investments.
- **Experimentation & Learning** will be facilitated and used to build capacity and shared understanding of partners, stakeholders and communities.
- **Evidence-based** decision making is advanced through the creation of evaluation frameworks and tools for monitoring and assessing new urban form.
- **Curation** of partners and growth of social and institutional networks is nurtured, knowledge is actively passed on and scientifically-based impact frameworks are (developed, updated and) used to guide experimentation and learning.

Darwin Living Lab Governance

Governance arrangements support the Darwin Living Lab principles and feature a Management Committee (decision-making group) comprised of funding partners and an Advisory Group comprised of local industry and community and diverse expert knowledge representatives. These structures support a novel governance that facilitates co-produced knowledge and the ability to challenge 'business-as-usual' decision making.



Management Committee 2019-20

Chris Chilcott, Research Leader, Northern Australia Development, CSIRO (Chair).

Adam Stankevicius, Acting First Assistant Secretary, Cities Division; Department of Infrastructure, Transport, Regional Development and Communications.

Janet Hanigan, Department of Chief Minister, Northern Territory Government.

Melissa Reiter, City of Darwin.

Advisory Group 2019-20

Belinda Carlson, Office of Northern Australia

Holly Pederson, Office of Northern Australia

Carrie Fleming, DITRDC

Joshua Sattler, City of Darwin

Douglas Lesh, DIPL

Oliver Penman, DIPL

Tracey Duldig, DCM, NTG

Jude Scott, BOM

Kylie Climie, Power and Water Corporation

Matthaius Santamouris, UNSW

Robert Cooper, Larrakia Corporation

Vimal Parashar, CDU

Lawrence Nield, Independent

Sarah Whitten, PM&C

Key outcomes and impacts for 2019/20

Developing a Darwin Heat Mitigation Strategy

Local knowledge meets global best practice

As per the Darwin City Deal, the Darwin Living Lab fostered collaboration between local city and territory leaders and knowledge experts to ensure the latest science and information on urban heat was available to the Northern Territory Government and City of Darwin as they developed Darwin's Heat Mitigation Strategy. Work included: setting up a collaboration with the University of New South Wales Urban Heat Island program; holding a researcher workshop in August 2019; further scoping of heat mitigation responses at the Darwin Living Lab Symposium (Dec 2019); and delivering of a report on global approaches to heat mitigation with a focus on best practice for wet-dry tropical climates, highlighting case studies relevant to Darwin. The report on global approaches to heat mitigation provides recommendations on potential next steps and strategic actions that could be tested in future trials and pilots in Darwin, such as making physical changes:

- Cool building design and materials, focusing on low-cost retrofit of current building types
- Water-sensitive urban design to encourage water retention, and the use of water misting and water features
- Increasing vegetation cover with a focus on tree shading
- Creating cool transport corridors, using cool road and path technologies and using permeable pavements.

"There are few examples of heat mitigation activities from cities with an analogous climate to Darwin... This presents an opportunity for Darwin to become a world-leader in the science and innovation of heat mitigation among cities characterised by wet-dry tropical climates."

In addition to physical changes occurring in Darwin, it is suggested that advances can be made through increased education and awareness about behavioural change to reduce heat and heat exposure.



A copy of this report is available at: [Lin BB, Meyers J, and Cook S \(2020\) Developing a Darwin Heat Mitigation Strategy: A resource towards strategy development for the Northern Territory Government and City of Darwin. CSIRO, Australia.](#)

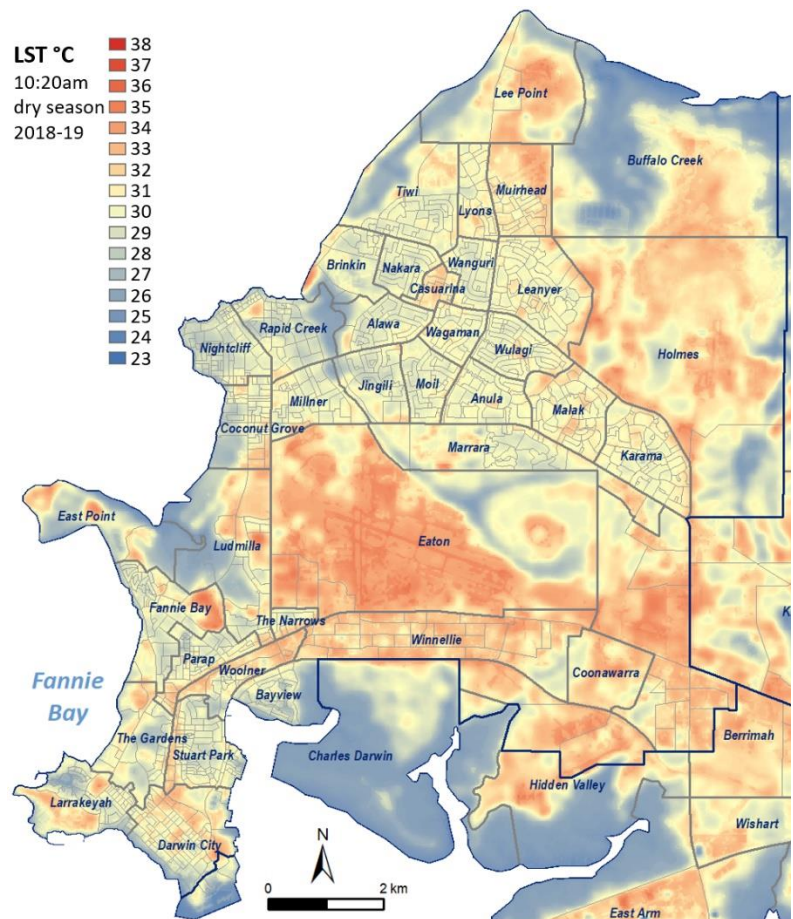
Enabling new data and knowledge

The Northern Territory Government has been progressing an agenda to develop a world-class Heat Mitigation Strategy for Darwin.

To complement earlier and ongoing research by the University of New South Wales in the Darwin CBD, the Darwin Living Lab has generated new data maps of land surface temperatures across Greater Darwin.

Land surface temperature mapping allows us to identify both hotter and cooler features across the landscape and built environment. Data was generated from Landsat8 satellite imagery during the 2018 and 2019 dry seasons and was down-scaled to provide land surface temperature at a 30 metre resolution. This data has been integrated with demographic and socioeconomic data to highlight areas where more residents

may be exposed to higher temperatures, have a higher risk of heat-related illness, and fewer economic resources to respond. The focus on heat-health vulnerability is captured within a technical report, and provides decision-makers with guidance on where to focus effort to minimise the impact of extreme heat across Greater Darwin.



Hotter Features include:

- Paving/Bitumen
- Rooftops
- Bare ground
- Dry sparse grass
- Few trees
- Unirrigated

Cooler Features include:

- Water
- Trees
- Irrigation (grass)
- Built shade structures
- Proximity to coast

A copy of this report is available at: [Meyers J, Langston A, Devereux D and Lin BB \(2020\) Mapping land surface temperatures and heat-health vulnerability in Darwin. CSIRO, Australia.](#)

Your Tropical City


Understanding Darwin as a 'Wet-Dry' Tropical City

Darwin is known as a tropical city. However, it is important to understand that Darwin does not have a tropical rainforest climate like Singapore, nor a tropical monsoon climate like Cairns. Darwin's climate has a Köppen-Geiger climate classification of *Aw-Tropical Savanna*, which is unique within Australian capital cities and is characterised by its climate extremes and distinct wet and dry seasons.

The Darwin Living Lab, working closely with local partners, planners, researchers and practitioners, has developed a Web-based resource that celebrates design and innovations that are suited to Darwin and its urban context. Darwin may be unique in Australia, but many of the worlds largest cities share their *Aw Tropical Savanna* climate (Hi Chi Minh City, Vietnam; Dhaka, Bangladesh; Mumbai, India). This creates the opportunity for Darwin to export successful design and innovations internationally.

Your Tropical City website provides a resource on tropical living and design for Darwin residents as well as those wishing to build and do business in Darwin. The website highlights opportunities to improve thermal comfort and liveability with buildings and public open space; primarily within the Darwin CBD but with relevance to the greater Darwin area. For example: {I think you need to give an example on what is actually included on the website and how someone (a builder? A developer?) will use it.


The website will be updated during the lifetime of the Darwin Living Lab, showcasing the latest innovations in tropical design and progressing Darwin's urban character, celebrating its vibrant lifestyle and climate-appropriate responses.



OUTDOOR LIFESTYLE

Darwin's wet-dry tropical climate, laid-back lifestyle and access to the outdoors are some...


[Learn more](#)



BUILT ENVIRONMENT

The character of Darwin's built environment emerges from the local context where the built...

[Learn more](#)



INTERACTIVE HUB

Darwin is undertaking innovative approaches to help cool the city. This section highlights...

[Learn more](#)

Find out more on the Website: youtropicalcity.com.au

Local knowledge meets global expertise

Building capacity and networks

On 12-13 December 2019, the Darwin Living Lab held its inaugural Annual Science Symposium in Darwin. The theme was Urban Design and Heat Mitigation in the Tropics.

The symposium combined global and national expertise with local knowledge of architects, researchers, policy makers, developers, engineers, urban planners, community groups and the general public.



The Symposium, held over two days, attracted more than 75 participants who explored Darwin's heat mitigation strategy and sharing knowledge (including Larrakia traditional owners) on how to cool the city, its buildings and public spaces. Further detail on the Symposium can be found at: research.csiro.au/darwinlivinglab/inaugural-science-symposium/

Adapting to COVID with webinars

The impacts of COVID on public contact led to a hiatus in our stakeholder and public engagement during April to August 2020. In place of our planned 2020 Symposium, a virtual webinar series was developed and launched in November 2020. The first session focussed on "How can smart sensor data lead to a more liveable Darwin?"; it featured presenters from Smart Cities Council Australia and New Zealand, City of Darwin, RMIT University and CSIRO. The Darwin Living Lab webinar series will continue throughout 2021 and will combine local, national and international speakers on topics related to current Darwin Living Lab projects. Recordings of the webinars are available online, at <https://research.csiro.au/darwinlivinglab/events/>

The Darwin Living Lab seeks to expand its partnerships and collaborations. During the period of April-May 2019 a public call for expressions of interest in project co-development was circulated through our networks. This helped identify five new potential collaborators of interest. Five new projects for the Darwin Living Lab were announced in December 2020:

- Understanding community needs for urban green space in Darwin
- Analysis of City of Darwin sensor network data and integration with AirRater
- Towards a Digital Twin of Darwin to monitor and navigate change
- Monitoring, Evaluation and Learning (MEL) baseline data collection
- Larrakia-led Darwin biodiversity values.

Tracking Darwin

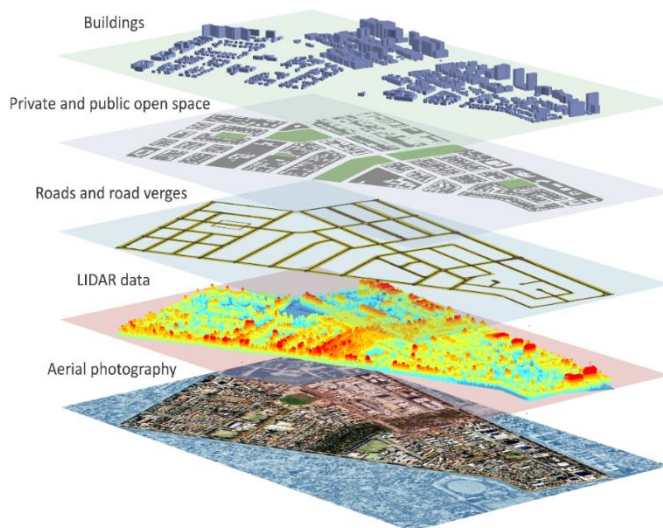
A framework for monitoring change

The Darwin Living lab uses purposeful experimentation to translate the vision (*Thriving, Cool Capital of the North*) into concrete actions and practices that are embedded within new governance approaches and policies. Evaluation is a core aspect of living labs and a means to identify what interventions are the most promising to achieve transformation and how to implement them effectively.

The 'Tracking Darwin' framework has two key objectives:

- To monitor, evaluate and learn from the activities and outcomes of the Darwin Living Lab, so that we can inform and enhance the Lab's performance over time.
- To monitor the trajectories of Darwin's liveability, sustainability and resilience, building the data infrastructure and analytics for tracking change over time and informing decision making.

The Darwin Living Lab will assemble, collate and integrate quantitative datasets within a spatial-temporal platform (that works towards a Digital Twin for Darwin). This will facilitate data access and analysis to assist with reporting, dialogue and decisions regarding the liveability, sustainability and resilience of Darwin, and exploration of the complex trade-offs when navigating change.



Series of spatial layers of different types of datasets, the foundation of Digital Twin for Darwin (Schandl et al, 2020).

A copy of this report is available at: [Williams R, Meharg S and Muster TH \(2020\) Tracking Darwin – a framework for monitoring, evaluation and learning about change in Darwin and its impact of the Darwin Living Lab](#)

Impact Pathways

A co-developed 'Theory of Change' has identified four impact pathways for the Darwin Living Lab:

1. Develop and foster innovation in urban heat mitigation for Darwin that improves liveability and grows the economy
 - In partnership with government, industry and community, identify and test new ideas and approaches
 - Work with Larrakia as the traditional custodians of the Darwin region, to respectfully learn from their cultural knowledge about living with heat
2. Develop infrastructure and analytics for tracking change in Darwin's liveability, sustainability and resilience
3. Build the capacity and networks for collaborative governance to guide urban transformation
4. Utilise effective co-production processes to develop and deliver outputs that are tailored to user needs and attract wider involvement from across CSIRO and all partners.

Annual Monitoring, Evaluation and Learning will provide a reflection on whether expected impact is being achieved and provide instruction on where future effort should be placed.

Tracking Darwin

Monitoring, Evaluation and Learning (MEL)

A Darwin Living Lab (MEL) survey was conducted in Dec 2020 and a follow up review workshop held with participants from Commonwealth Government, Northern Territory Government (NTG), the City of Darwin (CoD) and CSIRO. These activities were undertaken as part of the Tracking Darwin framework to regularly review DLL operations and progress to inform improvements in how the DLL is operating and learn how to effectively develop and implement an urban living lab.

The survey results were distributed to participants prior to the workshop. During the workshop, participants were invited to share their reactions to the results and to revisit an early Theory of Change for the DLL and update the impact pathways which outline how the DLL is anticipated to contribute to improved outcomes for Darwin.

Results

Achieving better outcomes for Darwin will require changes in policy-making and planning to enable different decisions to be made. For that to occur, there needs to be a change in the way people evaluate costs and benefits that broadens their perspective and considers a longer timeframe. How to bring this change about remains an open question but most of the suggestions raised by participants reflect actions which could contribute to enhancing the potential for improving policy and planning outcomes for Darwin.

The MEL review produced several suggestions for the CSIRO and its DLL partners to act upon in their quest to progress Darwin as a thriving, cool capital of the north:

- Researchers and policymakers need to engage with each other early, share and test ideas and iteratively co-develop opportunities based on partners' needs, to build trust and shared understanding.
- Look for specific opportunities to influence change in policy and planning decisions, e.g. policy windows, policy/planning experiments, broadening involvement in decision-making.
- Form an inter-partner working group to advise on translating ideas/opportunities into action
- Improve information flow between stakeholders involved in different phases of projects (planning - construction - operation) to bridge between the project intent and practicalities of implementation.
- Focus more on the local scale to help engage and influence current ways of doing things; enable a spatially explicit, precinct/village scale focus to help engage community as well as policy/planning, and perhaps over time provide 'nudges' for change.
- Increase DLL visibility to raise awareness and attract community interest and engagement. For example: a public Heat Mitigation display; sharing and inviting public commentary on observable improvements; enabling the public to provide input via the Your Tropical City website.
- Maintain effective engagement and communication within the DLL targeted and focused: expand on the successful model of regular CSIRO-CoD meetings; extend these to NTG and other partners; Increase cross-project interaction to share information, make cross-project connections and identify project synergies/interdependencies.
- Ensure Communications cater to new entrants and allow for staff turnover.

Applied research projects 2020 – 2021

| Strategic purpose | Project Title | Project Partnerships | Scope | Benefits and Impact |
|--|--|--|--|---|
| Heat mitigation, liveability & tropical design | P1. Understanding community needs for urban green space | Dr John Gardner and Dr Brenda Lin , CSIRO | Understand how different user groups in Darwin interact with green spaces and how their needs and preferences for amenities and benefits vary | Green spaces in Darwin can be re-designed to be more functional, attractive and beneficial (assist with cooling) to residents and visitors |
| | P2. Analysis of CoD sensor network and integration with AirRater | Dr Erin Dunne and Jennifer Powell , CSIRO; Krishan Maheson and Jack Silburn, City of Darwin; NT EPA; BoM | Assess CoD environmental sensor network data against NT EPA/BoM reference sites to prepare maintenance and calibration protocols, enabling reliable live data reporting | Provide localised heat and air quality data for use in AirRater App and other data portals. To provide ongoing evidence to report on spatial and temporal trends |
| Tracking Darwin baseline & implementation | P3. Towards a Digital Twin of Darwin to monitor and navigate change | Dr Sorada Tapsuwan , Dr Ray Marcos Martinez and Guy Barnett , CSIRO; Ron Grinsell, Joshua Forner, Eric Ledo, Krishan Maheson, City of Darwin; NT DIPL. | Acquisition of spatial and temporal datasets for Darwin to develop a digital twin to monitor change, with initial application focus on environmental economic accounting of ecosystem services provided by Darwin's green infrastructure | Evaluate the economic value and return on investment of cooling and greening initiatives, through a data platform to understand, monitor and navigate change in Darwin. Assist Darwin to be a truly Smart City through evidence-based decision making |
| | P4. Monitoring, Evaluation and Learning (MEL) baseline data collection | Dr Rachel Williams and Dr Seona Meharg , CSIRO along with DLL partners | A framework for monitoring and evaluation of the DLL to support learning and inform decision-making within the DLL. In parallel with the Digital Twin, it will monitor the impacts of the lab and trajectories of Darwin's liveability, sustainability and resilience | Maximise value of the DLL and its projects. Darwin and partners learn how to improve liveability and how to get better at it. Provide an evidence-base for liveability outcomes (i.e. activation of public spaces, improved thermal comfort, reduced carbon emissions) |
| | P5. Larrakia-led Darwin biodiversity values | Adam Liedloff , Emma Woodward and Jon Schatz , CSIRO; Lorraine Williams, Larrakia partner; Ben Smith, Larrakia Rangers. | A working list of Larrakia biodiversity values including habitats and native plant species, that can be considered for Darwin urban greening and protection | Darwin's unique sense of place is developed through the lens of engagement with Larrakia Traditional Owners and the Larrakia rangers to incorporate Indigenous knowledge to enhance wellbeing and urban greening |
| Capability development with partners | P6. Developing local capacity to monitor and evaluate urban innovations using UAV's | Assoc. Prof Hamish Campbell , Dr Deepak Gautum and Dr Hooman Mehdizadeh Rad, Charles Darwin University; Dr Shaun Levick , CSIRO. | A collaboration between Charles Darwin University and CSIRO to develop new urban data collection capability through a PhD student. The project will assemble a light-weight fixed wing unmanned aerial vehicle (UAV) with radiometric cameras to enable aerial thermography collection in the Darwin CBD and other zones of interest | Enhanced local capacity to undertake aerial radiography in Darwin. Provision of aerial radiography data at sufficient cost, scale and resolution to evaluate the effectiveness of city heat mitigation initiatives. DLL-CDU collaboration leads to further innovative proposals |

Financial Reporting

Partner investments

The Darwin Living Lab is a 10-year project running from July 1st 2019 to June 30th 2029. Seed funding of \$6.8 million has been provided by the following partners:

| | |
|----------------|----------|
| Commonwealth | \$2.7m |
| CSIRO | \$2.1m |
| NT Government | \$1.0 m |
| City of Darwin | \$1.0 m. |

2019-20 Expenditure

The Partners Management Committee approved resources to be front-loaded within the first eighteen months of the Darwin Living Lab with a view to accelerate early impact.

| Item | Actual expenditure (July 1 2019 - Dec 31 2020) |
|--------------------------------------|---|
| Labour | \$520,461 |
| Labour Overhead | \$442,895 |
| Operational costs/procurement | \$194,576 |
| Total Position | \$1,157,932 |



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