UTS Climate Change Cluster

Future Reefs

Opportunities for Impact

Our Team

We are a diverse group of biogeochemists, coral and marine biologists, investigating how environmental changes shape coral health and survival to develop coral reef restoration programs that are viable, ensuring improved reef resilience.

The Future Reefs Team consist of dedicated members including 3 post-doc researchers, 4 undergraduate students (including Honours students), 12 HDR students, and 4 affiliate researchers.

We established **The Coral Nurture Program** in 2018, a globally unique partnership between reef scientists, the tourism industry and traditional owners on the Great Barrier Reef. The program aims to develop industry-led tools and workflows for managing and rebuilding healthy coral communities of "economically high value" reefs used for tourism. Our team demonstrates how tourism-research partnerships and collective community action can improve the success of coral restoration efforts in high-value sites such as the Great Barrier Reef.

Our Impact

Coral reefs are the most biodiverse marine ecosystems in the world, but they face multiple threats to their survival from overfishing, water pollution and rising sea temperatures caused by climate change.

Globally coral reefs have an estimated value of US$36 billion per year – value that is under threat if they are lost. Researchers now fear, without innovative restoration efforts, coral reefs will continue to be lost.

While the task of maintaining and restoring the health of the world's reefs is a huge challenge requiring concerted effort from governments and industry, our team shows what can be achieved when communities work collectively to benefit the reef and the many stakeholders that rely on reef resources.

Our work aligns with the United Nations' Sustainable Development Goals (SDG), 13 and 14, to support achieving a better and more sustainable future for all.

Future Reefs Team Leaders

Dr. Emma Camp

ORCID ID: 0000-0003-1962-1336

I am the team leader of the Future Reefs team (FRT) within the Climate Change Cluster at UTS. I co-founded the Coral Nurture Program (CNP), a new approach for caring for the Great Barrier Reef initiated by a partnership between tourism and science. Since 2018 CNP has out-planted over 100,000 corals on the Great Barrier Reef.

I am passionate about future proofing community coral restoration through innovative science. My work spans the study and propagation of natural "super corals" to engineering new coral nutrition to enhance resilience. My research within the Future Reefs Team, directly informs how reefs will look and function into the future, but also how to better preserve and re-build "healthy reefs".

Alongside my research I am passionate to champion the introduction and retention of women and girls in STEM. I am a National Geographic Explorer and Rolex Associate Laureate. In 2020 I was named an inaugural Australian Academy of Sciences STEM Women's Gamechanger and made Time Magazines Next Generation Leaders list. I am passionate about communicating research to engage society to become part of the solutions required to ensure a perpetual Earth.

Dr. Jen Matthews

ORCID ID: 0000-0002-2766-8671

I am a Postdoctoral Research Fellows within the Future Reefs Research group in the Climate Change Cluster. I am a coral biologist and marine metabolomicist with research interests in marine symbiosis and coral reef conservation.

I am especially interested in coral nutrition, and am currently developing innovative ways to optimise larval coral nutrition to boost growth, survival and resilience. This research has exciting potential for the development of coral health diagnostic tools, allowing for focused conservation activities, saving time, money, and coral reefs.

My contributions have been internationally recognised, being part of the International Coral Bleaching Research Coordination Network, and the International Metabolomics Society Early-Career Members Network. In 2009, I founded 'Big Blue Conservation', a not-for-profit organisation protecting and restoring beautiful reef ecosystems in Thailand.

Our vision is to be a leading public university of technology recognised for delivering global impact.

UTS2027

UTS 2027 has set UTS's vision for the next decade: to be a leading public university of technology recognised for delivering global impact.

UTS will establish partnerships in climate mitigation and adaptation to drive the economic, social and cultural prosperity of our communities. C3 will drive with UTS as a world-leading university by advancing knowledge and learning through research- inspired teaching, research with impact and partnerships with industry, the professions and the community.

C3 has a strong track record of forming industry links and using technology to develop innovative climate mitigation strategies, as well as delivering research excellence in the fundamental sciences relevant/linked to human and environmental health.

Facilities

We have state-of-the-art facilities that underpin research at different stages and scales, including:

Environmental Biogeochemistry Facilities

Includes continuous monitoring of temperature, salinity, O2, pH, carbon chemistry, and respirometry chambers (photosynthesis, respiration and calcification).

Photobiology and Optics Facilities

Includes state-of-the-art active fluorometry suites, and Joliot-type spectroscopy used for phenotyping.

In-house Coral Husbandry Aquarium Facility

Includes holding and quarantine tanks for propagating an array of hard and soft coral species, and nano-tanks for custom environmental experimentation.

Examples of Our Research Impact

The Coral Nurture Program

Great Barrier Reef expansion

Our team established The Coral Nurture Program (CNP) in 2018, resulting in a unique partnership with Government and Great Barrier Reef stakeholders. The CNP implemented the first reef restoration activity on the Great Barrier Reef, rapidly transforming local management capabilities.

To date the CNP has had extraordinary success, planting more than 95,000 corals at 27 sites throughout the Cairns-Port Douglas tourism hub. The CNP developed innovative tools and simplistic workflows that could be integrated into day-to-day stakeholder operations. Local operators have now installed over 100 reef coral nurseries propagating 1000s of corals for future stock.

In 2022, the CNP launched in The Whitsundays– making it the first region-wide coral restoration enterprise integrating diverse tourism operations. Recently the CPN was recognised by the United nations an official actor for the UN Decade of Ecosystem Restoration.

CORAL NURTURE PROGRAM

Boosting Coral Abundance of the Great Barrier Reef

Low cost restoration

Cost of intervention can be a major limitation in the successful restoration of reef sites. This project, developed uncomplicated low-cost restoration tools for innovative coral planting.

The development of the Coralclip® lead to planting of coral 10 times faster than conventional methods. Thanks to the simplicity of the Coralclip® CNP partners, tourism operators and traditional reef owners can now facilitate the propagation of coral, enhancing site recovery and longer-term resilience.

The Coralclip® is now being used by practitioners in over 19 Countries. It has also helped inform a novel return-on-effort score that is now being utilized by other reef practitioners worldwide.

Australian Government
Great Barrier Reef Marine Park Authority

Elements of a Super Coral

What makes it “Super”?

The Future Reefs team pioneered a new way to investigate what makes super corals so “Super”. We set out to understand how the availability of elemental resources is linked to the coral’s elemental composition.

Our team is continuously working to understand how and where super corals use elements to survive in harsh environments. This knowledge allows us to map and quantify the elemental composition of Super corals to better understand how they are able to survive conditions more extreme than what is predicted for the open-ocean over the next 200 years.

Our research has resulted in identification of new Super Corals, helping future proof restoration and community action. Gaining fundamental knowledge of these nutrient networks has led to the development of new solutions such as nutrient supplementation boosting corals resilience to thermal stress.

UNITED NATIONS DECADE ON ECOSYSTEM RESTORATION 2021-2030

Our findings and knowledge have the potential to be transcribed cross the globe, supporting wide-scale restoration of our ocean's reefs.

Responding to Change

Continued increases in surface seawater temperatures that drive marine heat waves which cause coral bleaching events are likely to keep occurring, even if climate policy is improved quickly. Hence, saving the Great Barrier Reef extends beyond coral management and restoration – it is a complex task.

The sheer size and complexity of the reef, as well as the cost of intervention, means that saving the reef is only possible with effective global action on climate change, in addition to continuing the existing management of fishing, and runoff.

In the meantime, we are developing the know-how to buy time at a scale that helps coral at the most valuable (ecological and economic) locations. A focus on site specific management, as demonstrated in our CNP, is key to success at any scale.

The Future Reefs team is developing new solutions such as nutrient supplementation to add new tools to the restoration tool box. Our research has resulted in identification of new Super Corals to help future proof community action.

Our Approach

Achieving our mission of sustainable change requires genuine connections across all levels of industry, government and civil society.

We work hard to build and foster innovative, robust and effective collaborations focused on mutual learning that inform and add value to our research. Our approach is to build restoration programs that facilitate collective community action.

Our current work demonstrates how these partnership and collective community action can lead to the successful restoration of high value reef sites. The CNP is considered one of the only successful restoration activities on the Great Barrier Reef to date. The success of this program is thanks to the innovation of low-cost, simple but effective workflows and tools that enable stakeholders to actively participate in reef restoration and management.

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Opportunities for Impact

Assessing Long Term Impacts of Restoration

How coral restoration can positively enhance coral diversity and resilience.

Due to the current success of the Coral Nurture Program (CNP), we strive to continue our work to improve knowledge of how coral restoration can positively enhance local coral cover, diversity, resilience and sustain reef functions.

We will assess the effects of out-planting corals over a 10-year period, conducting ecological and functional assessments. Continuing CNP efforts will improve our ability to identify environmental factors governing coral restoration success, such as growth and survivorship and functional retention.

$502,400
per year

Micro Fragmentation

Optimizing community restoration practices.

This project will bring together, scientists, communities and stakeholders to improve the diversity of corals that can be propagated within the CNP. Diversity on the reef is fundamental in supporting long term ecological resilience. Hence, we are developing an optimising propagation methods for under represented corals.

Central to this project is improving community education and engagement regarding coral restoration. Once optimal prototype moulds are designed they can be distributed to interested citizen science organisations (e.g. schools) for manufacturing of propagation plugs. This project will improve the ability to propagate a diverse range of corals, and generate new knowledge on the role diversity plays in restoration success.

$380,600
over 3 years

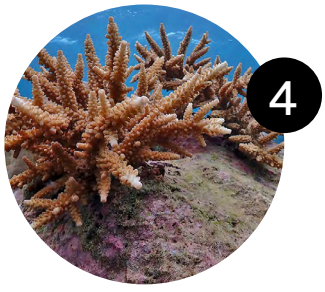
Future Proofing Restoration

Maximising community restoration success by pro-active planning.

We aim to maximize community restoration success by pro-active planning for future environmental stress. Key to the success of restoration is the correct identification of how, what, where and when to act.

We will trial and integrate innovative technology to optimize the genetic and phenotypic selection of thermal tolerant species. Additionally, this project aims to identify and create locations that have higher resistance and or resilience to environmental disturbances. This project will improve site and societal resilience to change, enhancing coral survival and reef health.

$802,000
over 3 years



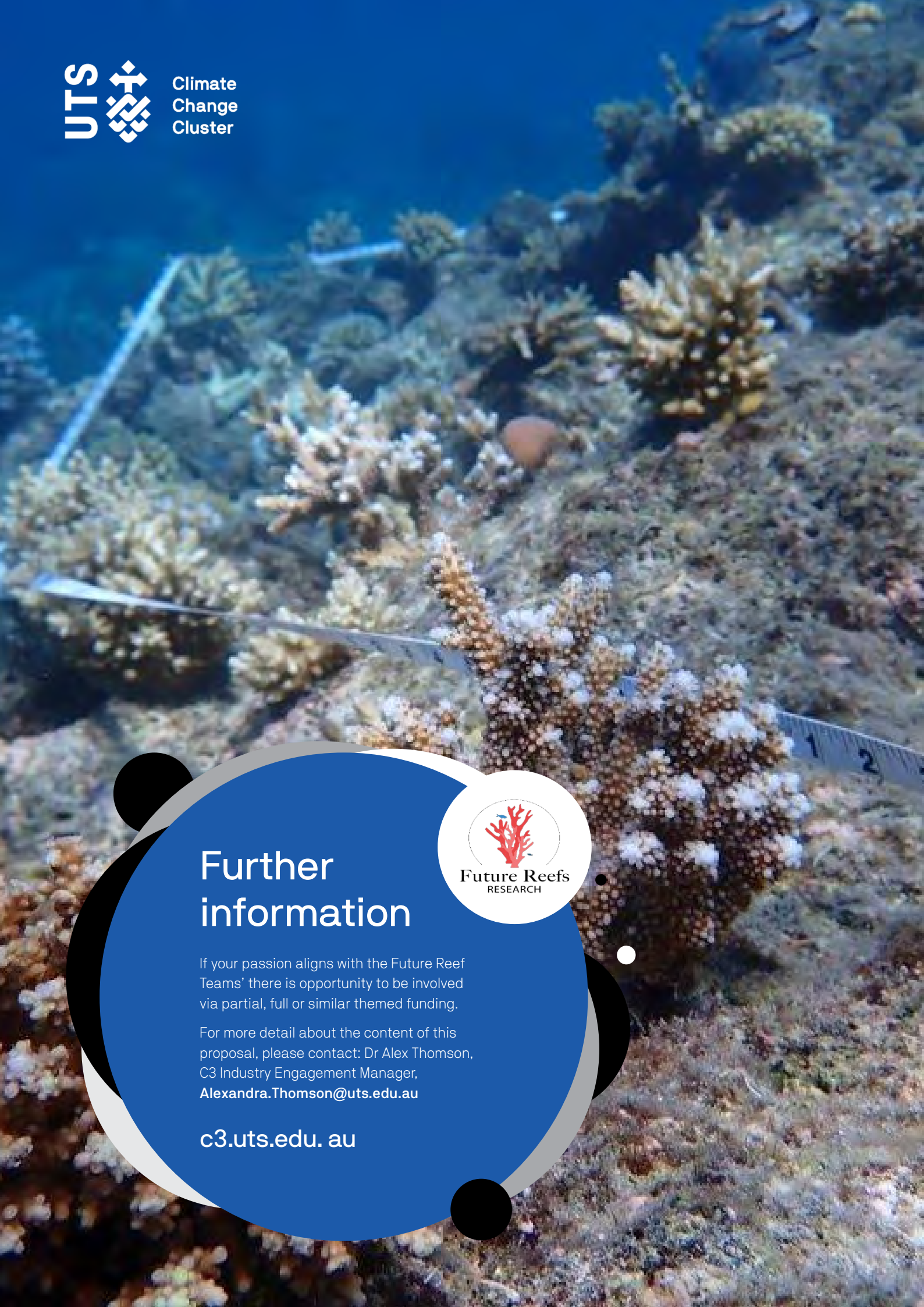
Coral Nutraceutical

Tailored nutrition delivery supporting stress tolerance.

This project is working to understand the natural nutrient dynamics on reefs, under both ambient and stress conditions.

This project will integrate and trial innovative techniques to develop ways to deliver nutrition tailored to support corals to withstand stress. This work is critical in improving coral survival, and resilience when under stress conditions.

$2.4m
over 3 years



UTS Climate Change Cluster

Future Reefs RESEARCH

Further information

If your passion aligns with the Future Reef Teams' there is opportunity to be involved via partial, full or similar themed funding.

For more detail about the content of this proposal, please contact: Dr Alex Thomson, C3 Industry Engagement Manager, **Alexandra.Thomson@uts.edu.au**

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