Accelerating science and innovation for a better future
Discussion paper (Queensland Government)

The Australian Citizen Science Association (ACSA) appreciates the time and effort taken by the Queensland Government Department of the Environment, Tourism, Science and Innovation, to develop *Accelerating science and innovation for a better future: Discussion paper.* We also welcome the opportunity to provide this submission on behalf of the citizen science community of Australia. This community is very strong in Queensland, on account of its high diversity of ecosystems, habitats and species—not all of these of biological attributes are located in protected areas and globally significant world heritage areas. Understanding how these ecosystems, habitats and species function, together with knowing their conditions, trends and threats are the focus of much of the citizen science being undertaken in Queensland. This research is mostly in collaboration with professional scientists.

Background

What is citizen science and what are its benefits?

Citizen science involves public participation and collaboration in scientific research with the aim of increasing scientific knowledge (Australian Citizen Science Association definition, 2017)[1]. Citizen science can involve but is not limited to

- ⇒ identifying research questions,
- ⇒ designing/conducting investigations,
- ⇒ collecting and analysing data,
- ⇒ developing data applications, communications and other technologies for science, and
- ⇒ solving complex problems.

By involving members of the public in authentic scientific research, citizen science helps test new concepts, accelerates discovery, and involves the public in evidence-based decision-making to create an informed and active society. Citizen science can also support raising awareness, literacy, and skills in science, technology, engineering and mathematics (STEM). This is done by offering students opportunities to use innovative technologies inside and outside the classrooms in the process of making contributions to real-world scientific research.

Citizen science can also augment and enhance traditional scientific research with the public

[1] https://citizenscience.org.au

collaborating across large geographical scales, over long periods of time, offering access to information at scales not otherwise possible. Citizen science harnesses the power of communities across a wide range of disciplines from microbiology, biodiversity conservation, medicine and public health, to ecology, environmental sciences and astronomy.

Another phrase is also gaining momentum. "Indigenous science" has clear overlap with Traditional Ecological Knowledge. Indigenous science is grounded in continuous, trans-generational, place-based observation built over tens of thousands of years. Cultural burning uses weather, fuel and ecological indicators to gently burn Country while supporting biodiversity, while seasonal calendars tied to flowering plants and wildlife movements enabled practical decisions about when to collect bush tucker, travel and care for Country. In our experience, enduring insights emerge from the overlapping space between Indigenous, citizen and mainstream science.

How many citizen scientists are there in Queensland?

Until recently, the number of citizen scientists in Australia was estimated at between 100,000 and 130,000 people. But this is a major underestimate. A recent survey of about 20 key organisations suggests there are likely more than a million in Australia[2]. Given Queensland's high biodiversity and large range of ecosystems and habitats, an estimate of at least 200,000 Queensland-based citizen scientists seems reasonable.

The technology revolution is happening fast and benefitting both mainstream science and citizen science. There are only a limited number of professional (paid) scientists, but anyone with a smartphone can log observations, and professional scientists increasingly work alongside citizen scientists.

Citizen science can be as simple as a keen birder posting sightings of a rare orange bellied parrot to *eBird* or a fisher posting a sighting of a bull shark to *iNaturalist* where citizen and professional scientists can see it. But it can also be volunteering to help in large-scale practical projects organised by professional scientists. These include tracking bushfire recovery, reporting weed infestations, monitoring koalas or fishes, assessing microplastic hotspots and tracking water quality.

It took six years (2008–14) for Australian citizen scientists to collectively contribute 10,000 species observations on *iNaturalist*. Now, more than 10,000 are posted every day. Hence, citizen science is now recognised for its contributions to health, astronomy, agriculture and – especially – nature conservation. Australia's Strategy for Nature, Threatened Species Strategy and State of the Environment reports recognise the worth of citizen scientist data.

Who is ACSA?

The peak body for citizen science in Australia, Australian Citizen Science Association (ACSA)[3], was formed in May of 2014. ACSA is a volunteer-led, member-based, incorporated

[2] https://www.linkedin.com/pulse/one-million-plus-community-citizen-scientists-adam-smith-phd-mba-suoac/

[3] https://citizenscience.org.au

association that seeks to advance and support citizen science. ACSA's mission is to advance citizen science through the sharing of knowledge, collaboration, capacity building and advocacy for citizen science in public and private policy and practice.

ACSA welcomes multidisciplinary and transdisciplinary approaches and the integration of western and Indigenous knowledge systems to understand the patterns of climate change, biodiversity loss, biosecurity threats, human health and well-being, primary industries and tourism. We too find this essential to guide the creation of innovative solutions to reverse environmental degradation and improve people's lives and regional economies. Perspectives from multiple disciplines and diverse forms of knowledge are the only path forward to achieve priority objectives in a coherent and sustainable way.

Of relevance to this discussion paper, is a recent Great Barrier Reef (GBR) citizen science project delivered by ACSA, with funding from the Australian Government[4]. The review provided insights into what is being monitored and where, along with opportunities that may exist for future Citizen Science in the region. Gathering feedback from Project Leaders, we also learned where the sector needs more support in the future. With over 40 different activities on offer and over 140 individual groups delivering citizen science, the commitment to the GBR is clear, Queensland's citizen scientists are not only monitoring, educating, and increasing awareness, but the majority are also stewards for GBR species and habitats. Importantly, 94% of respondents from a survey of GBR citizen science project leaders said that some or all their citizen science participants were also involved in GBR stewardship activities. This study provides credible evidence that citizen science is contributing to the scientific understanding, sustainable use and stewardship of one of the seven recognised natural wonders of the world[5].

Queensland is emerging as Australia's most climate-exposed state[6], facing intensifying natural hazards and growing risks to communities, infrastructure and the economy. Experts warn that without urgent action to limit global warming; parts of Northern Australia (and most of Queensland) could become unliveable and uninsurable within decades[7]. Specifically:

- Queensland is Australia's most climate-exposed state, with its large, decentralised population and already hot tropical and subtropical climates placing it on the frontline of global warming.

[4] https://citizenscience.org.au/citizen-science-across-the-great-barrier-reef/

[5] https://7wonders.org/natural-wonders/

[6] Turton, S.M. (2023) *Surviving the Climate Crisis: Australian perspectives and solutions* (CRC Press, Taylor and Francis Group, London UK), 256 p. https://www.routledge.com/Surviving-the-Climate-Crisis-Australian-Perspectives-and-Solutions/Turton/p/book/9781032039473

[7] https://theconversation.com/dangerous-climate-change-threatens-northern-australias-big-food-bowl-dreams-265727

- Climate change will amplify natural hazards across the state, increasing pressure on health systems, critical infrastructure, ecosystems and key industries—and pushing emergency services to their limits.
- More frequent and intense heatwaves, bushfires, floods and tropical cyclones will heighten risks to life and property, disrupt communities and drive migration away from the most vulnerable regions.
- On current warming trajectories, parts of Queensland risk becoming unliveable and uninsurable within decades, with far-reaching economic and social consequences.

Climate change will adversely impact Queensland's natural capital, including its ecosystems, habitats and biodiversity. The state's natural assets are the basis of its multi-billion-dollar agriculture, mining and tourism industries. Other key industries, like commercial fisheries and forestry are also under serious threat.

Climate change will also have serious implications for Queensland's biosecurity, with pests and diseases likely to enter the state via Cape York and from accidental introductions via sea and airports. Such introductions have the potential to threaten human health and wellbeing, to decimate our primary industries and threaten the integrity of our world heritage sites and their ecosystems, habitats and biodiversity.

ACSA suggests making the following revisions to prioritise pathways for Queensland to 'net zero' carbon emissions by 2050. While climate change is fundamentally an environmental challenge, its effects extend far beyond the natural environment and have significant implications for various sectors of Queensland society. Climate change is a major driver of ecological, economic, social and cultural conditions across all sectors and disciplines and requires multi-sectoral mitigation and adaptation responses at various levels, in Queensland, Australia and internationally.

Queensland is in an excellent position to build its science and innovation expertise around a low carbon economy and future, and to be global leaders in this space. Additionally, we can build our expertise as 'tropical' experts and innovators in our universities, government research facilities and industry partners. Such expertise will be invaluable as the planet warms further, and tropical climates migrate into currently temperate parts of Australia and elsewhere.

Queensland-based citizen scientists are involved as keen observers of our natural world, harnessing their combined expertise to inform scientists working across primary industries, biosecurity, public health, protected areas and world heritage, and to engage first nation's people in deepening our understanding and appreciation for "caring for country". With this backdrop, ACSA responds to specific questions below.

Comments and suggestions on consultation questions

Section 1: Boosting capability

"Queensland's ability to attract investment and create jobs depends on developing talent, enhancing skills and improving access to world-class research infrastructure. By removing barriers and upskilling, including for underrepresented communities, we

can better leverage our science and innovation system to drive economic growth and help position Queensland as a leader."

Creating pathways for Queensland's future innovators
Queensland's scientists, researchers, and innovators are at the forefront of breakthroughs and discoveries that improve the lives of Queenslanders. To further build on their success, we need dynamic talent pathways that inspire young people to start businesses, pursue studies and careers in STEM, health, and social sciences from school through university, vocational education, and beyond. At the same time, we recognise there is a growing need for specialist skills such as commercialisation and product development, to support the effective translation of ideas into impact.

Leveraging Queensland's unique natural assets
Leveraging Queensland's unique natural assets Queensland's unique natural environment has helped us to excel in environmental science and innovation. From the Great Barrier Reef and tropical rainforests to expansive rangelands and world-class national parks, Queensland's natural assets are not only iconic but also critical to advancing research and solutions in key areas. We are leading the way in climate adaptation, biosecurity, marine research, tropical health, and environmental science, while fostering partnerships with First Nations knowledge holders to integrate traditional knowledge.

Page 9: ACSA provides evidence to support these two questions:

1. *What is the role of the Queensland Government in supporting people and organisations to create new knowledge and innovative solutions?*
2. *What Queensland resources could be leveraged further for science and innovation?*

   ACSA endorses the Queensland Government's bold vision for science and innovation. We request they give serious consideration to harnessing the skills and expertise of the state's many citizen scientists to fill gaps in knowledge that cannot be met by the science community alone. This is an invaluable resource for leveraging science and innovation to work towards understanding and responding to many wicked problems, such as biodiversity decline, climate change impacts and adaptation, biosecurity threats and human health and wellbeing. Our greatest strengths are in tropical expertise in environment and public health. As the climate warms, this expertise will be demanded in the more populated southern regions of Australia.

   We request that the Queensland Government works with ACSA to prioritise where citizen science can play a role in driving high quality science and innovation. This will likely be in the environment space (climate, biodiversity, biosecurity, water quality, etc), but there is also huge potential for leveraging research and innovation in the public health space. The real advantages will be Queensland's tropical expertise in these core areas of science and innovation.

Section 2: Enhancing connections

"Strong connections across Queensland's science and innovation system unlock collaboration, accelerate knowledge sharing, and drive innovation. By linking expertise across industries, research sectors, precincts, and regions, we can leverage existing and evolving opportunities."

Unlocking collaborative solutions

Queensland's economy faces unique environmental, social and economic challenges, but these also present opportunities to lead the way in innovation and problem-solving. Queensland's scientists, researchers, innovators and high-growth firms are key to developing and deploying solutions and advanced technologies to tackle these challenges.

Connecting people, ideas and opportunities through precincts and hubs

Innovation precincts and hubs are vital to Queensland's science and innovation system, attracting talent, investment, and fostering collaboration between researchers, businesses, and industries.

Focusing on Queensland's strengths in biotechnology, environmental science, renewable energy, and advanced manufacturing, these hubs attract talent, provide access to shared research infrastructure, foster collaboration, and turn ideas into tangible solutions.

Regional hubs like Townsville drive research in key areas such as marine ecosystem (at the Australian Institute of Marine Science), tropical health (at the Australian Institute of Tropical Health and Medicine), and Indigenous health (at James Cook University).

These hubs provide local research and innovation capability through training, mentoring, infrastructure and more, improving local environmental, health, social and economic outcomes.

With Queensland's proximity to Asia-Pacific markets these hubs strengthen international collaboration and open pathways for growth. To maximise their impact, Queensland must better connect precincts, unlock resources, and adopt international best practices. This includes partnering with Traditional Owners to deliver benefits across Queensland's communities.

Page 13: ACSA provides evidence to support these four questions:

1. How can we better connect Queensland businesses, researchers, and communities to create a thriving science and innovation system in Queensland?
2. What opportunities exist to better connect innovators, researchers, businesses, and communities?
3. How can we better connect Queensland's innovation precincts and hubs to create a more cohesive and impactful network? And how can we ensure that these precincts and hubs are accessible and beneficial to local communities, including underrepresented groups?
4. How can science and innovation best leverage the unique geography of Queensland, including through support of regional economies?

ACSA states that citizen science can contribute to environmental management and public health and wellbeing in Queensland. ACSA and its many partner organisations have established links with local communities and the science community across the state.

Citizen science can play a role as a great connector between science and innovation, researchers, businesses and communities, including underrepresented groups. ACSA has strong developed links with regional communities that depend on health and sustainable use of natural assets, e.g. Great Barrier Reef. As well as environmental studies, we also have strong links in other areas, including astronomy and public health. The latter grew out of an appreciation by public health scientists that working with citizen scientists could add value to their epidemiological studies of COVID-19. For numerous tropical diseases, the value of engaging with citizen scientists is worth acknowledging and supporting.

Section 3: Supporting commercialisation

"Unlocking Queensland's economic potential requires fostering innovation, building strategic partnerships, and supporting the commercialisation of cutting-edge research. By focusing on priority businesses and emerging technologies that transform industries such as AI, quantum, renewable energy, and digital health, Queensland can attract global investment, support businesses to scale, and turn scientific discoveries into solutions."

ACSA supports this approach by the Queensland Government. We also note that AI is already playing a significant role in various applications(Apps) used by everyday citizen scientists on their smart phones. These applications range from astronomy to zoology. ACSA is willing to work with the Queensland Government to assist businesses to trial and test a range of AI and digital platforms with our vast network of citizen scientists.