

Please note: the substantive content of the 2026 NRI Roadmap Survey begins at Question 20 (with prior questions dealing with administrative and other information).

As such all submissions that are published include the responses submitted from Question 20 onwards only.

Q20.

Part 2: Research themes

2.1 NRI comprises the assets, facilities and associated expertise to support leading-edge research and innovation in Australia and is accessible to publicly and privately funded users across Australia and internationally. We are seeking your input on possible directions for future national-level investment - i.e., where the requirements are of such scale and importance that national-level collaboration and coordination are essential.

The [2021 Roadmap](#) used a challenge framework to support NRI planning and investment. With this in mind, consider likely future research trends in the next 5 - 10 years, and with respect to one or more of the 8 challenge areas identified in the 2021 Roadmap as listed below:

- describe emerging research directions and the associated critical research infrastructure requirements that are either not currently available at all, or not at sufficient scale and
- describe current national infrastructure requirements that you anticipate will no longer fit the definition of NRI in 5-10 years.

Do not limit your commentary to NCRIS funded capabilities.

Q21.

Resources Technology and Critical Minerals Processing

Q22.

Food and Beverage

Our food and security is underpinned by effective and efficient primary production. Improved agricultural practices are necessary to help ensure a sustainable future. Research infrastructure and critical data streams are needed in a number of areas to support our future food security. Data are particularly needed to help fisheries and aquaculture activities which are operating in a rapidly changing ocean environment. For example, changes to ocean temperature impact fish distribution patterns, growth rates, and overall health. Marine heatwaves can cause extensive damage to fish populations and aquaculture activities. Data are needed at industry operation scales to help inform operations as conditions are changing and underpin forecasting and predictions to support industry and management decisions in advance of changes. Similar examples apply to harmful algal blooms, tropical storms, flood runoff and other disruptive events. Long-term trend data on ocean conditions are also needed to inform management decisions on where to allow operations, how much harvest to allow, etc. Industry operators also need long-term trend information to help determine their future level and location of effort and investment. Additional ocean observing capability to track long-term and episodic events related to water temperature, pH, algal blooms, salinity, currents and more are needed at greater scale and resolution to address these needs.

Q23.

Medical Products

Q24.

Defence

As an island nation, understanding ocean conditions is critical to Australia's defence forces. The Royal Australian Navy has a great need for additional ocean observations to inform their operating environment, increase the ability to detect foreign vessels such as submarines, and more. These needs are greatest in under-observed regions such as northern Australia. To help meet defence needs, greater ocean observations are needed most urgently in northern Australia. This includes: increased data on ocean temperature, salinity and currents; improved bathymetric mapping; and improved modelling capability. Bathymetry data are critical to understand vessel clearances and operating environment as well as coastal waves and currents integral to maritime operations. There are a range of technologies that can be applied to collect the required data such as gliders, profiling floats, sensor moorings, animal-borne sensors, side-scan sonar, and more. While the technology is available, greater investment is needed to fill the geographic based information gaps.

Q25.

Recycling and Clean Energy

Australia is moving toward development of offshore renewable energy in the form of wind and wave infrastructure. The ocean is a harsh operating environment and these industries require a range of data inputs to establish and maintain safe operations. The data required range from understanding wind and wave conditions and knowledge of bathymetry and bottom composition to potential threatened species interactions. The dynamic nature of the ocean means these data need to be continually collected to inform planning and management. For example, climate driven changes in water temperature are causing range expansion and shifts in threatened species. This means threatened species could become more or less prevalent in areas of renewable energy operation. Similarly, if ocean current or wave conditions change these operations may become more or less safe and/or effective. Long-term data on ocean state, trend and change is needed to ensure the sustainability and success of these industries. The technology to deliver this is largely available, but not at scales relevant to industry operations. Expansion of existing infrastructure is needed to fully support development of these industries. There is also likely need/opportunity for more autonomous vehicles or remote data collection via industry platforms that should be considered in the future.

Q26.

Space

Q27.

Environment and Climate

Climate change impacts are increasing with more frequent and intense tropical storms, more frequent marine heatwaves damaging ecosystems, increasing loss of sea ice, increasing ocean warming, and more. All of these changes will impact Australia's coastal zone, the area where the majority of our population, industries and communities lie. There is an increasing need to understand climate-driven ocean change to support decision-making related to coastal development and coastal communities. Open ocean processes, including sea level rise are connected to coastline change. Therefore we need a suite of observing capability/infrastructure to help understand future scenarios and these data must span from offshore to inshore. Tracking the open ocean will help inform modelling and predictions for coastal regions while coastal observing can improve the accuracy of models. There is an ongoing need for ocean observations and a need to expand our capability in this area. Our ocean territory is twice the size of our land mass, more infrastructure is needed to understand this vast and valuable estate. The required infrastructure includes: additional research vessels to operate nearshore and offshore, additional real-time ocean data from floats and moorings, additional observing of boundary currents that drive coastal conditions, additional coastal observing, additional modelling capability, and dedicated data systems and data integration to address the complex issues we are facing.

Q28.

Frontier Technologies and Modern Manufacturing

Q29.

2.2 The 2024 statement of National Science and Research Priorities (NSRPs) includes outcomes linked to each priority to assist in identifying critical research needed in the next 5 to 10 years.

Consider the priority statements and, with respect to one or more of the 5 priority areas as listed below:

- describe emerging research directions and the associated critical research infrastructure requirements that are either not currently available at all, or
- not at sufficient scale and describe current national infrastructure requirements that you anticipate will no longer fit the definition of NRI in 5-10 years.

Do not limit your commentary to NCRIS funded capabilities, and where relevant, refer to the underpinning outcomes and research identified in the NSRPs document.

Q30.

Transitioning to a net zero future

As noted for clean energy: Australia is moving toward development of offshore renewable energy in the form of wind and wave infrastructure. The ocean is a harsh operating environment and these industries require a range of data inputs to establish and maintain safe operations. The data required range from understanding wind and wave conditions and knowledge of bathymetry and bottom composition to potential threatened species interactions. The dynamic nature of the ocean means these data need to be continually collected to inform planning and management. For example, climate driven changes in water temperature are causing range expansion and shifts in threatened species. This means threatened species could become more or less prevalent in areas of renewable energy operation. Similarly, if ocean current or wave conditions change these operations may become more or less safe and/or effective. Long-term data on ocean state, trend and change is needed to ensure the sustainability and success of these industries. The technology to deliver this is largely available, but not at scales relevant to industry operations. Expansion of existing infrastructure is needed to fully support development of these industries. There is also likely need/opportunity for more autonomous vehicles or remote data collection via industry platforms that should be considered in the future.

Q31.

Supporting healthy and thriving communities

Q32.

Elevating Aboriginal and Torres Strait Islanders knowledge systems

Australia's First Nations people are our first scientists and the holders of extensive knowledge and wisdom, especially related to our environment. Integration of Traditional Ecological Knowledge and western science data have the potential to provide more holistic perspectives and solutions to environmental issues. The integration of these two information types will have ecological, management and economic implications. There is a great need to support First Nations groups to collect and manage their own data and to facilitate integration of their data with western data. However, these activities must come with appropriate controls and permissions to ensure First Nations rights, needs and priorities are met. Training and capacity building to help Indigenous communities access and use available data is essential. There is also a strong need for data products such as dashboards to make data and information accessible to non-experts and ease use. There is a subsequent need to educate science and infrastructure providers on the use and integration of Indigenous data and how to deliver western data for Indigenous users. Any steps here should be guided by First Nations needs and priorities. Dedicated systems for integration, such as an Indigenous data space, might provide a platform for sharing; while customisable or modular data dashboards could be used to meet the needs of many through a single approach.

Q33.

Protecting and restoring Australia's environment

Climate change is impacting Australia's environment at unprecedented rates. The full implications for ecosystems are difficult to realise in the current environment due to lack of data. The lack of data can take a number of forms; it may relate to limited geographic coverage, unmeasured variables, or unavailable technology. As marine heatwaves and ocean acidification impact marine and estuarine ecosystems, there is increasing need for additional infrastructure and data to understand impacts at a scale relative to management decisions and restoration efforts. It is difficult to determine where to target restoration without an understanding of which areas will be most suitable in the future and therefore have the greatest chance of success. More observations at greater spatial resolution are needed to inform management/protection and restoration. Advances in genomics are helping improve our understanding of ecosystem and community dynamics, but more support is needed in these areas. Environmental DNA (eDNA) relies on genetic reference libraries which don't yet exist, our sampling/observing and understanding of microbial communities is limited despite their likely critical roles in ecosystem maintenance and recovery. In contrast, harmful algal blooms and other similar changes have impacts on ecosystems and industries, but we have little understanding of the conditions that drive these events or how to predict or manage them. Carbon dioxide removal (CDR) techniques are increasing in prominence and will eventually reach our shores with commercial operators wanting to take advantage of Australian resources. Marine CDR is being proposed as a rapid pathway to carbon dioxide removal, but we have little understanding of the implications of increased alkalinity or other proposed options. We must have a baseline understanding of our ecosystems and how they respond to change and disturbance to have any chance of understanding the implications of mCDR or similar approaches, whether they can or should be applied in Australia, and whether they will have any impact. There are a range of reasons why we need to expand our environmental infrastructure, but ultimately we must recognise that we rely on our environments for food, for shelter, for transport, for industry, for leisure, and more. We need to understand their state and trends in order to protect, preserve and sustainably use them.

Q34.

Building a secure and resilient nation

As noted in Defence, understanding ocean conditions is critical to Australia's defence forces. The Royal Australian Navy has a great need for additional ocean observations to inform their operating environment, increase the ability to detect foreign vessels such as submarines, and more. These needs are greatest in under-observed regions such as northern Australia. To help meet defence needs, greater ocean observations are needed most urgently in northern Australia. This includes: increased data on ocean temperature, salinity and currents; improved bathymetric mapping; and improved modelling capability. Bathymetry data are critical to understand vessel clearances and operating environment as well as coastal waves and currents integral to maritime operations. The technology is available, but greater investment is needed to fill the information gap. As noted for Environment and Climate, there is a strong need to understand coastal change. The ability to monitor and predict coastal change is critical to mitigation efforts to protect cities, businesses and habitats alike. As a coastal country, national-scale coastal data are needed to ensure resilient coastal communities. The currently proposed CoastRI is a starting point to help fill this gap, but much more infrastructure and data will be needed to help Australia manage the pace and amount of coastal change at appropriate scales. There is an urgent need to understand where things will change most and where they will change fastest to inform decision-making.

Q35.

2.3 The case for a new NRI capability, or enhancements to existing capabilities, typically emerges through advocacy from research communities clustering around rigorously identified needs and goals. Such a concept

could respond to a requirement for novel or expanded capacity within a domain, or across domains, and must be such that it could only be made available with national-level investment. If you have identified such a requirement, briefly describe the need, the proposed infrastructure capability, the medium-term goals, impacted research communities, and the timeframe over which you advocate its establishment. Your response can include links to relevant existing reports.

There is a great need to expand existing infrastructure, particularly for environmental applications. There are areas where new capability is also required. One of these is outlined in Research Priority 3 related to elevating Aboriginal and Torres Strait Islanders knowledge systems. Another is increasing the efficiency of collecting and processing data. Collecting samples or conducting observing often requires vehicles or vessels as well as a number of staff. The costs of this kind of operation are continually increasing. While it is widely known there is potential for autonomous vehicles to do some of this work, the market for these vehicles is often small or niche, making it unprofitable. Bespoke, one-off research built vehicles can work, but often do not provide an effective model. Therefore, capacity to develop and deliver a suitably sized fleet of vehicles is needed to help drive innovation and spur production. Vehicles need to be readily accessible and easy to use for a range of applications. This attracts a wider range of users. Aerial drones are a good example of a technology that is accessible to many and useful for a range of purposes. There is no marine equivalent. Given our vast marine estate, the need to inform navy, offshore renewable energy, shipping, fisheries, resource managers, conservation agencies, restoration efforts, coastal planning and so much more – a suitable underwater vehicle or fleet of vehicles would increase the efficiency of data collection while reducing cost and effort. For example, vehicles that could dock at the base of offshore wind pylons could send critical data on environmental conditions or threatened species occurrence as well as monitoring cable infrastructure status. Vehicles that could patrol reef or coastal areas could help inform management decisions related to bleaching events, harvest strategies for fisheries and aquaculture, and forecasting of tropical storm path and intensity. These are a few examples of how an adequate autonomous platform could serve as a cost-effective research infrastructure. In conjunction with autonomous technologies is the need for improved AI/ML and data analytics to help sort and manage the vast amounts of data produced. For example, onboard processing with alerts to anomalies could be vital to inform operational decisions. In addition to autonomous vehicles, there is a growing need for real-time data delivery. Forecasts and predictions rely on real-time inputs. Delivering data in real-time or near real-time requires additional infrastructure and data transmission costs. This capability is rarely available in marine applications due to cost. However, as we work to understand the impacts of storms, floods and other environmental disturbances, real-time data will be critical to decisions directly related to public safety (e.g. opening of flood gauges, path projection for cyclones). As with autonomous technologies, improved data delivery and management practices/platforms are needed. Finally, additional modelling capability will underpin many of our future environmental questions and solutions. We need scope to develop digital twins, to project/predict changes, and capacity improve our models through data assimilation. If we want resilient communities and ecosystems we need more integrated approaches to observations, data integration and modelling/analyses than currently exist.

Q36.

Part 3: Industry perspectives

This section is seeking input specifically from industry-based respondents. Other respondents can skip this section.

Recommendation 6 of the [2021 Roadmap](#) related to improvements in industry engagement with NRI. To complement work on this topic that has occurred since then, we are seeking additional advice on NRI requirements as perceived by current or potential industry-based users.

Q37.

3.1 Have you (or your organisation) interacted with or used Australia's NRI?

- ☐ Yes
- ☐ No

Q38.

3.2 If so, please briefly outline the NRI capabilities you (or your organisation) have interacted with or used. Do not limit your response to NCRIS capabilities.

This question was not displayed to the respondent.

Q39.

3.3 Please indicate your (one or more) primary reasons for interacting with NRI:

This question was not displayed to the respondent.

Q40.

3.4 If you answered no, please indicate your (one or more) primary reasons:

This question was not displayed to the respondent.

Q41.

Part 4: Other comments

4.1 Please elaborate on any of your above responses or add any other comments relevant to the development of the 2026 Roadmap. Your response can include reference or links to existing reports that you recommend be considered during the 2026 Roadmap development process.

The National Marine Science Committee is developing an updated strategy for release during 2025. This document will outline a range of infrastructure needs. The DCCEEW Sustainable Ocean Plan outlines needs and priorities for a sustainable ocean.