

## Submission

# 2016 National Research Infrastructure Roadmap Capability Issues Paper

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### **Question 1: Are there other capability areas that should be considered?**

Agriculture and Food Security is an explicit omission even though implicitly included in the Environment and Natural Resource Management capability. Agriculture and Food production is a critical Australian industry (> 20% GDP) and represents a significant national scientific agenda across many research organisations including CSIRO, universities, State Government DPIs, Research and Development Corporations and Industry. This capability should be explicitly added to the Environment and Natural Resource Management capability.

At least four of the National Research Priorities are underpinned by Environment and Natural Resource Management infrastructure, as well as being relevant to at least four other Capability Focus Areas (Health and Medical Science, Understanding Culture and Communities, Data for Research and Discoverability, Underpinning Research Infrastructure). Therefore, specific provision for increased cross-capability collaboration would enable increased integration and leverage for investment in NCRIS.

Extending NCRIS investment to better support Environment and Natural Resource Management would strengthen almost all other NCRIS capabilities, and leverage investment in eResearch through reducing duplicative parallel investments in other Commonwealth departments. In addition to support of the Commonwealth, co-investment from other beneficiaries of research undertaken, such as the states and universities, is key to maximising infrastructure use and re-use.

### **Question 2: Are these governance characteristics appropriate and are there other factors that should be considered for optimal governance for national research infrastructure.**

A national research infrastructure should be designed to underpin and facilitate a nimble and agile national research capability able to address the changes, demands, and challenges the future will present. This is best achieved by ensuring that the individual facilities form an interactive ecosystem of capability ultimately enabling wide application by adopting organisations public and private. Hence the governance models for individual capabilities need to include consideration of effective measures for interacting with other facilities. It is also worth considering the creation of an overarching Infrastructure Council made up of senior governance/management from within each area to achieve greater coordination as well as engagement opportunities towards interdisciplinary application organisations.

### **Question 3: Should national research infrastructure investment assist with access to international facilities?**

### **Question 4: What are the conditions or scenarios where access to international facilities should be prioritised over developing national facilities?**

**Question 5: Should research workforce skills be considered a research infrastructure issue?**

Yes – see question 7 answer.

**Question 6: How can national research infrastructure assist in training and skills development?**

This is already happening, for example, the eResearch SA and revamped Nectar websites have associated online user guides and training resources, and are promoting various forums for building skills and capacity. The need for balance between online resources and facilitating face-to-face development opportunities seems to be appreciated by these groups. Periodic consultation with users can help refine this as needs evolve.

**Question 7: What responsibility should research institutions have in supporting the development of infrastructure ready researchers and technical specialists?**

They need to be change or evolution ready – institutions shouldn't just be teaching researchers/technical specialists to be infrastructure ready, but also how infrastructure needs to change to support evolving needs.

**Question 8: What principles should be applied for access to national research infrastructure, and are there situations when these should not apply?**

Where national research infrastructure can be leveraged by (any level of) government to support administrative or legislative operations, access should be enabled. Planning for this leverage should also be encouraged when governments are strategically planning upgraded or new systems that would benefit.

**Question 9: What should the criteria and funding arrangements for defunding or decommissioning look like?**

**Question 10: What financing models should the Government consider to support investment in national research infrastructure?**

The funding model needs to be targeted at providing effective access to underpinning, enabling capability and not just the provision of collections of equipment. The approach to funding national research infrastructure through the NCRIS programs has been effective in providing access to capability and in attracting significant cash and in-kind co-investment from state and territory governments, government agencies, universities and research institutes. It has also reduced waste by enabling implementation of agreed infrastructure without costly duplication.

Funding models can encourage application of enabling infrastructure by funding outward facing business analyst/intelligence that assesses how a facility might best be incorporated into a work flow or business application.

**Question 11: When should capabilities be expected to address standard and accreditation requirements?**

**Question 12: Are there international or global models that represent best practice for national research infrastructure that could be considered?**

Previous NCRIS investment in TERN has enabled Australia to become an internationally-recognised leader in terrestrial ecosystem observation infrastructure. TERN infrastructure has enabled Australian researchers to partner with natural resource agencies to deliver fit for purpose science to underpin policy and management.

**Question 13: In considering whole of life investment including decommissioning or defunding for national research infrastructure are there examples domestic or international that should be examined?**

**Question 14: Are there alternative financing options, including international models that the Government could consider to support investment in national research infrastructure?**

#### **Health and Medical Sciences**

**Question 15: Are the identified emerging directions and research infrastructure capabilities for Health and Medical Sciences right? Are there any missing or additional needed?**

**Question 16: Are there any international research infrastructure collaborations or emerging projects that Australia should engage in over the next ten years and beyond?**

**Question 17: Is there anything else that needs to be included or considered in the 2016 Roadmap for the Health and Medical Sciences capability area?**

#### **Environment and Natural Resource Management**

**Question 18: Are the identified emerging directions and research infrastructure capabilities for Environment and Natural Resource Management right? Are there any missing or additional needed?**

In local, state and Commonwealth government, the transition to open data for transparency and reuse value presents particular challenges around being fit for purpose. Policies, plans, actions, targets require data and monitoring to be aligned to specific purposes. This means data infrastructure is more than just good roads for 'data cars' to travel on, but ways to ensure everyone can understand the usability of car contents irrespective of make and model and how it got there.

Government needs for ecosystem science data resources vary from those of research/academia and this creates challenges.

- Data for science/research does not equal data for policy/reporting, despite often both drawing on the same sources or informing each other
- Open data for purposes unknown and new science, is different to open data for purposes known and transparency
- Governments have different legacy systems and different capacities to maintain and evolve them
- Considerations / opportunities for infrastructure capabilities:
  - Programs such as NCRIS must be leveraged by public agencies as well as academia
  - Communities of practice around data management must be fostered and supported as 'social infrastructure' to 'make the most of data resources' because technology

is only part of the story around creation of ecosystem science data for enduring use

- Open data policies can help inform and design interoperability through encouraging good data and metadata management

It is suggested that the directions and research infrastructure capabilities in the Environment and Natural Resources Management space recognise the mutual benefits shared by state level and national data infrastructure collaborations and the direct and indirect benefits that this has. For example, DEWNR has many data sharing networks at the national level across most of our NRM data themes. Many of these are overseen by national coordinating groups. Importantly, they provide an avenue for common agreement on data standards and sharing that enables Open Data to be delivered in a way that is mutually acceptable at a State and National level.

It is also suggested that the emerging demand for natural resource data integration and synthesis requires the establishment and long-term maintenance of a diversity of research infrastructure capabilities, and specific resourcing for strategic synthesis. The resultant whole-of-system thinking will enable interdisciplinary problem-solving to manage our emerging and increasingly complex future environmental risks.

The foundations for much of this essential integrated environmental research infrastructure and synthesis capacity have already been built through previous NCRIS investment in TERN. Examples of this long-term investment that have been beneficial for DEWNR include:

- enabling Australian researchers to take a leading role in the development of the international IUCN Red List of Ecosystems and enabling the Australian Government to meet its reporting commitments for this process
- helping Australia meet its Sustainable Development Goals through remote sensing and better estimating Australia's carbon and water fluxes at the continental scale
- enabling more accurate reporting to the United Nations Framework Convention on Climate Change (UNFCCC) and Kyoto, and measure progress against emissions targets, by coordinating the establishment of Australia's Biomass Plot Library
- North Australian Fire Information (NAFI) system which uses remote sensing data to help manage fire
- ensuring Australia has an influential role in two major international FAO programs, the Global Drylands Assessment and the Global Forest Survey
- sharing data with NASA which helps deliver precise information on the water and carbon exchanges everywhere on Earth's surface, vital for climate change forecasting
- Identification of the relative sensitivity of South Australia's six biodiversity hotspots to the impacts of climate change, under the first-ever systematic mapping of the State's plant biodiversity using a composite of TERN data and state herbarium records

The following provides some key examples of current partnering between DEWNR and research data infrastructure systems:

### **Biodiversity and Vegetation Data**

- Atlas of Living Australia (ALA) a public data portal – DEWNR delivers SA biological observations data to the ALA regularly and relies on it as an additional delivery platform.

- Australia's Virtual Herbarium (AVH) – Through the Commonwealth Heads of Australian Herbaria (CHAH), DEWNR is committed to supplying collection data to Australia's Virtual Herbarium which is hosted on ALA.
- Australian Ecological Knowledge and Observation System (AEKOS) – DEWNR has a partnership agreement with Adelaide Uni as part of NCRIS and funded Terrestrial Ecosystem Research Network (TERN) program. This results in detailed SA Biological Survey and Roadside Vegetation data (not accessible through ALA) being openly accessible through the AEKOS portal
- National Vegetation Information System (NVIS) – DEWNR contributes our native vegetation mapping data under open access licencing into the federated national vegetation information system. The Commonwealth Department of Environment manages this program.

## Soils

- SA contributes our soil site data to Australian Soil Resource Information System (ASRIS), managed by CSIRO, for open access and for use in generating Australia's digital soil mapping SA is in negotiations with CSIRO who manage the National Soil Archive on how SA soil specimens could be housed in the National Archive or for our state data to be included in the National Virtual Soil Archive (similar to that which exists for State Herbaria AVH)
- DEWNR has an MoU with all states, Commonwealth Department of Agriculture, CSIRO, Geoscience Australia (GA), Bureau of Metrology (BoM), Australian Bureau of Statistics (ABS), TERN to compile and share catchment scale land use data through ACLUMP as well as maintain the Australian Land Use and Management (ALUM) classification. SA Govt Chairs (NCLUMI), the national coordinating group that provides strategic direction for ACLUMP.

Our national soil information system is currently underrepresented in this discussion paper. Recent investment in the TERN Soil and Landscape Grid of Australia Facility has provided valuable development, demonstration and delivery of next-generation finer-resolution, more user-friendly soil attribute mapping. However these represent version 1 products and ongoing support for capability and infrastructure is required to improve information and knowledge of soils, that ultimately support diverse science, management and policy outcomes.

These needs are captured in the National Soil Research, Development and Extension Strategy (<https://soilstrategy.net.au/wp-content/uploads/National-soil-RDE-strategy.pdf>) and align with priorities of the Ecosystem Science Long-Term Plan. Proposed national sensor networks in the discussion paper may not address the full range of needs and uses for improved soil information, which underpin a variety of other scientific disciplines and social and economic outcomes.

## Water

In the context of existing collaborations WIRADA should be acknowledged here - <http://www.bom.gov.au/water/about/waterResearch/wirada.shtml>, which is BOM/CSIRO research partnership

- Data and information supplied to BoM is reused where possible by other Commonwealth agencies, such as MDBA, to meet their data requirements.
- DEWNR provides Geoscience Australia (GA) with detailed stream information in GIS format for integration with the Geofabric dataset for Australia.

**Question 19: Are there any international research infrastructure collaborations or emerging projects that Australia should engage in over the next ten years and beyond?**

Page 22, 6.2.2 – modelling and simulation capabilities need to be maintained along with international research relations e.g. The Nature Conservancy

Data modelling, data from conservation drones and metadata tools e.g. need a full suite of data models for research themes and topics under 11.3. Acknowledge that there are lots but the full suite of this could be considered infrastructure. At the moment its piece meal topic by topic – do we have everything covered and relatable, so that Appendix C is made possible?

The [US Administration](#) has recently issued a call to action, highlighting the need for better soil information systems to help secure the future of its soil for food production, climate mitigation, among other critical roles. New investment in remote sensing and national sensor networks to gather soil information should be balanced by investment and integration with more traditional expertise that could be funnelled through a revamped Australian Soil Resource Information System (ASRIS).

**Question 20: Is there anything else that needs to be included or considered in the 2016 Roadmap for the Environment and Natural Resource Management capability area?**

**Advanced Physics, Chemistry, Mathematics and Materials**

**Question 21: Are the identified emerging directions and research infrastructure capabilities for Advanced Physics, Chemistry, Mathematics and Materials right? Are there any missing or additional needed?**

**Question 22: Are there any international research infrastructure collaborations or emerging projects that Australia should engage in over the next ten years and beyond?**

**Question 23: Is there anything else that needs to be included or considered in the 2016 Roadmap for the Advanced Physics, Chemistry, Mathematics and Materials capability area?**

**Understanding Cultures and Communities**

**Question 24: Are the identified emerging directions and research infrastructure capabilities for Understanding Cultures and Communities right? Are there any missing or additional needed?**

**Question 25: Are there any international research infrastructure collaborations or emerging projects that Australia should engage in over the next ten years and beyond?**

**Question 26: Is there anything else that needs to be included or considered in the 2016 Roadmap for the Understanding Cultures and Communities capability area?**

**National Security**

**Question 27: Are the identified emerging directions and research infrastructure capabilities for National Security right? Are there any missing or additional needed?**

**Question 28: Are there any international research infrastructure collaborations or emerging projects that Australia should engage in over the next ten years and beyond?**

**Question 29: Is there anything else that needs to be included or considered in the 2016 Roadmap for the National Security capability area?**

#### **Underpinning Research Infrastructure**

**Question 30: Are the identified emerging directions and research infrastructure capabilities for Underpinning Research Infrastructure right? Are there any missing or additional needed?**

In the spatial information area there are a number of research programs/projects under the CRC-SI (<http://www.crcsi.com.au/>) that are relevant e.g. Program 3 Spatial Infrastructures, Spatial Analytics, Positioning, Agriculture, National Resources and Climate Change.

**Question 31: Are there any international research infrastructure collaborations or emerging projects that Australia should engage in over the next ten years and beyond?**

**Question 32: Is there anything else that needs to be included or considered in the 2016 Roadmap for the Underpinning Research Infrastructure capability area?**

#### **Data for Research and Discoverability**

**Question 33 Are the identified emerging directions and research infrastructure capabilities for Data for Research and Discoverability right? Are there any missing or additional needed?**

Chapter 11 highlights the importance of data as research paper its own right. The ability to access and utilise these data outputs are essential for government and industry as well as the research community. So see the capabilities required to enable such access and use as a key requirement of the future capability – in addition the data and technology elements this will also need to cover licensing/conditions of use etc.

**Question 34: Are there any international research infrastructure collaborations or emerging projects that Australia should engage in over the next ten years and beyond?**

**Question 35: Is there anything else that needs to be included or considered in the 2016 Roadmap for the Data for Research and Discoverability capability area?**

#### **Other comments**

DEWNR is a large state-based organisation with a broad business across all facets of natural resource management. DEWNR is highly dependent on scientific information to support decision making (policy and management decisions). While DEWNR have an excellent and significant agency-based scientific capability to meet our scientific information needs, we are placing increasing emphasis on the value of partnerships with other agencies and research institutions to support the delivery of

science to support our decisions. Developing and maintaining partnerships with research institutions provides two key benefits to DEWNR:

- enables DEWNR to support the design of research programs that best meet the local, context-specific science needs for decision making at state, regional and local scales;
- provides an avenue for DEWNR to engage with the broader environmental research sector, through the national and international networks that partner research institutions provide, and thereby draw in research information that is generated outside of, but that is still relevant to, South Australia

To best support DEWNR's data needs, we recognise that there is a need for better coordination across research institutions, government and industry to improve alignment across distributed monitoring infrastructure facilities, methodologies and standards, and data platforms. This would create better and more accessible environmental data and could facilitate a better use of limited funding by coordinated state and industry co-investment.