Submission
2016 National Research Infrastructure Roadmap
Capability Issues Paper

Name	Michelle Waycott
Title/role	Chair, Council of Heads of Australasian Herbaria (CHAH)
Organisation	Council of Heads of Australasian Herbaria

Declaration of Interests.

The **Council of Heads of Australasian Herbaria** is the peak body for Herbaria in Australia and New Zealand, with members from all States, Territories Australia and New Zealand. We partner the Atlas of Living Australia and the data our member institutions provide is made accessible through the Australia's Virtual Herbarium portal and through the ALA. This recently became Australasia's Virtual Herbarium through the inclusion of New Zealand Institutions records.

Preparation of the Submission.

The views in this submission have been reached through discussions with colleagues among some current and former CHAH members and through several forums with the wider collections community including members of Council of Heads of Australian Faunal Collections Inc. (CHAFC) and University Colleagues. The opinions expressed here are those of the Chair of CHAH on behalf of the Council.

Data for Research and Discoverability

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

The independent inclusion of the Agricultural Sciences other than as a linked component for outcomes of the capability area 6 Environmental and Natural Resource Management, appears to be a gap, and mentioned in 5.2 Current Capability and Emerging Capability Needs & 5.2.1 Biologics capabilities and 10.3 Desirable New Capabilities. Building the tools for emerging new agricultural industries, particularly in the area of developing appropriately environmentally adapted crops or even native plants and animals is viewed by many as highly desirable.

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

Governance of NCRIS Facilities appears to be highly variable and without consistency. This is perhaps expected as a single model is unlikely to be appropriate across all areas. Stakeholder engagement, independence and National Benefit are required as genuine efforts in these facilities and an approach of inclusion rather than exclusion should be adopted more genuinely. Improvement in collaboration/networking across NCRIS facilities is essential, and will result in high impact outcomes for everyone, as well as with the research community by sector. There is a potential role here for various peak bodies as well as our National Academy of Sciences Committees, depending on domain. In the current capabilities the lack of presence of key stakeholders at the table has led to missed opportunities for greater interaction and being included in global initiatives.

As a Peak Body, the Council of Heads of Australasian Herbaria (CHAH) can provide input representing National, International, State and Regional Herbaria and their member institutions.

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

Investment in significant international initiatives would leverage additional benefit to NCRIS capabilities. Of particular interest to CHAH is that currently, it appears that resources within NCRIS capabilities do not support the costs of access to resources and facilities (e.g. country memberships, steering committee meetings participation etc.). As a result access to some infrastructures is largely cobbled together from institutions that want to be involved and through *ad hoc* arrangements. Additionally, access to many international resources may be available through the University sector having combined their efforts to gain reasonable subscription rates (Universities Australia have consortia agreements for library access for example). However, other sectors, in particular State Based science and research groups have limited 'buying' power and leverage options could be significant to both access and contribute to global resources. It should be noted that many governments internationally, and in Australia have proactively moved to Open Access to digital resources meaning that funding to maintain these facilities must be sourced via alternative mechanisms, likely to include Government funding.

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

International collaboration is essential. Biodiversity science, and the infrastructure for taxonomy and understanding changing patterns of invasive species and other biosecurity threats make this critical. However there should be consideration as to the nature of such international infrastructure and their mode of Governance (and resourcing). For example, collections based institutions already collaborate internationally as they have a long standing network of institutions who share resources and whose focus is collaboration to deliver research infrastructure globally. To do this, the network of herbaria around the world share specimens allowing researchers to avoid travelling in many cases, to undertake their taxonomic and other work. Implementing new technologies globally in the last few years, has been done through the Global Plants Initiative where all type specimens around the world are being digitized to high resolution and shared via an online system (JSTOR PLANTS). This has been transformational to some taxonomic and systematic studies. This means, a researcher, say sitting in a herbarium in Adelaide or Alice Springs, can view a type specimen from Madagascar at the click of a button, alleviating the need to ship specimens, or to travel to Madagascar to view them. Initial funding, provided by the Mellon Foundation (USA) has developed the system and now the majority of the Australian flowering plant type specimens are now imaged and shared via this resource. However, cessation of funding means we now don't have freely available to access the shared image repository. Each institution have their own images, however, the global resource requires a fee. As a result many institutions, especially smaller ones, don't have access. The lesson here, and relevant to international facilities, is that resources may be only available transiently if care isn't taken to accommodate different model for ongoing resourcing.

In the biodiversity sciences, and specifically Environmental and Natural Resource Management, international participation is inevitable and critical. Appropriate agreements for participation and support for engagement will be key, particularly as Australian species and ecosystems are globally unique and the development of new, Australian native biota sourced products for a variety of uses developing in new and as yet unimagined ways.

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

Our member institutions all strongly believe that the infrastructure that is represented by the skill base and experience of staff who work in these institutions are an underutilised and certainly under-recognised resource. Critical to the future of many areas of work is the need for better ways of recognising and supporting this workforce, particularly at times when core, foundational science is rarely explicitly supported. This is increasingly the case for most national grants / funding programs amongst competitive funding schemes and thus researchers rely heavily on state or national investment into the institutions themselves. Crucial to this recognition is a widely recognised to continue building on existing taxonomy capability (section 6.3.3). Succession planning in the taxonomic expertise is currently compromised due to lack of recognition of the needs in the sector.

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

The feedback mechanisms to stakeholders as well as users of the various types of infrastructure, should be multifaceted and reviewed regularly. In addition, each facility should have an explicit education and training component. The more technical NCRIS facilities should also have strong engagement programs to encourage use and development of their facilities.

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

If each facility has an explicit education and training component even the more technical NCRIS facilities should also have strong engagement programs with researchers and specialists already aware of the infrastructure. Research institutions must be willing to allow their staff to get experience with facilities for this to be achievable.

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

Access should be open to all. If there is too much demand, then priority setting should be open and transparent. The type of facility should dictate any funding model with respect to cost recovery. Open source information resources, such as many eResources, are best if free or nearly so (e.g. see above answer to Question 4).

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

Ongoing high demand use should lead to some mechanism for support. If partial funding models are required they should be developed from the outset so there is not a ‘rude shock’ model and that the user sector is aware of the way the infrastructure plan will roll out. The decommissioning approach should be developed with the establishment of the infrastructure in real terms, not hypothetical ones, in other words a clearly articulated investment cycle from the outset would be appropriate so that if infrastructure requires long term Government support that is transparent.

It should also be noted that many NCRIS facilities are built from the contributions of its partners, stakeholders and sometimes even users. Decommissioning facilities will require explicit management of the expectations associated with these contributors and not leave them without the resource/s and infrastructure they have helped build.

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

Nil comment

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

Dependent upon the infrastructure under development, but for most, this should be clear from the outset.

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

CHAH strongly suggests that many elements of the Australian model have been examined closely by international organisations and is considered exemplary in creating national solutions that provide shared access and set priorities. Models are likely to vary due to the diversity of facilities under the NCRIS banner.

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?

Nil comment

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

Nil comment

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?

Nil comment

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

Nil comment

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?

Nil comment

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?

The Nationally Distributed Biological Research Collections (NDBRC) consists of over 73.8 million specimens representing investment of over $2 billion in Australia. These collections are a key piece of research infrastructure yet they are absent from the issues paper. These collections provide basic research tools that underpin biosecurity, genomics, fisheries, mining, forestry, agriculture, conservation and environmental management.

The ALA helps make accessible information about the specimens held and that this information has been used for significant and impactful research this data represents a small part of the potential of this infrastructure. These biological collections are managed by a

diversity of institutions including herbaria, museums, universities, botanic gardens, CSIRO, and others. The collections themselves are represented by the Council of Heads of Australasian Herbaria, Council of Heads of Australian Faunal Collections, Australian Seed Bank Partnership, Council of Heads of Australian Botanic Gardens and Council of Museum Directors.

These irreplaceable collections as well as their value as historical records of Australia's biodiversity provide many unrealised opportunities to understand our current biodiversity. These collections have traditionally been repositories and key infrastructure for the discovery of Australia's biodiversity. Today such collections are enabling new questions and problems to be addressed, largely due to new capabilities in high-throughput imaging, isotope analysis, genomics and informatics. These Nationally Distributed Biological Research Collections are largely supported by a combination of State Government, CSIRO and some regional infrastructure and represent a major co-investment in national research infrastructure.

Over the last ten years the value and relevance of the collections has increased enormously as they represent verifiable records that other data layers are increasingly added (e.g. genomic data, native digital images, etc.). the ALA provides access to a small proportion of the collections that have digital data available about them and an even smaller proportion of digital specimens. An opportunity exists where we should consider the possibility that Nationally Distributed Biological Research Collections might be considered a part of a national underpinning research infrastructure and their development built accordingly.

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

Global initiatives to document, catalogue and understand biodiversity.

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?

National Biological Research Collections as significant Research Infrastructure.

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?

Nil comment

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

Nil comment

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?

Nil comment

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?

Nil comment

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

Nil comment

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?

Nil comment

National Security

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

Nil comment

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

Global biosecurity threats due to new invasive plant and animal species.

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

Nil comment

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?

The biodiversity sciences (particularly taxonomy and systematics) are 'Underpinning Research Infrastructure' and it seems important to recognise them as such.

The digitisation of the national biodiversity collection is a particularly worthwhile direction, unlocking as it does an enormous amount of existing data that has proven utility and that in sum provides the core documentation of Australia's living natural resources. National coordination and funding would bring great benefit to many sectors.

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

Nil comment

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

National Biological Research Collections as significant Research Infrastructure.

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?

Open data considerations need clarity for researchers as well as data custodians.

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

Nil comment

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?

Nil comment

Other comments

If you believe that there are issues not addressed in this Issues Paper or the associated questions, please provide your comments under this heading noting the overall 20 page limit of submissions.