

Submission

2016 National Research Infrastructure Roadmap

Capability Issues Paper

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General Questions

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

Biodiversity Assets and Facilities Underpinning Basic Research. Examples include Collections (eg, Entomology, Wildlife, Seed banks), Herbaria, Field Stations

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

International Models for Infrastructure Underpinning Basic Research. One example is the USA where infrastructure needs are managed by the relevant government agencies (eg, National Science Foundation (NSF), National Institutes of Health, Dept of Agriculture, etc), not a single entity as proposed here.

Relevant to my reply to Question 1 above, in the NSF, each Division has a program funding nationally-significant infrastructure needs. For example, in the Division of Environmental Biology, the infrastructure program funds museum research collections, herbaria, field stations.

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?

Biodiversity! (Not sufficient to say “ecosystems”; see below!)

- Changes in the distributions and abundances of plants and animal species with climate change (eg, more than 90 species that have changed in ways consistent with global warming are listed in Steffen et al. 2009, “Australia’s Biodiversity and Climate Change”, CSIRO Publishing). These individual species move between ecosystems.
- The role of invasive plants (eg, gene transfer between some plants and crops, especially in the mustard family)

- The role of insects in pollination systems, vectors of diseases, etc. (again, not picked up in ecosystem studies that look only at water and soils; collections required as well).
- Costs to management, health, agriculture, and government can be reduced, and new innovations produced, by basic research in the field or by analyses of museum or herbarium collections of individual species. For example:
 - PCR techniques, critical to all DNA research, grew out of basic field research on the ecology of bacteria able to live in hot-springs;
 - The discovery that the pesticide DDT affects calcium metabolism in vertebrates (including humans) came first from investigations of thickness of egg shells over previous 50 years in museums;
 - The evidence that a tree species can adapt to less water when CO₂ is increased came first from analysis of stomata (leaf pores) density over 100 years of herbarium specimens.
 - Evidence that many of the changes in species distributions (and the fact they move between ecosystems) comes from analyses of the data on the labels of specimens in collections.

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?

Yes, include Biodiversity. See reply to Question 18.

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?

Missing: Biodiversity (Also see reply to Question 18).

The biological collections are critical infrastructure facilities. They represent past-monitoring efforts (eg, distributional data). Why do the large-scale monitoring efforts described in this document use only “fancier” and more recent techniques (eg, GPS data), ignoring the vast amount of information from labels of collections? Surely 200 years of data is better than 30 years?

The collections are also critical sources of adaptive material, both historical and going forward (eg, DNA), let alone living material such as seeds.

Field stations are critically important for research and education of the next generation. The federal government should not leave these infrastructure resources to hit-and-miss, temporary funding, local arrangements.

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?

Integrate historical data (eg, biological collections information) with recent large-scale environmental monitoring (eg, 30 yrs GSP).

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.

There is no definition of “Innovation”! The word is used throughout this document, but one has to guess—it seems the word is used to mean “development”, not research per-se.

So, change the title! “Infrastructure Capability in Support of National R&D”.

PAW; 16 August 2016