

*CRA description*  
**SCIENCE-DRIVEN E-INFRASTRUCTURES INNOVATION (SEI)**  
*FOR THE*  
**ENHANCEMENT OF TRANSNATIONAL, INTERDISCIPLINARY, AND**  
**TRANSDISCIPLINARY DATA USE IN ENVIRONMENTAL CHANGE RESEARCH**

## **Background and rationale**

The impact of environmental change research and data it produces can be dramatically increased through a transnational approach to critical technological and procedural barriers within the scientific community. In order to accelerate scientific discoveries and socioeconomic innovation, exponential increases in diversity, volume and throughput of crossborder, multidisciplinary data in environmental sciences demand delivery mechanisms that are more easily findable, accessible, integratable, and reusable for research, and must be sustainably curated and preserved for the benefit of future generations.

The capability to bring computer science and technology as well as large and complex data sets to bear on interdisciplinary<sup>1</sup> and transdisciplinary<sup>2</sup> science is emerging. It is therefore critically important to establish and enable transnational frameworks so that data-driven scientific knowledge can transcend disciplines and geographical borders, ultimately increasing the scientific underpinnings of policy and action. International collaboration within Belmont Forum priority research fields holds the potential to establish international foundations for federated data integration and analysis systems with shared services, convene the best practices from the public and private sectors, foster open data and open science stewardship among the science communities including related areas such as publishing, as well as encourage data and cloud providers and others to adopt common standards and practices for the benefit of all.

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<sup>1</sup> *Interdisciplinary* studies are defined here as a research process that involves the mutually dependent collaboration and cooperation of scientists from at least two disciplines and/or technology developers who apply their disciplinary competence to advance fundamental questions or solve problems that are beyond the scope of a single discipline or area of research practice, and to achieve new knowledge, new product and shared results, or a new meaning. The core characteristic of interdisciplinary approaches is their goal to integrate data, concepts, theories, methods, and tools from those disciplines into a more coherent and comprehensive framework involving study design and methodology that is not limited to any one field, and requiring the use of perspectives and skills of the involved disciplines throughout multiple phases of the research process.

<sup>2</sup> *Transdisciplinary* studies referred here as a problem-oriented research and organizational process, integrating the natural, social and economical sciences, together with other relevant scientific and technological disciplines, societal groups or stakeholders. In doing so it transcends their traditional boundaries to advance interrelated research challenges and problems generated in a scientific or extra-scientific context—such as sustainable food, land-use water, energy security while mitigating environmental and climate change— and contribute to their solution. Transdisciplinarity accepts local contexts and uncertainty and as such is a context-specific negotiation of knowledge that includes framing real world problems with the constraining and complex nature of social, organizational, and material contexts. As such it promotes new collection and research engagement of data (quantitative and qualitative) together with conceptual, theoretical, methodological, and translational innovations integrating and moving beyond discipline-specific approaches. For this reason, transdisciplinary research and practice require close and continuous collaboration during all phases of a research project or the implementation of a project. It is often action-oriented devoting effort to uncover, distil and collate the evidence into forms required by various group of users (research, public/private sectors, communities) and that will be used in decision and policy making. The quality of the knowledge produced is then not only judged by scientists (peer review), but also by other criteria such as competitiveness, cost effectiveness and social acceptance.

For these reasons, the **Belmont Forum** is launching a three-to-four year competitive **Research Coordinated Research Action (CRA)** on **Science-driven e-Infrastructure Innovation (SEI) for the Enhancement of Transnational and Interdisciplinary Data Use in Environmental Change**.

This SEI call targets initiatives that are well-positioned to bring together environmental, social and economic sciences with data science, computational sciences, and e-infrastructure and cyberinfrastructure developers and providers to solve one or more of the methodological, technological and/or procedural<sup>3</sup> challenges currently facing interdisciplinary and transdisciplinary environmental change research working with large, complex and multi-source transnational data. The SEI call will intimately link research thinking and technological innovation toward accelerating the full-path<sup>4</sup> of discovery-driven data use and open science, and enables a broader scientific community to benefit from the identified new and potentially disruptive demonstrators or pilots toward solutions.

The SEI CRA will implement this call as a “task force” requiring all funded projects to share results and participate in regular steering workshops (e.g., one per year), and to contribute to a knowledge hub catalyzing research efficiently with best practices, shared methods and their software implementation. This is intended to maximise the outcomes and add value across the projects. Information in the knowledge hub may also be used to deliver research-driven recommendations to the Belmont Forum for transnational federated data e-infrastructures, data policies, and capacity building needs where r existing strategies may be enhanced or appended to.

### **The SEI Call key features**

The competitive SEI call will support 3-4 year innovative projects that must be:

- **Science-driven.** Projects should aim to develop innovative demonstrators and pilots that enable the use of transnational multi-source data and enhance interdisciplinary and transdisciplinary environmental change research. They must specifically identify tangible research questions and objectives that will benefit from the proposed solutions.
- **Collaborative.** Projects should involve mutually-dependent collaboration between and among domain scientists and computer and data scientists, as well as possibly e- and cyber-infrastructure developers and providers, linking research thinking and technological innovation to solve well-identified, experience-based methodological and/or technological issues and barriers in transnational data use.
- **Translatable.** Projects are expected to deliver and share innovative demonstrators and pilots and open softwares that smooth the path from theoretical research through proof of concept to usable and effective solutions that are translatable and relevant to the wider scientific community for a sustained impact on research practices.
- **End-to-end.** Projects targeting specific segments along the full path of data use in a well-described science-driven context should demonstrate how this will accelerate

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<sup>3</sup> Procedural issues may be organizational, legal, security, and/or policy related, with respect to the potential benefits and limitations of open science, from data collection and management through the publication of results. Procedural issues may also influence the capacity of domain scientists to effectively use computing and data infrastructures, as well as to organize the ongoing integrity, accessibility, interoperability, and reuse of data (data stewardship).

<sup>4</sup> The full-path of date use extends from data capture, data access and management, data analysis and modeling, through data and model inter-comparison together with data provenance system.

the rates at which information is gleaned from data and impact the Belmont Forum research challenges.

- **Interdisciplinarity and/or transdisciplinarity.** Great premium will be placed on interdisciplinary and transdisciplinary research-driven initiatives with an emphasis on co-design, co-development and sharing within and across disciplines enabling open data and open science all along the full path of data use.

The SEI call emphasizes ‘going the last mile’ with data: not only uncovering evidence that support scholarly observations, but also distilling and collating the evidence into forms that can be used routinely in research across disciplines so that the data ultimately increases the wisdom behind policy and action in a transdisciplinary context.

## **Example Topics of the SEI CRA**

Research topics of interest include, but are not limited to:

### *Enable High-end Data assimilation and Broaden Data Model Intercomparison*

- Developing innovative multi-source data integration and analysis systems that improve the convergence between high-performance computing and high-end data analytics, building on national investments, to accelerate and broaden interdisciplinary data assimilation, data and model inter-comparison in the context of complex and comprehensive coupled multi-system environmental models, and to enable new research-based knowledge and information that can be distilled in support to decision making and adaptation policies, bridging the gap between government, general public on environmental issues.

### *Accelerate Data Access and Analysis for Disaster Monitoring and Mitigation*

- Improving and accelerating data access and streaming analysis of multi-source data for disaster monitoring and mitigation through innovative disaster-information platforms—while addressing imperfect and incomplete data together with uncertainty quantification—all through distilling and collating transdisciplinary information into forms that can be routinely used in decision making by various group of users.

### *Enable Science Reproducibility and Trust*

- Increasing science reproducibility and trust through improved e-infrastructure capabilities, and services to track and share research outputs from specific projects across disciplines, and to link agreed identifiers for funded research projects and web accessible versions of publications accurately to new digital objects that bundle together data, experimental descriptions, algorithms, models, softwares, workflows, provenance information and results in a standardized way.

### *Transdisciplinary Multi-source Data Management*

- Implementing shared, flexible and trusted multi-source open data management in transnational and transdisciplinary contexts with agreed data protocols and transfer mechanisms, data and metadata structures, ontology sharing together with provenance information for new type of data collections, demonstrating integrity, science quality and traceability throughout the data and knowledge lifecycle.

### *Lower Barriers to Open Science Practices*

- Lowering barriers to open science practices, including the context of citizen science approaches, through infrastructures and services facilitating the implementation of better open science practices together with the development of agreed standards,

quality estimation of results, ways of feeding results back to users, and sharing methods internationally.

## Project requirements

Projects will be selected competitively, but each must be open to collaboration and sharing with the other selected projects. All funded projects will be expected to adhere and contribute to the task force implementation of the call by attending regular steering meetings for joint cross viewing and dissemination and promoting synergies.

### Transnational

- Proposals must be transnational with collaborators from at least 3 different countries represented in the Call funding partners and who meet their eligibility criteria. Researchers not covered by participating funding agencies are also eligible to join projects using their own or other source(s) of funding.

### Science-driven

- Proposal must be science-driven approach with strong, mutually-dependent collaboration among domain, data and computing scientists, possibly together with infrastructure providers, aimed at providing methods and ICT solutions that will enable and impact environmental change and sustainable development research, and the reuse of data across disciplines.

### Problem-solving and translatable

- Proposals must be in line with the call objectives and topics, and demonstrate how solving the identified issues or barriers actually accelerate the full path of data use and enable further scientific discovery. They must provide clear and demonstrable deliverables that could be adopted beyond the proposal by broader science communities in a cost-effective manner and with sustained impact.

### Open Data Policy

- Proposals must comply with and implement the Belmont Forum open data policies, provide a data management plan, and demonstrate how it supports and contributes to the open science.

Consortium partners should identify a Leading Principal Investigator (LPI). The LPI is officially responsible for all communications with the Theme Program Office, including the submission proposal, in accordance with the LPI's funding agency requirements.

Various types of actors are encouraged to participate in accordance to the funding agency policies: public research organizations, private data-related companies, foundations, non-government organizations, infrastructure providers, publishers, public-private partnerships, etc.

Public-private sector partnerships for co-design and co-development are encouraged. In the case of partnerships with the private sector, all results and products directly resulting from the funded projects will remain in the public/research domain.

## Expected Timeline

The "**Science-driven e-Infrastructure Innovation**" CRA is envisioned as a single-stage call. Proposers will be only asked to submit a full proposal (~ 20 pages long). The expected timeline of the call is:

- February 2018: Pre-announcement of the SEI call
  - March 2018: Official launch and publication of the call documents
  - June 2018: Deadline for submitting
  - June-August 2018: Peer-review of the proposals by external reviewers
  - September 2018: Response by applicants to external reviews
  - October 2018: Panel of Expert meeting to evaluate the proposals
  - November 2018: GPCs decision and information communication to applicants
  - December 2018: Start date of the selected projects
  - January 2019: Kick-off meeting
  - 2019-2021: Task force workshops (one per year)
  - Fall 2022: Final workshop
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