

Belmont Forum e-Infrastructures & Data Management  
Community Strategy and Implementation Plan (CSIP)

**A PLACE TO STAND: E-INFRASTRUCTURES AND DATA  
MANAGEMENT FOR GLOBAL CHANGE RESEARCH**

*"Give me a place to stand, and I will move the world"*

*- Archimedes*

Delivering knowledge to support human action and adaptation to global environmental change



Established to foster global environmental change research;  
Initiated June 2009 by NSF and NERC, building on the work of the IGFA



Subsistence farming in Southern China.  
(Courtesy JialiangGao www.peace-on-earth.org,  
Wikimedia Commons)

[What is the Belmont Forum?](#)

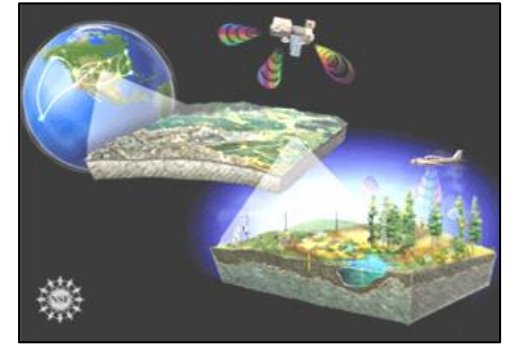
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# The Belmont Challenge



To **deliver knowledge needed for action** to avoid and adapt to detrimental environmental change, including extreme hazardous events.

This requires:

- **Assessments of risks, impacts and vulnerabilities**, through regional and decadal-scale analysis and prediction
- **Information on the state of the environment**, through advanced observing systems
- **Interaction of natural and social sciences**
- **Enhanced environmental information** service providers to users
- **Effective international coordination** mechanisms

# E-infrastructures and Data Management CRA

“....the need to address global environmental challenges requires a more coordinated approach to the planning, implementation, and management of data, analytics and E-Infrastructures” through international collaboration.

- Belmont Forum, New Delhi, February 2013



# Who has been involved so far?



- The CRA International Steering Committee (14 people)
  - 1 member per country or international organization
  - Members led 6 Work Packages (WPs) and sub-groups
- The Secretariat
  - Led by Robert J. Gurney OBE (UoR, UK) & Lee Allison (AZGS, US)
  - Approx. 4 UK (NERC) and 4 US (NSF) technical & support staff



# The International Assembly

- 120 + Cross-disciplinary Experts
- ~10 Experts per Country
- Divided into 6 Work Packages (WPs)
- End-user domain scientists
- Computer and information scientists
- Legal experts
- Social scientists

# Community Strategy and Implementation Plan

## Final Report - June 30, 2015

-The aims of the Final Report/CSIP are to;

- Provide a unified **vision that** clearly expresses global e-infrastructure **needs, barriers and gaps**
- Identify **strategic research policies**, outlining what can **be done better, in a multilateral way**, to support global change research, including to;
  - *Inform stakeholders*
  - *Prioritize action to address interoperability challenges, and to*
  - *Integrate existing national and international research in order to promote a more holistic environmental support system*



# Our Vision

“Our vision is of high quality, reliable and multidisciplinary global change research enabled by a sustained human and technical, internationally coordinated and data-intensive e-infrastructure able to process a continuous increase in the diversity and volume of data generated. In such a research-driven e-infrastructure, data should be discoverable, reusable, open and accessible by default as far as possible. In addition, the data’s fitness-for-purpose should be assessed by using transparent metadata relating to trustworthiness and quality. To realize this vision and maximize the return on public investments in research, all stakeholders need appropriate incentives to contribute to and support this vision.”

***The Belmont Forum can blaze a path towards achieving this vision by implementing the recommendations laid out in the Community Strategy and Implementation Plan (CSIP).***



# The 5 Final Report Recommendations

- 1. **Adopt Data Principles** that establish a global, interoperable e-infrastructure with cost-effective solutions to widen access to data and ensure its proper management and long-term preservation. Researchers should be aware of, and plan for, the costs of data intensive research.
- 2. **Foster communication, collaboration and coordination** between the wider research community and the Belmont Forum, and across Belmont Forum projects through a Data and e-Infrastructure Coordination Office established within a Belmont Forum Secretariat.
- 3. **Promote effective data planning and stewardship** in all Belmont Forum agency-funded research to enable harmonization of the *e-infrastructure data layer* through enhanced project data planning, monitoring, review and sharing.
- 4. **Determine international and community best practice** to inform Belmont Forum research e-infrastructure policy, in harmony with evolving research practices and technologies and their interactions, through identification and analysis of cross-disciplinary research case studies.
- 5. **Support the development of a cross-disciplinary training curriculum** to expand human capacity in technology and data-intensive analysis methods for global change research, and increase the number of scientists with cross-cutting skills and experience in best practice.

# 1. Adopt Data Principles

## -Research data must be:

- 1. **Discoverable** through catalogues and search engines, with data access and use conditions, including licenses, clearly indicated. Data should have appropriate persistent, unique and resolvable identifiers.
- 2. **Accessible** by default, and made available with minimum time delay, except where international and national policies or legislation preclude the sharing of data as *Open Data*. Data sources should always be cited.
- 3. **Understandable and interoperable** in a way that allows researchers, including those outside the discipline of origin, to use them. Preference should be given to non-proprietary international and community standards via data e-infrastructures that facilitate access, use and interpretation of data. Data must also be reusable and thus require proper contextual information and metadata, including provenance, quality and uncertainty indicators. Provision should be made for multiple languages.
- 4. **Manageable** and protected from loss for future use in sustainable, trustworthy repositories with data management policies and plans for all data at the project and institutional levels. Metrics should be exploited to facilitate the ability to measure return on investment, and can be used to implement incentive schemes for researchers, as well as provide measures of data quality.
- 5. **Supported** by a highly skilled workforce and a broad-based training and education curriculum as an integral part of research programs.

## 2. Foster Communication, Collaboration and Coordination

- An appropriate organizational and community-building environment is necessary to: resolve barriers and gaps in global data sharing and interoperability; build relationships; distil information from data; and align incentives for effective and collaborative data management. Otherwise, the current trend of competing or conflicting technology development and agency policies will endure. While this work is, and will continue to be, undertaken largely in a national context, the Belmont Forum can place it into a global context by fostering the appropriate coordination and collaboration environment.
- *The Belmont Forum can and must champion the organizational, community-building and technical framework needed to facilitate the international and interdisciplinary exchange of global change information through its member organizations, both individually and collectively.*

### 3. Promote Effective Data Planning and Stewardship

- Communicating best practice in data and information stewardship and sharing will not only help to improve collaborative efforts, but will also reduce the associated risks and costs of data management. This involves: paying attention to the full lifecycle of data use and the rates at which information is gleaned from data; changing policies to promote better and more effective data planning; adopting data stewardship principles; and implementing incentives for their adoption, similar to the ways in which scientists are incentivized to publish research results. Establishing good practice is fundamental to improving data availability and interoperability, enabling co-evolution of research needs with e-infrastructure, increasing data usefulness, building trust among stakeholders, and reducing overall costs resulting from ineffective data management.
- *The Belmont Forum is ideally positioned to achieve significant impact by collectively changing grant funding policies and reward systems to promote more effective data planning and stewardship.*

## 4. Determine International and Community Best Practice to Inform Belmont Forum Research e-Infrastructure Policy

- Individual research domains successfully exchange best practice, either through scholarly publishing or increasingly through exchanging information via the Internet using a variety of mechanisms and applications. While there are beacons of good practice, there are inconsistencies in the exchange of information, and the shaping and sharing data intensive e-infrastructure between nations and across domains and users. The rapid pace of change in technology and its adoption makes the normal development of good practice difficult, and it is unclear whether the market will produce suitable solutions without intervention. Environmental and social sciences have a strong need to preserve and exchange information globally, and all Belmont Forum members have examples of good practice to share.
- *The Belmont Forum is uniquely placed to review worldwide and discipline-specific current practice, and foster best practice (in data sharing stewardship, analysis, modeling and workflows, and implementation of e-infrastructures) to promote efficiencies and trust in data and e-infrastructure solutions.*

## 5. Support the Development of a Cross-Disciplinary Training Curriculum to Build Capability

- e-Infrastructures globally lack enough skilled people who understand data management and data intensive methods in environmental, social and health sciences, and engineering to effectively drive this area forward. While training exists in a number of domains, it is frequently restrictive in scope. In addition, formal training is typically aimed at university students and early career researchers, but there is also a strong need for established scientists to become more data-enabled and data-proficient. Significant progress in building this capability can be achieved through cataloguing, accrediting and enhancing existing training efforts, filling critical gaps in a nascent global curriculum, and sharing methods for interdisciplinary and transdisciplinary exploitation of data.
- *The Belmont Forum is well placed to stimulate new ways of thinking and working amongst distributed and diverse researchers, data and information scientists and data-enabled domain scientists, enabling them to better address global change research challenges.*

# The Knowledge Hub

[www.bfe-inf.org](http://www.bfe-inf.org)

The BF E-Inf. & DM CRA  
Final Report will be  
publically available online

The screenshot shows the website for the Belmont Forum E-Infrastructures and Data Management Collaborative Research Action. The header includes the logos for the "e-INFRASTRUCTURE DATA MANAGEMENT PROJECT" and the "BELMONT FORUM". A "Login to Workspace" button is located in the top right corner, along with social media icons for Twitter and email. The navigation menu contains links for "Home", "About", "Get Involved", "Documents", and "Announcements".

The main content area features a large aerial photograph of a river delta. Below the image is a quote: "... the need to address global environmental challenges requires a more coordinated approach to the planning, implementation, and management of data, analytics and E-Infrastructures" through international collaboration. — Belmont Forum, New Delhi, February 2013".

Below the quote is a world map with several countries highlighted in dark blue. To the right of the map is a text block: "The Belmont Forum E-Infrastructures and Data Management Collaborative Research Action brings together domain scientists, computer and information scientists, legal scholars, social scientists, and other experts from more than 14 countries to establish recommendations on how the Belmont Forum can implement a more coordinated, holistic, and sustainable approach to the funding and support of global environmental change research."

On the right side of the page, there is a "Tweets" section with two tweets from @BFE\_Inf. The first tweet says: "Find out what 120+ global experts in natural, comp, info & social sciences & law say are priorities for funding e-inf for envtl chg research". The second tweet says: "Interim Report on community-generated funding priorities for global e-inf for envtl change research is now available: [goo.gl/SZuH9Y](http://goo.gl/SZuH9Y)".