BELMONT FORUM E-INFRASTRUCTURES AND DATA MANAGEMENT COLLABORATIVE RESEARCH ACTION

Steering Committee Meeting 5 | April 9-11, 2015, Tokyo, Japan

FULL WORKSHOP REPORT

Workshop Overview

A fifth Steering Committee Meeting of the Belmont Forum e-Infrastructures and Data Management Collaborative Research Agreement (CRA) was held at the Japan Science and Technology Agency (JST) in Tokyo, Japan, on April 9-11, 2015. The 25 meeting participants consisted of the project Steering Committee (SC) and Secretariat, members of the Belmont Forum Group of Program Coordinators (GPC), and representatives from JST. Through a series of presentations, group discussions, and critical decision-making processes, meeting participants:

1. Ensured individual contributions to the Community Strategy and Implementation Plan (CSIP) were aligned with an overarching holistic and strategic vision which the Belmont Forum can make progress towards
2. Confirmed the content and strategic direction of the CSIP, focusing on:
    a. Vision statement and data principles
    b. Umbrella recommendations, including prioritized and sequenced short, medium and long-term actions
    c. Dependencies among the actions
    d. Findings and conclusions
    e. Appendices
3. Gave guidance to the project Secretariat on the process for integrating conclusions, recommendations and actions generated by the WPs into the synthesized CSIP
4. Assessed, evaluated and recommended next steps for taking action upon the CSIP following its completion on June 30, 2015
5. Identified best practices, lessons learned, and any implications for future Belmont Forum collaborative international projects

Key accomplishments and outcomes are described below.

DATA PRINCIPLES

On Day 1 the Steering Committee reviewed the Data Principles and Vision Statement (initially drafted at the 2014 Steering Committee Meeting in San Francisco, USA), and came to agreement on the following:

1. The CSIP will recommend that the Belmont Forum, as an organization, adopt the Data Principles (see Initial Action Themes, below)
2. The Data Principles and Vision statement should underpin all recommended actions in the CSIP; as such, these should be reviewed against the final list of actions in the CSIP
3. The Data Principles should include a preamble that refers to previous principles set out by other organizations, particularly those that inspired the new set of principles
4. There should be an extra heading for including people within the principles (capacity-building, etc.)

5. The Principles should be consistent with the Group of Eight (G8) principles

A series of editing and review sessions during the meeting generated the most recent version of the Data Principles, which are presented here and are included in the draft CSIP.

Revised Vision Statement and Data Principles

Our vision is of a sustained human and technical, internationally coordinated, data e-infrastructure to support the multidisciplinary scientific research needed to address the Belmont Challenge, especially under a continuous increase in the diversity and volume of data. In such a science-driven infrastructure, by default, data are open and, as far as possible, accessible, discoverable, reusable, and their fitness for purpose can be assessed using transparent metadata relating to their trustworthiness and quality. To realize this vision and maximize the return on public investments in research, appropriate incentives to contribute to and support this vision are needed for all stakeholders.

These are the ***five data principles*** that need to be adopted and implemented in order to establish a global, interoperable data e-infrastructure for widening access to data and ensuring its long-term preservation. They draw closely on earlier data principles recommended in many international programs, namely by the G8. Publicly-funded research data must be:

1. ***Discoverable*** through catalogues and search engines, with data access and use conditions, including licenses, clearly indicated, and 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 be cited.
3. ***Understandable*** in a way that allows researchers—including those outside the discipline of origin—to use them, with preference given to non-proprietary international and community standards via data e-infrastructures that facilitate access, use and interpretation of data; in addition, data must be reusable and, thus, requires proper contextual information and metadata, including provenance, quality and uncertainty indicators; provision should be made for other languages.
4. ***Manageable*** and protected from loss for future use in sustainable, trustworthy repositories with data management policies and plans for all data at both project and institutional levels; metrics can facilitate the ability to measure return-on-investment, and can be used to implement incentive schemes for researchers.
5. ***Professional***: the implementation of the above principles requires a highly skilled workforce and broad-based training and education as an integral part of research programs.

ACTIONS: INITIAL REVIEW AND CONSOLIDATION

The Steering Committee conducted a detailed review of the 22 action templates submitted by the six Work Packages in the following categories:[1]

1. Communication Collaboration Coordination (CCC) (4)
2. Citizen Science (CiSci) (1)
3. Case Studies (CS) (3)
4. Data (D) (1)
5. Legal (L) (1)
6. Mapping the Landscape (MTL) (5)
7. Security (S) (5)
8. Social and Natural Science Integration (SNSI) (1)
9. Training (T) (3)
10. Workshops (W) (3)

Discussions focused on developing: 1) a short list of actions for inclusion in the CSIP, 2) identifying whether an action (as a whole or as individual components) should be merged with other actions, 3) identifying common, overarching themes under which actions could be grouped, and 4) identifying modifications that could strengthen the action, either by providing more detail or by targeting the action towards the Belmont Forum.

[1] The actions templates were compiled and categorized by the Secretariat prior to the meeting. See Appendix 1 for a complete list.

Actions in the CSIP: Initial Action Themes

Throughout the review process, four overarching actions categories emerged. Although the exact titles of each action category were refined throughout the meeting, the final names referenced in the draft CSIP will be used throughout this report in order to avoid confusion. All four themes, along with the action templates that were placed under each theme, are outlined below.

1. Establish a Data and e-Infrastructure Coordination Office *within the Belmont Forum Secretariat to foster communication, collaboration and coordination with the wider community and across Belmont Forum projects and initiatives*

1. Foster Ongoing Communication, Collaboration and Coordination (CCC1)
2. Coordinate with other G8+ and GEO on data sharing principles and infrastructure funding (CCC2)
3. Strategic Coordination Network to identify collaborative strategies for addressing Belmont Forum objectives and actions (CCC3)
4. Community building and engagement activities to increase awareness trust and incentives to collect, manage, curate, store, share, publish and re-use research data (CCC4)
5. Data Policy Advisory Board (L1)
6. Security Advisory Board, with reactive and proactive elements (S1)
7. Ongoing mapping the Landscape efforts to identify the people, projects, programs and organizations working toward interoperability in global change research and the specific roles these individuals and groups are playing; best practices (MTL3)

2. Promote good data planning and stewardship in all Belmont Forum agency-funded research*, enabling harmonization of e-infrastructure through enhanced project data planning, monitoring, review and sharing.*

1. Data Management Plans Requirements and Monitoring (D1)
2. Data Policy Advisory Board (L1)
3. Security Advisory Board (S1)
4. Mapping the Landscape of International Data Repositories (MTL1)
5. Mapping the Landscape of standards and tools that enable integration of data from globally distributed repositories (MTL2)
6. Incentivisation of Data Sharing (T2)

3. Identify cross-disciplinary research examples*, which can be iterated and developed to demonstrate far reaching international best and common practice, and determine Belmont Forum research e-infrastructure policy.*

1. Harmonization of Data Infrastructures and High Performance Computing Infrastructures to Promote Interdisciplinary and Transdisciplinary Research and Data Usage (CS1)[2]
    a. Project-based data movement from HPCI to DIAI based on investigation and coordination of data transmission bandwidth and methodologies between two infrastructures (CS1, part 8)
    b. Co-located HPCI and DIAI for responding to wide range needs from close communities who are working with large data, large computation and well defined focus to disparate communities with a variety of data sets and small to moderate computation (CS1, part 11)
2. Assess Integration, Archiving, and Downstream Use of Natural, Social, Health, and Engineering Data in Existing Future Earth and Related Interdisciplinary Projects (SNSI1)
3. Consistent methodology for selecting comparative and targeted case studies (CS2)

[2] The action template CS1 had a list of components. The Steering Committee determined that components 8 and 11 were the most relevant to the Belmont Forum and decided to include them in the CSIP.

4. Support the development of a cross-disciplinary training curriculum to expand human capacity *in Informatics for Environmental Science, with the aim to ensure global change research is fully interoperable by increasing the number of scientists with cross-cutting skills and who use best practice.*

1. Training, including Computational Earth Sciences Summer School (T1)
2. Capacity building activity to that enable top-down transfer of technology and scaling-up of the data handling skills from central to local practitioner (T3)
3. Citizen monitoring and crowd sourcing activities for Earth science research (CiSci)

Actions Not in the CSIP

A goal of the detailed actions review process was to review the actions holistically and determine if any were out of scope, not best suited for the Belmont Forum, or were already being undertaken elsewhere. While most of the actions were merged into the initial themes listed above, the Steering Committee agreed that, while important, several would not be included in the CSIP. The reasons were that the actions were either best addressed at a national level rather than via the Belmont Forum, other bodies were doing these actions, or that they were outside the remit given to this CRA Steering Committee (Ex: promoting the conservation of physical samples). These actions include:

1. MTL4: Rescue of Legacy Data
2. MTL5: Mapping systems used for the management and digital representation of physical samples of planet Earth
3. CS3: Case study that includes the capture of provenance information and then uses this information to reproduce the results of the experiment
4. W1: Cross-domain data quality library

FINAL ACTION THEMES

On Day 2, the Steering Committee completed work in small and large groups focused on each of the action themes, in order to determine how the actions in each theme fit together holistically, and identify the tasks that fall under each action. This discussion confirmed the four initial action themes that were generated on Day 1, and added a fifth action theme to adopt the data principles. The final list of action themes (included in the first draft of the CSIP), were determined to be:

1. **Adopt Data Principles** that establish a global interoperable data e-infrastructure with cost-effective solutions for widening access to data and ensuring its long-term preservation.

2. **Establish a Data and e-Infrastructure Coordination Office** within the Belmont Forum Secretariat to foster communication, collaboration and coordination with the wider community and across Belmont Forum projects and initiatives.

3. **Promote good data planning and stewardship in all Belmont Forum agency-funded research**, enabling harmonization of e-infrastructure through enhanced project data planning, monitoring, review and sharing.

4. **Identify cross-disciplinary research examples**, which can be iterated and developed to demonstrate far reaching international best and common practice, and determine Belmont Forum research e-infrastructure policy.

5. **Support the development of a cross-disciplinary training curriculum to expand human capacity** in Informatics for Environmental Science, with the aim to ensure global change research is fully interoperable by increasing the number of scientists with cross-cutting skills and who use best practice.

Merging and consolidating the actions into action themes generated a recognition that most (if not all) actions have short, medium, and long-term components, and that most (if not all) actions are dependent on other actions.

ACTION DEPENDENCIES, PRIORITIZATION, SEQUENCING

The GPC provided guidance that the most effective way to present the action themes and associated short and medium-term components is to identify flexibility, and to demonstrate where dependencies between actions are critical. They suggested identifying a *critical path* with elements from all of the action themes, thereby identifying where the Belmont Forum can take a first steps, since it is likely that not all members will be able to implement all of the actions immediately. Finally, GPC members suggested creating a *network of dependencies*, so that Belmont Forum members are able to:

1. Identify which actions best address national priorities
2. Identify multiple options for implementing the recommendations
3. Be aware of what needs to be done in parallel, and what needs to be done in sequence
4. Be aware of the most important actions to take first, particularly the actions upon which other actions are dependent (such as setting up the Coordination Office)

The Steering Committee reconsidered prioritization after distilling the Action Templates. The group felt that the remaining actions were all interdependent, so it was not possible to say which were less important. Per GPC guidance, the Steering Committee identified the short and medium -term components of each action, and dependencies between within and across the action themes. The Steering Committee was then able to prioritize and sequence each of the tasks within the action theme in the near-term (0-2 years from June 2015) and medium term (1-5 years from June 2015). Dependencies and relationships with other action themes are identified in blue.

1. Adopt Data Principles

Near-Term

1. Belmont Forum to adopt the Data Principles (all other actions are dependent on this action)

Medium-Term

2. Belmont Forum members to consider next steps, implications for their agency and mechanisms to assess implementation of the Data Principles

2. Establish a Data and e-Infrastructure Coordination Office

Near-Term

1. Establish the Coordination Office to act as a focal point of e-infrastructure and data management activities within the broader Belmont Forum Secretariat (all action themes are dependent establishing this office)
2. Identify dedicated staff (ie Chief Data Officer, Coordinator, Support Staff, etc.)
3. Establish Data Policy Advisory Board and a Security Advisory Board (critical for Action Theme 1—Data Principles, and 3—Data Plans)
4. Establish initial scoping workshops (informs 3—Data Plans, 4—Cross-Disciplinary Research Examples, and 5—Human Capacity)
5. Develop a Strategic Coordination Network, building on existing networks, including;
    a. Networks formed as part of this project
    b. Funders (eg. RDA Colloquium)
    c. Pan-national bodies (eg. G8)
    d. Umbrella organizations (eg. GEO)
    e. Publishers, learned societies, libraries/institutional repositories/data centers
    f. Relevant national and international initiatives (eg. EarthCube)
6. Map organizations and best practices

Medium -Term

1. Oversee the implementation and regular reporting of actions that are outputs of this CRA
2. Manage Data Policy Advisory Board and a Security Advisory Board
3. Communicate results of scoping workshops, case study funding calls, the Strategic Coordination Network and others back to Belmont Forum and external stakeholders (dependent on Strategic Coordination Network, and 4—Cross-Disciplinary Research Examples [scoping workshops])
4. Manage an ongoing a Strategic Coordination Network
5. Ongoing Mapping of organizations and best practices

While some of these duties could be outsourced, the Steering Committee recommended that the Coordination Office within the Belmont Forum Secretariat still be responsible for ensuring they are carried out. Initial recommendations about staffing include: appointing a Chief Data Officer with a technology background to act as data champion within the Belmont Forum as a whole, appointing a Communication, Collaboration, Coordination Officer (responsible for process), appointing "champions" from the other action themes (Human Dimensions, e-Infrastructure, and Data Planning) to liaise with the Coordination Office, and hiring support staff to help carry out Coordination Office duties as needed.

3. Promote Good Data Planning and Stewardship in All Belmont Forum Agency-Funded Research

These actions are envisioned to be carried out by the Chief Data Officer under the auspices of the Coordination Office described above. Key tasks are outlined below.

Near-Term

1. Belmont Forum appoints a Coordinator to oversee activities and liaise with the Coordination Office
2. Belmont Forum adopts a common minimum data plan template and guidelines in conjunction with Belmont Forum agencies that addresses the Data Principles (dependent on 2—Coordination Office)
3. Coordination Office feeds inputs from legal and security boards to Data Plan template development (dependent on 2—Coordination Office [Legal and Security Advisory Boards])
4. Belmont Forum works with Coordinator to establish mechanisms to review and monitor data plans (dependent on 2—Coordination Office)
5. Policy – Belmont Forum assigns grant budget allocation to data plan implementation
6. Policy – Belmont Forum extends the current reward system to include implementation of data plans

Medium-Term

1. Coordination Office develops and maintains a set of metrics to assess Belmont Forum-funded research data plan compliance (Concurrent with 4—Cross Disciplinary Research Examples)
2. Belmont Forum reviews and monitors implementation of data plans (Concurrent with 4—Cross Disciplinary Research Examples)
3. Coordination Office Chief Data Officer improves data plan template over time, including feeding inputs from Legal and Security Advisory Boards, mapping the landscape efforts, and case studies to data plan template development (dependent on 2—Coordination Office [Legal and Security Advisory Boards, mapping the landscape activities], and 4—Cross Disciplinary Research Examples)
4. Identifies key repositories, in particular certified and trusted repositories, as guidance for data plans (feeds into improving the data plan over time, depends on 2—Coordination Office)
5. Coordination Office carries out gap analysis to identify data from Belmont Forum-funded research not stored in trusted repositories, and work with Belmont Forum agencies and the research community to explore ways of filling gaps in data plans (feeds into improving data plan over time)
6. Coordination Office develops a register of standards/software/workflows/policies relevant to global change research enabling interoperability as guidance for data plans (feeds into improving data plan over time)

4. Identify cross-disciplinary research examples

Near-term elements of this action (scoping workshops and analysis) are anticipated to be overseen or carried out by the Coordination Office, with medium-term Belmont Forum funding calls to be based on near-term outputs.

Short-Term:

1. Belmont Forum appoints a Coordinator to oversee activities and liaise with the Coordination Office
2. Coordination Office holds a series of scoping workshops to: (dependent on 2—Coordination Office, feeds into 3—Data Plan)
    a. Define an assessment matrix for analyzing, scoring and identifying interdisciplinary case studies, including social and natural science integration; results will be integrated into assessment matrix
    b. Identify and analyze relevant data and model inter-comparison projects (DMIPs), together with stakeholders such as the Intergovernmental Panel on Climate Change; results will be integrated into assessment matrix
3. Analyze e-infrastructure applications of existing Belmont Forum-funded projects and other international initiatives using the assessment matrix to identify critical gaps and barriers and define the funding calls for case studies (dependent on 2—Coordination Office, feeds into 5—Human Dimensions)

Medium-Term:

1. Belmont Forum to implement a 3-year competitive call to coordinate and monitor case studies (dependent on 2—Coordination Office [scoping workshops])
2. Coordination Office to review and analyze outcomes of case studies call and reflect the results in subsequent funding calls, (dependent on 2—Coordination Office to use outputs to continually guide e-inf. evolution and national investments according to research needs)
3. Coordination Office to work with the Belmont Forum to implement the resulting strategy for subsequent scoping workshops and a case studies funding call cycle (dependent on case studies element of this action, and 2—Coordination Office [scoping workshops])

5. Support the development of a cross-disciplinary training curriculum to expand human capacity

Training activities are anticipated to be carried out, or overseen, by the Coordination Office.

Short-Term

1. Belmont Forum appoints a Coordinator to oversee activities and liaise with the Coordination Office
2. Identifies relevant courses for researchers/students that Belmont Forum members are funding (outsourced activity)
3. Belmont Forum agencies support researchers/students from their countries to attend courses in other countries
4. Identifies and disseminates good practice examples of international crowd-sourcing and citizen science efforts to ultimately guide future Belmont Forum-funded projects (outsourced activity)

Medium-Term

4. Develops and carries out an interactive training program (to be reused online) that uses information from Data Plans and outputs of case studies, and produces toolkits for cascade of training (dependent on 2—Coordination Office [scoping workshops], 3—Data Plans, and 4—Cross-Disciplinary Research Examples)
5. Uses existing research projects that have products used by end users, and train the end users to collect and analyze data themselves in order to create longer-term products and data sets (related to 4—Cross-Disciplinary Research Examples)
6. Develops a website describing methodologies for data collection through citizen science ensuring data collected is fit for purpose (dependent on 2—Coordination Office)

BROADER IMPACTS

After the action themes and prioritized tasks were thoroughly reviewed, the Steering Committee discussed how to present the broader impacts in the CSIP. GPC members provided the following guidance:

- Highlight the fact that Belmont Forum Policies propagated within agencies could inform domestic policies. As such, the potential broader impacts of those domestic policies should guide the adoption of recommended actions.
- Make the case for how the recommended actions support, enable or improve open science.
- Connect the recommendations back to global change research and the Belmont Challenge. To foster the most effective environmental-social actionable science, the Belmont Forum needs to:
    - Fill gaps (capacity, data, and tech). If gaps aren't filled, the Belmont Forum won't be able to fully make progress on the Belmont Challenge
    - Enable new kinds of research
    - Enable existing research to happen more efficiently and effectively by removing barriers, reusing observations and tools, and helping people build on previous work
    - Improve the quality of science
    - Foster actionable science by addressing socio-economic components of global change research in addition to the science of the natural environment
- Focus on one or two socio-environmental research questions or thematic actions, such as disaster management.

LESSONS LEARNED

At the end of Day 3, the Steering Committee discussed lessons learned and best practices from this project, as well as their implications for future Belmont Forum collaborative projects.

- The changing of deadlines was very difficult, especially for Assembly members. If a collaborative international project is done again, project leads need to commit to deadlines before the project starts as much as possible
- There needs to be more time to set up the project before the actual work begins
- There is a need for face-to-face meetings at the beginning of the project to develop trust and establish a good group dynamic; a lack of face-to-face meetings in this CRA made it harder for Work Packages to work well together
- Face-to-face meeting participants need enough lead time to make necessary arrangement in order to attend (scheduling, funding, VISA's, etc. all take time)
- There is a need for multiple inlets allowing people to participate as they have different work styles (some do well online, some do better in-person, via conference call, etc.)
- Roles, responsibilities, expected time commitment, etc., of all project participants needs to be made clearer from the beginning of the project

BEST PRACTICES

- National Delegation calls and meetings worked well, as they helped clarify roles within the Work Packages, and the scope of each Work Package
- The Steering Committee worked very well together
- The Secretariat managerial and administration staff did well organizing the project and moving work forward
- The Secretariat co-chairs worked well framing conversations and letting them happen organically
- GPC as partners, active participants, and collaborators were extremely helpful
    - GPC feedback was always very useful
    - Increasing level of engagement of GPC members worked well
    - More GPC feedback in the next iteration of this project would be very helpful

IMPLICATIONS FOR FUTURE BELMONT FORUM COLLABORATIVE PROJECTS

- The Belmont Forum should consider long-term implementation (resources, time commitments) of future project outputs after the initial funding calls end
- Future collaborative projects should be a joint enterprise/co-design with GPC members and project leads actively collaborating throughout

NEXT STEPS

The Secretariat, GPC and Steering Committee discussed the possibility of this project continuing through the end of 2015, either as a whole or as separate individual components. With support from the Belmont Forum Principals and the project Theme Program Office (NSF and NERC), the Secretariat agreed to help the Belmont Forum prepare for the October 2015 annual meeting, as well as conduct community outreach and engagement to solicit further feedback on the CSIP. Steering Committee members also agreed to help the Secretariat with these tasks, pending continued support for their corresponding GPC member.

The Secretariat, Steering Committee and GPC agreed that the Assembly as a whole would disband on June 30, 2015, the original Assembly mandate runs through the end of June, 2015. Assembly members have so far participated based on goodwill, and there is not a clear role for them moving forward. However, national delegations may still play a role, depending on their availability and the funding agency's needs. In the future, the Belmont Forum could draw upon Assembly members who have actively contributed to this project, and whose expertise may benefit future projects.

A detailed overview of transition steps is presented in the draft CSIP. A revised timeline is presented below.

REVISED TIMELINE

April 2015

- April 12-15: SC members to review edited actions templates, make constructive comments
- April 13-16: Secretariat to stay in Japan and draft the CSIP
- April 17-27: SC to review draft CSIP and provide constructive comments
- April 28-30: Secretariat to respond to comments, draft version 2 of the CSIP

May 2015

- May 1: Secretariat to disseminate version 2 of the CSIP to the Assembly;
- May 2- May 31: Assembly to review the CSIP and provide constructive feedback possibly via Survey Monkey
    - Constructive comments will be incorporated as appropriate – need to improve report, not go back
    - Work Package and national delegation calls/meetings to be scheduled as needed

June 2015

- June 1-10: Secretariat to consider comments, draft the CSIP version 3, send to SC and GPC
- June 11- 19: GPC and SC to provide final comments on the CSIP; Secretariat and GPC members will send a letter to each Assembly member announcing the closing of the Assembly after June
- June 20-28: Secretariat to draft final CSIP
- June 30: Final CSIP due to the Belmont Forum; Assembly disbands at this time

July – December 2015

- Secretariat, SC and GPC members to work with national delegations to prepare briefing papers for the BF meeting in October and conduct broader community outreach and engagement
- Secretariat, SC and GPC to work following the annual meeting (to be determined by meeting outcomes)

APPENDIX 1: ACTION TEMPLATES SUMMARY LIST

Listed by category and order in which they were submitted and categorized.

Communication, Collaboration, Coordination

1. CCC1—Foster Ongoing Communication, Collaboration and Coordination
2. CCC2—Coordinate with other G8+ and GEO on data sharing principles and infrastructure funding
3. CCC3—Strategic Coordination Network to identify collaborative strategies for addressing Belmont Forum objectives and actions
4. CCC4—Community building and engagement activities to increase awareness trust and incentives to collect, manage, curate, store, share, publish and re-use research data

Citizen Science

5. CiSci1—Citizen monitoring and crowd sourcing activities for Earth science research

Case Studies

6. CS1—Harmonization of Data Infrastructures and High Performance Computing Infrastructures to Promote Interdisciplinary and Transdisciplinary Research and Data Usage
7. CS2—Consistent methodology for selecting comparative and targeted case studies
8. CS3—Case study that includes the capture of provenance information and then uses this information to reproduce the results of the experiment

Data, including legal aspects

9. D1—Data Management Plans Requirements and Monitoring
10. D2—Data Principles
11. D3—Multinational Data Policy Committee (Legal, formerly L1)

Mapping the Landscape

12. MTL1—Mapping the Landscape of International Data Repositories
13. MTL2—Mapping the Landscape of standards and tools that enable integration of data from globally distributed repositories
14. MTL3—Ongoing mapping the Landscape efforts to identify the people, projects, programs and organizations working toward interoperability in global change research and the specific roles these individuals and groups are playing; best practices
15. MTL4—Rescue of Legacy Data that extend the Longitudinal Record of Global Change
16. MTL5—Mapping the Landscape of systems used for the management and digital representation of physical 'Samples of Planet Earth'

Security

17. S1—Cyber Security Working Group

Social and Natural Science Integration

18. SNSI1—Assess Integration, Archiving, and Downstream Use of Natural, Social, Health, and Engineering Data in Existing Future Earth and Related Interdisciplinary Projects

Training

19. T1—Computational Earth Sciences Summer School
20. T2—Incentivisation of Data Sharing
21. T3—Capacity building activity to that enable top-down transfer of technology and scaling-up of the data handling skills from central to local practitioner

Workshops

22. W1—Global Cross domain data quality library

W2—Developing consistent international processes for data and model intercomparison projects (DMIPs)

23.

APPENDIX II: ACTION TEMPLATE (BLANK)

This template will replace the individual Work Package reports which were collected at the Interim Report stage. To ensure our findings are communicated successfully and convincingly, it is requested that all actions be supported by the following information.

Associated Recommendation Number (1, 2, 3, 4)	**Action Type** (e.g. Funding call, policy change)	**WP Number (and sub-group)** (e.g. WP4 - Training)	**Timeframe** (Short: 0-2 years, Medium: 2-5 years, Long: 5-10 years)	**Reference Documents**
				[1] Interim Report [2] Draft Actions Spreadsheet [3] Data Principles Document
Dependencies (Action Number and title)				

1 Action Title *Please insert title here.*

2 Executive Summary *Please try to be as succinct and clear as possible for maximum comprehension by the Belmont Forum principals.*

2.1. Description of the action: (e.g. funding calls, policy decisions, hackathons, networking or community-building actions, calls to run a summer schools or develop training material, small-scale catalyst projects to enable the establishment of interdisciplinary partnerships, pilot studies, the development of new methodologies, larger scale research activities, etc.)

2.2. Transitional Steps: Please describe any transitional steps that the Secretariat, Steering Committee, Assembly or other existing body should carry out (e.g. toward making progress on this action between June 30, 2015 and the Belmont Forum Annual Meeting in October 2015)

2.3. Action type: Is this a collaborative project, competitive funding call etc. and why? I.e. If collaborative, with whom? If competitive, what will the selection process be? Please provide justification for suggested action type.

2.4. Relationships: Identify, where possible, relationships with other organizations or initiatives undertaking or planning similar activities and actions. E.g. Best Practice Exemplars.

3 Justification in Context *Why are we recommending the Belmont Forum address this issue? Why is the Belmont Forum well or best suited to act in this way, considering the overarching recommendation?*

3.1 Relevance: Why should this action be taken in general, and why should the Belmont Forum specifically

take this action?

3.2 History: Has this action been undertaken before? (By whom? When? How? Mechanism for action? Was the action successful? If not why not? etc.)

3.3 Internationality: What do agencies need to do to participate at a global level (if applicable)?

4 <u>Anticipated Impact</u> ***For example: influence on policy and practice; impact of adopting or not adopting the recommendation including institutionally, nationally, internationally; reproducible science, data principles.***

4.1 Scale: including justification (*local, regional, national, international, etc.*)

4.2 Influence: e.g. on policy, practice, economics, collaboration, communication, wellbeing, trust-building, etc.

4.3 Scope: Including extant and prospective operations and including expected consequences of adopting versus not undertaking the action.

4.4 Reproducible Science: How does this support and/or connect to Reproducible Science?

4.5 Data Principles: How does this support our Data Principles? [Data Principles Document]

5 <u>Evidence Bank</u> ***If links are listed please provide explanatory text.***

5.1 Supporting publications, engagement, reports, data, and external validation etc. including brief explanation of why the resource supports this action.

5.2 New data collected during/for this CRA *(e.g. The Open Data Survey, Interviews, Scoping papers etc.*

6 <u>Any other information</u>

6.1 Authors, contributors, recognition, etc. *(Include institutions and affiliations)*

6.2 Technical details (*if applicable*)