Assessment, Usability, and Sociocultural Impacts of DataONE: A Global Research Data Cyberinfrastructure Initiative

Robert J. Sandusky
University of Illinois at Chicago

Suzie Allard
University of Tennessee, Knoxville

Lynn Baird
University of Idaho

Leah Cannon
University of Tennessee, Knoxville

Kevin Crowston
Syracuse University

Amy Forrester
University of Tennessee, Knoxville

Bruce Grant
Widener University

Rachael Hu
California Digital Library

Robert Olendorf
Penn State University

Danielle Pollock
Simmons University

Alison Specht
University of Queensland, Australia

Carol Tenopir
University of Tennessee, Knoxville

Rachel Volentine
University of Tennessee, Knoxville

Abstract

DataONE, funded from 2009-2019 by the U.S. National Science Foundation, is an early example of a large-scale project that built both a cyberinfrastructure and culture of data discovery, sharing, and reuse. DataONE used a Working Group model, where a diverse group of participants collaborated on targeted research and development activities to achieve broader project goals. This article summarizes the work carried out by two of DataONE's working groups: Usability & Assessment (2009-2019) and Sociocultural Issues (2009-2014). The activities of these working groups provide a unique longitudinal look at how scientists, librarians, and other key stakeholders engaged in convergence research to identify and analyze practices around research data management through the development of boundary objects, an iterative assessment program, and reflection. Members of the working groups disseminated their findings widely in papers, presentations, and datasets, reaching international audiences through publications in 25 different journals and presentations to over 5,000 people at interdisciplinary venues. The working groups helped inform the DataONE cyberinfrastructure and influenced the evolving data management landscape. By studying working groups over time, the paper also presents lessons learned about the working group model for global large-scale projects that bring together participants from multiple disciplines and communities in convergence research.

International Journal of Digital Curation
2021, Vol. 16, Iss. 1, 48 pp.

1

http://dx.doi.org/10.2218/ijdc.v16i1.678
DOI: 10.2218/ijdc.v16i1.678

Introduction

DataONE (Data Observation Network for Earth) is a global community of domain scientists, scientific data repository managers, informaticians, librarians, computer scientists, and others providing long-term access to research data describing the earth, the environment, and the organisms that live there. Conceived in the mid-2000s, the project was funded by the U.S. National Science Foundation (NSF) through two consecutive five-year cooperative agreements (2009-2019). The main goals of the project were to (1) develop community and promote cultural change around data sharing, data reuse, data description, and data management practices; and (2) develop cyberinfrastructure to support collection and ingest of earth and environmental sciences datasets and metadata, enable dataset discovery, sustain the entire socio-technical ensemble, and preserve scientific datasets for the long-term and throughout all stages of the research data life cycle (Allard, 2012). DataONE is, at time of writing, transforming from a highly centralized project relying primarily upon direct funding from NSF to a community-led program sustained by a range of support including grants, volunteer service from community members, sponsorships, memberships, and funds generated from premium services.

In addition to building cyberinfrastructure, the DataONE project provides the opportunity for a team of multidisciplinary social and domain scientists to conduct a range of studies, using multiple methods, to understand the stakeholders, project artifacts, and the internal project dynamics of a scientific cyberinfrastructure effort. DataONE offers a unique opportunity to examine a project simultaneously building reliable research data cyberinfrastructure, creating and sustaining a broad multidisciplinary community of stakeholders, and effecting cultural change in scientific cultures. The summative and reflective description of the processes and products of two DataONE working groups presented in this paper will be useful for other social science researchers who wish to analyze or participate in large socio-technical enterprises.

This article describes the work carried out by two of DataONE's working groups: Usability & Assessment (2009-2019) and Sociocultural Issues (2009-2014). The members of these two working groups, hereafter the U&A WG and the SC WG, were composed predominantly of social scientists (primarily Library and Information Science and Political Science), practitioners (User Experience experts, Librarians, Publishers, and Data Managers) and domain scientists (Earth and Planetary Sciences, Environmental Sciences, Computer Science, and Biomedical Informatics) with an interest in multidisciplinary research (see Appendix A for a list of members 2009-2019).

The interdisciplinary make-up of the working groups led to a productive interchange of ideas. Indeed, as the members of the working groups continued their interaction, they started to develop a shared understanding of data reuse and an integrated approach to the issues. Such integration is characteristic of convergence research, which has been identified as one of NSF's 10 Big Ideas and is defined by NSF as "the deep integration of knowledge, techniques, and expertise from multiple fields to form new and expanded frameworks" (NSF, 2017). According to the National Research Council (2014), "Convergence is an approach to problem solving that integrates expertise from life sciences with physical, mathematical, and computational sciences, medicine, and engineering to form comprehensive synthetic frameworks that merge areas of knowledge from multiple fields to address specific challenges." Convergence research increases the potential for innovation and successful problem solving by harnessing diverse expertise through new collaborations that engage stakeholders and partners. In DataONE's case, participants were drawn not only from academia, but also from national laboratories, industry partners, citizen science groups, federal agencies, and funding bodies.

This paper begins with background on the project, followed by a literature review covering previous research on infrastructure, scientific collaboration, convergence research, and the open data/open science movements. The next section describes what the SC and U&A WGs did and how they did it, including methods and approaches employed to better understand priority stakeholder communities. Reflection on these studies paints a picture of change, sometimes

slower than expected, and a growing realization of the importance of sound data practices by some, while also, at the same time, a realization of barriers that inhibit data sharing. The paper continues with a discussion of the broader impacts of the work done by working groups and ends with conclusions and future directions.

Background

The DataONE team formed in late 2007 to design a project that would comprehensively address NSF's goals for its DataNet program with the intent of being selected as one of the "small set of full-scale exemplars" envisioned by NSF. The DataNet program goals were to:

> '(1) combine expertise in library and archival sciences, computer, computational, and information sciences, cyberinfrastructure, and domain sciences and engineering;
>
> (2) develop models for economic and technological sustainability over multiple decades;
>
> (3) engage at the frontiers of science and engineering research and education as an information resource, an object of research, and a research entity; and
>
> (4) work cooperatively and in coordination to create a functional data network with revolutionary new capabilities for information access, use, and integration without regard to conventional barriers such as data type and format, discipline or subject area, and time and place' (NSF, 2007).

From the beginning, the working group structure was fundamental to the DataONE project and its goal to engage broadly with stakeholders and thus effect cultural change in researchers, institutions, data management education, and research and academic libraries. The DataONE project created a small executive team consisting of the principal investigator, executive director, and directors of (1) cyberinfrastructure and (2) community engagement and outreach. Co-investigators were named as co-chairs of ten working groups or as members of the Core Cyberinfrastructure Team, which was responsible for the detailed technical design and infrastructure development (see Figure 1). Working group members, other than the co-investigators supported by the project, were volunteers who were solicited and screened by the DataONE leadership to ensure that a diverse range of skills and backgrounds were represented in each working group.

Five working groups were designed to address technology issues and five to address community engagement and outreach topics.[1] Each working group developed its own charter and worked independently on tasks as well as working together towards achieving the overall DataONE goals.

---

[1]   The charters and membership for each of the ten working groups can be found at https://www.dataone.org/previous-working-groups. The original working groups had varying lifespans and the number of working groups was reduced during the second NSF cooperative agreement; see https://www.dataone.org/working_groups.
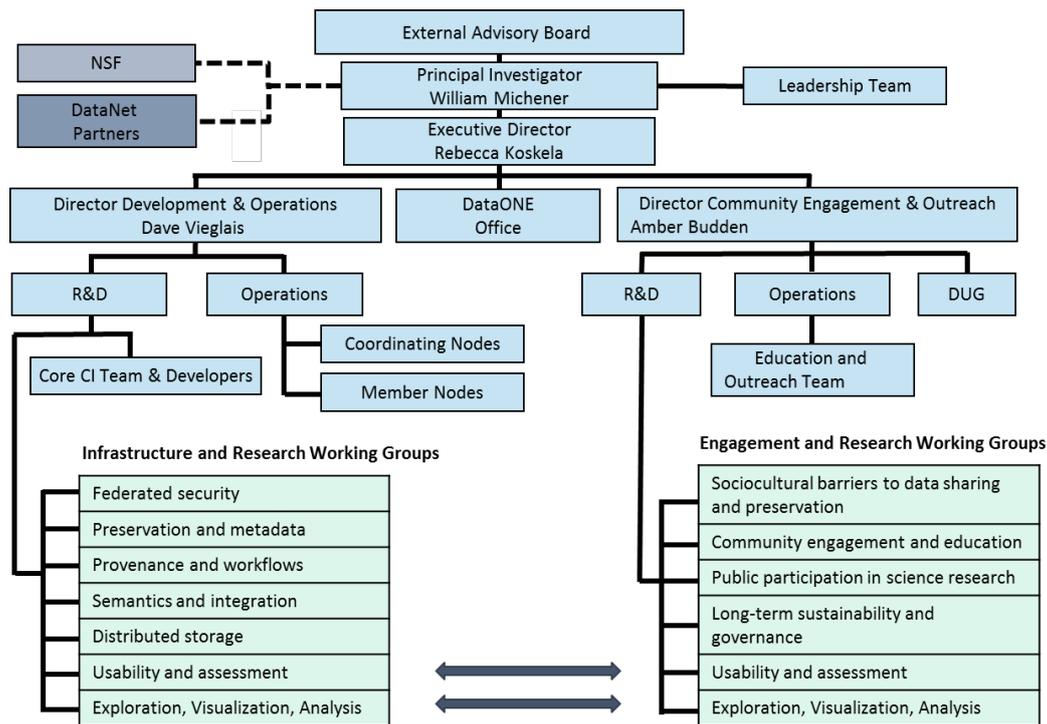
Figure 1. Phase 1 DataONE organization.[2] [DUG: DataONE Users Group; CI: Cyberinfrastructure].

The Sociocultural Issues (SC) WG, active from 2009 through 2014, expressed its purpose, scope, and mission in its charter:

> 'This working group is responsible for informing the efforts of DataONE from a set of diverse perspectives: sociocultural, international and interdisciplinary. The working group engages in identifying, promoting, assessing and developing models, frameworks, definitions, theories, policies, practices and products that can be used within DataONE as well as in the broader scientific community…
>
> This working group researches the social and cultural context of the scientific data lifecycle to devise strategies that maximize the impact of DataONE.
>
> This working group thinks and visualizes from large-scale, long-term perspectives, considering the sociocultural aspects of data management, data use, data sharing, data access and preservation.
>
> The working group succeeds by inspiring innovations in the data practices of scientists and other stakeholders to ensure preservation and access to multi-scale, multi-discipline and multi-national environmental science data.'[3]

The Usability & Assessment (U&A) WG, active from 2009 through 2019, had the following purpose, scope, and mission:

> 'This working group will focus on the research, development, and implementation

---

of the necessary processes, systems, and methods to ensure DataONE products and services meet network goals, include appropriate community involvement, and demonstrate progress and achievements of DataONE.

The scope of the Usability & Assessment Working Group is defined as activities necessary to establish program performance indicators, measure usage and impact, and adopt usability analysis principles and methods to ensure that high quality, community-driven products and services result from DataONE activities. This includes periodic testing of versions of the system and tools as they are being developed. The Working Group also establishes and implements appropriate methods, tools, and instruments for usability and assessment of all DataONE stakeholders.'[4]

The SC and U&A WGs held joint face-to-face meetings twice per year during the first five-year cooperative agreement (Phase 1 of the project) and there was cross-participation between the groups and with other working groups on many activities during this period. At the start of the second NSF cooperative agreement (Phase 2), the project was reorganized and streamlined (Figure 2) to focus on growing the number of participating data repositories and providing new cyberinfrastructure services. Several members and leaders of the SC WG joined the U&A WG, ensuring that the sociocultural perspective was not lost.
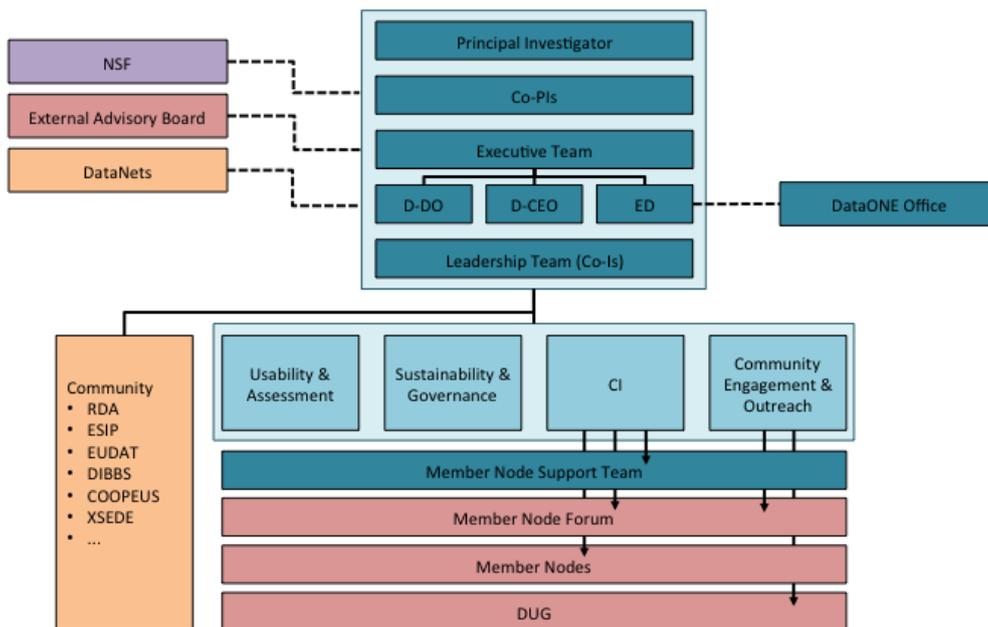

Figure 2. Phase 2 DataONE organization.[5]

Literature Review

The work of the SC and U&A WGs was influenced by scholarship in the following areas: infrastructure, science and technology studies, cyberinfrastructure, computer-supported cooperative work, collaboratories and virtual organizations, digital libraries, human-computer interaction, and free/libre/open source software. Lee and Schmidt (2018) provide a thorough

---

4   DataONE Usability & Assessment working group charter:
     https://www.dataone.org/sites/all/documents/U&A_Charter.pdf
5   DataONE: https://www.dataone.org/organization

review and critique of the literature covering the first five of these areas. The earliest critical and analytical work on infrastructure conceived the interrelationships between computing machinery, software, people, and organizations as a sociotechnical web (Kling and Scacchi, 1982). Throughout the 1980s and the early 1990s, social scientists and some computer scientists continued to develop methods and theory based on empirical research illustrating the social aspects of computing (Gasser, 1986; Suchman, 1987; Star and Griesemer, 1989; Bowker, Star, Turner, and Gasser, 1997). Among their interests were: determining the factors that support or stand in the way of the adoption of computing technologies; studying how organizational routines adapt to the introduction of new technology; and exploring the social impacts of technology use (Gasser, 1986; Kling, 1987).

According to Lee and Schmidt (2018), "…'infrastructure' refers to a technical facility that provides a service to the wider world." Infrastructure can be primarily physical, like transportation systems, or virtual, like the Internet. Infrastructure grounded in computation, data, and networks is sometimes referred to as cyberinfrastructure (NSF, 2003). The term cyberinfrastructure was coined in a 2003 NSF report (Atkins et al., 2003) to refer to infrastructure such as DataONE's that is "based upon distributed computer, information, and communication technology" (Atkins et al., 2003). Lee and Schmidt (2018) urge researchers to carefully consider how they define the term *infrastructure*: "The point … is that [infrastructure] refers to a system that under some description supports another: an infrastructure in its relation to a superstructure." For example, multi-modal transportation systems comprised of ships, trains, and trucks are the infrastructure that supports the supply chains required to produce products in the globalized economy (the superstructure). DataONE's computational layer of repositories and software comprise the infrastructure that supports emerging practices (the superstructure) of data science, synthetic research, data citation, and data reuse.

Scientific collaboratories were described and their feasibility discussed in an influential 1993 report from the U.S. National Research Council (NRC, 1993). By the mid-2000s many workshop reports about a range of disciplines had been published by NSF (see, for example, NSF, 2003). Many independent researchers had published about the challenges and successes of collaboratories (Finholt, 2003; Jirotka, Lee, and Olson, 2013). Star and Ruhleder (1996) studied the complexities of large-scale infrastructure for multi-disciplinary distributed collaboration and described multiple levels of technical, social, and structural challenges, characterizing the challenges as differences among users based in their disciplinary practices, cultures, domain knowledge, and understanding of the infrastructure itself.

The NSF has recognized the crucial role of secure, scalable data cyberinfrastructure in multi-disciplinary scientific collaborations.[6] These collaborations can involve deep integration, or convergence, between two or more disciplines. According to the NSF (2017), convergence research is defined by two characteristics: first, it is driven by a specific and compelling problem, and second, it involves deep integration between disciplines. This integration of disciplinary expertise leads to novel research approaches, new research paradigms, and the formation of new research communities (Pollock, Yan, Parker, and Allard, 2019b). Multiple sources have noted the success of such approaches in addressing complex challenges in areas including computation, engineering, the environment, and human health (Bainbridge, 2004; MIT, 2011; NRC, 2014; Sharp, Hockfield, and Jacks, 2016). DataONE may be examined as both a facilitator of and an example of convergence research.

Boundary objects, as defined by Star and Griesemer (1989) are "objects which are both plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites." Boundary objects – including repositories and repository networks – can help facilitate communication and cooperation between different individuals or communities with differing viewpoints and areas of expertise. Bowker and Star (1999) introduced the concept of "boundary infrastructure," serving multiple communities of practice and maintaining a consistent structure while allowing heterogeneity in information types and information practices among the communities it serves. As further

---

6 NSF: https://www.nsf.gov/pubs/2018/nsf18076/nsf18076.jsp

detailed below, multiple WG products function as boundary objects, while DataONE itself can be interpreted as boundary infrastructure.

Many of the concepts and approaches described above were integrated and applied to the study and development of open, web-based research infrastructure through the NSF/ARPA/NASA-funded Digital Library Initiative (1994-1998). The six DLI projects intentionally included social scientists, library and information science researchers, and human factors experts as well as computer scientists, domain experts, and engineers. The research approach social informatics emerged during this period as Rob Kling and other colleagues from the University of California Irvine participated in some of the six DLI projects, providing exemplars for numerous future digital library and cyberinfrastructure projects (Bishop, Neumann, Star, Merkel, Ignacio and Sandusky, 2000; Borgman, 2003; Hill, Carver, Larsgaard, Dolin, Smith, Frew, and Rae, 2000; Marchionini, Plaisant and Komlodi, 2003; Van House, 2003).

DataONE Working Groups: What We Did and How We Did It

Projects undertaken by the SC and U&A WGs were designed to help the entire DataONE team understand the practices of the broader research community as they related to the management of research data. The projects proposed by the SC and U&A WGs were discussed with the entire DataONE team and benefited from these discussions through a process of iterative feedback and refinement. The products resulting from these projects helped inform and guide the work of the entire DataONE project. The SC and U&A WG members also participated in the framing and review of a wide range of foundational artifacts, documentation, and resources created by other WGs.

These artifacts not only established a framework for the SC and U&A WGs as they embarked on their work, but were also a central resource that helped other DataONE working groups come to a common understanding of our stakeholders, their needs, and their overall research workflows. For example, the contextual and socio-cultural information derived from various studies of DataONE stakeholders conducted by the SC and U&A WGs fed into the design and development work performed by the Cyberinfrastructure Team. These artifacts also provided a baseline structure that informed the work of the Community Engagement and Education Group (Phase 1), as well as enriched the strategic and sustainability planning spearheaded by the Leadership Team.

Three artifacts – a stakeholder matrix, the data life cycle model, and personas – served as boundary objects that facilitated the connections between different groups and researchers with different expertise. This established a foundation and shared language which was critical for future knowledge development and achieving convergence.

Stakeholder Matrix

The SC and U&A working groups realized early on that a guiding structure would help identify and prioritize stakeholders to study. A stakeholder matrix was developed by the SC WG to identify all possible groups that could be a part of or benefit from the DataONE community (Figure 3). In Phase 1, the SC WG explained: "To facilitate understanding of stakeholders' education and training needs, system specifications, socio-economic and political contexts and to facilitate measuring DataONE's progress the Sociocultural Working Group has created a stakeholder matrix. The matrix includes five key stakeholder sectors (private industry, academia, community, government, non-profit) and numerous stakeholder employment settings. It can be

used to understand the kinds of questions various stakeholders address in their work, their information needs and the ways in which DataONE can positively impact their work."[7]

DataONE project participants subsequently prioritized and identified those groups who would most likely contribute to or benefit from the changing culture of data stewardship and reuse by employment setting (academia, private industry, etc.) rather than workplace (libraries, publishers, institutions, etc.). These priority stakeholders included scientists (both as researchers and educators in any employment setting), libraries and librarians in federal and academic settings, and science data managers in government and academic settings.

Data Lifecycle Model

The SC WG "review[ed] … numerous models developed to describe and depict the Data or Information Life Cycle…" and created a concise model for use by the DataONE project.[8] The life cycle includes eight steps and describes a generally sequential process. The model was unique at the time because it visualized data as the focus of the lifecycle with stakeholders entering and exiting the cycle at various points as they interacted with data. The first iteration of the life cycle included these steps: Collect, Assure, Describe, Deposit, Preserve, Discover, Integrate, and Analyze. The current version adds the step "Plan" and subsumes the discrete step "Deposit" within "Preserve" (Figure 4).
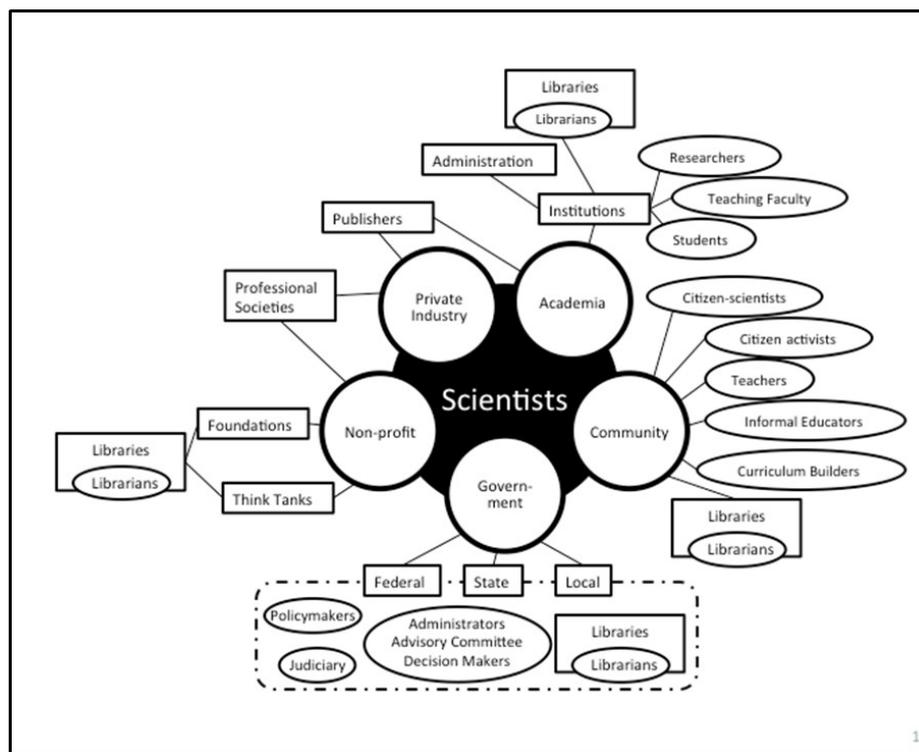

Figure 3. Relationships among stakeholder communities (Michener et al., 2012).
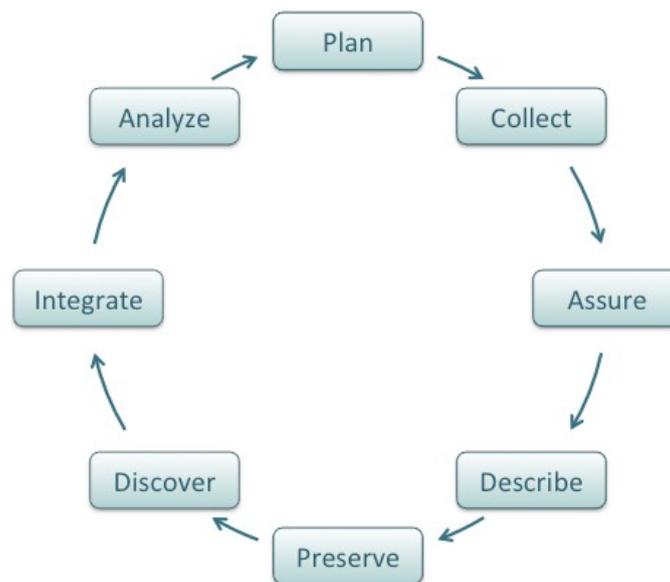
Figure 4. The data life cycle model.[9]

The DataONE Data Life Cycle Model established a simple, easy-to-understand, action-oriented visual model of the research data workflow that has been widely disseminated across disciplines. The model has been used by internal DataONE teams as they build and develop services for researchers that conduct work at any phase within the life cycle model. Additionally, the model has been widely used by the broader research and information community, as illustrated by website usage statistics. The model has been regularly accessed since its publication on the DataONE website in December 2015 (an average of more than 700 unique page views per month of the webpage describing the model). A data management primer expanding upon the model was created and linked to this page and deposited in the eScholarship Publishing and Repository Platform, hosted by the California Digital Library (CDL).[10] CDL metrics on this document report an average of 35 hits and 11 downloads per month. Additionally, Google Scholar reports 32 citations to this primer.

Personas

The concept of personas was introduced by Alan Cooper (1999) in the context of user interaction design. Within the systems development discipline, user stories and scenarios that make up a persona are valuable tools to help a community develop a shared understanding and perspective on users and stakeholders within their systems' community (Crowston, Bissell, Grant, Manoff, and Davis, 2015a).

Personas were created by members of the SC and U&A WGs to describe the DataONE community of users: five types of scientists and a science data librarian as primary users, as well as five secondary roles. An example is shown in Figure 5. Each persona description includes background, reasons for using DataONE, needs for and expectations of the tools, skills that could be applied, technical support available, personal biases about data sharing and reuse, and associated DataONE use cases. Personas descriptions also include a name, picture, personal background, and life and career goals, hopes, and fears to make the user more real and thus salient to users. Personas were based on interviews and practical experience in each of the roles described. The collection of personas was published on the DataONE website[11] and the development process was described in a journal article (Crowston, 2015).

---

9   DataONE: https://www.dataone.org/data-life-cycle

10   See: https://escholarship.org/uc/item/7tf5q7n3

11   Personas: https://www.dataone.org/user-personas

The personas were developed to help the entire DataONE team understand the stakeholders for whom they were building their tools, educational resources, and communication efforts. The development team used the personas to group together related use cases supported in a particular release, for planning future releases, and to identify which kinds of users should be involved in system testing. The community engagement team found them useful as a way to engage potential new users by showing that the system was designed for people like them. Personas can also illustrate how users might benefit from DataONE tools and services to augment their data creation, use, management, and reuse. As such, the personas were an important tool to help the DataONE external community understand their own role within the data life cycle and help them understand how they contribute to the overall data landscape.

The personas, used in conjunction with the data life cycle, serve to explain how different stakeholders participate in data management, illustrating their involvement in different stages of the life cycle. Website usage shows that these persona resources have been regularly accessed since its publication on the DataONE website in fall 2015 (70 unique page views per month across all the personas).

In addition to informing DataONE project participants, the stakeholder matrix, the data life cycle, and the personas continue to help external community users understand the interactions of stakeholders at different stages of the data life cycle.

Figure 5. Example introduction of a DataONE persona.[12]

Framing and Refining Internal Resources

The SC and U&A WGs both reviewed and contributed to framing and refining internal and external documentation and resources created by other project WGs including, but not limited to: DataONE policies, best practices for data citation, DataONE member node guidelines, DataONE cyberinfrastructure and governance, documentation for DataONE tools, DataONE executive summary, DataONE terms and conditions for use, network analysis of DataONE working group structure and membership, DataONE FAQs, education modules, user metrics, and building the DataONE usability analysis strategy. These reviews helped the broader DataONE team and informed the work of other DataONE working groups, in particular the

---

12 DataONE: https://www.dataone.org/personas/sun-early-career-herpetologist

Community Engagement and Outreach Working Group and the Core Cyberinfrastructure Team.

Tests, Methods, and Approaches

The U&A WG used a variety of methods to discover current data practices, attitudes, and opinions from many of the stakeholder groups initially identified (Figure 3) to measure the impact of DataONE publications and presentations and to plan the future work of both the SC and U&A WGs. Figure 6 shows the methods used over time for each group, including surveys, usability tests, interviews, persona development, and environmental/website scans. Taken together these provided input to improving DataONE products and services and demonstrated some of the impacts of DataONE on the broader community.

| Stakeholders | **Methods & Tests** | | | | |
	Surveys	**UX Testing**	**Interviews**	**Personas**	**Scans**
Scientists	3 International	DataONE search and website, DMPTool, Make Data Count metrics	Environmental health researchers	Multiple disciplines and job responsibilities	
Library/ Librarians	LIBER (European)	ARL website, Libguide widget, DataONE search and website	ACRL library leaders		ARL library websites
	3 ACRL (North American)				
Federal Workers	Subset of surveys of scientists	DataONE search, USGS library catalog, ORNL-ARM Data Discovery			
	Federal libraries and librarians (independent)				
	USGS scientists and data managers				
Data Managers (+ Member Nodes)	Member Node managers	DMPTool, ADC Metadata Editor, Make Data Count	New and emerging communities	Multiple disciplines and job responsibilities	
	Scientist data managers (self-identified)				
Others	College educators		Synthesis center directors	Citizen scientists, project managers, K-12 educators, college educators, university administrators	Data repositories, Data centers

Figure 6. Methods and tests used to study major stakeholder communities 2010-2019.

Usability/UX tests

User Experience (UX) testing was integrated into the design, development, and refinement of the DataONE technical infrastructure. UX testing measures the usability, efficiency, and effectiveness of a product or a system by capturing the users' experiences to identify problems.[13] The goals of UX testing in DataONE were to improve DataONE products and to help

---

13 Usability.gov: https://www.usability.gov/how-to-and-tools/methods/usability-testing.html

understand community needs and expectations. Iterative UX testing and evaluation using a variety of usability testing methods occurred throughout the project. During the design and development phases, heuristic evaluations, prototype testing, and eye tracking studies were completed to identify any problems before the product was released. Following product release, iterative UX testing was performed to ensure the product continued to meet users' needs. Some of the products evaluated include:

- The current DataONE Search and the former ONEMercury Search

- Specific parts of the DataONE Search (e.g., provenance display, semantics display, sign-in features, member node profiles, metadata display)

- DataONE website

- Data Tools (e.g., MatLab, DMPTool, metadata editor, ONEDrive).

To reach users from across a range of DataONE stakeholder groups, UX testing was conducted at conferences, scientists' work places, the University of Tennessee's state-of-the-art User-eXperience Lab, by telephone, and online. Approximately 50 UX studies were conducted throughout the project.

In addition to helping improve its products and services, UX testing strengthened DataONE's relationship with its users. Users felt a sense of pride and connection with the project because they were able to be a part of developing and refining the products and services.

Surveys

When the project began in 2009, published reports of empirical research into the data management, data sharing, and data reuse practices and attitudes of DataONE's key stakeholder groups was limited or non-existent. Surveys were designed to gather data to guide the development of products and services, and to understand where more education and training was needed. Understanding the user (and potential user) communities was not a sole responsibility of the U&A WG. The Community and Engagement WG also worked on understanding user practices and attitudes in order to identify training opportunities and create shared materials and webinars. Additionally, DataONE learned from other projects investigating changing stakeholder perceptions and practices (see for example, Wallis, Rolando, and Borgman, 2013; Faniel, Kriesber, and Yakel, 2016; Van Den Eynden et al., 2016; Yoon, 2017; Yoon and Schultz, 2017; Bezuidenhout and Chakauya, 2018).

The DataONE U&A WG first prioritized which of the many potential stakeholders were key to changing the culture of data practice and then made a recurring plan to study these key stakeholders over time. The two primary stakeholder groups were 1) scientists in all workplaces and 2) academic libraries and librarians. Knowing stakeholder attitudes and practices and how they may be changing helped to understand how the culture for open data could be improved. It was decided to survey those groups every three years for a total of three cycles. Scientists and librarians also often serve a dual role as educators or data managers, so those additional stakeholder groups were reached by surveying scientists and libraries.

Surveys of scientists were published in 2011, 2015, 2018 and 2019 (Tenopir et al., 2011; 2015a; 2018; 2019a, in press). Surveys of academic libraries in North America were published in 2012 (Tenopir, Birch, and Allard, 2012) and 2015 (Tenopir et al., 2015b) and 2019 (Tenopir, Allard, Kaufman, Sandusky, and Pollock, 2019a, in press) and of European academic libraries in 2017 (Tenopir et al., 2017). The unit of analysis for the library surveys were the libraries as organizations – measuring the policies, practices, and services of the library as a whole. In order to get attitudes of the librarians who work in those libraries, we also surveyed individual academic librarians (Tenopir, Sandusky, Allard, and Birch, 2013; Tenopir et al., 2019).

Interviews

Interviews were conducted both to explore new areas of stakeholder research and interests and to triangulate quantitative survey results. Supplemental interviews with members of key stakeholder groups were conducted to augment survey data, which allowed a more nuanced picture and probed issues that needed clarification from survey responses. For example, in the second libraries survey there was not as much progress in offering RDS as was expected based on answers about future planning in the first survey. Interviews with five directors of academic libraries revealed that implementing RDS was more time-consuming than they originally thought or that other priorities had emerged in the meantime (Tenopir et al., 2015b).

The goal of another project was to understand the role of environmental data in emerging research communities, here defined as those that have begun to converge around new areas of science and new scientific challenges. In 2016, interviews were conducted with domain scientists who had participated in convergence research in the area of environmental health to understand the role of data in their research teams (Pollock et al., 2019b). Participants were selected based on their co-authorship of an environmental health journal article that made use of open environmental data held by a DataONE member repository.

Participants described challenges when sharing data within these multidisciplinary convergence teams as interpersonal rather than technical, related to things such as making sure data are understood even by non-domain experts. Participants described team members filling a role that can be described as a *data mediator*, a trusted member of the team skilled at communicating across disciplines, who is often relied upon to interpret the raw data for others. Additional interviews with four directors of synthesis centers that have helped facilitate environmental health research also point to the interpersonal challenges of sharing data among convergence research teams (Pollock, Allard, Yan, and Parker, 2019a). Here again, respondents primarily described interpersonal and disciplinary-level data challenges and noted the need for expert personnel able to listen and communicate across different domains, particularly as disciplinary divides between environmental and health science remain. Additional interviews are recommended to examine the role of environmental data in other convergence research communities (Parker, Pollock, and Allard, 2018).

Environmental scans

Surveys and interviews monitor attitudes and behaviors of individuals or institutions, but do not give a big picture explanation of the data management landscape. Organizations have come to recognize the need for gauging their place in the broader environment by assessing resources and relationships and making adaptations based on their findings (Bolman and Deal, 2009). Environmental scans were conducted in both Fall 2013 and Fall 2018. These were multifaceted analyses of projects and initiatives in the DataONE mission space to help DataONE leadership better understand the existing competitive ecosystem. Assessing DataONE's place in this broader environment provided valuable information and insight to inform the transition from a project to a sustainable program.

In 2018, 21 organizations were identified whose missions aligned loosely with the DataONE mission.[14] Four were comparable to DataONE in that they held metadata, but not data (Forrester, Allard, Cannon, Pollock, and Specht, 2019). One organization was characterized as a data search tool and the rest represented either data support services or data repositories.

Results from the scan indicated that DataONE is well positioned to concentrate on the following service areas that currently exist or are extensions of on-going work: usage reporting, data replication, and data quality. Additionally, DataONE's proximity to the data distinguished it from training-only or data support services and gives DataONE a competitive advantage in the area of data science training.

---

14 DataONE Mission: Enable access and use of data about life and the environment.

Summary of Foundational Work and Assessments

As described above in Figure 6, multiple methods were used to study the major stakeholder communities, in particular focusing on scientists and on libraries and librarians. The studies assessed both the stakeholders' ability to use the DataONE cyberinfrastructure through usability testing and their attitudes toward and practices regarding research data management or the data landscape in general. Reflection on these studies paint a picture of change, sometimes slower than expected, and a growing realization of the importance of sound data practices by some segments and also of barriers that inhibit data sharing. The results of the studies (and often the datasets associated with them) have mostly been published and widely disseminated (Appendix B provides a bibliography of the WG publications). The purpose of this paper is not to repeat detailed findings from those publications, but instead, to highlight some of the important findings above and show the reach and impact of the DataONE assessments.

Broader Impacts – Outcomes and Evidence

There are a few broad areas that categorize the impacts of the SC and U&A WGs: understanding research data management practices; developing practitioner and professional research data management communities; and improving the usability of research data management resources. The specific outcomes and work that was undertaken provide evidence of DataONE's impact on research data management and specifically the work of these two working groups.

Impact of the Working Groups on the Awareness, Learning, and Understanding of Research Data Management

As the literature of working groups and research data management described previously shows, a dedicated group of interdisciplinary members can collectively make important contributions to the issues they are working on together. By participating in the scholarly discourse, the WGs promoted the importance of sound data practices and conveyed results and insights from thousands of scientists and librarians. This can be demonstrated by the number of scholarly works (Appendix B) and presentations (Appendix C) produced by all WG members and participants. Between 2009-2019, 48 papers were published across 25 different journals and eight conference proceedings. Based on subject classification in Ulrichsweb.com™, the disciplinary audience reach of the publication titles present in the database is shown in Figure 7. Sciences include environmental studies, earth sciences, biology, agriculture, and astronomy.
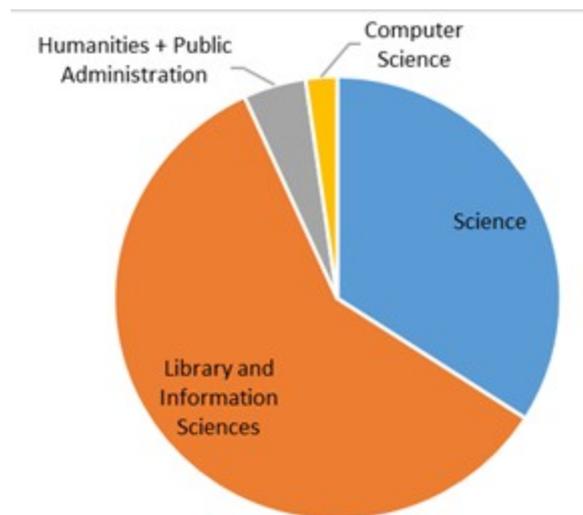
Figure 7. Audience reach of publications using subject classification in Ulrichsweb.com™.

For the ten-year period, and as of writing, members of the SC and U&A WGs made at least 170 presentations (talks, papers, and posters) in 22 different countries (Figure 8).[15] The reach is actually greater, because there were also at least 13 virtual presentations with audiences in multiple locations (Table 1). Some were recorded for viewing later. While it is unknown exactly how many people were present at all these face-to-face, virtual, and recorded presentations, an estimated minimum of 5,000 people heard a DataONE related presentation from SC or U&A WG members.
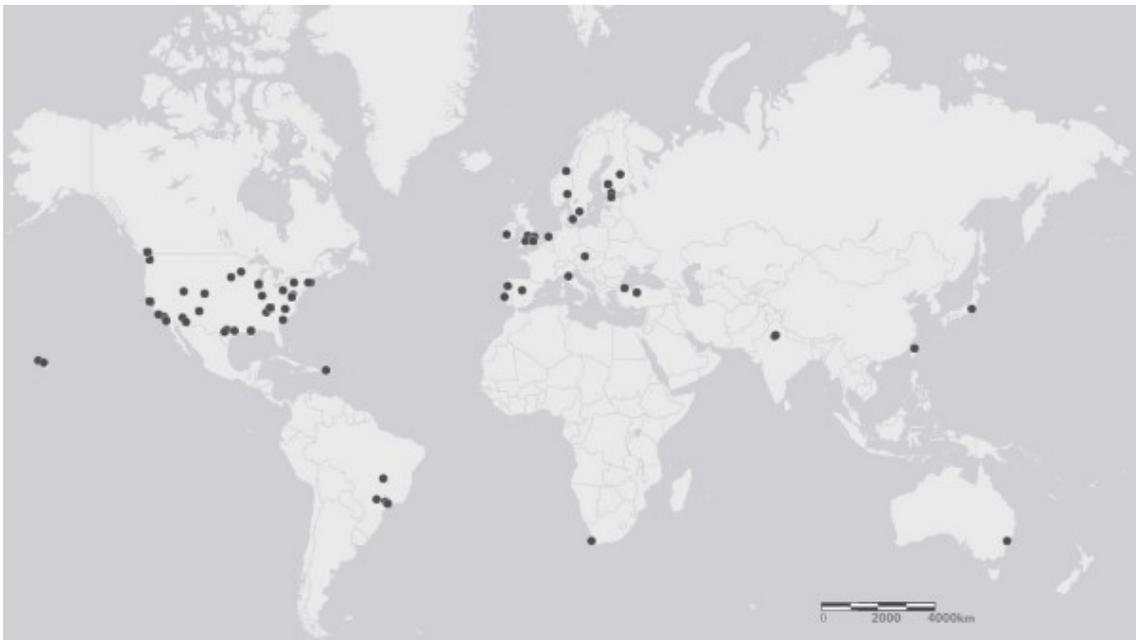
Figure 8. Geographic distribution of WG talks and presentations 2009-2019 (n=170).

---

15 Reports on what we have collected as of July 1, 2019.

Table 1. DataONE WG presentations

Year	# countries presented in	# virtual presentations	Total presentations
2009	4		17
2010	4		15
2011	5	3	25
2012	5	1	20
2013	5		11
2014	5		10
2015	5		19
2016	4	2	10
2017	9	2	21
2018	1	2	13
2019*	2	3	9

*2019 data reports partial year (as of July 2019)

The WGs disseminated their understanding of sound data practices, as well as barriers to data sharing and data reuse, through scholarly publication. One measure of evidence of the influence of DataONE WG activities on other researchers is citation analysis. To measure this impact, the U&A WG compiled a list of publications (Appendix B) resulting from the various activities and searched for citations in the Clarivate Web of Science Database (WoS), Elsevier Scopus database, and Google Scholar. Altmetrics scores were also collected. Results are presented in Table 2.[16]

Table 2. DataONE WG Publications (2010-2019)

Publication Type	# Publications	Citation Counts			Altmetrics Score
		Scopus	Google Scholar	WoS	
Journal article	30	1056	2094	790	773
Conference proceeding	18	45	131	4	9
Book chapter	2	0	5	0	0
Thesis & Dissertations	2	0	0	0	0
Web log post	1	0	0	0	0
White paper	1	0	160	0	0
Total	**54**	**1101**	**2390**	**794**	**782**
# of pubs listed in each dbase		33	50	19	37

Survey data from several of these publications were placed in data repositories to make them accessible and citable. Additional metrics were gathered to illustrate the discoverability and potential reuse of the individual data sets through views and downloads recorded by the repositories (Table 3).

---

16 Citation counts collected July 1, 2019

Table 3. Metrics for survey datasets placed in repositories as of June 30, 2019.

Published Article	Data DOI	Data Repository	Views	Downloads
Tenopir et al. (2011)	10.5061/dryad.6t94p	Dryad	2225	303
Tenopir et al. (2012)	10.15146/R3FG6P	ONEShare	59	17
Tenopir et al. (2015a)	10.5061/dryad.1ph92	Dryad	95	169
Tenopir et al. (2015b)	10.15146/R39G6F	ONEShare	68	19
Tenopir et al. (2017)	10.7910/DVN/SKNGGW	Harvard Dataverse	0	153

Impact of the Working Groups on the Development of Practitioners and the Professional Research Data Management Community

WG participation

The large and varied participant composition of the WGs catalyzed new partnerships through WG participation. Over the period of 2010-2019, there have been a total of 27 WG members from a range of organization types and professional roles and more than 79 volunteer affiliates (e.g., students, post-docs, visiting scholars, interns, practitioners) who attended WG meetings. In total, 88 individuals came from eight countries (Figure 9) and represented 40 organizational affiliations. More than half of all WG members and affiliates are characterized as working in academic organizations (Figure 10).[17]

Figure 9. Geographic distribution of all working group members and affiliates (n=88).

---

[17] Over the ten years, several individuals shifted between roles as WG member and affiliate and/or had more than one organizational affiliation.
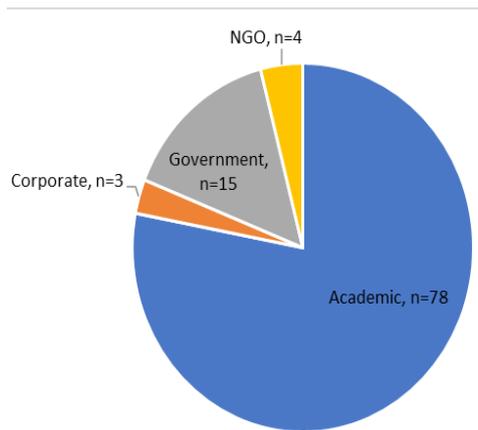
Figure 10. WG members/affiliates by organization type.

The SC and U&A WG members conducted internal assessments of satisfaction, perceived communication issues, and perceived effectiveness of the WG model. These assessments included members of all DataONE working groups, not just the SC and U&A WGs (Crowston, Specht, Hoover, Chudoba, and Watson-Manheim, 2015b). Results from Phase I analysis indicated that working groups can be effective when they are structured well (Crowston et al., 2015b). While team problems are likely to arise, shared routines and mental model such as openness to diverse opinions, shared communication practices, and active participation of bridge builders, such as librarians, can lead to success (Crowston et al., 2015b).

Crowston et al. (2015b) found that the DataONE working groups generally functioned well, with a commitment to share information and keep group members informed. Working group participants overall felt their WG was successful and they felt their WG was above average in comparison to other groups, no matter to which group the respondent belonged. Participants "felt the work of 'their' group was innovative, had produced valuable outcomes, and the team had worked effectively together. In summary, group members respected their fellow member's contributions and felt the work of their group was of value, the great majority expressing a long-term commitment to the project" (Crowston et al., 2015b).

Workforce development

Many of the volunteer affiliates in the SC and U&A WGs were graduate students at the time of their involvement with DataONE (Figure 11). These students have gone on to a variety of jobs and four continued participating after transitioning from student status to being members of the workforce. As of April 2019, the employment of 34 of the 44 students (2010-2019) could be identified. The majority are employed in academia as faculty, librarians, and staff (Table 4) and hold data-related positions with titles such as: Data Curation Librarian, Data Scientist, Metadata Content Editor, Data Ingest, Engineering Project Manager, Information Specialist, Business Analyst, Lead Digital Analytics Manager. They hold positions in the USA, Brazil, India, and Turkey.

Although not specifically analysed, the student participation in working group activities surely had an impact on their successful employment. Student involvement in real-world experiences (e.g., practical internships) make them more competitive on the job market and employers recognize the benefits of participation in these types of activities (Ferrer-Vinent and Sobel, 2011; Pymm and Juznic, 2014). The DataONE WGs provided an opportunity for students to be involved in solving complex real-world problems and further develop transferable skills, such as communication, teamwork, and professionalism, critical to success in any job environment.

In addition, the interdisciplinary nature of the working groups helped bring a variety of perspectives. There were a number of librarians and other information professionals in the

groups, who led studies on how librarians learn about research data management and what libraries are doing to help scientists at their institutions (Tenopir et al., 2012; Tenopir et al., 2013; Tenopir et al., 2015b).
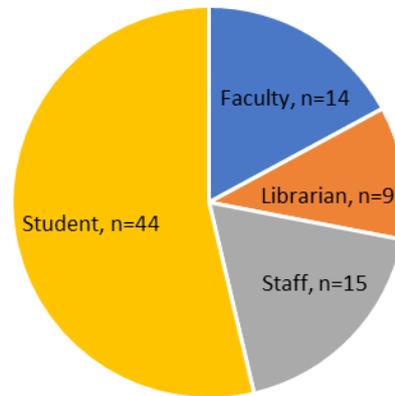

Figure 11. Academic roles of all WG members and affiliates.

Table 4. Current employment affiliation of former student participants.

Organization Type	Academic Role	# of Former Students
Academic		21
	Faculty	9
	Librarian	8
	Staff	4
Corporate		7
Government		4
Non-Governmental Organization		1

Many of these students were supported by grants from other agencies that resulted from their institutions' involvement in DataONE. The Institute of Museum and Library Services (IMLS) provided almost $2 million for several capacity-building grants to the University of Tennessee, Knoxville and University of Illinois at Urbana-Champaign. Over a period of nine years these grants helped the universities to educate almost 30 graduate students in the areas of team science, data management, and usability and assessment.

Website scans

The role of academic librarians is important in disseminating information about DataONE and its resources. The U&A WG conducted website scans of academic library members of the Association of Research Libraries (ARL) to measure mentions of DataONE (a mention is defined as an occurrence of the exact term "dataone"). ARL websites were defined to include resource lists as well as library and research guides. Of the 116 academic library members of the ARL, 67% mentioned DataONE at least once and 357 total mentions were found on these pages. Of the total mentions, 80% link to best practices or other informational tools and 20% point to the DataONE search and discovery system (Cannon, 2018).

Impact of the Working Groups on Improving the Usability of Research Data Management Products

Again, an interdisciplinary and dedicated group of participants can collectively contribute in important ways to the overall design and usability issues. The U&A WG applied usability analysis principles and methods to ensure that high quality, community-driven products and services were available to the community. This included conducting heuristic analysis and iterative usability testing of DataONE websites and products to ensure they followed general usability principles. Each instance of usability testing resulted in a report to the WG or team that had requested the testing. The work of the U&A WG improved the functionality and appearance of the DataONE website and search and enhanced the user experience on the interfaces, increasing the website's value as a data and data management resource. Many visual changes to the DataONE website and search occurred over the ten years in response to reports and recommendations provided to DataONE (Figure 12).

March 2015 — July 2015 — May 2019

2015 UX testing of the search.dataONE website found users had difficulty using the geographic search feature because the geolocation grid made the underlying map difficult to read. The study recommended lightening the squares to allow for better synergy between the map and the geolocation feature. Several usability studies and heuristic evaluations were conducted before reaching the current search interface.

2016 — 2019
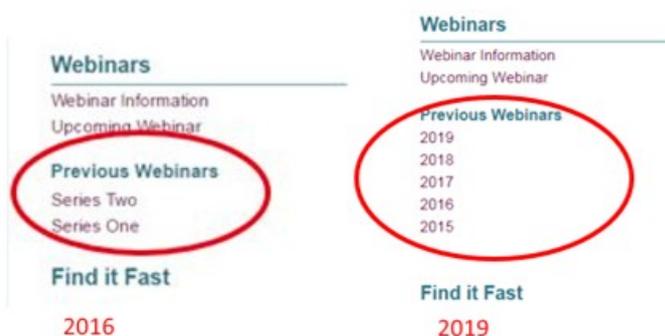
2016 UX testing of the DataONE website identified confusion with the webinar listings ("previous webinars"). Listing the webinars by year allowed users to more easily search the recorded webinars.

Figure 12. Examples of changes to DataONE search and website interfaces resulting from U&A WG activities to improve user experience.

The U&A WG scope also expanded beyond DataONE-specific products and had an impact on improving the usability of products and services in the broader research data management community. An ICPSR-Sloan challenge grant to Syracuse University built upon the DataONE best practices and developed a Capability Maturity Model (CMM) for Research Data Management. The CMM provides a rubric to help projects or organizations assess their level of

data management practices as a set of capability levels, from no data management practices (level 0) to institutionalized practices (level 3) (Qin, Crowston, and Kirkland, 2014).

Usability work has been conducted with several DataONE partners, including Atmospheric Radiation Measurement Climate Research Facility (ARM), United States Geological Survey (USGS), and the Oak Ridge National Laboratory Distributed Active Archive Center (ORNL DAAC). This capability led to the incorporation of usability work into other DataONE-related projects, including Whole Tale, Make Data Count, and DMPTool, as well as community research projects. In one example, researchers from the University of Sao Paulo conducted usability tests of non-native English speakers' interaction with DataONE. Results indicated that non-native English speakers rely on the website search function rather than menus. These are important findings if an objective of a data repository search interface is to draw more users who are not fluent in English.

Conclusions

Opportunities for the broad, iterative types of assessment performed by the DataONE community on global-scale information infrastructure are rare. This paper provides a summative description and reflection on the activities and broader impacts of the work performed by two of the working groups established at the beginning of the DataONE cooperative agreement. The SC and U&A WG members and affiliates established close working relationships with each other and often met together, with participants from both groups contributing to many sociocultural, usability, and assessment projects. The working groups provided analysis that informed a wide range of DataONE activities, both for the better function of the research project, and in interface with the broader community.

Due to the interdisciplinary nature of the DataONE SC and U&A WGs and the extensive interaction of a broad range of members throughout the project, a new vocabulary and set of frameworks emerged for thinking about research data management, indicators that the working groups were conducting convergence research. For example, in envisioning the research data life cycle, the group decided on a simplified, action-oriented model that was relevant across disciplines and functions. Furthermore, these vocabularies and framework have influenced thinking in the wider community, thus promoting broader convergence around data management, as documented above.

The position of WGs in the DataONE structure was deliberately pragmatic (Figure 13). Using the evaluation and advice of a wide group of experts organized into working groups, the project was able to refine and realize the project goals. The research community had a voice through the WG members, providing some quality assurance and reality-testing along the way. The WG members themselves were DataONE interpreters to their respective communities, acting as agents of outreach.

The WG members have expanded the research data community through many follow-on grants and projects. Many of these relationships cannot be quantified, but some are evidenced by grants or projects that brought together WG participants and others into new relationships. The interdisciplinary, transorganizational, and transnational reach of DataONE and its collaborative working group model has created and strengthened networks across the data-ecosystem science space. An example of this was a successful application from one of the WG members with colleagues, largely met through DataONE, to the Belmont Forum, for Science-Driven e-Infrastructures Innovation (SEI) for the "enhancement of transnational, interdisciplinary, and transdisciplinary data use in environmental change research." This application (Building New Tools for Data Sharing and Re-use through a Transnational Investigation of the Socioeconomic Impacts of Protected Areas (PARSEC)) has partners from Brazil, France, Japan, and the United States and collaborators from Earth Science Information

Partners (ESIP), ORCID, Research Data Alliance (RDA), DataCite, National Computational Infrastructure (NCI) Australia, and the British Geological Survey (BGS UK).[18]
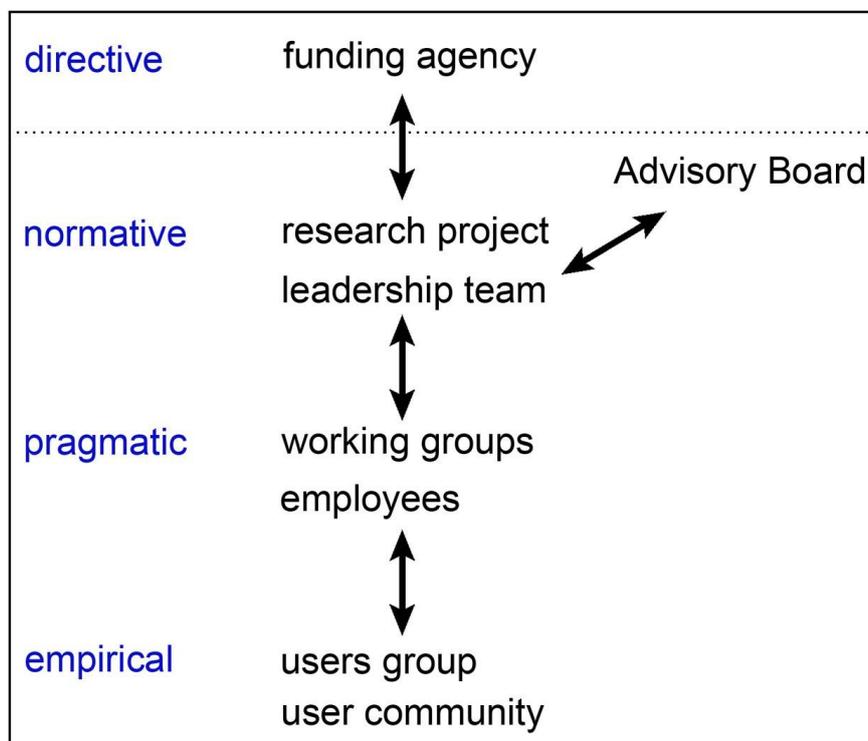

Figure 13. Application of the multi-level organisational innovation system as employed by DataONE based on Jantsch (1970).

DataONE is an early example of a large-scale project that built both a cyberinfrastructure and culture of data discovery, sharing, and reuse during its first two phases. In the decade from 2009-2019 the open data landscape has evolved, with increased awareness by scientists, mandates from government and other funding agencies, and requirements from publishers. The work done by the SC and U&A WGs provided a unique longitudinal look at how scientists, librarians, and other key stakeholders progressed in their thinking and practices around research data management. While the WG model is not part of the long-term sustainability of DataONE, the work of the SC and U&A WGs informs the ongoing operations as it transitions to its third phase. The new DataONE Governance Model will ensure a community driven organization comprised of four primary groups: Management Team, Advisory Board, DataONE Community, and the DataONE Community Board.[19] User Experience (UX) testing will continue to be an important tool to ensure the needs of the broad stakeholders are continually met.

Future Directions and Lessons Learned

The work and reach of these working groups will not stop after ten years of NSF funding. As shown, the studies continue to be cited and still influence the work of others beyond the immediate DataONE community. The DataONE cyberinfrastructure and community

---

18 See: http://www.belmontforum.org/news/science-driven-e-infrastructure-innovation-sei-projects-awarded/

19 DataONE: https://www.dataone.org/community/

engagement activities will continue, headquartered at the University of California, Santa Barbara, National Center for Ecological Analysis and Synthesis (NCEAS).

Throughout the first ten years of DataONE, the members of the SC and U&A WGs have learned lessons about what works in large-scale projects that bring together global interdisciplinary communities (Crowston et al., 2015b) and cautionary tales of what can be done better. The working group model can be incredibly powerful, productive, and impactful. Some important lessons to increase working group effectiveness include:

- working groups need to have effective leadership that is responsive to the participants and project objectives;

- diversity (e.g., different countries, disciplines, career stages, demographics) enables flexible responses to challenges;

- face-to-face meetings (with adequate travel budget) are essential to establishing effective working groups; virtual communication can facilitate group cohesiveness between meetings;

- development and acceptance of convergence boundary objects (e.g., the data life cycle model) facilitates communication across a multidisciplinary project;

- foundational work performed by the working groups influenced and shaped the nature, operations, and success of the project as a whole;

- feedback is important to members of the working groups to acknowledge the importance of their contributions to the project as a whole;

- iterative usability and assessment provide quality assurance mechanisms at all stages of a project.

Although this working group model is successful in building community and achieving goals of a large-scale project, continued sustainability after ten years of funding will be a challenge. Not all working groups or members will continue, but the strong sense of a shared purpose will ensure that research on topics related to data sharing and data re-use will continue. One suggestion for ensuring continued momentum is the toolkit approach, suggested by Gold et al. (2019).

While not all projects will be on the scale of DataONE, some lessons are important for projects of any size. Articulating and understanding the needs, attitudes, behaviors, and expectations of external and internal stakeholders is key to success. This needs to be a continuous process throughout the life of the project as the landscape changes. Organizations often fail to adapt as innovations introduced at the onset of a project become standard practices. It is vital for a project to institutionalize learning in order to advance. As part of this, multiple types of assessment are useful, including surveys, interviews, landscape analysis, and others. Engaging stakeholders in iterative usability testing at all stages of any development project is crucial. Diverse and well-functioning working groups contribute to the larger organization's cycle of innovation, assessment, and integration. However, if a project lacks a formal working group structure such as that described in this paper, the project will benefit from seeking feedback and including diverse points of view throughout the life of the project.

Acknowledgements

References

Allard, S. (2012). DataONE: Facilitating eScience through collaboration. *Journal of eScience Librarianship, 1*(1), 3.

Atkins, D., Droegemeir, K.K., Feldman, S.I., Garcia-Molina, H., Klein, M.L., Messerschmitt, D.G., … Wright, M.H. (2003). Revolutionizing science and engineering through cyberinfrastructure: Report of the National Science Foundation blue-ribbon advisory panel on cyberinfrastructure. Retrieved from http://www.nsf.gov/cise/sci/reports/atkins.pdf

Bainbridge, W.S. (2004). Early convergence research and education supported by the National Science Foundation. *Annals of the New York Academy of Sciences, 1013*(1), 234-58.

Bezuidenhout, L., & Chakauya, E. (2018). Hidden concerns of sharing research data by low/middle-income country scientists. *Global Bioethics, 29*(1), 39–54.

Bishop, A.P., Neumann, L.J., Star, S.L., Merkel, C., Ignacio, E., & Sandusky, R.J. (2000). Digital libraries: Situating use in changing information infrastructure. *Journal of the American Society for Information Science, 51*(4), 394-413.

Bolman, L.G., & Deal, T.E. (2009). Reframing organizations: Artistry, choice and leadership. San Francisco, CA: Jossey-Bass.

Borgman, C.L. (2003). Designing digital libraries for usability. Digital library use: Social practice in design and evaluation, A.P. Bishop, Van House, N.A., & Buttenfield, B.P. (Eds.), 85-118.

Bowker, G.C., & Star, S.L. (1999). Sorting things out: Classification and its consequences. Cambridge, MA: MIT Press.

Bowker, G.C., Star, S.L., Turner, W., & Gasser, L. (Eds.). (1997). Social science, technical systems, and cooperative work: Beyond the great divide. Mahwah, NJ: Lawrence Erlbaum Associates.

Cannon, L. (2018). DataONE presence on ARL library websites. White Paper by DataONE Usability & Assessment Working Group Subgroup. Retrieved from https://trace.tennessee.edu/utk_dataone/22

Cooper, A. (1999). The inmates are running the asylum. Indianapolis, IN: Sams.

Crowston, K. (2015). 'Personas' to support development of cyberinfrastructure for scientific data sharing. *Journal of eScience Librarianship, 4*(2): e1082. doi:10.7191/jeslib.2015.1082

Crowston, K., Bissell, A., Grant, B., Manoff, M., & Davis, R. (2015a). DataONE personas. Report by DataONE Socio-cultural and Usability & Assessment Working Groups Subgroup. Retrieved from https://www.dataone.org/sites/default/files/dataone_personas_all.pdf

Crowston, K., Specht, A., Hoover, C., Chudoba, K., & Watson-Manheim, M. (2015b). Perceived Discontinuities and Continuities in Transdisciplinary Scientific Working Groups. Science for the Total Environment, 534: 159-172. doi:10.1016/j.scitotenv.2015.04.121

Faniel, I.M., Kriesberg, A., & Yakel, E. (2016). Social scientists' satisfaction with data reuse. *Journal of the Association for Information Science and Technology, 67*(6), 1404–1416.

Ferrer-Vinent, I.J., & Sobel, K. (2011). A study of master of library science candidates and librarians at a practicum site library. *New Library World, 112*(7/8), 365–376.

Finholt, T.A. (2003). Collaboratories as a new form of scientific organization. *Economics of Innovation and New Technology, 12*(1), 5-25.

Forrester, A., Allard, S., Cannon, L., Pollack, D., & Specht, A. (2019). Environmental scan for DataONE. White Paper by DataONE Usability & Assessment Working Group Subgroup. Retrieved from https://trace.tennessee.edu/utk_dataone/150/

Gasser, L. (1986). The integration of computing and routine work. *ACM Transactions on Information Systems (TOIS), 4*(3), 205-225.

Gold, E.R., Ali-Khan, S.E., Allen, L., Ballell, L., Barral-Netto, M., Carr, D., Chalaud, D., Chaplin, S., Clancy, M.S., Clarke, P., Cook-Deegan, R., Dinsmore, A.P., Doerr, M., Federer, L., Hill, S. A., Jacobs, N., Jean, A., Jefferson, O.A., Jones, C., Kahl, L. J., … Thelwall, M. (2019). An open toolkit for tracking open science partnership implementation and impact. *Gates open research, 3*, 1442.

Hill, L.L., Carver, L., Larsgaard, M., Dolin, R., Smith, T.R., Frew, J., & Rae, M.A. (2000). Alexandria digital library: User evaluation studies and system design. *Journal of the American Society for Information Science, 51*(3), 246-259.

Jantsch, E. (1970) Inter- and transdisciplinary university: A systems approach to education and innovation. *Policy Sciences, 1*, 403-428.

Jirotka, M., Lee, C.P., & Olson, G.M. (2013). Supporting scientific collaboration: Methods, tools and concepts. *Computer Supported Cooperative Work, 22*(4-6), 667-715.

Kling, R., & Scacchi, W. (1982). The web of computing: Computer technology as social organization. In M.C. Yovits (Ed.), Advances in Computers Volume 21. pp. 1-90. New York, NY: Academic Press.

Kling, R. (1987). Defining the boundaries of computing across complex organizations. In R. J. Boland, Jr. & R. A. Hirschheim (Eds.), Critical issues in information systems research. pp. 307-362. New York, NY: Wiley.

Lee, C.P., & Schmidt, K. (2018). A bridge too far? Critical remarks on the concept of "infrastructure" in CSCW and IS. In V. Wulf, et al. (Eds.). Socio-Informatics: A Practice-based Perspective on the Design and Use of IT Artifacts. pp. 177-217. Oxford: Oxford University Press.

Marchionini, G., Plaisant, C., Komlodi, A. (2003). The people in digital libraries: Multifaceted approaches to assessing needs and impact. Digital library use: Social practice in design and evaluation, A.P. Bishop, Van House, N.A., & Buttenfield, B.P. (Eds.), 119-160.

Massachusetts Institute of Technology (MIT). (2011). The third revolution: The convergence of the life sciences, physical sciences, and engineering. Washington, D.C.: MIT Washington Office. Retrieved from http://www.aplu.org/projects-and-initiatives/research-science-and-technology/hibar/resources/MITwhitepaper.pdf

Michener, W.K., Allard, S., Budden, A., Cook, R.B., Douglass, K., Frame, M., ... Vieglais, D.A. (2012). Participatory design of DataONE – Enabling cyberinfrastructure for the biological and environmental sciences. *Ecological Informatics, 11*, 5-15.

National Research Council (NRC). (1993). National collaboratories: Applying information technology for scientific research. Washington, D.C.: National Academies Press.

National Research Council (NRC). (2014) Convergence: Facilitating transdisciplinary integration of life sciences, physical sciences, engineering, and beyond. Washington, DC: The National Academies Press. doi:10.17226/18722

National Science Foundation (NSF). (2003). Cyberinfrastructure for environmental research and education. Report from NCAR Workshop Oct 30-Nov1, 2002. Retrieved from http://www.kgs.ku.edu/Geoinfo2/cyber_report_new.pdf

National Science Foundation (NSF). (2007). Sustainable digital data preservation and access network partners (DataNet): Program solicitation NSF 07-601. Retrieved from https://www.nsf.gov/pubs/2007/nsf07601/nsf07601.htm

National Science Foundation (NSF). (2017). Convergence research at NSF. Retrieved from https://www.nsf.gov/od/oia/convergence/index.jsp

Parker, M., Pollock, D., & Allard, S. (2018, February). Data usage of the environmental justice movement. Poster session presented at the ALISE Annual Meeting, Denver, CO.

Pollock, D., Allard, S., Yan, A., & Parker, M. (2019a, October). The role of data and synthesis centers in convergence research. *Proceedings of the Association for Information Science and Technology 56.1* (2019): 745-746.

Pollock, D., Yan, A., Parker, M., & Allard, S. (2019b). The role of scientific data in an emerging research community: Environmental health research as an exemplar. Manuscript submitted for publication.

Pymm, B., & Juznic, P. (2014). The view from industry. LIS students on placement. *Library Review, 63*(8/9), 606-623.

Qin, J., Crowston, K., & Kirkland, A. (2014). A capability maturity model for research data management. Syracuse. NY: School of Information Studies, Syracuse University. Retrieved from https://surface.syr.edu/istpub/184/

Sharp, P., Hockfield, S., & Jacks, T. (Eds.) (2016). Convergence: The future of health. Washington, D.C.: MIT Washington Office. Retrieved from http://www.convergencerevolution.net/2016-report/

Star, S.L., & Griesemer, J.R. (1989). Institutional ecology, translations' and boundary objects: Amateurs and professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39. *Social Studies of Science, 19*(3), 387-420.

Star, S.L., & Ruhleder, K. (1996). Steps toward an ecology of infrastructure: Design and access for large information spaces. *Information Systems Research, 7*(1), 111-134.

Suchman, L.A. (1987). Plans and situated actions: The problem of human-machine communication. Cambridge, UK: Cambridge University Press.

Tenopir, C., Allard, S., Douglass, K., Aydinoglu, A.U., Wu, L., Read, E., Manoff, M., & Frame, M. (2011). Data sharing by scientists: practices and perceptions. *PLOS ONE, 6*(6), e21101.

Tenopir, C., Birch, B., & Allard, S. (2012). Academic libraries and research data services: Current practices and plans for the future. An ACRL White Paper. Chicago, IL: American Library Association. Retrieved from http://www.ala.org/acrl/sites/ala.org.acrl/files/content/publications/whitepapers/Tenopir_Birch_Allard.pdf

Tenopir, C., Sandusky, R., Allard, S., & Birch, B. (2013). Academic librarians and research data services: Preparation and attitudes. *IFLA Journal, 39*(1), 70-78.

Tenopir, C., Dalton, E., Allard, S., Frame, M., Pjesivac, I., Birch, B., Pollock, D., & Dorsett, K. (2015a). Changes in data sharing and data reuse practices and perceptions among scientists worldwide. *PLoS One, 10*(8), e0134826.

Tenopir, C., Hughes, D., Allard, S., Frame, M., Birch, B., Baird, L., Sandusky, R., Langseth, M., & Lundeen, A. (2015b). Research data services in academic libraries: Data intensive roles for the future. *Journal of EScience Librarianship, 4*(2), E1085.

Tenopir, C., Talja, S., Horstmann, W., Late, E., Hughes, D., Pollock, D., … Allard, S. (2017). Research data services in European libraries: A LIBER-DataONE survey. *Liber Quarterly, 27*(1), 23–44.

Tenopir, C., Christian, L., Allard, S., & Borycz, J. (2018). Research data sharing: Practices and attitudes of geophysicists. *Earth and Space Science, 5*(12), 891-902.

Tenopir, C., Allard, S., Baird, L., Sandusky, R., Lundeen, A., & Pollock, D. (2019). Academic librarians and research data services: Attitudes and practices. *Information Technology and Libraries Journal (Informačné technológie a knižnice), 1*. Retrieved from http://itlib.cvtisr.sk/archiv/2019/1/academic-librarians-and-research-data-services-attitudes-and-practices.html?page_id=3579

Tenopir, C., Allard, S., Kaufman, J., Sandusky, R., & Pollack, D. (2019a, in press). Research data services in academic libraries: Where are we today? Choice White Paper. Chicago, IL: American Library Association.

Tenopir, C., Rice, N., Allard, A., Baird, L., Borycz, J., Christian, L., … Zolly, L. (2019b, in press). Data sharing, management, use, and reuse: Practices and perceptions of scientists worldwide. *PLoS One.*

Van Den Eynden, V., Knight, G., Vlad, A., Radler, B., Tenopir, C., Leon, D., … Corti, L. (2016). Towards open research: Practices, experiences, barriers and opportunities. London, UK: Wellcome Trust. doi:10.6084/m9.figshare.4055448

Van House, N.A. (2003). Digital libraries and collaborative knowledge construction. Digital library use: Social practice in design and evaluation, A.P. Bishop, Van House, N.A., & Buttenfield, B.P. (Eds.), 271-295.

Wallis, J.C., Rolando, E., & Borgman, C.L. (2013). If we share data, will anyone use them? Data sharing and reuse in the long tail of science and technology. *PLoS One, 8*(7), e67332.

Yoon, A. (2017). Data reusers' trust development. *Journal of the Association for Information Science and Technology, 68*(4), 946–956.

Yoon, A., & Schultz, T. (2017). Research data management services in academic libraries in the US: A content analysis of libraries' websites. *College & Research Libraries, 78*(7), 920.

Appendix A.
Working Group Members

Phase I (2010–2014)

Sociocultural Issues

WG Members	Affiliation
Suzie Allard	University of Tennessee
Lynn Baird	University of Idaho
Ahrash Bissell	Science Commons
Miriam Blake	Los Alamos National Lab
Kevin Crowston	National Science Foundation; Syracuse University
Miriam Davis	University of Tennessee
Kimberly Douglass	University of Tennessee
Heather Joseph	SPARC
Maribeth Manoff	University of Tennessee
Heather Piwowar	UNC Chapel Hill

Usability & Assessment

WG Members	Affiliation
Denise M. Davis	American Library Association; Sacramento Public Library
Miriam Davis	University of Tennessee
Mike Frame	U.S. Geological Survey
Bruce Grant	Widener University
Carol Hoover	Los Alamos National Lab
Rachael Hu	California Digital Library
Holly Mercer	University of Tennessee
Theresa Pardo	SUNY Albany
K.K. (Rama) Ramapriyan	NASA Goddard Space Flight Center
Eleanor Read	University of Tennessee
Alison Specht	University of Queensland
Carol Tenopir	University of Tennessee
Lisa Zolly	U.S. Geological Survey

Phase II (2014–2019)

Usability & Assessment

WG Members	Affiliation
Suzie Allard	University of Tennessee
Lynn Baird	University of Idaho
Kevin Crowston	National Science Foundation; Syracuse University
Mike Frame	U.S. Geological Survey
Bruce Grant	Widener University
Rachael Hu	California Digital Library
Robert Olendorf	Los Alamos National Lab; North Carolina State University; Penn State University
Bob Sandusky	University of Illinois, Chicago
Alison Specht	University of Queensland; Centre for the Synthesis and Analysis of Biodiversity
Carol Tenopir	University of Tennessee
Lisa Zolly	U.S. Geological Survey

Appendix B.
Working Group Publications Used in Metrics Analysis

2010

Gunia, B., & Sandusky, R. J. (2010). Designing metadata for long-term data preservation: DataONE case study. Proceedings of the American Society for Information Science and Technology, 47(1), 1-2. doi:10.1002/meet.14504701435

Piwowar, H. (2010). A method to track dataset reuse in biomedicine: Filtered GEO accession numbers in PubMed Central. Proceedings of the American Society for Information Science and Technology, 47(1), 1-2. doi:10.1002/meet.14504701450

Weber, N. M., Piwowar, H. A., & Vision, T. J. (2010). Evaluating data citation and sharing policies in the environmental sciences. Proceedings of the American Society for Information Science and Technology, 47(1), 1-2. doi:10.1002/meet.14504701445

2011

Aydinoglu, A. (2011). Complex adaptive systems theory applied to virtual scientific collaborations: The case of DataONE (Unpublished doctoral dissertation). University of Tennessee, Knoxville, TN. https://trace.tennessee.edu/utk_graddiss/1054

Kim, Y., & Crowston, K. (2011). Technology adoption and use: Theory review for studying scientists continued use of cyber-infrastructure. Proceedings of American Society for Information Science and Technology, 48(1), 1-10. doi:10.1002/meet.2011.14504801197

McNamee, S. (2011). Geospatial data accessibility in Web 2.0 environments (Unpublished Master's Thesis). University of Tennessee, Knoxville, TN. https://trace.tennessee.edu/utk_gradthes/898/

Piwowar, H., Vision, T., & Whitlock, M. (2011). Data archiving is a good investment. Nature, 473(7347), 285. doi:10.1038/473285a

Sayogo, D.S., & Pardo, T.A. (2011). Exploring the determinants of publication of scientific data in open data initiative. In J. Davies, M. Janssen, & E. Estevez (Eds.), Proceedings of 5th International Conference on Theory and Practice of Electronic Governance (pp. 97-106). Tallinn, Estonia: ACM. doi: 10.1145/2072069.2072087

Sayogo, D.S., & Pardo, T.A. (2011). Understanding the capabilities and critical success factors in collaborative data sharing network: the case of DataONE. In J. Bertot, L, Felipe, & S. Chun (Eds.), Proceedings of the 12th Annual International Digital Government Research Conference: Digital Government Innovation in Challenging Times (pp. 74-83). College Park, Maryland: ACM. doi: 10.1145/2037556.2037568

Tenopir, C., Allard, S., & Davis, M.L.E.S. (2011). Understanding the data management needs and data sharing challenges of environmental scientists. In M.B. Jones & C. Gries (Eds.), Proceedings of the Environmental Information Management Conference (pp. 138-144). Santa Barbara, CA: University of California.

Tenopir, C., Allard, S., Douglass, K., Aydinoglu, A. U., Wu, L., Read, E., Manoff, M., & Frame, M. (2011). Data sharing by scientists: Practices and perceptions. PLOS ONE, 6(6), e21101. doi: 10.1371/journal.pone.0021101

Tenopir, C., Palmer, C. L., Metzer, L., van der Hoeven, J., & Malone, J. (2011). Sharing data: Practices, barriers, and incentives. Proceedings of the American Society for Information Science and Technology, 48(1), 1-4. doi:10.1002/meet.2011.14504801026

2012

Allard, S. (2012). DataONE: Facilitating eScience through collaboration. Journal of eScience Librarianship, 1(1), 3. doi:10.7191/jeslib.2012.1004

Allard, S. (2012). National Data Management Initiatives & the U.S. Exemplar: DataONE. Interdisciplinary Data Science Education. In N. Xiao (Ed.), e-Science, Data Management, and Primary Data (pp. 47-67). Washington, DC: ACS Books. doi:10.1021/bk-2012-1110.ch004

Michener, W. K., Allard, S., Budden, A., Cook, R. B., Douglass, K., Frame, M., Kelling, S., Koskela, R., Tenopir, C., & Vieglais, D. A. (2012). Participatory design of DataONE: Enabling cyberinfrastructure for the biological and environmental sciences. Ecological Informatics, 11, 5-15. doi:10.1016/j.ecoinf.2011.08.007

Newman, G., Wiggins, A., Crall A., Graham, E., Newman, S., Crowston, K. (2012). The future of citizen science: Emerging technologies and shifting paradigms. Frontiers in Ecology and the Environment, 10(6), 298-304. doi:10.1890/110294

Olendorf, R., & Koch, S. (2012). Beyond the low hanging fruit: data services and archiving at the University of New Mexico. Journal of Digital Information, 13(1).

Stanton, J., Palmer, C., Blake, C., & Allard, S. (2012). Interdisciplinary data science education. In N. Xiao (Ed.), e-Science, Data Management, and Primary Data (pp.97-113). Washington, DC: ACS Books. doi:10.1021/bk-2012-1110.ch006

Tenopir, C., Birch, B., & Allard, S. (2012). Academic libraries and research data services: Current practices and plans for the future. An ACRL White Paper. Chicago, IL: Association of College and Research Libraries.

2013

Aydinoglu, A. (2013). Toward a new understanding of virtual research collaborations: complex adaptive systems framework. SAGE Open, 3(4). doi: 10.1177/2158244013507269

Eaker, C., Thomer, A., Johns, E., & Siddell, K. (2013). How information science professionals add value in a scientific research center. iConference 2013 Proceedings, 812-815. doi:10.9776/13397

Sayogo, D. S., & Pardo, T. A. (2013, January). Exploring the determinants of scientific data sharing: Understanding the motivation to publish research data. Government Information Quarterly, 30(1), S19-S31. doi:10.1016/j.giq.2012.06.011

Tenopir, C., Sandusky, R. J., Allard, S., & Birch, B. (2013). Academic librarians and research data services: Preparation and attitudes. IFLA Journal, 39(1), 70-78. doi:10.1177/0340035212473089

Vision, T., & Piwowar, A. (2013). Data reuse and scholarly reward: understanding practice and building infrastructure. PeerJ PrePrints, 1, e14v1. doi:10.7287/peerj.preprints.14v1

2014

Allard, S. (2014). Evaluating a Complex Project. In Ray, J. (Ed.,), Research Data Management: Practical Strategies for Information Professionals (pp. 255-274). West Lafayette, IN: Purdue University Press.

Aydinoglu, A., Suomela, T., & Malone, J. (2014). Data management in astrobiology: Challenges and opportunities for an interdisciplinary community. Astrobiology, 14(6), 451-61.

Davis, M. L. S., Tenopir, C., & Allard, S. (2014). Agriculture and natural resource scientists' biodiversity information needs: Barriers and facilitators to use and access in the US Southeast. Agricultural Information Worldwide, 6, 66-76.

Davis, M. L. S., Tenopir, C., Allard, S., & Frame, M. T. (2014). Facilitating access to biodiversity information: A survey of users' needs and practices. Environmental Management, 53(3), 690-701. doi:10.1007/s00267-014-0229-7

Douglass, K., & Bilal, D. (2014). Constructing the Role of School Librarians in the 21st Century Workforce: Implications of NSF-Funded DataONE for K-12 Librarianship. iConference 2014 Proceedings, 1157-1159. doi:10.9776/14411

Douglass, K., Allard, S., Tenopir, C., Wu, L., & Frame, M. (2014). Managing scientific data as public assets: Data sharing practices and policies among full-time government employees. Journal of the Association for Information Science and Technology, 65(2), 251-262. doi:10.1002/asi.22988

Douglass, K., Tenopir, C., Birch, B., Hoover, C., Zolly, L., & Frame, M. (2014). The role of federal libraries and federal librarians in research data services (RDS): An exploratory study. DttP, 42, Summer, 15.

Murillo, A. P. (2014). Examining data sharing and data reuse in the DataONE environment. Proceedings of the American Society for Information Science and Technology, 51(1), 1-5. doi:10.1002/meet.2014.14505101155

Tenopir, C. (2014). The importance of data, information, and knowledge in scholarly communication. In C. Bitso, & R. Raju (Eds.), LIS Education and Research in a Dynamic Information Landscape: Proceedings of the Library and Information Studies Centre 75 years Commemorative Conference (pp. 54-62). Cape Town, South Africa: University of Cape Town Libraries.

Tenopir, C., Allard, S., & Frame, M. (2014). An accessible infrastructure. International Innovation, 148, 95-97.

Tenopir, C., Sandusky, R. J., Allard, S., & Birch, B. (2014). Research data management services in academic research libraries and perceptions of librarians. Library & Information Science Research, 36(2), 84-90. doi:10.1016/j.lisr.2013.11.003

2015

Crowston, K, Specht A., Hoover, C., Chudoba, K., & Watson-Manheim, M. (2015). Perceived discontinuities and continuities in transdisciplinary scientific working groups. Science for the Total Environment. 534, 159-172. doi:10.1016/j.scitotenv.2015.04.121

Crowston, K. (2015). "Personas" to support development of cyberinfrastructure for scientific data sharing. Journal of eScience Librarianship, 4(2), 2. doi:10.7191/jeslib.2015.1082

Tenopir, C., Dalton, E. D., Allard, S., Frame, M., Pjesivac, I., Birch, B., Pollock, D., & Dorsett, K. (2015). Changes in data sharing and data reuse practices and perceptions among scientists worldwide. PLOS ONE, 10(8), e0134826. doi:10.1371/journal.pone.0134826

Tenopir, C., Hughes, D., Allard, S., Frame, M., Birch, B., Baird, L., Sandusky, R., Langseth, M., & Lundeen, A. (2015). Research data services in academic libraries: Data intensive roles for the future? Journal of eScience Librarianship, 4(2), 4. doi:10.7191/jeslib.2015.1085

2016

Pollock, D. (2016). Understanding Scientific Data Sharing Outside of the Academy. Proceedings of the Association for Information Science and Technology, 53(1), 1-5. doi:10.1002/pra2.2016.14505301144

Sandusky, R. J. (2016). Computational provenance: DataONE and implications for cultural heritage institutions. In J. Joshi, G. Karypis, L. Liu, X. Hu, R. Ak, Y. Xia, …T. Suzumura (Eds.), 2016 IEEE International Conference on Big Data (Big Data) (pp. 3266-3271). Washington, DC: IEEE. doi:10.1109/BigData.2016.7840984

Tenopir, C., Allard, S., Sinha, P., Pollock, D., Newman, J., Dalton, E., Frame, M., & Baird, L. (2016). Data management education from the perspective of science educators. International Journal of Digital Curation, 11(1), 232-251. doi:10.2218/ijdc.v11i1.389

Tenopir, C., Pollock, D., Allard, S., & Hughes, D. (2016). Research data services in European and North American libraries: Current offerings and plans for the future. Proceedings of the Association for Information Science and Technology, 53(1), 1-6. doi:10.1002/pra2.2016.14505301129

2017

Aydinoglu, A. U., Dogan, G., & Taskin, Z. (2017). Research data management in Turkey: perceptions and practices. Library Hi Tech, 35(2), 271-289. doi:10.1108/LHT-11-2016-0134

Curty, R. G., Crowston, K., Specht, A., Grant, B. W., & Dalton, E. D. (2017). Attitudes and norms affecting scientists' data reuse. PLOS ONE, 12(12), e0189288. doi:10.1371/journal.pone.0189288

Qin, J., Crowston, K., & Kirkland, A. (2017). Pursuing best performance in research data management by using the Capability Maturity Model and rubrics. Journal of eScience Librarianship, 6(2), e1113. doi:10.7191/jeslib.2017.1113

Sandusky, R.J. (2017). How recordkeeping ensures trust in digital archives. Proceedings of the Association for Information Science and Technology, 54(1), 796-797.

Tenopir, C., Talja, S., Horstmann, W., Late, E., Hughes, D., Pollock, D., Baird, L., Sandusky, R.J., & Allard, S. (2017). Research data services in European academic research libraries. Liber Quarterly, 27(1), 23-44. doi:10.18352/lq.10180

Volentine, R., Owens, A., Tenopir, C., & Frame, M. (2017). Usability testing to improve research data services. Qualitative and Quantitative Methods in Libraries, 4(1), 59-68.

2018

Allard, G. & Allard, S. (2018). A Methodology for Scientific Cyberinfrastructure Sustainability Research. Proceedings of the Association for Information Science and Technology, 55(1), 743-744.

Curty, R.G., Crowston, K., Specht, A., Grant, B.W., & Dalton, E.D. (2018, March 20). What factors do scientists perceive as promoting or hindering scientific data reuse? [LSE Impact Blog]. Retrieved from https://blogs.lse.ac.uk/impactofsocialsciences/2018/03/20/what-factors-do-scientists-perceive-as-promoting-or-hindering-scientific-data-reuse/

Specht A., Bolton, M.P., Kingsford B., Specht R.L., & Belbin L. (2018) A story of data won, data lost and data re-found: the realities of ecological data preservation. Biodiversity Data Journal, 6, e28073. doi: 10.3897/BDJ.6.e28073

Tenopir, C., Christian, L., Allard, S., & Borycz, J. (2018). Research data sharing: Practices and attitudes of geophysicists. Earth and Space Science, 5(12), 891-902. doi:10.1029/2018EA000461

2019

Tenopir, C., Allard, S., Baird, L., Sandusky, R., Lundeen, A., Hughes, D., & Pollock, D. (2019). Academic librarians and research data services: attitudes and practices. Information Technology and Libraries Journal, 1, 24-37.

Appendix C.
Working Group Presentations and Talks Used in Analysis

2009

Allard, S. Cragin, M., Curse, P., Palmer, C., Renear, A., Sandusky, R., & Tenopir, C. (2009, November 9). The DataNet Partners: Sharing science, linking domains, curating data. Presentation at the Annual Meeting of the American Society for Information Science & Technology, Vancouver, BC, Canada.

Allard, S., Cruse, P., Sandusky, R.J., & Tenopir, C. (2009, November 10). DataONE: Protecting the future of environmental and ecological data. Panel presentation at ASIST Annual Meeting, Vancouver, BC, Canada.

Allard, S., Tenopir, C., & Wilson, B. (2009, February. DataNetONE (Observation Network for Earth): An earth environmental and ecological sciences data center from a communication and information perspective. Poster session presented at the University of Tennessee Thirty-First Annual Communications Research Symposium, Knoxville, TN.

Allard, S., Curse, P., Sandusky, R., & Tenopir, C. (2009, November 8-9). DataONE: Protecting the future of environmental and ecological data. Presentation at the Annual Meeting of the American Society for Information Science & Technology, Vancouver, BC, Canada.

Cruse, P., Michener, W., Allard, S., Allen, P., Buneman, P., Butler, R., Cobb, J., Cook, R., Deelman, E., DeRoure, D., Duke, C., Frame, M., Goble, C., Hampton, S., Hobern, D., Honeyman, P., Horsburgh, J., Hutchison, V., Jones, M., Kelling, S., Kranowitz, J., Kunze, J., Ludaescher, B., Manoff, M., Pereira, R., Pouchard, L., Sandusky, R., Scherle, R., Servilla, M., Smith, K., Tenopir, C., Vieglais, D., Welch, V., & Weltzin, J., Wilson, B. (2009, December 2). DataONE: Enabling data-intensive environmental research through cyberinfrastructure. Poster session presented at 5th International Digital Curation Conference "Moving to Multi-Scale Science: Managing Complexity and Diversity," London, UK.

Kunze, J., Cook, R., Cruse, P., Tenopir, P., Vision, T., & Michener, W. (2009, December 14-18). Defining the data citation problem in the DataNet context. Presentation at American Geophysical Union Meeting, San Francisco, CA.

Manoff, M. (2009, November 20). Overview of DataONE Project. Presentation at the University of Tennessee Research Librarians' Team Meeting, Knoxville, TN.

Manoff, M., & Allard, S. (2009, November 5). Overview of the NSF DataONE Grant. Presentation at the University of Tennessee Data & GIS Users Discussion Forum, Knoxville, TN.

Michener, W., Allard, S., Allen, P., Buneman, P., Butler, R., Cobb, J., Cook, C., Cruse, P., Deelman, E., DeRoure, D., Duke, C., Frame, M., Goble, C., Hampton, S., Hobern, D., Honeyman, P., Horsburgh, J., Hutchison, V., Jones, M., Kelling, S., Kranowitz, J., Kunze, J., Ludaescher, B., Manoff, M., Pereira, R., Pouchard, L., Sandusky, R., Scherle, R., Servilla, M. S., Smith, K., Tenopir, C., Vieglais, D., Welch, V., Weltzin, J., & Wilson, B. (2009, August 7). DataONE: A virtual data center for biology, ecology, and the environmental sciences. Presentation at The 94th ESA Annual Meeting. Austin, TX.

Michener, W., Allard, S., Allen, P., Buneman, P., Butler, R., Cobb, J., Cook, C., Cruse, P., Deelman, E., DeRoure, D., Duke, C., Frame, M., Goble, C., Hampton, S., Hobern, D., Honeyman, P., Horsburgh, J., Hutchison, V., Jones, M., Kelling, S., Kranowitz, J., Kunze, J., Ludaescher, B., Manoff, M., Pereira, R., Pouchard, L., Sandusky, R., Scherle, R., Servilla, M. S., Smith, K., Tenopir, C., Vieglais, D., Welch, V., Weltzin, J., & Wilson, B. (2009, June 1). DataONE: A virtual data center for biology, ecology, and the environmental sciences. Poster session presented at e-Biosphere'09 (International Conference on Biodiversity Informatics), London, UK.

Sandusky, R.J. (2009, December 14-15). DataONE: Open persistent access to earth observational data. Panel presentation on The DataNet Partners Update: DataONE and the Data Conservancy. Coalition for Networked Information (CNI) Fall 2009 Membership Meeting, Washington, DC.

Sandusky, R.J., Cruse, P., Kunze, J., Allard, S., & Tenopir, C. (2009, July 13). The role of academic libraries in DataONE: Engaging in e-science through project partnership. Poster session presented at ACRL Science and Technology Section, ALA Annual Conference, Chicago, IL.

Tenopir, C. (2009, June 16). Interdisciplinary science and its impact on information professionals. Presentation at Special Libraries Association Annual Meeting, Washington, DC.

Tenopir, C. (2009, June 25). Books and journals and beyond. Presentation at Third Annual Bloomsbury Conference, London, UK.

Tenopir, C. (2009, May 20). DataONE. Presentation at ARL Annual Meeting, Houston, Texas.

Tenopir, C. (2009, October 5-8). Measuring the value and return on investment of academic libraries, including DataONE. Presentation at International Conference on Academic Libraries (ICAL), Delhi, India.

2010

Allard, S. (2010, December 9). Research in the socio-cultural aspects of data curation: Measuring and improving data practices. Presentations at Data Curation Research Summit, Chicago, IL.

Allard, S. (2010, January 14). Collaborative approaches to training the 21st century LIS workforce: Spotlight on projects recently funded by IMLS. Presentation at Association of Library and Information Science Educators (ALISE) Conference, Boston, MA.

Allard, S. (2010). Invited participant at Data Curation Workforce Summit, Chicago, IL.

Allard, S., & Aydinoglu, A. (2010, January 15). Collaborations between LIS and science: The DataONE case study. Presentation at the Association of Library and Information Science Educators (ALISE) 2010 Annual Conference, Boston, MA.

Aydinoglu, A.U. (2010). Emergence of a scientific collaboration: DataONE case study. Presentation at the Society for the Social Studies of Science (4S) Annual Meeting, University of Tokyo, Tokyo, Japan.

Branch, B.D., Tenopir, C., Allard, S., Douglas, K., Wu, L., & Frame, M. (2010, December 13-17). DataONE: Survey of earth scientists, to share or not to share data. Presentation at 2010 AGU Fall Meeting, San Francisco, CA.

Douglass, K. (2010, February 26). An organizational context for scientific data practices: Analysis of a subset of the preliminary results from the DataONE Baseline Assessment of Scientists. Poster session presented at UT College of Communication and Information Annual Symposium, Knoxville, TN.

Enriquez, V., Judson, S.W., Walker, NM, Cook, R., Piwowar, H., Sandusky, R., Vision, T., & Wilson, B. (2010, December 6). DataONE – University of Tennessee-Knoxvillle. Data citation in the wild. Poster session presented at International Digital Curation Conference, Chicago, IL.

Klassen, T.W., Blecic, D.D., De Groote, S., Hepburn, P., Lowery, R., Martin, K.E., Raszewski, R., Sandusky, R.J., & Shultz, M. (2010, June 26). E-research and data management at a large research university: Using survey results to develop a library plan. Poster session presented at ALA Annual Conference, Washington, DC.

Michener, W., Allard, S., Cobb, J., Cook, R., Cruse, P., Frame, M., Hampton, S., Hutchison, V., Jones, M., Kelling, S., Koskela, E., Tenopir, C., Vieglais, D., Vision, T., Wilson, B., Allen, P., Buneman, P., Butler, R., Deelman, E., DeRoure, D., Duke, C., Goble, C., Hobern, D., Honeyman, P., Horsburgh, J., Kunze, J., Ludaescher, B., Manoff, M., Pouchard, L., Sandusky, R., Scherle, R., Servilla, M., & Weltzin, J. (2010, March 15-17). DataONE: Enabling data-intensive biological and environmental research through cyberinfrastructure. Poster session presented at NASA Terrestrial Ecology Meeting, La Jolla, CA.

Sandusky, R.J. (2010, January 25). Open persistent access to scientific data. Presentation at Biomedical and Health Informatics Colloquium, University of Illinois at Chicago, Chicago, IL.

Tenopir, C. (2010, June 16-18). Building the future by understanding the past: Scholarly use patterns and e-pubs. Presentation at 14th International Conference on Electronic Publishing, Helsinki, Finland.

Tenopir, C. (2010, June 24-25). Baseline assessment of scientists' data sharing practices. Presentation at 4th Bloomsbury Conference on E-Publishing and E-Publications: Valued Resources: Roles and Responsibilities of Digital Curators and Publishers, London, UK.

Tenopir, C. (2010, May 23). E-science: Transcending disciplines and new roles for librarians. Presentation at Medical Library Association Annual Meeting, Washington, DC.

Weber, N., Piwowar, H., & Vision, T. (2010, October 22-27). Evaluating data citation and sharing policies in the earth sciences. Poster session presented at ASIS&T Meeting, Pittsburgh, PA.

2011

Allard, S. (2011, April 6). Collaborations between librarians and scientists: DataONE. Presentation at Annual eScience Symposium, Shrewsbury, MA.

Allard, S. (2011, February 15-17). Environmental empowerment: Citizens as contributors to science digital archives. Presentation at the International Conference on the Convergence of Libraries, Archives and Museums, New Delhi, India.

Allard, S. (2011, February, 14-16). Building a DL for the future: DataONE. Presentation at the International Conference on Digital Libraries and Knowledge Organization, Gurgaon, Haryana, India.

Allard, S. (2011, March 9-11). Perfecting STEM Partnerships: Environmental scientists, information scientists, librarians and educators, Oh My! Presentation at WebWise, Baltimore, MD.

Davis, M.L.E.S., Allard, S., Tenopir, C., Caldwell, C., & Redmond, J. (2011, November 2-6). Natural Resource Manager's (NRM) biodiversity information needs: Barriers and facilitators in the US southeast. Poster session presented at 2011 Society of American Foresters Convention, Honolulu, HI.

Douglass, K. (2011, February 25). Components of a cohesive research agenda: SciValue and other research tools. Presentation at 33rd Annual Research Symposium, College of Communication & Information, University of Tennessee, Knoxville, TN.

Frame, M. (2011, August 16). DataONE & USGS. Presentation at U.S Geological Council for Data Integration Annual Workshop, Denver, CO.

Garnett, A., Piwowar, H., Holmberg, K. Priem, J. Pikas, C.K., & Weber, N. (2011). Shaken and Stirred: ASIS&T 2011 attendee reactions to shaking it up: Embracing new methods for publishing, finding, discussing and measuring our research output. Poster session presented at American Society for Information Science and Technology Annual Meeting. New Orleans, LA.

Garnett, A. H., Holmberg, K., Pikas, C.K., Piwowar, H.A., Priem, J., & N. Weber. (2011, October 10). Shaking it up: Embracing new methods for publishing, finding, discussing and measuring our research output. Panel presentation at the American Society for Information Science and Technology, New Orleans, LA.

Jones, M., Vieglais, D., Wilson, B., & Sandusky, R.J. (2011, July 28). DataONE cyberinfrastructure. Presentation at Code4Lib Midwest 2011 Meeting, University of Illinois at Chicago, Chicago, IL.

Piwowar, H.A. (2011, October 22). Open research data: Fun, important, and in need of librarians. Presentation at ACCESS 2011 The Library Is Open, Vancouver, BC, Canada.

Piwowar, H.A. (2011, October 24-30). Open data carrots. Open access for climate scientists [Webinar]. Open Access Week 2011 Online Seminar.

Piwowar, H.A. (2011, October 24-30). Recycle, reuse, research: Using open data in scholarly research. Presentation at Open Access Week 2011, Simon Fraser University, Burnaby, BC, Canada.

Piwowar, H.A. (2011, October 24). Open data carrots. New directions in scholarly communication [Webinar]. SLA (Special Libraries Association) Open Access Week Online Seminar.

Piwowar, H.A. (2011, October). Preliminary report on tracking 1000 data sets from public repositories into the published literature. Workshop at the American Society for Information Science and Technology Annual Conference- Special Interest Group Information Needs Seeking and Use, New Orleans, LA.

Piwowar, H.A. (2011). Data citation challenges. Presentation at DataCite Summer Meeting, Berkeley, CA.

Piwowar, H.A., Carlson, J.D., & Vision, T.J. (2011). Beginning to track 1000 data sets from public repositories into the published literature. Poster session presented at American Society for Information Science and Technology Annual Meeting, New Orleans, LA.

Piwowar, H.A. (2011, December 6). A future where data citation counts. Presentation at 7th International Digital Curation Conference, Bristol, UK.

Piwowar, H.A. (2011, March 29). Seven data citation challenges illustrated with data, includes elephants. Presentation at JISC Managing Research Data Conference, Birmingham, UK.

Sayogo, D. S., & Pardo, T. (2011, September 26-28). Exploring the determinants of publication of scientific data as part of an open data initiative. Presentation at the 5th International Conference on Theory and Practice of Electronic Governance, Tallinn, Estonia.

Sinha, P., & Malone, J. (2011, October 10). Increasing biological information sources: An information needs, use & practice assessment of southeastern scientists. Panel presentation at American Society for Information Science and Technology, New Orleans, LA.

Tenopir, C. (2011, February). DataNet: Collaboration, curation and data in the iSchools. Presentation at iConference 2011, Seattle, WA.

Tenopir, C. (2011, October 10). Sharing data: Practices, barriers, incentives. Panel presentation at American Society for Information Science and Technology, New Orleans, LA.

Tenopir, C., & Allard, S. (2011, April 21). Scientists' data and information practices and needs: An assessment & analysis [Webinar]. USGS Management.

Tenopir, C., Allard, S., & Davis, M.L.E.S. (2011, September 28). Understanding the data management needs and data sharing challenges of environmental scientists. Presentation at Environmental Information Management Conference (EIM 2011), Santa Barbara, CA.

2012

Allard, S. (2012, April 19). Data sharing in biomedical research compared to other fields. Invited speaker at Translational Science 2012: Improving Health Through Research and Training, Washington, DC.

Allard, S. (2012, March 22). DataONE. Presentation at Research Data Access and Preservation Conference, New Orleans, LA.

Allard, S. (2012, March 22). The data life cycle & information professionals. Poster session presented at Research Data Access and Preservation Conference, New Orleans, LA.

Allard, S., & Aydinoglu, A.U. (2012). Environmental researchers' data practices: An exploratory study in turkey. Presentation at IMCW 2012: 3rd International Symposium on Information Management in a Changing World, Ankara, Turkey.

Allard, S., Birch, B., & Tenopir, C. (2012, March 22). Data management from the perspective of data managers. Poster session presented at Research Data Access and Preservation Conference, New Orleans, LA.

Aydinoglu, A., & Allard, S. (2012, February 19). Understanding virtual scientific organizations using the Transdisciplinary Index. Poster session presented at the American Association for the Advancement of Science (AAAS) Annual Meeting, Vancouver, Canada.

Aydinoglu, A. (2011, April 22). The emergence of multidisciplinary and multi-institutional scientific collaborations: DataONE case study. Presentation at the College of Communication & Information Doctoral Colloquium, University of Tennessee. Knoxville, TN.

Davis, M.L.E.S., & Tenopir, C. (2012, February 29). Biodiversity information for natural resource management: Information needs and practices in southern Appalachia. Poster session presented at the 34th Annual Research Symposium, College of Communication & Information, University of Tennessee, Knoxville, TN.

Frame, M. (2012, April 17-18). DataONE and USGS. Presentation at USGS DataONE Workshop. Denver, CO.

Frame, M., & Michener, W. (2012, November 30). DataONE: Big data implications. Virtual presentation for the Office of Science and Technology Policy (OSTP).

Piwowar H. A. (2012, February 19). Accelerating scientific progress through public availability of research data. Presentation at the American Association for the Advancement of Science (AAAS) Annual Meeting, Vancouver, BC, Canada.

Piwowar H. A. (2012, March 13). Big shoulders in scholarly communication: data archiving+altmetrics. Presentation at HighWire Press Spring Publisher's meeting, Stanford University. Palo Alto, CA.

Read, E. (2012, June 5). DataONE: A glimpse into the practices of data managers. Presentation at the 2012 Conference of the International Association for Social Science Information Services and Technology (IASSIST), National Opinion Research Center (NORC). Washington, DC.

Sandusky, R.J., & Greenberg, J. (2012, June 24). Long-term stewardship of scientific data: Your library can participate in DataONE. Presentation at the LITA (Library and Information Technology Association) session at the ALA (American Library Association) Annual Meeting, Anaheim, CA.

Sayogo, D. S., & T. Pardo, T. (2012, January). Exploring the motive for data publication in open data initiative: Linking intention to action. Presentation at the 45th Hawaii International Conference on System Sciences, IEEE Computer Society, Maui, HI.

Tenopir, C. (2012, April 13). Just because you can't see them, doesn't mean they aren't there: Tracing scholars and their use of resources. Presentation at the 14th Fiesole Collection Development Retreat. European University Institute (EUI), Florence, Italy.

Tenopir, C., Sandusky, R. J., Allard, S., & Birch, B. (2012, August 13). Institutional motivations for research data services in North American Academic Libraries. Poster session presented at the 78th International Federation of Library Associations and Institutions (IFLA) General Conference and Assembly, Helsinki, Finland.

Tenopir, C., Sandusky, R. J., Allard, S., & Birch, B. (2012, August 14). Academic librarians and research data services: Preparation and attitudes. Presentation at the International Federation of Library Associations and Institutions (IFLA) World Library and Information Congress 2012, Helsinki, Finland.

Tenopir, C., Sandusky, R.J., Allard, S., & Birch, B. (2012, Aug 11-17). North American academic libraries and research data services: Institutional motivations. Poster session presented at the 78th IFLA General Conference and Assembly. Helsinki, Finland.

West, M.B.R., & Davis, M.L.E.S. (2012, February 29). Challenges to data sharing among environmental scientists and data managers in the Southeastern United States. Poster session presented at the 34th Annual Research Symposium, College of Communication & Information. University of Tennessee: Knoxville, TN.

2013

Allard, S. (2013, February 26). Strategies for finding earth observation research data. Presentation at Finding the Needle in the Haystack. Symposium on Strategies for Discovering Research Data Online, Board on Research Data and Information, Washington, DC.

Allard, S. (2013, March 17). Invited participant in DigCCurr PhD Symposium: Curate Thyself: Defining and Cultivating an Academic Trajectory in Digital Curation. School of Information and Library Science, University of North Carolina. Chapel Hill, NC.

Davis, M., Tenopir, C., & Allard, S. (2013, June 22-24). Challenges to data sharing among environmental scientists and data managers' in the Southeastern United States. Poster session presented at International Association of Agriculture Information Specialists World Congress 2013, Cornell University, NY.

Mullins, J., Salo, D., Sandusky, R.J., & Starr, J. (2013, June 29). Data, E-data, data curation: Our new frontier. Invited panel presentation at the LITA (Library and Information Technology Association) session at American Library Association Annual Meeting, Chicago, IL.

Sandusky, R.J. (2013, April 3). Tools you can use to manage research data. Presentation at the UIC 2013 IT Professionals Forum "Support Success," Chicago, IL.

Suomela, T. (2013, October 12). Understanding amateur data: Interactions in astronomy and environmental science. Presentation at the 2013 Annual Meeting of the Society for Social Studies of Science (4S), San Diego, CA.

Suomela, T., & Allard, S. (2013, January). Libraries as centers for science literacy and public science. Presentation at BOBCATSSS 2013, Hacettepe University, Ankara, Turkey.

Tenopir, C. (2013, March). Shaping the future of scholarly communication. Invited Keynote at Beyond the PDF 2, Amsterdam, Netherlands.

Tenopir, C. (2013, November). Research data services: A new focus for librarians. Keynote at the CONsortium on Core Electronic Resources in Taiwan (CONCERT), Taipei, Taiwan.

Tenopir, C. (2013, October 3). The role of universities and libraries in enabling research data management. Panel presentation at eResearch and Data Management Symposium, Brigham Young University, Provo, UT.

Tenopir, C. (2013, April). Research data services: New roles for academic libraries? Invited presentation at Charles Sturt University, Sydney, Australia.

2014

Allard, S. (2014, November 28). The ABC2s of science data: Access, big data, curation & communication. Keynote delivered virtually for the First International Forensic Biology and Genetics Congress, Ankara, Turkey.

Beaudoin, J.E., Charbonneau, D.H., Allard, A., Tenopir, C., Chen, H.L., Zhang, Y., Qin, J., & Zilinski, L. (2014, November 3). Transforming the data landscape: Connecting data, policies and communities. Panel presentation at the 77th Annual Meeting of the Association for Information Science and Technology (ASIS&T), Seattle, WA.

Budden A.E., Volentine, R., & Hughes, D. (2014). Usability analysis within The DataONE network of collaborators. Poster session presented at American Geophysical Union Fall Meeting 2014, San Francisco, CA.

Frame, M., Budden, A., & Volentine, R. (2014, December). DataONE and usability. Poster session presented at the American Geophysical Union (AGU) 2014 meeting, San Francisco, CA.

Palmer, C.L., Thompson, C.A., Tenopir, C., Allard, A., Mayernik, M.S., & Kreft, J. (2014, November 3). Responding to emerging data workforce demand: Harnessing data center expertise. Panel presentation at the 77th Annual Meeting of the Association for Information Science and Technology (ASIS&T), Seattle, WA.

Sandusky, R., Koskela, R., Budden, A., & Vieglais, D. (2014, Nov 7). Advancing data discovery: Academic libraries and DataONE. Presentation at the 2014 LITA (Library and Information Technology Association) Forum, Albuquerque, NM.

Tenopir, C. (2014, June). Text + Images + Data: A more complete way to convey results of scientific research. Presentation at Strand Symposium, London, UK.

Tenopir, C. (2014, May). Assessing data practices for DataONE. Seminar presentation for Hanken School of Economics, Helsinki, Finland.

Tenopir, C. (2014, November 27-28). The importance of data, information, and knowledge in scholarly communication. Invited presentation for the 75th Anniversary Conference for the Library and Information Studies Center at the University of Cape Town, Cape Town, South Africa.

Volentine, R. (2014, May). Usability testing to improve research data services. Presentation at the Qualitative and Quantitative Methods in Libraries (QQML), Istanbul, Turkey.

2015

Allard, S. (2015 November 18). Big data management: The DataONE approach. Presentation at Challenges in Contemporary Context to Promote the Data-Driven Science Workshop, Escola Politécnica da Universidade de São Paulo, São Paulo, Brazil.

Allard, S. (2015, January 27-30). Cyberinfrastructure teams and developing the virtual team workforce. Juried panel presentation at the Association of Library and Information Science Educators (ALISE) Conference, Chicago, IL.

Allard, S. (2015, March 8-11). Synergies in scientific communication & information. Invited speaker at CENDI: Federal STI Managers Group Meeting. National Library of Medicine, Washington, DC.

Allard, S. (2015, November 16). DataONE overview. Presentation at Workshop on Contemporary Challenges in the Context to Promote the New Science Based on Data Research, Ministério daCiência, Tecnologia e Inovação, Brasilia, Brazil.

Allard, S., Tenopir, C., Douglass, K., Rentsch, J., & Levine, K. (2015, November 15). Data Specialists enabling Team Science. IMLS Focus, Project Showcase, New Orleans, LA.

Dalton, B., Pjseviac, I., Hughes, D., Pollock, D., & Dorsett, K. (2015, February 25). Data sharing and reuse: What's new? Revisiting the practices and perceptions of scientific researchers. Poster session presented at the 37th Annual Research Symposium, College of Communication & Information, University of Tennessee: Knoxville, TN.

Frame, M. (2015, March 5). Government open data: So what's next? Presentation for Big Data Analytics meeting, Oak Ridge Associated Universities (ORAU), Oak Ridge, TN.

Frame, M. (2015, September 16). USGS assessment results related to preservation science data life cycle. Briefing to USGS Managers and Earth Resources Observation and Science Center (EROS), Garretson, SD.

Freeman, M. (2015, March 24). Usability, assessment, and metrics. Poster session presented at 2015 Open Science Grid All-hands meeting, Northwestern University, Evanston, IL.

Moyers, L., Wilson, B., & Allard, S. (2015, February 25). The University of Tennessee and Phase 2 of DataONE: Continuing a successful relationship. Poster session presented at the 37th Annual Research Symposium, College of Communication & Information, University of Tennessee, Knoxville, TN.

Pjesivac, I., Dalton, B., & Tenopir, C. (2015, May 22). The effects of attitudes toward access to data, perceived risk, and funding sources on data sharing practices. Presentation at the 65th Annual Conference of the International Communication Association, San Juan, Puerto Rico.

Tenopir, C. (2015, February 3). What researchers want from publishers and how data fits in. Presentation at AGU 2015 Editors in Chief Meeting, Bernalillo, NM.

Tenopir, C. (2015, September 29). Research data services: Multiple roles for academic libraries. Invited talk at Tampere University Library, Tampere, Finland.

Tenopir, C. (2015, September 24). Scholarly reading and scholarly sharing: Some indicators of change. Invited speaker at Tampere Research Center for Information and Media (TRIM), Tampere, Finland.

Tenopir, C., Allard, S., & Frame, M. (2015, November 18). Data sharing and re-use: Barriers and incentives. Symposium session at the 2015 International Annual Meeting of the American Society of Agronomy: Benefits and Barriers to Data Sharing, The Crop Science Society of America and the Soil Science Society of America, Minneapolis, MN.

Volentine, R., Frame, M., & Tenopir, C. (2015, February 25). Usability analysis within the DataONE network of collaborators. 37th Annual Research Symposium, College of Communication & Information, University of Tennessee, Knoxville, TN.

Wilson, B. (2015, June 1). An introduction to DataONE. Presentation at EU BON General Meeting plenary session, 1, Cambridge, UK.

Wilson, B. (2015, June 1). DataONE: Enabling new science by supporting the management of data throughout its life cycle. Poster session presented at the 2015 EU BON General Meeting. European Biodiversity Observation Network, Cambridge, UK.

Wilson, B. (2015, June 2). Metadata formats and data interoperability for DataONE. Presentation at the EU BON General Meeting. European Biodiversity Observation Network, Cambridge, UK.

2016

Allard, S. (2016, March 7). The Data Horizon. Invited talk at SPARC MORE, San Antonio, TX.

Allard, S., Nelson, J., Pollock, D, Dorsett, K., Forrester, A., Partee, R., & Waldrupe, T. (2016, May 16-19). Creating the next generation Team Science workforce: Lessons from Tennessee. Panel presentation at SciTS (Science of Team Science) 2016 Conference, Phoenix, AZ.

Frame, M. (2016, December 11-15). Innovative, yet familiar tools to access USGS earth science data. Presentation at the American Geophysical Union (AGU) Fall 2016 Meeting, Session IN021: Innovative Tools and Services to Enable Data Use across Broad User Communities, San Francisco, CA.

Frame, M. (2016). USGS science data catalog – Data visualization, discovery and use [Webinar]. American Society for Photogrammetry and Remote Sensing (ASPRS).

Tenopir, C. (2016, December 1). Research data services in European libraries: Current offerings and plans for the future [Webinar]. LIBER (League of European Research Libraries).

Tenopir, C. (2016, November 9). E-Scholarship and new roles for research libraries. Presentation at the 2016 meeting of the CONsortium on Core Electronic Resources in Taiwan (CONCERT): Transformation of Information Services in the Age of Evolving Scholarly Communication, Taipei, Taiwan.

Tenopir, C., & Horstmann, W. (2016, June 29). Research data services in European libraries: Current offerings and plans for the future. Presentation at LIBER Annual Meeting, Workshop on "Skills for Supporting Research Data Management," Helsinki Finland.

Tenopir, C., Pollock, D., Allard, S., & Hughes, D. (2016, October 14-16). Research data services in European and North American libraries: Current offerings and plans for the future. Poster session presented at the 79th ASIS&T Annual Meeting: Creating Knowledge, Enhancing Lives through Information & Technology, Copenhagen, Denmark.

Yan, A. (2016). New & emerging communities: Fulfilling the potential of open access earth science data. Presentation at DataONE All Hands Meeting, Knoxville, TN.

2017

Allard, S. (2017, August 14-15). Cyberinfrastructure workforce. Presentation at National Science Foundation Research Coordination Network Workshop, Alexandria, VA.

Allard, S. (2017, March 2). DataONE: The Data Life Cycle. Invited speaker at CENDI: Federal STI Managers Group. Government Publishing Office, Washington, DC.

Allard, S. (2017, October 27-November 1). Sustainability under construction: DataONE. Panel presentation at ASIS&T 80th Annual Meeting, Washington, DC.

Allard, S. (2017, October 17). Data & scientists. Invited speaker at Escola de Artes, Ciências e Humanidades, Universidade de São Paulo, São Paulo, Brazil.

Allard, S. (2017, October 23). DataONE. Invited speaker at III Workshop Em Ciência Dos Dados. Escola Politécnica da Universidade de São Paulo, São Paulo, Brazil.

Allard, S. (2017, October 20). Data management & the biological sciences. Invited speaker at Instituto de Biologia, Universidade Estadual de Campinas.Campinas, Brazil.

Allard, S. (2017, October 24). E-Science: Perceptions, changes and practices in data sharing and data reuse. Invited speaker at XVIII Encontro Nacional De Pesquisa Em Ciência Informação (XVIII Enancib), Marilia, Brazil.

Frame, M., Zolly, L., Tenopir, C., & Allard, S. (2017, May 23-16). Assessing stakeholders to inform open science policies: The case of the US Geological Survey. Poster session presented at the 9th Qualitative and Quantitative Methods in Libraries International Conference, Limerick, Ireland.

Sandusky, R.J. (2017, October 27-November 1). How recordkeeping ensures trust in digital archives. Poster session presented at ASIST Annual Meeting, Crystal City, VA.

Specht, A. (2017, October 25-27). Engaging the domain expert: is it just a dream? Keynote presentation to the16th International Semantic Web Conference (ISWC 2017), Vienna, Austria.

Tenopir, C. (2017, April 24). Research data services in European universities. Presentation at Helsinki University Library, American Resource Center (American Embassy), and Fulbright-Finland, Helsinki, Finland.

Tenopir, C. (2017, February 8). Open science: What, why, and how? Invited speaker at University of Eastern Finland, Kuopio, Finland.

Tenopir, C. (2017, January 17). Research data services in European libraries: Current offerings and plans for the future [Webinar]. LIBER (League of European Research Libraries).

Tenopir, C. (2017, January 25). Researchers need information too: How information improves the quality of worklife. Keynote presented at BOBCATSSS 2017, Tampere, Finland.

Tenopir, C. (2017, March 31). Research data services in European libraries: Current offerings and plans for the future. Universidade do Minho, Portugal, Guimaraes, Portugal.

Tenopir, C. (2017, March). Research data services in European libraries: Current offerings and plans for the future. Presentation at the 2nd RDM Forum for the Portuguese Secretary of State for Science and Higher Education, Lisbon, Portugal.

Tenopir, C. (2017, October). Data sharing and re-use: Barriers and incentives. Invited presentation by the Department of Archivistics, Library and Information Science, Oslo and Akershus University College of Applied Sciences, Oslo, Norway.

Tenopir, C. (2017, October). Research data services and the role of libraries. Presentation at Norwegian Special Libraries Association, Trondheim, Norway.

Tenopir, C. (2017, March 2). Research data services in European libraries: Current offerings and plans for the future. Presentation at Universidad Carlos III de Madrid, Madrid, Spain.

Tenopir, C. (2017, May 12). Research data services: What researchers need and what libraries are doing. Invited lecture at Linnaeus University, Växjö, Sweden

Tenopir, C. (2017, January 17). Research data services in European libraries: Current offerings and plans for the future [Webinar]. LIBER (League of European Research Libraries).

2018

Allard, S. (2018, December 11). Data FAIR: Credit for data work. Invited speaker at American Geophysical Union Fall Meeting, Washington, DC.

Allard, S. (2018, December). Cultural considerations and FAIR. Invited speaker at American Geophysical Union Fall Meeting, Washington, DC.

Allard, S., & D. Pollack, D. (2018, February 6-9). Team Science: Development of an immersive curriculum for information professionals to play an expanding role in scientific collaboration. Presentation at ALISE'18, Denver, CO.

Allard, S., & Borycz, J. (2018, December 11). Assisting geophysicists in data management: Perceptions and opportunities. Presentation at AGU Fall Meeting, Washington, DC.

Allard, S. (2018, March 8). Scientific data management: An international perspective. Virtual presentation at Sistema Integrado de Bibliotecas USP Library Conference: Managing Research Data and Good Practices for the Development of Science, São Paulo, Brazil.

Benedict, K., Sandusky, R.J., Budden, A.E., & Jones, M.B. (2018, December 10-14). Engaging the DataONE community in sustainability planning and execution to enable future evolution and use of the DataONE cyberinfrastructure. Presentation at American Geophysical Union Fall Meeting, Washington, DC.

Borycz, J., Allard, S., Christian, L., Frame, M., & Tenopir, C. (2018, December 10-14). Assisting geophysicists in data management: Perceptions and opportunities. American Geophysical Union Fall Meeting. Washington, DC.

De Groote, S., Griffin, T., & Sandusky, R.J. (2018, May 30). data management workshop. Workshop presented at the IT Community Conference, University of Illinois at Chicago, Chicago, IL.

Forrester, A., Sandusky, R.J., Schuler, A., & Staines, H. (2018, November 5-9). Data is approaching: The changing culture of data citation, elaboration, and transparency lies ahead. Panel presentation at The Charleston Conference, Charleston, SC.

Jones, M., Sandusky, R.J., & Vieglais, D. (2018, July 17). Interoperability within the DataONE federation: Participating in the network. Workshop presented at Earth Science Information Partners (ESIP) 2018 Summer Meeting, Tucson, AZ.

Sandusky, R.J., Michener, W., Benedict K., & Maron, N. (2018, December 10-11). DataONE: From DataNet project to engaged global community in the contemporary data landscape. Presentation at Coalition for Networked Information (CNI) Fall 2018 Membership Meeting, Washington, DC.

Tenopir, C. (2018, September 7). Data sharing and re-use: Barriers and incentives. Presentation at Indiana University, Bloomington, IN.

Volentine, R. (2018, February 7). University of Tennessee's User-eXperience Lab. Virtual Presentation to the ESIP Usability Cluster Monthly Meeting.

2019

Cannon, L. (2019). Preparing, not repairing: A case study and best practices in proactive link management. Presentation at Tennessee Library Association 2019 Annual Conference, Chattanooga, TN.

Cannon, L., Dosch, B., & Gunderman, H. (2019). Preparing, not repairing: A case study and best practices in proactive link management. Poster session presented at the 41st Annual CCI Research Symposium, Knoxville, TN.

Cannon, L., Dosch, B., & Gunderman, H. (2019). Preparing, not repairing: A case study and best practices in proactive link management. Poster session presented at 5th Annual Women in STEM Research Symposium, Knoxville, TN.

Cannon, L., Dosch, B., & Gunderman, H. (2019, February 11). Preparing, not repairing: A case study and best practices in proactive link management. Poster session presented at CCI Research Symposium, Knoxville, TN.

Cannon, L., Dosch, B., & Gunderman, H. (2019, May 28-31). Preparing, not repairing: A case study and best practices in proactive link management. Presentation at 11th Qualitative and Quantitative Methods in Libraries, Florence, Italy.

Gunderman, H. (2019, May 10). Research Data Management. Workshop presented to the University of Tennessee, Knoxville Department of Geography, Knoxville, TN.

Sandusky, R.J., Budden, A.E., & Benedict, K. (2019, April 10). DataONE: Data partner for science communities [Webinar]. A Science Gateways Community Institute.

Specht, A. (2019, January 7). A story of data won, data lost and data re-found: The realities of ecological data preservation [webinar]. DataONE Webinar Series.

Tenopir, C. (2019). Libraries in an age of data science: Research data management services [Webinar]. Lawrence Livermore National Lab.