

CDI SSF Category 4: Community Innovation

myScience: USGS Citizen Science Project Discovery & Public Engagement Web Application

Applicants/Principal Investigator(s):

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Abstract

How may the public discover opportunities for participation in USGS scientific research? What citizen science projects are currently active within the USGS? How may PIs increase public engagement in and awareness of their citizen science projects? To address these questions, a web application leveraging existing Community for Data Integration (CDI) and USGS work will be created to allow unprecedented public access to USGS citizen science project metadata and highlights of key science outcomes. Such an application will enable, for the first time, high-visibility, unified open access to information about projects and practices related to citizen participation in USGS research. The need for such information was identified in AESIR-supported research on citizen science cyber-infrastructure (Holl, 2012). This research also identified the need for innovative tools and resources to increase public engagement in and awareness of existing USGS citizen science projects and to connect and inform bureau scientists about public participation in scientific research. The proposed product, *myScience: USGS Citizen Science Project Discovery & Public Engagement Web Application*, will directly address these needs and benefit both USGS scientists across all disciplines and geographic regions as well as the public to whom they serve.

Total funding amount requested -\$32,425

Total in-kind funding - \$23,463 - (72% in-kind match)

Datasets used/impacted/exposed

USGS Citizen Science Project Inventory; 2012; USGS-led projects; 16 records to date representing projects containing thousands of citizen observations with local to international participation.

Context – Geographic/Geologic/Ecosystem/Habitat/Taxonomic/Other

US national, inter-disciplinary

Type of Product(s) Generated

Web-based *myScience* project discovery application, Database of Citizen Science Project Metadata, Web-based database management interface, Documentation, Fact Sheet, Presentations

Summary

Introduction and background

Citizen Science: Science 2.0

Citizen science projects are "research collaborations that enable non-scientist members of the public to assist with scientific investigations" (Prestopnik & Crowston, 2012). Citizen science "enlists the public in collecting large quantities of data across an array of habitats and locations over long spans of time" (Bonney et al., 2009). Volunteers can collect data over a larger area and longer time period than is possible in traditional research. The larger resulting datasets allow for identification of anomalies, spatial or temporal comparisons, trends analysis, and understanding differences among subgroups (Cohn, 2008). Because of its high-impact potential in scientific research, citizen science has been described as "Science 2.0" (Cohn, 2008). More than 200 such projects are being conducted by researchers in North America, with some speculation that the number of projects may be in the thousands (Cohn, 2008).

Modern Momentum: Citizen Science at USGS

Volunteer data collection has an established role in the science of the USGS. Bureau records contain volunteer information dating back to the late 1800s when, for example, citizen volunteers monitored streamflow. The public continues to participate in programs such as "Did You Feel It?" for earthquake science and response, the USA National Phenology Network "Nature's Notebook" for monitoring climate change impacts on the Nation's plants and animals, and the USGS's North American Breeding Bird Survey for monitoring status and trends for more than 420 bird species.

To better characterize and quantify the nature, extent, requirements, and outcomes of recent USGS citizen science projects, the CDI Citizen Science Working Group (CSWG) initiated an informal USGS Citizen Science Project Inventory in early 2012. Principal investigators and others submitted project metadata to the inventory, resulting in a growing database of USGS projects that have a public participation component (CDI Citizen Science Working Group, 2012a). Leaders representing some of these USGS citizen science projects and others convened in an energetic exchange of ideas and vision in a September 2012 USGS Citizen Science Workshop (CDI Citizen Science Working Group, 2012b; Wiggins, 2012).

Concurrent with the CSWG inventory and workshop activities in 2012, the USGS Applied Earth Systems Informatics Research (AESIR) group initiated research in citizen science cyber-infrastructure requirements to address the increasingly important role of computer and information sciences in citizen science as well as the larger USGS mission. Also in 2012, the USGS Office of Communications produced a handout featuring selected USGS citizen science projects (U.S. Geological Survey, 2012). This handout was available at the 2012 Ecological Society of America Annual Meeting along with a joint AESIR-CSWG poster about the current landscape of public participation in USGS science (Holl & Hines, 2012).

Challenge Statement

The existing outcomes, products, and momentum achieved in FY12 will be leveraged to advance USGS science in FY13 by answering the following questions: How may the public discover opportunities for participation in USGS scientific research? What citizen science projects are currently active within the USGS? How may PIs increase public engagement in and awareness of their citizen science projects? To address these questions, a web application leveraging existing Community for Data Integration (CDI) and USGS work will be created to allow unprecedented public access to USGS citizen science project

metadata and highlights of science outcomes. Such an application will enable, for the first time, high-visibility, unified open access to information about projects and practices related to citizen participation in USGS research. The need for such information was identified in AESIR-supported research on citizen science cyber-infrastructure (Holl, 2012). This research also identified the need for innovative tools and resources to increase public engagement in and awareness of existing USGS citizen science projects and to connect and inform bureau scientists about public participation in scientific research. The proposed product, *myScience: USGS Citizen Science Project Discovery & Public Engagement Web Application*, will directly address these needs and benefit both USGS scientists across all disciplines and geographic regions as well as the public to whom they serve.

CDI SSF Category

4. Community Innovation

Project title

myScience: USGS Citizen Science Project Discovery & Public Engagement Web Application

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Context – geographic/geologic/ecosystem/habitat/taxonomic/other

This web application will offer an integrated view of the various citizen science efforts spanning the USGS disciplines at the National scale. This metadata is valuable to other outreach and citizen-engagement coordinators at the USGS and DOI who regularly communicate and are asked about public-engagement activities. It will also be useful as a communication and awareness tool for USGS scientists and potential partners who can benefit by leveraging existing efforts discovered on this site. Future work can build on this solid foundation of interoperable data and well-documented inventory workflows to expose the information as a parsable stream of information (a web service) for external inventories and applications to consume and populate their own registries and interfaces.

Scope

Project description

In 2012 there was a collaborative investment led by the CDI Citizen Science Working Group to build a database of USGS citizen science project metadata (CDI Citizen Science Working Group, 2012a). Investment was concurrently made in research and publications by AESIR and the Office of Communications, respectively. It is proposed that the FY12 work be leveraged and integrated to create a citizen science project discovery application called *myScience*. The application will be built on a robust, interoperable database of project metadata which is updated by project information providers through an improved web interface. The public will view and search the project information through the *myScience* project discovery web interface. Viewable project information in the Citizen Science Project Inventory currently includes the project name and lead USGS personnel, USGS program name, data and protocols, project partners and affiliations, references, and geographic coverage. The database will be strengthened and expanded to include highlights of specific science outcomes and achievements of the projects and additional fields as needed to improve interoperability with project inventories of USGS partners.

This application will add value and dynamic content to existing federal/USGS education and/or recreation websites. The vision is to enable open access to citizen science project metadata in a format that will help engage public participants in these projects, raise awareness about them, and stimulate discussion and partnerships within both the scientific community and the general public.

Providing unified information access through an engaging web app linked to the USGS Education website is envisioned as a collaborative effort among the CDI Citizen Science Working Group, AESIR, the USGS Office of Communications, the USGS Office of Education, USGS Texas Water Science Center, USGS Fort Collins Science Center, and University of Wisconsin-Madison. Improving data access and collaboration across disciplines by leveraging partnerships and existing assets is closely aligned with the Community for Data Integration mission.

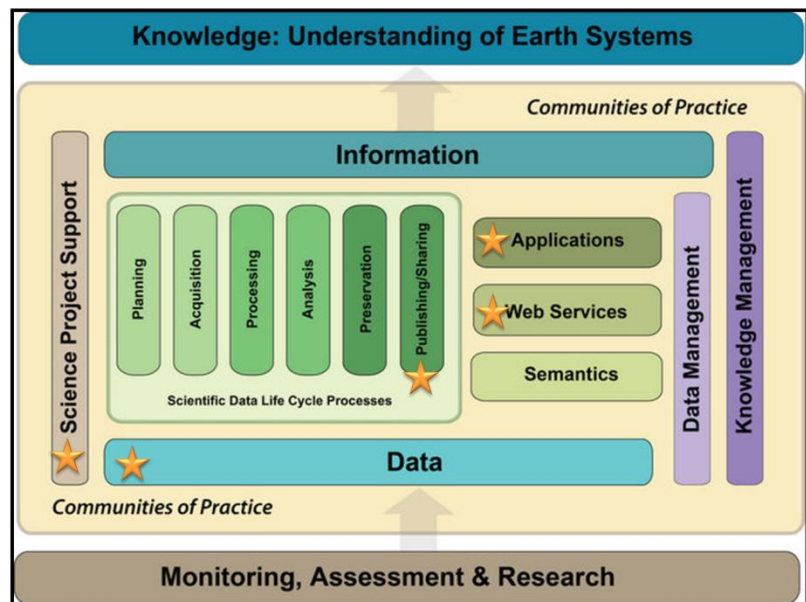


Figure 1. CDI Science Support Framework (SSF). Stars indicate SSF elements addressed by the proposed work.

The proposed application addresses several elements of the CDI Science Support Framework (SSF; Figure 1). Public engagement tools are key components of citizen science efforts and one need identified for USGS projects (Holl, 2012). As a high-visibility web product with the potential to increase public engagement through linkage with the USGS Education website, the citizen science discovery app will provide overall science project support for USGS citizen science projects. The application web interface will highlight key science outcomes of projects and link to project websites and datasets, and in this way,

address the data sharing component of the scientific data life cycle within the SSF Data element. The feasibility of sharing the Citizen Science Project Inventory data via web services will be evaluated, addressing the SSF web services element also.

Project goals

The goal of this project is to create a unified, publicly-accessible web hub for USGS citizen science project metadata, including project result highlights when available. The questions addressed by a project discovery web application are:

- (1) How may the public discover opportunities for participation in USGS scientific research?
- (2) What citizen science projects are currently active within the USGS?
- (3) How may PIs increase public engagement in and awareness of their citizen science projects and outcomes?
- (4) How may scientists have access to information about projects and results within the USGS citizen science community of practice for the purpose of improving communication, creating and strengthening partnerships, improving workflows and resulting science outcomes, and increasing results-sharing?

Project milestones

Milestones within this project are:

- (1) Opening access to USGS Citizen Science Project Inventory data to the public, USGS, and broader scientific community via a web search interface.
- (2) Improving and documenting the project data entry and update workflow and interface for principal investigators.
- (3) Education, outreach, partnership building, and improved communication and collaboration among the scientific community and the public regarding USGS citizen science projects, protocols, and outcomes.

Outcomes and benefits

The benefits of this product to USGS science include increasing public engagement in existing citizen science projects; connecting scientists leading projects with each other; and raising awareness among bureau scientists about the nature, methods, and results of public participation in USGS scientific research. Linking the project discovery app to the long-standing education.usgs.gov domain has the advantage of leveraging that site's pre-existing and well-established public audience base, resulting in maximum visibility and integration with existing USGS Education resources. The resulting benefit to USGS Education website would be enhanced relevance, currency and visibility.

The benefits to USGS projects include raising awareness about projects that will increase public engagement and lead to better research results. Projects may also generate partnerships and begin dialogues as a result of making project metadata, including contact persons, openly available. For example, a DataONE participant and expert on citizen science cyberinfrastructure suggested that it would be useful if USGS provided access to information about project leads and practices related to citizen participation in research. Transparent access to this information will improve communication, create or strengthen partnerships, improve workflows and results, and increase results-sharing.

The benefits to the public include better access to information about experiential science education opportunities. Experiential learning such as that provided by participation in a citizen science project is one proven and highly effective way to teach science process skills (Brotherton & Preece, 1996) and have

higher sensory involvement than lectures and demonstrations. A web search portal will empower students, guardians, and teachers to discover and engage in USGS science opportunities.

Technical Approach

Task 1: Improve database schema and access

- The Citizen Science Project Inventory database will be strengthened and expanded to include highlights of specific science outcomes and achievements of the projects and additional fields as needed to improve interoperability with project inventories of USGS partners.
- An API is not currently available to access the records. An API will be created with in-kind contributions or the database will be migrated to enable access via an API or SQL-based requests.

Task 2: Streamline database update interface

- The interface for updating project information will be improved based on end-user feedback. For example, PIs currently click a button ambiguously-labeled “Event Registration” to modify or enter citizen science project information. If the database is migrated, an interface for data entry and updating will be created using existing infrastructure and software.
- To keep the project metadata current, a documented workflow for scientists to update and add to their project metadata in the database will be created and made readily available on the CSWG Confluence space. Features like user-established automated reminders for updating records on a periodic basis may be included.

Task 3: Design and test the project discovery application interface

- User requirements will be gathered to determine key user interface functionality and design requirements, with an emphasis on simplicity and usability for the general public and ADA compliance.
- A web user interface will be designed and tested based on user requirements. Website functionality will include project search based on the existing data in the current USGS Citizen Science Project Inventory.
- The feasibility of adding a geospatial or map component to the database and project search app will be assessed and based on availability of higher-resolution geospatial data from individual projects.

Task 4: Evaluate methods for data sharing with other project inventories

- To make USGS Citizen Science Project Inventory metadata accessible to other project inventories and applications hosted by USGS partners, the feasibility of creating and documenting web services will be evaluated. Citizen science project discovery hubs like citizenscience.org may then consume metadata from the service to populate project inventories. This would prevent the need for project members to re-enter project metadata in multiple repositories.

Task 5: Outreach and education

- Outreach to the public about the *myScience* application will be achieved by linking the reviewed and approved end product with the USGS Education and other websites; through a post written for the USGS Blogs website; through an existing poster and handout made available at the National Science Teachers Association Annual Meeting; through direct outreach at schools; and through a presentation at the 2013 Ecological Society of America Public Participation in Scientific Research Workshop.

- Education for USGS scientists (project information providers) about how to enter and update project metadata will be made through the USGS Blogs, documentation on the CSWG and *myScience* Confluence pages, and presentations at the CDI Expose and CDI Workshop.

Project Experience

Sally Holl is a Geographer at the Central Texas Program Office of the U.S. Geological Survey Texas Water Science Center in Austin, Texas. She earned her B.A. from Oberlin College in Geology and Secondary Science Teaching Credential from Cal State Fullerton. She performed her graduate work at University of California, Irvine and University of Texas at Austin where she earned an M.S. in Hydrogeology. Following her graduate work, Sally was a professional science educator, developing and teaching earth, physical and life science curriculum to students in grades 6 to 12. Ms. Holl currently leads production of data-driven web and desktop applications and geospatial products for environmental data integration, visualization and analysis. She has produced database and communications products to quantify and summarize USGS scientific achievements for the public and overseen DOI Climate Science Center website design and content. An active member of CDI since 2010, she recently conducted research on citizen science cyber-infrastructure, has been active in four CDI working groups (Citizen Science, Data Management, Data Policy and Tech Stack), and participated in the 2012 Citizen Science Workshop.

Megan Hines is the Technical Manager for the Wildlife Data Integration Network research project at the University of Wisconsin at Madison. She has experience in developing web-based applications and desktop and web-based geospatial tools. Her interests are in web-based mapping and mashup application APIs, geospatial visualization tools, development of data driven websites and information feeds (RSS, GeoRSS, KML). She created several on-line mapping applications including the Global Wildlife Disease News Map, a geospatial representation of the Wildlife Disease News Digest contents. She was instrumental in the development of two online reporting systems, SEANET - the Seabird Ecological Assessment Network and WHER – the Wildlife Health Event Reporter. Megan chairs the U.S. Geological Survey Citizen Science Working Group at the Community for Data Integration, a team of cross-disciplinary researchers working towards greater understanding of citizen science and public participation in science and research at the USGS.

Deanna Terry is a Web Coordinator at the Central Texas Program Office of the USGS Texas Water Science Center in Austin since 2000. Deanna oversees and manages the Texas Water Science Center web presence. She develops and maintains web and database applications for state and national programs using ASP.NET MVC, JQuery, SQL Server, Photoshop, ArcGIS Server, and Adobe Flex.

Justin Robertson is a Web Developer at the Central Texas Program Office of the USGS Texas Water Science Center in Austin. He has been working with the USGS since 2011. Justin has experience working with building innovative database-driven web applications using the .NET framework and the Google maps API. In the past year, he has built and maintained asset management, financial reporting, and resource scheduling databases and corresponding front-end web applications to manage them. Justin also built a Green Initiative web application to track CO₂ emissions as a part of a commuter challenge aimed at reducing emissions.

John Gordon is the Publications Specialist at the Texas Water Science Center. He reviews all publicly-distributed USGS publications and presentations produced by the Texas Water Science Center and manages the IPDS publications workflow.

Commitment to Effort

This project will result in providing a strong foundation for unified, open access to integrated, interoperable information (metadata) about USGS citizen science projects and their positive outcomes. Applying a crowdsourcing approach to promote sustained expansion of and updates to the database, project metadata may be added to the Citizen Science Project Inventory using the improved, well-documented interface established by this project. Because the data are entered into the inventory by scientists, the primary activity beyond deployment of the site will be to continue outreach and provide reminders to scientists add to or make updates to their project records as necessary to keep information up-to-date. Scheduled reminders could be included in notices or annual announcements.

As more projects are added to the inventory, future phases to improve the site could include expanding the metadata capture to include additional information such as data services available from projects, required technologies to participate, seasonality of the project, time commitment for each contribution, target age groups, costs to participate, and topic keywords. These additional filters would complement the information many existing registries of citizen science projects accumulate or collect. An additional future improvement would be to expose a dynamic stream of the project metadata (a web service) to the public that could be consumed by external crawlers or registries to parse and include in their own inventories. Informal discussions with the Cornell Lab of Ornithology in 2012 highlighted this need to share project metadata in an automated fashion.

The web application will be tested and hosted initially on web servers at the USGS Texas Water Science Center. Collaboration and partnerships among CDI CSWG Working Group members, USGS Office of Education, Fort Collins Science Center, AESIR, and USGS Office of Communications will increase sustained use and evolution of the myScience application.

The publically-accessible web application will serve as a platform for sharing and informing the general public about citizen science projects they may contribute to, which will promote the sustainability and growth of the projects themselves.

Budget

Budget Category	CDI Funding Requested	In-Kind Contribution		
1. Salaries (incl. fringe)				
Personnel			Hourly Rate (incl. fringe and overhead)	Budgeted Hours
Sally Holl	\$12,576.20		\$44.92	280
Megan Hines		\$6,580.00	\$41.13	160
Deanna Eames	\$5,363.80		\$53.64	100
Justin Robertson	\$1,445.00		\$14.45	100
John Gordon	\$1,040.32		\$65.02	16
Liz Colvard		\$1,537.20	\$64.05	24
Collaborators				
Scott Horvath		\$276.12	\$69.03	4
Sky Bristol		\$278.32	\$69.58	4
Tim Kern		\$8,791.20	\$73.26	120
Total Salary and Benefits:	\$20,425.32	\$17,462.84		
2. Travel Expenses				
Travel for one person to CDI Expose (Reston, VA)	\$2,500.00	\$0.00		
Travel for two people to CDI Workshop (Denver, CO)	\$2,000.00	\$2,000.00		
Travel for one person to present results at external professional conference	\$2,500.00	\$0.00		
Travel for two persons to meet at 2013 National Science Teachers Assn. Conference (San Antonio, TX)	\$0.00	\$4,000.00		
Total Travel Expenses:	\$7,000.00	\$6,000.00		
3. Other Direct Costs				
CDI Fact Sheet Publication	\$5,000.00	\$0.00		
Total Other Direct Costs:	\$5,000.00	\$0.00		
	CDI Funding Requested	In-Kind Contribution		
Total Net Project Requirements	\$32,425.32	\$23,462.84		

Timeline

Deliverables will be completed by August 31, 2013.

Project Work Plan					
Tasks	Months from receipt of funding				
	1	2	3	4	5
Task 1: Ensure access to project inventory database					
Task 2: Streamline database update interface					
Task 3: Design and test the application interface					
Task 4: Evaluate methods for data sharing with other project inventories					
Task 5: Outreach and education					

Appendix

Works Cited

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