

March 23, 2015

FACT SHEET: Empowering Students and Others through Citizen Science and Crowdsourcing

Citizen science and crowdsourcing projects are powerful tools for providing students with skills needed to excel in science, technology, engineering, and math (STEM). Volunteers in citizen science, for example, gain hands-on experience doing real science, and in many cases take that learning outside of the traditional classroom setting. As part of the 5th White House Science Fair, the Obama Administration and a broader community of companies, non-profits, and others are announcing new steps to increase the ability of more students and members of the public to participate in the scientific process through citizen science and crowdsourcing projects.

New Steps Being Announced by the Administration

Installation of a Rain Gauge in the White House Garden: The White House, in collaboration with the National Atmospheric and Oceanographic Administration (NOAA) and the National Park Service (NPS), will install a new rain gauge in the First Lady's Kitchen Garden as the White House becomes a new participant in the CoCoRaHS ([Community Collaborative Rain, Hail and Snow Network](#)) citizen science project. The White House will begin making contributions as an additional data source to the citizen scientist project during Science Fair. There are millions of citizen scientists in this country willingly contributing valuable time and effort to help advance our collective understanding of the world around us. The CoCoRaHS Network's over 20,000+ active volunteers serve as the largest source of daily precipitation data in our country, reporting measurement from coastal lowlands to the high peaks of Rocky Mountain National Park. CoCoRaHS data are used by a wide variety of groups, including: NOAA's National Weather Service, private sector and university meteorologists, hydrologists, emergency managers, city utilities (water supply, water conservation, and storm water), insurance adjusters, USDA, engineers, mosquito control, ranchers and farmers, outdoor and recreation interests, teachers, and students.

Fall 2015 Forum to continue the momentum: The White House Office of Science and Technology Policy will also convene a Citizen Science Forum before the end of 2015 with Federal agencies and external organizations to co-develop a vision for cross-sector scaling of citizen science and crowdsourcing.

Response by Broad Array of Organizations

Organizations are expanding the number of students that have the opportunity to participate in real science through citizen science projects, including:

- Enabling tens of thousands of families and school groups to explore habitats, observe birds, and contribute citizen-science data from Federal lands during the 2015-2016 school year: In support of President Obama's "[Every Kid in a Park](#)" initiative, the [Cornell Lab of Ornithology](#) will work with organizations including the National Park Service and U.S. Fish and Wildlife Service's National Wildlife Refuge System to develop and distribute a Bird Quest Booklet that will enrich the experiences of families and school classes who visit national parks, wildlife refuges, and other Federal lands. Equipped with information and fun activities in the free downloadable Quest, and supported with targeted lessons for use in 4th-grade classes, tens of thousands of families and school groups will explore habitats, observe birds, and contribute citizen-science data from Federal lands during the 2015-2016 school year. The Quest activities will inspire children to discover bird diversity in their home communities and on their visits to public lands. Using eBird, one of the world's largest citizen-science databases, they can discover which bird species are commonly seen in the park or wildlife refuge they plan to visit and then create a list of the species they hope to see. Using Merlin, a free app designed to help beginners identify birds, children can identify birds they see on field trips and at home. Free webinars will be provided for park and wildlife refuge personnel, volunteers, and 4th grade teachers interested in learning more about implementing the Quest.
- Train hundreds of people to incorporate plant phenology citizen science observations in at least 20 national wildlife refuges programs: Starting in spring 2015, the U.S. Fish and Wildlife Service (FWS) and NEON's [Project BudBurst](#) will offer a new citizen science course to hundreds of FWS staff, volunteers, Friends groups, and others. The online course will include detailed information about the importance of citizen science, plant phenology and climate change to the FWS. Utilizing Project BudBurst ([budburst.org](#)), a national citizen science plant phenology program and platform, participants will be able to contribute observations from national wildlife refuges, schoolyard habitats, local communities, and other areas of interest. Involvement in Project BudBurst includes hands-on experience in collecting phenology data that contribute to ongoing research by scientists interested in observations made by individuals across the country. The [National Ecological Observatory Network \(NEON\)](#) is funded by the National Science Foundation.

This includes the creation of new tools and resources that are freely or readily available to enable new and scale existing citizen science projects, including:

- Putting 6,000 new, low-cost, accessible sensors and measurement kits in the hands of community environmental researchers to enable residents to identify pollution affecting their own backyards:* The [Public Laboratory for Open Technology and Science \(Public Lab\)](#) commits to welcoming 1,000 new community members into the development and application of low-cost accessible tools for environmental research. Two new tools will be launched in the Open Water, Land and Air program areas: a conductivity / temperature / depth sensor, and an Oil Testing Kit. With these tools added to the four already in the Kits Initiative, residents can easily identify pollution affecting their own backyard, such as citizen-led aerial monitoring of urban wetlands restoration projects funded by the U.S. Environmental Protection Agency, and share the results through our online software and archive. Since 2010, the Public Laboratory for Open Technology and Science has grown into a diverse, global community of 5,000 members including scientists, filmmakers, technologists, anthropologists, community organizers, and local residents across the United States and the world working for environmental health justice.
- Creating a new citizen science tool lending library to loan thousands of research tools annually, enabling more than 50,000 people the opportunity to participate in scientific inquiry:* [SciStarter](#) and Public Lab are working in collaboration with the [Museum of Science Boston](#) and [Arizona State University's Center for Engagement and Training in Science and Society](#), to connect citizen scientists to data collection tools via a citizen science tool library. Public Lab's local lending libraries and Kits Initiative will engage with SciStarter's network and broad project taxonomy to create the infrastructure and the opportunity for 50,000 more people to participate in scientific inquiry. This partnership will broaden the scope of tools available to the schools and the general public by distributing and loaning thousands of research tools per year.
- Releasing free software tools that will enable students across the country to easily create their own mapping projects:* Later this year [esri](#) will release a free open crowdsourcing app designed to empower citizen science. Teachers, students and youth groups will be able to easily create their own projects and use this app in the field to report observations and explore them on a dynamic map. [A prototype of this app](#) is being used to power a live snapshot of the White House Science Fair by pulling tweets from around the globe and continually updating them on a map, which will allow more people to discover citizen science in their communities as well as existing resources. Esri is also investing in developing more inquiry-based curriculum targeted for specific subject areas, for free download, to make it even easier to use in class and afterschool programs.
- Creating new frameworks and highlight exemplary practices to support the integration of STEM learning objectives within established and newly developing citizen science projects:* Over the coming year, the newly formed [Citizen Science Association \(CSA\)](#) is committing to create a suite of resources, such as a Framework to Support the Integration of Citizen Science into the STEM Learning Ecosystem, designed to support STEM learning within

established and newly developing citizen science projects. With support from the National Science Foundation, the draft version of this framework was introduced at the inaugural meeting of the CSA and has been shaped by the input of over 60 Association members. To further promote integration of citizen science with STEM learning, the CSA will create an online mechanism by which the community can nominate outstanding examples of projects or resources that support citizen science for STEM learning. Exemplar projects will be highlighted on both the Citizen Science Association website and SciStarter.com in collaboration with SciStarter.com's initiative to align 500 existing citizen science projects with Science and Engineering Practices and provide this information on their website for use by educators and citizen science practitioners.

Background on the Growing Citizen Science Movement

Crowdsourcing and citizen science are tools that educate, engage, and empower students, educators, and the broader American public to apply their curiosity and contribute their talents to a wide range of real world problems. *Crowdsourcing* is an online, distributed problem-solving and production model whereby organizations submit an open call for voluntary assistance from a large group of unknown individuals. Through *citizen science*, members of the public participate in the scientific process in ways that may include identifying research questions, making new discoveries, collecting and analyzing data, interpreting results, developing technologies and applications, or problem solving. The Administration seeks to enable and scale the use of open innovation methods such as citizen science and crowdsourcing to harness the ingenuity of the public to accelerate science and technology innovation. In addition to the STEM education benefits of these tools, citizen science and crowdsourcing are powerful tools that can help:

- Advance and accelerate scientific research through group discovery and co-creation of knowledge.
- Improve delivery of government services with significantly lower resource investments.
- Connect citizens to the missions of Federal agencies by promoting a spirit of open government and volunteerism.
- Increase science literacy.
- Further science diplomacy through collaborations between scientists and citizens worldwide.

The Administration has made citizen science and crowdsourcing a component of the [2013 Second Open Government National Action Plan](#) in which President Obama called on agencies to harness the ingenuity of the public by accelerating and scaling the use of open innovation methods such as citizen science and crowdsourcing. Also in 2013, the Administration [highlighted 12 pioneers in the field of citizen science through its Champions of Change effort](#). More recently, the Administration has been [amplifying](#)

[citizen science projects on the OSTP blog](#) and is working on the [development of a citizen science toolkit](#) to better prepare the government to support citizen science projects.

Equipped with interactive web tools and everyday sensors, like cell phone cameras and water quality test kits, the public can collect data, help solve complex problems, and act on the results. Thousands of people already have been mobilized to accomplish fascinating and important work – from solving the structure of an AIDS-related enzyme, which may lead to new medications, to mapping the 3D structure of neurons in the brain, from discovering a new class of galaxy to mapping the surface of Mars, from providing time-critical information for emergency response to collecting air quality and other environmental data. Researchers and entrepreneurs also are crowdsourcing human genome data and analysis, contributing to the field of precision medicine. Smart cities are combing crowdsourced congestion maps with traffic images and distributed sensor data via Internet of Things to shorten commuting times and make our roads safer.

Open innovation approaches such as crowdsourcing and citizen science can be highly cost-effective. For example, based on an analysis of 338 citizen science biodiversity projects around the world, researchers at the University of Washington estimated that the in-kind contributions of 1.3–2.3 million citizen science volunteers to biodiversity research has an economic value of up to \$2.5 billion per annum, nearly 40% of the annual budget of the National Science Foundation in 2013.¹ Another study by researchers at George Tech and Politecnico di Milano School of Management found that using a crowdsourcing platform had saved seven science project organizers more than \$1.5 million.²

Grassroots efforts at some agencies also have begun to lay the groundwork for a Federal government-wide effort to stimulate the use of citizen science and crowdsourcing. The [Federal Community of Practice on Crowdsourcing and Citizen Science](#) is a network of nearly 130 members from more than 20 agencies that shares lessons learned, develops best practices, and offers training. A number of additional agencies have launched successful projects, including examples below:

- [Measuring Broadband America](#) (FCC) enabled 2 million volunteers to measure their actual Internet speeds, creating a National Broadband Map that revealed digital divides.

¹ Theobald et al. 2014. [Global change and local solutions: Tapping the unrealized potential of citizen science for biodiversity research](#). *Biological Conservation* 181: 236-244. doi:10.1016/j.biocon.2014.10.021

² Sauermann, H. and Franzoni, C. 2014. Crowd science user contribution patterns and their implications. *Proceedings of the National Academy of Sciences*. 112(3): 679-684. Doi: 10.1073/pnas.1408907112

- In 2014, [Nature's Notebook](#) (USGS, NSF) volunteers recorded more than 1 million observations on plants and animals that scientists use to analyze environmental change.
- [Did You Feel It?](#) (USGS) enabled more than 3 million people globally to share what they experienced in earthquakes, contributing to rapid assessments of damage and providing valuable data for scientific research, particularly in areas without dense sensor networks.
- The [mPING](#) (NOAA) mobile app has collected more than 600,000 ground-based observations that help verify weather models with data of what happens at the surface.
- USAID opened its [loan guarantee data](#), while protecting privacy, to volunteers who mapped 10,000 data points in only 16 hours, compared to the 60 hours officials expected.

###