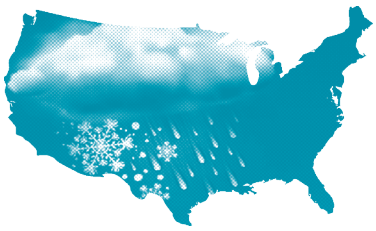
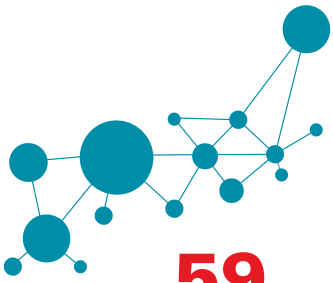
THE FUTURE OF FEDERAL CITIZEN SCIENCE & CROWDSOURCING

Strategic Recommendations for Advancing U.S. Federal Policies, Programs and Partnerships



20,000 volunteers

in all 50 States, D.C., Puerto Rico, the U.S. Virgin Islands and Canada are collecting real-time rain, hail and snow data



59 government organizations

300 federal employees from 59 different government organizations are participating in the Federal Community of Practice on Citizen Science and Crowdsourcing

303

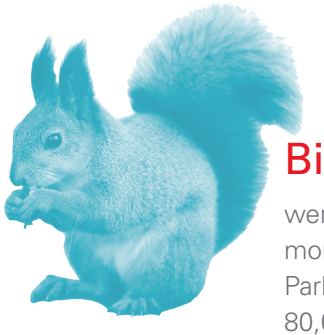
federally funded citizen science & crowdsourcing projects being supported by 25 different agencies

1,600 volunteer groups

in the United States are engaged in water quality monitoring

$2.5 billion economic value

Researchers at the University of Washington estimate that the in-kind contributions of 1.3–2.3 million citizen science volunteers to biodiversity research have an economic value of up to $2.5 billion per year.



116 BioBlitzes

were held across the U.S. to monitor species in our National Parks in 2016, with an estimated 80,000 volunteers

Citizen science mobilizes the public to participate in the scientific process to address real-world problems, in ways that include identifying research questions, collecting and analyzing data, interpreting results, making new discoveries, developing technologies and applications, and solving complex problems.

Crowdsourcing is a process of obtaining needed services, ideas, or content by soliciting contributions from a large group of people, especially from an online community.

Not all crowdsourcing is considered citizen science, but it is a vital tool in the toolbox.

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Wilson Center
wilsoncenter.org

WHY IS **CITIZEN SCIENCE** AND **CROWDSOURCING** IN THE **FEDERAL GOVERNMENT** IMPORTANT?

Enhance scientific research and efficiency

Independent researchers often work with small teams, or in collaborative networks. However, this network of researchers will never equal the 80,000 volunteers that attended the 100+ BioBlitzes hosted this summer to inventory species in our National Parks. These volunteers can collect data over large geographic and temporal scales at a fraction of the cost.

Address societal needs

There are no better civil society actors to prioritize research areas than the citizens themselves. Their diverse opinions and proximity to the problems we face are crucial to directing research agendas that address societal problems.

Provide hands-on STEM learning and increase STEM literacy while contributing to science

There is a growing amount of evidence demonstrating the strong connection between participating in citizen science and crowdsourcing and STEM learning. Involving K-12 classrooms, community colleges, senior citizens, outdoor enthusiasts, inmates, and the rest of the general public in authentic scientific projects through STEM education efforts embodies the wisdom of an old Chinese proverb, "Knowing is not as good as putting it into practice."

INTRODUCTION

Citizen Science, also known as Public Participation in Scientific Research (PPSR), and Crowdsourcing leverage the ingenuity of the public to participate in the scientific research process at any step. Citizen Science and Crowdsourcing may be considered a method or a set of tools that expedites and reduces research costs while increasing public engagement and understanding of science. A scientific project may employ the use of the method or study public participation through the method; therefore it is simultaneously a field of research exploring "how and why does the public participate in scientific research projects through citizen science and crowdsourcing" and an applied method, "how to use citizen science and crowdsourcing in a scientific project."

Achievements in citizen science and crowdsourcing projects are well-documented and continue to grow. One of the most relevant to 2016, with the appearance of the Zika virus in the United States, is the **GLOBE program**, which has developed a mosquito monitoring protocol to identify the vector that carries the disease in the Gulf of Mexico. Concerned citizens, including students, teachers and scientists, are monitoring and tracking these vectors using GLOBE's protocol. Having more eyes on the problem means faster and more efficient intervention and eradication of larvae that eventually transmit the Zika virus.

Growth of citizen science and crowdsourcing is global. In 2012, practitioners held the first meeting that established the idea for a U.S. Citizen Science Association. In 2014, we witnessed the establishment of the European Citizen Science Association followed by momentum and the eventual establishment of the Australian Citizen Science Association. Support for the method is maturing, and with it so are the professional services and infrastructure around it,
but public investment is crucial to sustained growth.

Current **Federal Policies, Programs** and **Communities**

Executive Office of the President

The Office of Science and Technology Policy (OSTP) within the Executive Office of the President has worked to encourage the advancement of citizen science and crowdsourcing approaches to address societal and scientific challenges. A September 2015 Memorandum outlined principles that agencies should apply to ensure the future use of citizen science and crowdsourcing as a means to improve value and impact of scientific research. The Memo also required agencies to identify a coordinator for citizen science and crowdsourcing projects within each federal agency as well as catalog agency-specific projects. Lastly, a 2016 White House event celebrated these achievements and showcased the diversity of federal citizen science and crowdsourcing through a catalog of over 303 projects from 25 agencies.

Federal Agency Projects and Programs

Today, federal agencies are employing citizen science and crowdsourcing to inform a broad range of research activities and programs. The following is a small subset of the breadth of examples of projects currently underway: USGS is asking the public to report earthquakes in near real time in an effort to improve and calibrate instrumental measurements and generate data points where there may be no instruments to measure earthquakes. NOAA is testing, via the public's Smartphones, whether citizens can be mobile sensors for the Earth's magnetic field and crowdsource a map of the Earth's ever-changing magnetic field. NASA is enlisting citizen scientists to calibrate their newly launched satellite that measures soil moisture – incredibly important for measuring droughts – by asking volunteers to test the soil in their backyard and report their findings when the satellite passes overhead.

Funding for Citizen Science and Crowdsourcing

As citizen science and crowdsourcing continue to grow, so does the funding in different key geographies. Below are some examples of government funding packages from different countries, followed by an estimation of annual U.S. federal funding by select federal agencies.

European Union

The European Commission is coming to the end of a **two stage funding initiative** to demonstrate the utility of five Citizen Observatories for monitoring environmental pollution, biodiversity and marine litter. The total budget for the call was 50,000,000 EUROS ($56,000,000 USD).

Austria

E.U. member nations also fund their own programs. For example, the Ministry of Science, Research and Economy in Austria has spent $36,200,000 Euros ($39,859,458 USD) over an 8 year period on a systematic funding package called **Sparkling Science** to support projects in which students of all levels of education are actively involved in the authentic research process.

Australia

Ministry for Industry, Innovation and Science **announced** a $930,000 AUS ($693,501 USD) funding package for a nation-wide online citizen science project as part of National Science Week, as well as for a new Eureka prize in citizen science, and additional funding for support of the Australian Citizen Science Association.

United States

Below is the annualized federal investment of select federal agencies for citizen science and crowdsourcing. This was calculated using agency grant databases and third-party databases such as Star Metrics. Some agencies that have decades of funding history, like the National Aeronautics and Space Administration (NASA), the U.S. Geological Survey (USGS) and many others were difficult to obtain funding information for and are therefore not included in this estimation. However, they should be recognized as key contributors to the growth of citizen science and crowdsourcing in the federal government. Further details on the methodology and source data can be found here: **http://bit.ly/2g1FRKo**

Estimated U.S. Federal Agency **Annual Investment**

National Science Foundation
$44,271,721

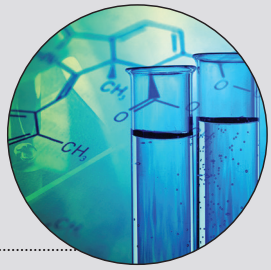
Department of Defense
$2,955,317

Department of Agriculture
$68,471

National Parks Service
$198,375

Environmental Protection Agency
$965,001

Health and Human Services
$1,244,106



National Oceanic and Atmospheric Administration
$10,836,046

Recommendations

What can be done to further **federal policies** and programs for **citizen science and crowdsourcing**?

The recommendations below build on over 12 interviews with experts in citizen science, both from within and outside of government. Based on these interviews and desk research, the Science and Technology Innovation Program at the Wilson Center developed the following 10 recommendations so the next Administration can continue to apply citizen science and crowdsourcing to advance scientific research, address societal needs, and improve STEM education.

EXECUTIVE OFFICE OF THE PRESIDENT

1 Increase active support from the Executive Branch Office of Science and Technology Policy (OSTP) for the Federal Community of Practice for Crowdsourcing and Citizen Science (CCS) and the Agency Coordinators

The value of both communities cannot be underestimated as they provide a space for federal employees to share ideas, work on common legal and administrative concerns, and cross-promote and create various projects. OSTP should designate an appropriate high-level individual to serve an active role in attending the Federal Community of Practice for Crowdsourcing and Citizen Science. In addition, that individual should be the primary point of contact for the Agency Coordinators as they implement new measures to support citizen science and crowdsourcing in their agency, hosting meetings as necessary and serving as a facilitator. The Federal Community of Practice should be encouraged to produce a short annual report of its activities for OSTP, summarizing key accomplishments and highlighting any issues going forward.

2 The Office of Management and Budget (OMB) and OSTP should *jointly* provide renewed policy guidance to federal agencies for citizen science and crowdsourcing in their first memorandum

The previous Administration took important initial steps to further the use of citizen science and crowdsourcing within the US government through memorandums, events at the White House, and by supporting the creation of citizenscience.gov. OSTP and OMB should use their initial joint memo to the government agencies outlining science priorities to highlight citizen science as a high priority area. In addition, OSTP and OMB should use other opportunities early in the new Administration to provide support for citizen science and crowdsourcing projects, through strategy or planning documents focused on areas such as S&T funding, innovation, or interagency initiatives. Finally, OSTP and OMB should verify the budget numbers presented in this document, filling in gaps as needed, so a government-wide assessment of citizen science and crowdsourcing funding is available.

3 A legal framework for conducting citizen science and crowdsourcing initiatives should be created to improve administrative efficiency and eliminate administrative and legal grey areas

The **America COMPETES act** clarified legal issues related to open innovation approaches using prizes and challenges. A similar framework should be developed for citizen science and crowdsourcing, to remove or significantly reduce legal barriers and improve efficiencies. For example, this framework could create a government-wide generic Information Collection Request (ICR) to facilitate the collection and use of data from large numbers of citizens (OMB and EPA have already negotiated a generic ICR; DOI and USGS are currently under negotiation with OMB). The framework could also define keywords like consent, data, and human subjects; and explicitly permit the use of funds appropriated by Congress for citizen science and crowdsourcing projects.

FEDERAL AGENCIES

4 The General Services Administration *Office of Citizen Services and Innovation Technologies* should increase their budget request to expand resources and structured support for citizen science and crowdsourcing

The General Services Administration (GSA) hosts the platform www.citizenscience.gov, and in collaboration with the Wilson Center, the **Federal Crowdsourcing and Citizen Science Catalog.** In addition, GSA provides community support through social media and interactive webinars. This structured support should continue, but with increased commitment in the following ways: (1) a full-time employee should be dedicated to the community management and technological development of the Catalog and the citizenscience.gov platform; (2) GSA should cover hosting fees and necessary improvements to the Catalog; (3) GSA should establish a pre-approved procurement vendor list for citizen science and crowdsourcing apps and platforms.

5 Agencies and Departments should incorporate citizen science and crowdsourcing into thematic priority areas and strategic plans

These methods can achieve agency and departmental missions, goals, and strategies more democratically, efficiently and sustainably. To encourage the seamless integration of these methods into everyday agency practice, leadership should highlight these methods as a way of achieving their strategic plans. For example, the **Department of Interior strategic plan for FY 14 – 18** outlines a mission area of "Ensuring healthy watersheds and sustainable, secure water supplies." A sub-strategy that encourages the use of this method could read "To increase understanding of the state of watersheds, utilize citizen science and crowdsourcing for near real-time monitoring of water supplies on public lands."

6 Continue and expand support for citizen science and crowdsourcing through research grant funding calls

For the federal government to lead the way in scientific research and encourage the adoption of novel methods like citizen science and crowdsourcing in projects, their granting mechanisms must specifically call out the use of these methods in grant requests or precursors to actual grants, such as Dear Colleague letters. This encourages grassroots initiatives that utilize these methods to seek federal support for their local initiatives, efficiently connecting bottom-up to top-down initiatives. To date, U.S. agencies including the National Science Foundation, National Aeronautics and Space Administration, National Oceanic and Atmospheric Administration, U.S. Environmental Protection Agency, U.S. Geological Survey and the National Institutes of Health have included this language in funding calls.

7 Agencies should use existing Federal Advisory Committees to expand stakeholder input and engagement in their citizen science and crowdsourcing efforts

The Environmental Protection Agency recently tasked its National Advisory Council on Environmental Policy and Technology (NACEPT) to "…assess EPA's approach to citizen science in the context of current activities, and to recommend a coordinated framework for the Agency to embrace citizen science as a tool in protecting public health and the environment." This allows external stakeholders from academia, industry, NGO's and other key groups to provide advice on an agency's programs, strategies, partnerships and current practices involving citizen science and crowdsourcing. Agencies should explore the use of their FACA committees to engage a range of stakeholders in the development and improvement of their citizen science and crowdsourcing projects and programs.

8 Agency Coordinators should facilitate inter-agency discussion, initiatives, and community building

In addition to updating projects in the Federal Catalog, the Agency Coordinators are in an excellent position to identify and share knowledge from citizen science and crowdsourcing in areas such as: best practices, data quality and assurance, and different approaches to project development and evaluation. These individuals should consider their efforts complimentary with members of the Federal Community of Practice for Crowdsourcing and Citizen Science, to facilitate dialogue between agency leadership and other communities within and beyond the federal government. The Agency Coordinators should also explore opportunities to align citizen science and crowdsourcing partnership efforts with Agency-specific challenges and **big ideas**.

9 Continue to leverage fellowships and early career government employees for citizen science and crowdsourcing research, programs and projects

A significant number of federal employees advocating for and promoting citizen science and crowdsourcing within their agency are often early career government employees or former or current fellows, i.e., American Association for the Advancement of Science (AAAS) Fellows, Presidential Management Fellows (PMFs), and Presidential Innovation Fellows (PIFs). These individuals play a vital role in bridging the academic, practitioner and governmental interests. This critical human resource should be expanded in the future.

PUBLIC-PRIVATE PARTNERSHIP

10 New citizen science and crowdsourcing initiatives should leverage public-private partnerships to address national needs

Agency Coordinators, the Federal Community of Practice for Crowdsourcing and Citizen Science, and other open innovation communities should collaborate with the private sector to tackle 2-3 grand challenges of national interest. For example, national drinking water remains a huge concern as the ability to test water for toxins, including lead, cheaply and at scale is still out of reach. New initiatives should leverage public-private partnerships, for example, through Small Business Innovation and Research (SBIR) programs designed to engage the private sector in solving grand national challenges.

Moving Forward

National Drinking Water Challenge

Charging open innovation communities across different federal agencies to come together and tackle a national challenge of how to monitor drinking water cheaply and effectively.

Open innovation is based on the concept that excellence is driven by new ideas from external sources. Within the U.S. Government, federal agencies and the Executive Branch are starting to recognize this and inviting the public to participate, as exemplified by citizen science and crowdsourcing and other forms of open innovation. At the same time, we as a nation are facing considerable challenges such as a declining infrastructure, massive flooding due to climate change and the introduction of new tropical diseases.

Charging these open innovation communities -- citizen science and crowdsourcing, prizes and challenges, the Federal Games Guild, and the Maker Guild – to work with each other on a similar goal of national importance will increase collaboration across federal agencies, increase the breadth of federal open innovation and tackle problems that have a scope far greater than that of a single government agency or academic field. Our last recommendation is to encourage the ingenuity of the American public to come together under these open innovation communities, with the support of an inter-agency working group and the private sector, to tackle our Nation's most pressing challenges.

Key Federal Open Innovation Communities

Federal Community of Practice on Crowdsourcing and Citizen Science (CCS) - a grassroots community open to all federal practitioners working on, funding, or just interested in learning more about crowdsourcing and citizen science. This community created a citizenscience.gov Toolkit, which outlines the steps to take when establishing a new project, offers case studies that document the process of successful federal projects or programs, and hosts other resources.

Agency Coordinators - a group of federal employees designated by federal agency leaders to be responsible for implementing various tasks within their agency as outlined in a September 2015 memo from OSTP to the heads of federal departments and agencies.

Prizes and Challenges –Challenge.gov hosts a listing of challenge and prize competitions, all of which are run by more than 80 agencies across thefederal government. These include technical, scientific, ideation, and creative competitions where the U.S. Government seeks innovative solutions from the public, bringing the best ideas and talent together to solve mission-centric problems.

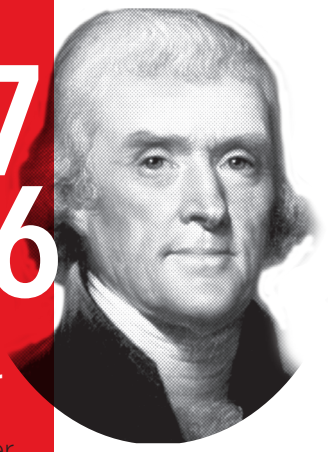
Federal Games Guild, a group of federal employees interested in or actively using video game technologies to address various societal challenges and Federal agency missions (such as education, workforce development, healthcare, and citizen science) by connecting with leaders in the field and sharing experience, strategies, and opportunities.

Brief History of Citizen Science

1776 - 1816

Thomas Jefferson makes unbroken line of weather observations.

1776



1800
1820
1840
1860
1880
1900

1890 -1900

Cooperative Observer Program Established

The National Weather Service's Cooperative Observer Program (COOP) is established by an act of Congress. COOP sets up stations around the U.S., where volunteers contribute observations.

1890

1995

Term "Citizen Science" is Coined

Alan Irwin, a University of London Professor, coins the term citizen science to describe the contributions of lay people to environmental monitoring as complementary to scientific initiatives. At the Cornell Lab of Ornithology, Rick Bonney also begins using the term citizen science during a similar timeframe.

1995

CHRISTMAS BIRD COUNT

The Audubon Society establishes the Christmas Bird Count, where volunteers count the number of birds they see during the weeks surrounding Christmas. Considered one of the longest running citizen science programs.

2008

Oaks are Mysteriously Dying in U.S.

Oaks were mysteriously dying across the United States. The NSF-NIH-USDA Ecology and Evolution of Infectious Diseases Program asked residents in the San Francisco Bay area to report outbreaks of Sudden Oak Death, an invasive disease that kills oak trees. Volunteer collected data contributed to a predictive model which uncovered new findings about the disease.

2008

2009

Memorandum on Transparency

President Obama issues a Memorandum on Transparency and Open Government, highlighting participatory, transparent and collaborative government.

2009

2011

First National Action Plan for Open Government, seeking to open government through 26 initiatives such as open data, and prizes and challenges.

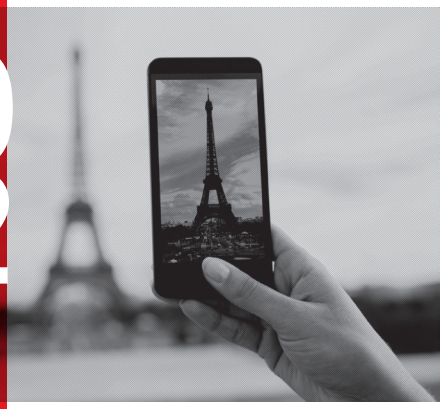
2011

2012

The first conference on Public Participation

The first conference on Public Participation in Scientific Research is held in Portland, OR and the community decides to create the U.S. Citizen Science Association, a professional network for practitioners and academics.

2012



2013

Federal Community of Practice

Federal employees establish *Federal Community of Practice on Crowdsourcing and Citizen Science.*

2013

SECOND NATIONAL ACTION PLAN

is published by the Executive Branch, setting precedent for the Open Innovation Toolkit, and encouraging development of citizen science and crowdsourcing programs.

2014

Citizen Science Associations Established

The European and Australian Citizen Science Associations are established.

2014

2015

CITIZENS SCIENCE IN THE FEDERAL GOVERNMENT GETS RECOGNITION

Senator Coons introduces The Crowdsourcing and Citizen Science Act of 2015.

OSTP issues a Memorandum on Citizen Science and Crowdsourcing.

National Science Foundation establishes a priority area for Public Participation in Scientific Research.

2015

Federal Toolkit

White House hosts event celebrating the many uses of citizen science and crowdsourcing and unveils the Toolkit.

2016

www.citizenscience.gov

White House launches website with resources for federal employes including the Federal Catalog.