

National Advisory Council for Environmental Policy and Technology

EPA Strategic Directions on Using Citizen Science for Environmental Protection

Background: Citizen science is a form of open collaboration where 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, and problem solving; citizen science is one type of crowdsourcing, a process of obtaining needed services, ideas, or content by soliciting contributions from a large group of people. Citizen science and crowdsourcing, which have a long history, are now possible on a scale that was previously impossible (enabled by low-cost sensors, smart phones, the Internet, advanced computing, etc.).

Citizen science and other crowdsourcing approaches that promote open collaboration (hereinafter referred to as citizen science) offer the opportunity to educate, engage, and empower the public to apply their curiosity and contribute their talents to advancements in science and technology. Active volunteers can provide broad geographic observations and information that would not otherwise be obtainable due to time, geographic, or resource constraints.

Environmental Protection: Citizen science represents a huge opportunity to advance EPA's mission to protect human health and the environment. Confronting our environmental challenges depends on engagement with all parts of society, and the people affected by climate change or pollution in air, water, or land need to be included in the solutions. Citizen science produces a direct connection between our government, the communities we serve, and our environment and health.

Public contributions provide an opportunity to support and invigorate EPA programs and regional activities. Stubborn problems and routine research tasks can become opportunities by harnessing the energy and creativity of the crowd. Successful citizen science programs and partnerships exist across the country, empowering the public to take part in the scientific process and provide real benefits, including:

- Advancing and accelerating scientific research through group discovery and co-creation of knowledge. For instance, engaging the public in data collection can provide information at resolutions that would be difficult for federal agencies to obtain due to time, geographic, or resource constraints.
- Increasing science literacy and providing students with skills needed to excel in science, technology, engineering, and math (STEM). Participants in citizen science projects gain hands-on experience doing real science outside the classroom setting.
- Improving delivery of government services with significantly lower resource investments.
- Connecting citizens to the federal agency missions by promoting open government and volunteerism.

At EPA: The Agency has embraced citizen science because solutions to today's environmental problems benefit from public participation. EPA is a natural fit with citizen science because health and the environment affect everyone. Citizen science, if properly utilized, will open up new opportunities for EPA in partnership with other entities and stakeholders (e.g. states and tribes, communities, citizen science associations, museums, universities, colleges, schools, and other organizations) to connect with the public about science, human health, and environmental protection while improving research and environmental and health outcomes.

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Our aim is to achieve multiple outcomes at once:

- An educated and engaged citizenry that can help solve environmental and health problems
- Use of local data about environmental conditions to empower communities
- More environmental data that will fill current gaps in data collected by the Agency and State, Local, and Tribal governments
- Low-cost contributions to environmental and health research
- Improved environmental governance through citizen involvement

In addition to the NACEPT review, the Agency has stated its intention to charge the National Environmental Justice Advisory Council (NEJAC) with the task “to advise the Community Resource Network on community best practices, lessons learned and needs around monitoring, including useable formats for monitoring data.” These two FACA committees should work together to share knowledge and experience around these topics in evaluating the role of citizen science in environmental protection.

Charge: The benefits of citizen science to EPA’s mission include: better environmental science and more data that can be used in decisions and policies; an informed citizenry that leads to civic engagement on environmental problems; and, increased transparency and credibility in the scientific process.

To realize the full benefits of citizen science and to use EPA resources efficiently, we need to evaluate the current and potential roles for citizen science in environmental protection and prioritize our efforts. The charge to NACEPT is 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. We ask NACEPT to provide advice and recommendations on specific actions the Agency may consider to resolve issues that hinder the effective production and use of knowledge and data generated through citizen science.

Three overarching questions frame the NACEPT review:

1. *How can we sustain and improve current EPA projects and programs?* EPA does not have a formal strategy on citizen science but considerable work is underway in EPA programs and regions. These projects and activities on citizen science support four areas of emphasis that help EPA accomplish its mission. In each area of emphasis, we ask NACEPT to evaluate current work and provide advice on how EPA can optimize its existing citizen science projects and activities to increase the impact and value of this work, including through possible collaboration with states, tribes, communities, citizen science associations, museums, universities, colleges, schools, and other organizations.

- **Empower communities.** Citizen science advances environmental protection by helping communities understand local problems and collect quality data that can be used to advocate for or solve environmental and health issues. Citizen science provides effective

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methods to respond to a community's questions about their environment and health. EPA provides tools, technical expertise, and funding for citizen science led by community groups to better understand local problems and advocate for improved environmental health.

- **Monitor the environment and human health.** Citizen science advances environmental protection by creating useful monitoring data. Citizen science programs can increase the temporal and geographic coverage of environmental monitoring to support EPA programs and environmental protection. EPA continues to support and enable a small number of citizen science monitoring programs and projects.
- **Conduct environmental research.** Citizen science advances environmental protection by supporting environmental and health research. Citizen science approaches are diverse, ranging from national data collection, to online crowdsourcing to community-based participatory research. Although some Federal agencies now create large, robust datasets through established research programs, EPA is just beginning to explore this approach.
- **Educate the public about environmental issues.** Citizen science advances environmental protection by educating the public about environmental issues. EPA, working with other agencies and organizations, can use citizen science as a STEM education tool, including involving young people in science and research. EPA strives to incorporate well-designed citizen science activities into environmental education while also creating high-quality data that may be utilized to advance science.

2. *How can EPA invest in citizen science approaches for the greatest gain?*

EPA can build capacity in citizen science approaches as a whole and broadly support effective projects and programs through strategic investments; progress in a few key areas could enhance all four areas of emphasis at the Agency.

What citizen science opportunities, directions, and collaborations should EPA consider to assist the agency in accomplishing its mission? Are there partnership approaches that would allow EPA to work with other organizations to more effectively support citizen science methods? Frameworks are needed to ensure data quality, proper data management, and to evaluate and validate instruments used in citizen science; what investments in this areas would facilitate the use of these approaches?

- a. Data quality.** Standards or guidelines for quality control of citizen science data at EPA would help ensure that these data are suitable for their intended purpose.

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- b. *Data management.*** Data from citizen science projects can be more effectively used if EPA can build capacity for managing and maintaining these data.
 - c. *Instrument evaluation.*** Low cost (\$100-\$2500) sensors for air and water is an emerging technology area that has potential to increase the effectiveness and impact of citizen science projects. However, current versions of these sensors and instruments vary widely in the quality of data that they collect, including data accuracy, precision, and bias. By providing guidance to citizen science organizations on low cost sensor technologies, EPA can facilitate the collection of high quality, actionable data.
- 3. *How can EPA help increase the impact of knowledge and data generated via citizen science?*** There is a need to have policies and guidelines in place that address citizen science approaches. How can EPA best leverage citizen science to protect human health and the environment?

- a. *How can EPA support the use of citizen science knowledge and data for environmental protection at the local and state level?*** Citizen science can strengthen EPA's work, resulting in outcomes for individual participants, for communities, and for environmental protection. **Participants** increasingly value the integrity, transparency and caliber of EPA science, increased understanding of environmental research, improved sense of place and stewardship, and a deeper relationship with the natural world. **Communities** better understand their environmental health issues, which will lead to improved solutions to problems and a better public understanding of the scientific process.

How can EPA facilitate the role of citizen science in outcomes for individuals and communities, including governance and decision-making by local, tribal, and state governments?

- b. *How can EPA support the use of citizen science knowledge and data for environmental protection at the federal level?*** Quality data from well-designed citizen science projects can provide valuable information to **supplement** EPA research on standards and regulations; for example, these data can act as a screening tool to determine when more research is needed. With policies and guidance on the importance and purpose of citizen science data at the Agency, individuals and communities will be motivated to target their efforts towards an outcome that is mutually beneficial.

How can the Agency leverage data collected via citizen science to better protect human health and the environment? What standards of data quality are needed to use citizen science data for its intended purpose (e.g., research, as a screening tool, for background monitoring, etc.)?

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- c. How can EPA work with the public to interpret data from citizen science efforts?* Citizen science is an effective tool to foster public engagement and communicate environmental science. When communities who collect data around an environmental concern approach EPA, the Agency has the opportunity to engage communities and support a common understanding of data collection and the scientific process.

How can EPA provide an appropriate response to community groups who collect data indicating an environmental concern? How can EPA communicate with individuals and community groups to promote an understanding of the data they collect, how the results relate to regulations or standards, and what the results mean in terms of health or risk?