

Public Participation for Actionable Science

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Call to Action:

We recommend that NSF use the CoPe hub concept to broaden participation in the sciences needed to enhance interdisciplinary research on change and impacts in coastal systems. Expanding support for citizen science at NSF into a recognized and well-supported component of research will promote the collection of valuable, quality-controlled information that provides high resolution data while engaging citizens and communities in the scientific process. Citizen-based data collection can enhance mainstream science through its high volume and location-specific information, creating baselines that are essential for time series and evaluation of system change (e.g., Theobalda et al. 2015, Buckland-Nicks et al. 2016). Data can be integrated with information from surveys, cruises and sensors deployed by agencies and academic scientists. However, there is a need for careful program design, data review, and quality control to ensure that citizen science efforts produce valuable data in addition to outreach (Burgess et al. 2017). Commitment of resources and expertise from NSF can improve the quality of citizen science and contribute to participatory research that enhances public awareness of science and its value to coastal communities.

Specific Recommendation:

Regional CoPe hubs should devote resources to public participation in research via well-designed citizen science programs (e.g., trained volunteer programs that regularly collect data for monitoring environmental conditions or phenomena) and mentored community science (projects that enhance sample size or scope of data collection that are supervised by a professional scientist). This recommendation stems from an identified need to acknowledge the importance of local context and the centrality of “sense of place” in securing community engagement and buy-in. Place-based programs establish relevance for local actors, including policy makers, philanthropic agencies, aid and event response organizations, and the public at large.

Resources committed to citizen science programs should be broader than simple project funding. Regional hubs could provide support in a variety of ways, including:

- Design and Development. Identification of best practices in the design and development of citizen science programs, participant recruitment and retention, community engagement, data quality assurance and control, integration of citizen science with mainstream science, and dissemination of results to scientific and layperson audiences. Creation of processes and templates that can be utilized across regions, projects, and disciplines with guidance for how to tailor programs to fit local conditions and needs. Training investigators on design and implementation with on-going support.
- IT support. Computing resources and expertise for data storage, management, and

integration. Technical assistance with web design, maintenance, and hosting. Development of mobile applications and/or web-based interfaces for reporting and dissemination.

- GIS support and data visualization. Mapping data to show patterns over broad geographic areas is one of the best ways to illustrate change in space and time to broad audiences. GIS also provides a platform for integrating local knowledge, data collected through citizen science programs, and data collected through mainstream science.
- Communication tools and training for scientists to “report back” to communities. Citizen science programs that have successfully contributed to mainstream science rely on volunteers who contribute regularly and stay with a program for extended periods, providing reliable expertise. Retaining volunteers requires feedback to engage them and encourage continued participation, but scientists who use citizen collected data may not be very good at providing that feedback. NSF hubs can help scientists who work with communities to collect data by providing public engagement training, reports that are easy to read and interpret, social media engagement, and websites that show how data collected at local scales feed into larger scale evaluations.

Impact and Value:

Active participation in actionable science programs adds value to traditional research and is a tool for expanding participation in the mainstream science community of practice. Community participation in problem identification, data collection, analysis of patterns and processes, and dissemination of results can enhance the quantity, scope, and quality of science in many disciplines.

Cost Effective Data Collection

- Well-designed and compatible local programs can be linked to expand scope of knowledge both spatially and temporally in biological, physical, and social sciences
- CoPe hubs can serve to facilitate the sharing of resources, such as research protocols, between community programs to increase their connectivity and analytical power
- Coordinated sampling programs can be leveraged across larger landscapes and inform multi-scale modelling efforts

Regular monitoring that is critical for data time series development can be maintained through citizen science programs (Conrad and Hilchey 2011). A few examples include: a) Baseline information on the quantity and diversity of animals or plants in a region can help distinguish extreme events from natural spatio-temporal variation; b) Water quality sampling can identify problems that enable rapid and targeted response to pollution events and harmful algal blooms; c) The response of people to destructive events such as floods and hurricanes can be gathered through citizen science programs that collect social data; d) In the physical sciences, data on erosion, precipitation, pH and wave height are just a few factors that can be measured over wide spatial and temporal scales with the help of citizen scientists and simple instruments. For a recent review of the diversity of citizen science programs related to environmental and ecological monitoring, see Pocock et al. 2017.

Community Engagement & Broadening Participation:

- Citizen science programs can establish and grow long-term relationships between mainstream science and the coastal communities.
- Locally specific science programs support and further actionable science, i.e. locally relevant and accessible investigations that support decision making.
- Building relationships around observing environmental change and working together to understand the drivers of events and change over time, inviting all to be a part of the science “team”.
- With local involvement of coastal community residents, we can combine multiple sources of knowledge and data types to best protect and restore coastal ecosystems, and adapt into the future.
- We envision a future of locally driven environmental science where the communication barriers between scientists and community have fallen away through shared knowledge.

Cost effective data collection and the benefits of community engagement are not independent and should be a common goal of CoPe supported programs. Well designed community science programming will maximize both benefits by illustrating the importance of standardized methods and the value of integrating locally collected data over broad spatial scales (Haywood et al. 2012).

Reasoning and Supporting Evidence

There is untapped potential of citizen science to

- Create pathways to accelerate local ecosystem understanding
- Augment participation in locally relevant data collection engaging communities in the processes connecting science to action
- Conduct long term ecological research to establish local baselines and event monitoring to inform early warning systems and adaptation planning
- Facilitate dissemination of locally-relevant information
- Broaden participation in science
- Expand data availability over geographic space (e.g., hard to reach areas) and with higher spatial and temporal resolution

Successful programs exist and could be replicated/expanded utilizing existing program experiences. The NOAA Citizen Science and Crowdsourcing site includes a number of programs and resources connected to coastal systems that can be reviewed and potentially linked to the CoPe hubs (<https://www.noaa.gov/office-education/citizen-science-crowdsourcing>).

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