

Title: Citizen Science and Ecosystem Services: Promoting Research, Translating Knowledge

Authors: Stephen Baines, Billy Spitzer, Lorrie Backer

Concept:

“Adopt a marsh” citizen science network can serve as a model for generating scientific knowledge and understanding the propagation of new knowledge within coastal communities

Need:

Scientific studies have demonstrated that coastal marshes provide an array of services to human communities, including pollutant removal, storm surge protection, carbon storage, and habitat for protected and economically important species. However, it’s difficult to disseminate the value of marshes to the public in ways that inform both personal perceptions and the management priorities held by stakeholders. In addition, we often don’t have good quantitative information about the value of important services or how and why they vary among wetlands. This limitation results in part from the amount of data collection that is possible within the constraints of traditional grants.

Opportunity:

Citizen science can be a framework that unites the production of traditional scientific knowledge and the propagation of that knowledge through affected communities. Citizen science involves communities in the generation of scientific knowledge and empowers citizen scientists to become sharers of that knowledge. The ability of citizen scientists to change the values ascribed to marshes can be assessed and understood through the lens of social science.

For example, we know that wetlands provide many benefits to communities, such as removal of nutrients/contaminants and protection from storms. However, communities adjacent to wetlands often do not fully recognize or appreciate their value, and do not account for these benefits in decision making, such as zoning and property management. This project will use “Adopt a Marsh” to engage citizens in data collection, making them science learners. We will assess how science learners become science sharers—distributing their new knowledge throughout their communities.

Specific Example:

Specific current practice: Nitrogen is a major environmental pollutant implicated in local anoxia, harmful algal blooms, and loss of seagrass habitat. Students from Brentwood high school, which serves an immigrant-rich and economically disadvantaged community on Long Island in New York State, act as citizen partners in high-level biogeochemical research. They help study the link between plant traits and nitrogen removal in wetlands by measuring vegetation characteristics such as root depth and major nitrogen species in sediments and water. Advanced students may build on these specific skills to measure key process rates, such as nitrification

and mineralization, to support more involved projects. The students aid biogeochemical research by increasing the grain and scope of observations and expanding the research effort.

Realizing the potential of citizen science: The baseline perceptions of value attributed to coastal marshes could be assessed using environmental economic methods. Through presentations to civic meetings, or via live-casting to local facebook groups, students could then act as **sharers** of the scientific knowledge they helped produce to inform perceptions of marshes in their communities. Their effectiveness in transferring knowledge could then be assessed as changes in both baseline comprehension of key concepts and perceptions of marsh value. Social network analysis could be used to understand the main pathways of information exchange and why perceptions did or did not change..

Expanding the scope of citizen science: This process can be duplicated across Long Island by having different school districts “adopt” local marshes. Expanding the observational footprint will make possible a region-wide assessment of nitrogen removal services. Students in the project could also be trained to conduct more complex scientific activities such as interpreting hyperspectral remote sensing data to help ground-proof attempts to map nitrogen removal at finer scales .. Finally, “adopt a marsh” programs will vary in social context, which may help clarify key factors influencing the effective transferal and use of information.

Generalization:

Building on the specific example, we can expand the program to address other ecosystem services or other hypotheses about what controls them. This approach is adaptable as it can be expanded to additional types of participants (e.g., summer camps, community organizations, informal science centers, nature centers, community organizations). It is also scalable and expandable as needed for local, regional and even national scientific questions about ecosystem services or information transfer to and use by communities. Embedding research on multiple scientific questions within a single broad network becomes possible.

Impacts:

Engaging citizen scientists in data collection produces benefits for the individuals and the scientific leaders of the project. For young citizen scientists from underrepresented communities, participation can contribute to their personal knowledge, provide STEM-related experiences, allow them to participate in local science competitions, educate them about civic involvement and even provide a publication record, all of which enhance college and job applications. The teachers and schools gain prestige and proof of concept for future funding from state and federal sources. For the scientific leaders, data otherwise unavailable will be available for analysis, interpretation, and publication, and the scope of possible questions can be expanded. The program provides a clear framework for collaboration between social scientists and environmental scientists in their efforts to understand the challenges to distributing newly acquired knowledge to the communities that may find it useful. By assessing changes in perceptions and pathways of social influence using social network analysis, we can assess

community-level impacts on perceived social/economic/ecological value of habitat. Finally, it also provides a mechanism to clarify research goals by assessing community attitudes so that they better fit community needs.