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CLEARING THE PATH

CITIZEN SCIENCE AND PUBLIC DECISION
MAKING IN THE UNITED STATES





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Citizen Science and Public Decision Making in the United States

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The Commons Lab of STIP seeks to mobilize public participation and innovation in science, technology and policy.

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ELI is responsible for the report's content. Information on specific citizen science projects was provided by the Commons Lab as well as the final review and edit. Although this report discusses legal requirements and their potential effects on uses of citizen science by public decision makers, it is not intended to serve as or substitute for legal advice.



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FOREWORD

Considering it's difficult for professional scientists to reach public decision makers, the Commons Lab and the Environmental Law Institute assumed disconnects might occur in citizen science projects as well. As a step towards identifying and remedying these disconnects, we designed a research paper that would illustrate the many legal and administrative procedures that dictate whether certain data and research conclusions can be used and relied upon to make decisions about air quality, land use, water quality and many more environmental factors. Knowledge of these procedural qualifiers can greatly enhance the quality assurance and control factors in citizen science project design and ideally reach intended decision makers more effectively.

Numerous informational resources are available to groups starting citizen science programs. Many of these resources emphasize the importance of planning, organization, volunteer recognition, quality assurance, and funding. This report supplements these resources by identifying some constraints that can affect the use of citizen science by public decision makers in environmental information dissemination, standard setting, planning, monitoring, regulation, and enforcement. It uses example projects to illuminate these interactions, and suggests appropriate design considerations for projects to clear the path toward greater governmental access to, and reliance on, citizen science.¹

On page 17 volunteers and practitioners can understand what types of barriers and opportunities exist in regards to incorporating their projects into public decision making. For example, a project that targets public awareness and natural resource management decisions in a local park or reserve might wish to familiarize themselves more closely with the Information Quality Act, Paperwork Reduction Act and Federal Advisory Committee Act which can be found in depth on page 39. Or a project that aims to impact regulatory decisions should learn more about record review and procedural timing in court decisions which can be found on page 46.

It's our hope that this report directs volunteers and project leaders to reach out to their public decision makers with an understanding of the legal and administrative restrictions the decision makers adhere to. With this shared understanding among citizen science practitioners and public decision makers, the incredible environmental information from these projects can reach audiences that need this information the most.



ELIZABETH TYSON

CoDirector, Commons Lab
Science and Technology Innovation
Program
Wilson Center

¹ Paragraph taken directly from report.

LIST OF ACRONYMS

APA	Administrative Procedure Act
ANSI	American National Standards Institute
CWA	Clean Water Act
DYFI	“Did You Feel It,” a project of the United States Geological Survey
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FACA	Federal Advisory Committee Act
FDA	Food and Drug Administration
FERC	Federal Energy Regulatory Commission
FRCP	Federal Rules of Civil Procedure
HHS	Department of Health and Human Services
IQA	Information Quality Act
IRB	Institutional Review Board
LEED	Leadership in Energy and Environmental Design
LIMPETS	Long-term Monitoring Program and Experiential Training for Students
MPA	Marine Protection Area

NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
OMB	Office of Management and Budget
OST	California Ocean Science Trust
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plans
SMCRA	Surface Mining Control and Reclamation Act
TMDL	Total Maximum Daily Load
USGS	United States Geological Survey

WORKING DEFINITIONS

Citizen science is a form of open collaboration where members of the public undertake scientific work, often in collaboration with professional scientists and scientific institutions, to meet real world goals. Related terms include public participation in scientific research, volunteer monitoring, crowd-sourced science, and participatory action research. **Citizen science practitioners** are individuals or organizations that execute citizen science projects or programs or support the research field as a whole.

Citizen science programs are organized efforts in citizen science that are intended to engage multiple volunteers to address a common subject or set of subjects. The term **citizen science project** is sometimes used to distinguish particular instances in which a citizen science program is being applied in a specific place or to a specific activity. For example, a citizen science program that engages volunteers in collecting data on aquatic invertebrates to measure stream health on a statewide basis may encompass citizen science projects carried out in individual watersheds staffed by a unique set of citizen volunteers. Citizen science projects may also be components of larger programs that also include non-citizen science activities. For example, the USA National Phenology Network (USA-NPN) includes a citizen science project, Nature's Notebook, in addition to non-citizen science activities.

Volunteers are individuals who participate in or otherwise contribute to citizen science programs and projects.

Public decisions are decisions made by governmental bodies (including agencies, elected and appointed officials, elected representative bodies, and courts and administrative tribunals) that are governed by rules, regulations, and constitutional requirements. Public decisions are made at the federal, state, and local levels.

Public policy domains are topical areas where governance or regulation of public resources (air, water, land, pollution) are required in order to maintain adequate benefits to all and reduction of risk.

OUTLINE OF THE REPORT

This report is intended to be a US centric guide book for volunteers and citizen science practitioners who wish to understand in detail how they can reach decision makers across multiple issues like water, land use and air quality. The structure of the report is as follows:

First we provide working definitions for the report and provide a brief background on citizen science (Page 9).

Second, we define the different policy domains that can be influenced by citizen science projects which are the following: Information Generation, Outreach, Indicators, Natural Resource Management, Regulatory Decisions, Standard Setting, and Enforcement (Page 13).

Third, we examine the legal and procedural constraints and opportunities that exist within these domains using a matrix and provide some examples of citizen science projects that have achieved success in some of the domains (Pages 16 and 23).

Fourth, we define laws that invite public participation into environmental decision making (Page 29).

Fifth, we consolidate this information into a work flow for designing citizen science projects for maximum impact (Page 37).

Sixth, in the Appendix, we unpack all the legal, administrative and procedural topics defined in the beginning and explain the nuances and details that either support or constrain public decision making (Page 39). The Appendix provides citations to, and discussions of, laws that affect public decision makers' ability to use and rely on citizen science outputs. This discussion examines issues like, timing and procedural limits on when each type of decision maker may receive and consider scientific information (Appendix, Page 48) and the evidentiary needs of enforcement entities (Appendix, Page 47).

For the audience approaching both subjects for the first time, the first, second and third sections of the report will provide valuable background information. For the audience who is already familiar with citizen science and policy then the sixth part of the report, which provides a careful analysis of laws, and legal procedures that might interfere with incorporating citizen science data and analysis into public decisions will provide valuable additional information.

CLEARING THE PATH CITIZEN SCIENCE AND PUBLIC DECISION MAKING IN THE UNITED STATES

WHAT TYPES OF CITIZEN SCIENCE ARE CONDUCTED?

Citizen science describes a range of activities that engage members of the public in applying scientific methods for various purposes. Goals of citizen science programs may include advancing knowledge, stimulating public learning, supplementing the work of professional scientists by using volunteers to collect and analyze data, and encouraging desired changes in public policies influenced by scientific information. Haklay (2014)¹ identifies six types of citizen science activities:

- passive sensing (allowing use of property, personal space, or resources for data gathering),
- volunteer computing (access to unused computing resources for large problems),
- volunteer thinking (pattern recognition, cognitive surplus),
- environmental and ecological observation (monitoring conditions, collecting data),
- participatory sensing (active data collection using protocols), and
- civic-community science (problem solving by organizing science-based activities to define and address issues of community interest).

Some of these engage volunteers in scientific activities that may inform public decision makers of a problem or condition and prompt them to take desired actions, such as launching investigations, undertaking rulemaking, or changing resource management practices. Citizen science programs may inform decision makers about conditions and provide guidance for new or adaptive responses. Some provide a basis for setting or revising government standards. Still others provide an evidentiary basis for direct decisions by courts, administrative judges, or other tribunals imposing liability and ordering corrective actions.



Tonawanda coke plant in New York.
Photo Credit: John Poole/NPR

Cleaning the Air in Tonawanda, New York

Residents of Tonawanda, New York noticed unusual odors in their neighborhood. After discovering little scientific information on possible sources, they organized and conducted citizen-collected air quality sampling using simple tools obtained from a retail hardware store. The newly formed organization Clean Air Coalition of Western New York brought this evidence to the New York Department of Environmental Conservation, which then funded its own air quality study. The state study detected unacceptable amounts of benzene, a pollutant and known carcinogen. Following this state study, New York indicted the Tonawanda Coke plant for violating environmental laws, including the Clean Air Act; the company was convicted, and required to fund and conduct community impact studies and to pay fines.

*These boxes are used throughout the report to demonstrate citizen science projects or programs that have achieved significant impact in public decision making

WHAT KINDS OF PUBLIC DECISIONS CAN BENEFIT FROM CITIZEN SCIENCE?

When the goal of citizen science is to improve public policy, there are different opportunities for citizen science practitioners and volunteers to interact with public decision makers. It is important to note that federal, state, tribal, and local governments operate in each of these policy domains. For a brief overview of the relationship between different decision makers and their respective policy domains, please see Figure 1. Other decision makers that can also impact these policy domains include regional agencies with specialized functions, such as operators of public infrastructure, including dams, water projects, or economic development

or conservation areas, as well as entities such as interstate compacts that exercise authority over certain interstate river basins or water resources. **Each of these entities has constraints on what information it may use in making different kinds of decisions.**

One of the key challenges for citizen science practitioners is determining how to interact effectively with government officials and other authorities to convey information and improve public decisions. These public decision makers are often subject to constraints imposed by laws, rules of practice, or procedures. **Understanding these constraints can help citizens design more effective citizen science projects and/or target their communication of results more effectively.**

Figure 1

<p>Federal Agencies</p> <ul style="list-style-type: none"> • Authority prescribed by laws enacted by Congress, and defined by federal regulations • Subject to federal constitutional limitations • <i>Example: U.S. Forest Service adopting forest plans</i>
<p>State Agencies</p> <ul style="list-style-type: none"> • Authority prescribed by state laws and state regulations • Subject to federal AND state constitutional limitations • <i>Example: Department of Environmental Quality permitting programs for stormwater management</i>
<p>Tribal Governments</p> <ul style="list-style-type: none"> • Authority includes attributes of sovereignty • Treaty rights/Federal trust obligations • Subject to constitutional/federal law limitations • <i>Example: Tribal government setting water quality standards</i>
<p>Local Governments</p> <ul style="list-style-type: none"> • Authority entirely dependent on state laws • Defined by local ordinances and regulations • Subject to federal AND state constitutional limitations • <i>Example: County or city zoning decisions</i>
<p>Regional Agencies</p> <ul style="list-style-type: none"> • Authority defined by federal statute or interstate compact • Subject to federal constitutional limitations • <i>Example: Delaware River Basin Commission rules on water withdrawal</i>

Courts and administrative tribunals also affect the interpretation and application of laws, rules, and constitutional provisions. They conduct trials in which they receive various kinds of evidence, or they may review decisions of administrative agencies based on the records compiled by those agencies.

Rules and laws constrain or shape the ability of public decision makers to rely on citizen science outputs. In general, the more directive and prescriptive a government action may be, the more limits apply to decision makers' use of citizen-generated data.

Public decision makers typically have the greatest degree of freedom to consider and incorporate the products of citizen science when they are acting in a broad policy-setting domain – such as elected legislators enacting a new law, local governments adopting a new comprehensive land use plan, agencies launching an educational initiative. For example, a local government adopting comprehensive land use plans to protect open space and wildlife corridors may rely on citizen science information that

identifies which lands in the jurisdiction are most important for biological diversity.

Public decision makers typically are subject to more constraints when they act in ways that directly affect the rights and obligations of persons and property owners, such as when they set a regulatory standard authorized by legislation, rule on an application, or initiate an enforcement action. For example, a state regulatory agency may designate a waterway as impaired based on data generated by citizen science. But because such a designation will require more strict pollution limits for future discharges to the waterway, its own state regulations usually require high standards of quality assurance and reproducibility for the citizen science data in order for the impairment designation to be lawful and to withstand any anticipated court challenges from opponents. Likewise, although citizen science may help a governmental agency decide to launch an investigation leading to an enforcement case, the agency usually then conducts its own independent scientific data collection in order to ensure that evidentiary standards required in court will be met.

PUBLIC POLICY DOMAINS

Below, a basic typology of six public policy domains is defined based on a legal review and consideration of different citizen science projects. An example program or project follows each domain.

INFORMATION GENERATION

Citizen science can add to the efforts of government science agencies to advance knowledge. Such actions chiefly seek to contribute to the sum of available scientific knowledge (e.g., archeology of a region, baseline water quality).



iNaturalist is a social media program in which volunteers upload observations of flora and fauna. Members on the website verify the identifications, and after

three verifications, the observation is designated 'research grade' and may be used by scientists and natural resource managers.

OUTREACH: STIMULATION OF PUBLIC AWARENESS, AND EDUCATIONAL CAMPAIGNS

Action and outputs can create interest in volunteer opportunities for citizen conservation, or help with recognition of hazards and identification of conditions by members of the public. Outputs inform the public and generate broader interest in issues where action can be taken (e.g., fire safety, habitat conservation, environmentally sensitive lighting).

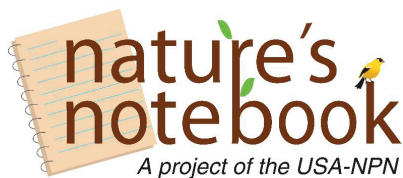


Landslide in California.
Photo credit: U.S. Geological Survey.

“Did You See It?”-Report a Landslide is a crowd sourcing program launched by the U.S. Geological Survey’s Landslide Hazards Program to collect data about occurrence of landslides. It is intended to help scientists better understand the causes of landslides, possibly leading to improved disaster mitigation strategies, and it can stimulate interest in and inform residents about possible landslide risks in their own communities.

INDICATORS: PLANS, GOALS, AND INDICATORS FOR USE BY GOVERNMENT OFFICIALS IN PLANNING FOR FUTURE ACTIVITIES

Programs can generate data that support planning and goal setting for future decision making (e.g., municipal comprehensive land use plans, design of adaptive management indicators). Note: programs in this category include information generation and data accumulation activities, but enjoy a greater connection with decision makers than projects included in information generation category.



Nature’s Notebook is a citizen science phenology observation network run by the USA National Phenology Network. Volunteer observations are used by science agencies and local natural resource

managers to anticipate and address management challenges in a changing environment.

NATURAL RESOURCE MANAGEMENT: MANAGEMENT PRACTICES FOR RESOURCES UNDER THE DIRECT CONTROL OR INFLUENCE OF GOVERNMENT AGENCIES

Focused projects can help government agencies specify how public natural resources under their control are managed (e.g., forest management and harvest plans, marine protected areas plans, water resources plans).



California’s Ocean Science Trust coordinates citizen science activities gathering data to support scientific management of the state’s designated Marine Protected Areas.

REGULATORY DECISIONS: GOVERNMENT DECISIONS GRANTING OR DENYING APPLICATIONS FOR PROPOSED ACTIVITIES

Public decision makers use data to make decisions about land development permits, licenses, leases, and environmental permits. Regulatory decisions that affect

private parties might, for example, include granting or denying air emissions or water quality permits, or may affect zoning and rezoning, site plan approvals, and mitigation requirements.



Greater Sage-Grouse. Photo Credit: Wikipedia Commons

Montana Audubon's **Greater Sage-Grouse Adopt-A-Lek project** (started by the National Wildlife Federation) conducts field surveys of breeding sage grouse. Data from the project inform federal management decisions, including decisions relating to regulations and permit conditions.

REGULATORY STANDARD SETTING

Citizen science can support adoption of new mandatory and voluntary standards, development of best practices, revision of prior standards, and changes in methodologies for measuring compliance status (e.g., water quality limits, threshold reporting levels, cleanup triggers, best management practices, "safe harbor" practices that obviate regulatory schemes, energy efficiency public-private standards recognized for public purposes such as LEED, or Forest Stewardship).

Want to learn whether your soil is healthy for vegetable gardening?

gardenroots
The Dewey-Humboldt, Arizona Garden Project

Gardenroots was designed in response to your research interests.

Source: *Gardenroots manual for community members.*

Gardenroots, a citizen science project led by Monica Ramirez-Andreotta at the University of Arizona, initiated with the community in Dewey-Humboldt Arizona which is located next to an EPA Superfund site. The goal was to determine if it was safe for the community to grow vegetables due to the high levels of arsenic in the soil from the Superfund site. Using data from the community samples in their backyard researchers were able to characterize potential risk and contribute to exposure risk understanding and standards set forth by the EPA.

ENFORCEMENT

These actions include the launching of inspections, investigations, prosecution of administrative, civil, or criminal violations, and imposition of new permit conditions. Scientific information can help governmental entities impose liability through enforcement of regulatory requirements in courts or administrative bodies through administrative orders, injunctions, criminal and civil penalties, or citizen suits.



The **Louisiana Bucket Brigade** provides training and resources to environmental

justice communities seeking to use scientific techniques to identify and evaluate the local impacts of industrial air pollution using an EPA-approved device for sampling and tracking air quality, which has triggered enforcement and other governmental responses.

WHAT LEGAL ISSUES MAY ARISE IN APPLYING CITIZEN SCIENCE TO PUBLIC DECISIONS?

Differing legal standards and limits apply to use of citizen science in each of the **seven public policy domains** described above. And the relevant limitations also vary substantially depending upon whether the public decision maker is a state, federal, or local entity, because different laws and regulations apply. **The Appendix provides citations to, and discussions of, laws that affect public decision makers' ability to use and rely on citizen science outputs.** For the most part, the designer of a citizen science program should consider the following issues:

Data quality and peer review requirements (Appendix, Page 40)

Limitations on using survey instruments to collect information from people (Appendix, Page 44)

Timing and procedural limits on when each type of decision maker may receive and consider scientific information (Appendix, Page 46)

Privacy, identification of participants (through discovery, disclosure) (Appendix, Page 51)

Limitations on human subjects research (Appendix, Page 52)

Rules for bringing and maintaining a case in court or administrative tribunal (Appendix, Page 48)

The evidentiary needs of enforcement entities (Appendix, Page 47)

Limitations on who may act as a formal provider of "advice" to a governmental body (Appendix, Page 50)

The following matrix illustrates how citizen science projects encounter these issues across the identified public policy domains. The first column (policy domains) shows the possible uses of citizen science to affect public policy. The second and third columns identify possible public decision makers and the decisions they may make within these policy domains.

The last two columns show the constraints and opportunities created by laws or rules that will affect the capacity of particular decision makers within these domains to use and rely on citizen science. **The constraints and opportunities referenced in the last two columns are explained in more detail in the Appendix.**

Matrix: The constraints and opportunities for citizen science in public policy decisions

Policy Domains	Decision Makers (local, state & federal)	Type of Decisions	Constraints	Opportunities
Information Generation	<ul style="list-style-type: none"> Science agency Resource management agency 	<ul style="list-style-type: none"> Constructing/Improving databases Future research agenda 	<ul style="list-style-type: none"> Paperwork Reduction Act (PRA) Institutional Review Board (IRB) 	<ul style="list-style-type: none"> Very broad; some limits if federally-sponsored
Outreach	<ul style="list-style-type: none"> Legislators Agencies General public 	<ul style="list-style-type: none"> Policy changes Voluntary behavior changes Support public dissemination of data 	<ul style="list-style-type: none"> Information Quality Act (IOA) -IRB -PRA 	<ul style="list-style-type: none"> IOA does not apply if not federal dissemination
Indicators	<ul style="list-style-type: none"> Agencies Legislators Local governments Tribal governments 	<ul style="list-style-type: none"> Create land use plans, ocean, wildlife management plans Implement adaptive management plans 	<ul style="list-style-type: none"> Federal Advisory Committee Act (FACA) IRB PRA Timing-procedures 	<ul style="list-style-type: none"> Legislative plans (incl. land use plans) can rely on any data Improving indicators
Natural Resource Management	<ul style="list-style-type: none"> Resource management agency Tribal governments 	<ul style="list-style-type: none"> Resource management Decisions on access Environmental Mitigation 	<ul style="list-style-type: none"> FACA IRB PRA Timing-procedures Record review 	<ul style="list-style-type: none"> Rules specify data standards and sources Review in court/tribunal
Regulatory Decisions	<ul style="list-style-type: none"> Regulatory agency 	<ul style="list-style-type: none"> Permit/License 	<ul style="list-style-type: none"> FACA IRB Timing-procedures Record review Discovery 	<ul style="list-style-type: none"> Rules specify data standards/sources Review in court/tribunal
Regulatory Standard Setting	<ul style="list-style-type: none"> Legislators Regulatory agency Regulatory board Public/Private standards entity 	<ul style="list-style-type: none"> Mandatory standards Reporting thresholds Voluntary standards recognized by government 	<ul style="list-style-type: none"> FACA IRB PRA Timing-procedures Record review 	<ul style="list-style-type: none"> Rules specify data standards/sources Cooperative standard-setting (Best Management Practices, American National Standards Institute, incentive programs)
Enforcement	<ul style="list-style-type: none"> Regulatory agency Prosecutors/Investigators Court or administrative tribunal 	<ul style="list-style-type: none"> Inspection/investigation Replication of citizen results Administrative order Civil/Criminal prosecution Citizen suit 	<ul style="list-style-type: none"> Timing/procedures Record review Daubert & Rule 11: evidentiary rules for courts Discovery 	<ul style="list-style-type: none"> Information can create basis for government action Citizen suits available under most environmental laws

WHERE CAN CITIZEN SCIENCE HAVE THE MOST IMPACT?

Identifying the intended user of information is helpful to those designing a citizen science program with the goal of improving public decisions. **The organizers should, in each instance, seek to determine which, if any, public agencies or decision makers have authority to address the subject matter and geography of concern, and what capacity they have to use and understand scientific information that may be generated by the project.**

The following table shows a selection of subject areas that may be of interest to

citizen science programs. The first column identifies the subject matter of concern, with a further subdivision where the scale or identity of the decision maker is likely to be different. The geographical scale column refers primarily to the geographical range or physical area covered by the decision, where citizen science information is likely to be of management interest. It also notes some institutional geographical limitations (e.g., lands or resources that are government-owned, or distinctions based on different local governments or states). Finally, the last column identifies the relevant level of government and the kind of public decision maker mostly likely to be engaged in decisions.

Subject	Geographical Scale	Public Decision Makers
Land Use -Privately Owned -Public Domain	<ul style="list-style-type: none"> Private lands regulated at parcel/town/county scale Public lands at ecosystem scale, or institutional management system scale 	<ul style="list-style-type: none"> Federal/State land management agencies Local Governments Tribes
Biological/Ecological -Ecological Health/Function -Wildlife and Habitat -Ecosystem Services	<ul style="list-style-type: none"> Scientifically defined, or scope of geog. jurisdiction Defined by habitat range of species, but limited by jurisdiction Area of offset/economic analysis 	<ul style="list-style-type: none"> Federal/State land management & wildlife agencies Regulatory agencies/land managers Local governments Tribal governments
Air Quality -Emissions and Ambient -Indoor Air	<ul style="list-style-type: none"> States and air regions Building level (or city-wide) 	<ul style="list-style-type: none"> Federal/state/tribal/metropolitan air regulators City/state indoor air reg/bldg
Water -Quality -Quantity -Watershed Function	<ul style="list-style-type: none"> Waterbody, reach, common discharger categories Waterbody or statewide scheme Landscape/watershed scale 	<ul style="list-style-type: none"> Quantity regulation by state laws or by court decisions State/tribal water pollution agencies; nat. res. agencies; interstate compacts; EPA and cities (stormwater)
Oceans -Management of Uses -Protected Areas	<ul style="list-style-type: none"> Coastal, nearshore (3 mile), offshore, deep water 	<ul style="list-style-type: none"> Federal gov't, international agreements, and state regulatory agencies (coastal zone and 3 mi)
Climate	<ul style="list-style-type: none"> Global, Local 	<ul style="list-style-type: none"> Fed gov't, intn'l bodies, states
Hazardous Releases/Exposures	<ul style="list-style-type: none"> Local, Regional, Global 	<ul style="list-style-type: none"> EPA, state/tribal regulators, state health, local health depts.
Industrial Activities	<ul style="list-style-type: none"> Regional or industry sector 	<ul style="list-style-type: none"> Federal, state, voluntary BMPs

In the United States, authority over any land use or environmental issue is typically not concentrated in a single level of government nor handled by a single agency within any level of government. Multiple agencies may be able to set standards, grant or deny permits, engage in land and water management practices, or provide funding and technical assistance to industry and members of the public.

If a citizen science project has a geographically-significant target of inquiry, it will be important at the outset to determine which federal, state, regional, and local government entities may have jurisdiction over the area (or the subject activities of interest). This will enable the project designers to determine in advance what level of data quality may be needed, what the scientific capacity of the public decision maker(s) may be, and what timing or process issues will shape consideration of the science outputs by the decision maker.

Some geographic areas of interest to a citizen science project (such as a stream reach or small watershed) may be subject to the decisions of dozens of local governments, state agencies, water authorities, and other entities. Thus, citizen science project designers will need to be very strategic about the format and presentation of potentially relevant data so that it can be considered by the potential user and so that it addresses the issues within their purview. For example, energy use data may be of great community interest, but not necessarily relevant to a decision to grant or deny a building permit or water hookup.

Conversely, where a public decision maker does have authority or discretion to take such issue into account, it will be important to ensure that the data are presented in the context of that discretionary decision.



Source: Pixabay

Federal. There are, for example, more than twenty federal environmental laws, each with numerous sub-programs that have their own rules and standards. Federal environmental laws are administered by, among others, the Environmental Protection Agency (EPA), National Oceanic and Atmospheric Administration (NOAA), numerous Department of Interior agencies, Department of Agriculture agencies, the Department of Energy, Federal Energy Regulatory Commission (FERC), Food and Drug Administration (FDA), Department of Health and Human Services (HHS), various commissions and boards, and other entities. Many environmental laws and regulations specifically build in opportunities for public participation, and for consideration by the agencies of “reasonably available” data. The National Environmental Policy Act (NEPA) also provides for assessment of environmental impacts from major federal

actions significantly affecting the human environment; and the analyses will include health effects, and community-based issues (including environmental justice).

Most federal agencies have substantial technical capacity, but are also subject to a great many rules and laws that are intended to define their processes and activities tightly.



Source: Wikipedia Commons.

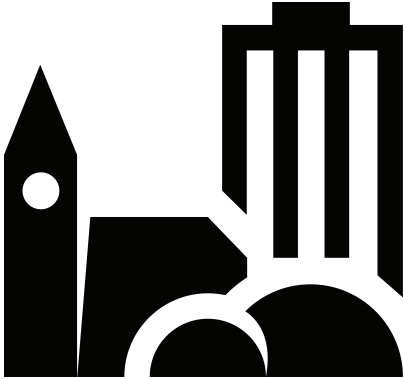
State. States have corresponding environmental laws and regulations, usually carried out by state agencies, some of which have substantial technical capacity. Like federal agencies, these are subject to rules and laws intended to define and constrain their processes and activities. In addition to state laws and regulations adopted to implement delegated federal programs under the Clean Air Act, Clean Water Act, Safe Drinking Water Act, and others, states have enacted statutes and developed programs that cover topics that are not addressed in federal laws. These

include most forms of oil and gas regulation, forestry and agriculture laws, building codes, energy regulation, and management of wildlife that is not federally listed as threatened or endangered. In addition to state legislatures and state executive branch agencies, state decision makers include independent bodies such as commissions, boards, and authorities (e.g., public utility regulators, water resource authorities, state health boards). Each of these has its own rules.



U.S. Tribal Seal for the Ely Colony of the Shoshone Tribe in Nevada's high desert. Photo Credit: Nathan Soliz/Flickr.

Tribal. Tribes have jurisdiction over reservation lands and certain tribal trust lands. Tribes may, like states, exercise power in carrying out some delegated federal environmental programs. Tribes also exercise treaty rights and manage their natural resources, at times subject to federal oversight. Some tribal governments have substantial technical capacity, while others rely more on federal agency expertise.



Source: Wikimedia Commons

Local. State laws define and circumscribe the powers of their local governments. Local governments have adopted extensive ordinances and regulations on land use, environment, and public health issues. Local governments have the most immedi-

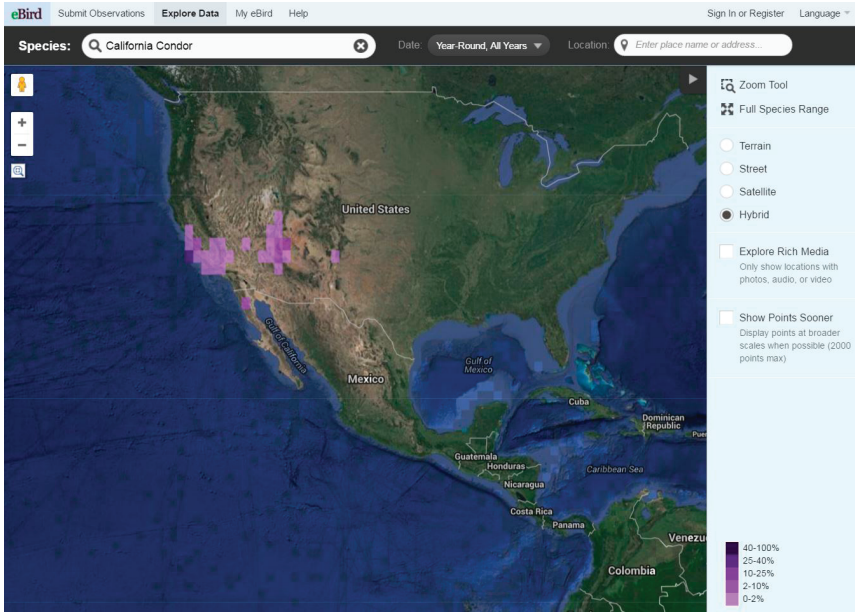
ate impact on issues dealing with development of land, transportation, location of infrastructure, light and noise standards, education, and public safety. Some local governments have a great deal of technical capacity, while others may have no professional staff at all (or very limited capacity). Local governments, too, may have very restrictive rules on when information may be submitted for and considered by decision makers in revising a comprehensive plan or zoning map.

ADDITIONAL EXAMPLES OF CITIZEN SCIENCE IN ACTION

The following examples show how citizen science activities can relate to the public policy domains we have identified. They illustrate differing kinds of interactions

based on project design and rules, and in some cases show formal relationships between decision makers and the citizen science projects.

Ecological Monitoring



The screenshot shows the eBird interface for the California Condor. The search bar contains 'California Condor'. The map displays the species' range across the United States and Mexico, with a color-coded legend indicating observation density from 0-2% to 40-100%. The legend categories are: 40-100% (dark purple), 25-40% (medium purple), 10-25% (light purple), 2-10% (very light purple), and 0-2% (white). The map also shows the Gulf of California, Gulf of Mexico, and Caribbean Sea. The interface includes navigation controls on the left and a settings panel on the right with options like 'Zoom Tool', 'Full Species Range', 'Terrain', 'Street', 'Satellite', 'Hybrid', 'Explore Rich Media', and 'Show Points Sooner'.

Screenshot of the eBird platform displaying volunteer observations of the California Condor.

Many citizen science programs enlist volunteers in collecting and recording observations, cooperatively creating and maintaining a database using standard protocols. eBird is an ongoing, funded citizen science program associated with the Cornell

Lab of Ornithology that generates and compiles millions of bird observations each month from volunteer data collectors. eBird data are used in the semiannual State of the Birds report, which is published by academic partners, non-profits, and government agencies. The eBird web site notes that data are archived daily and are accessible to anyone via the eBird web site and through other applications developed by “the global biodiversity information community.” Notably, while some other citizen science programs are conducted to drive management decisions (e.g., by illustrating a need to expand protected areas or to conserve declining species), eBird data are often used to evaluate the effectiveness of conservation policies by serving as a ground truth indicator of where birds are.

As with other ecological monitoring data, these data can be used by public decision makers seeking to examine trends, determine areas where conservation measures may be needed, and target focused professional research projects.

The policy domains most often affected by eBird are (1) information generation and data collection, and (2) public awareness. While the data may be used for (3) planning, and (4) management of resources, the effort is not designed specifically for these latter purposes.

A notable use of eBird data as a secondary use for (4) management of resources, is a collaboration between farmers in the state of California and The Nature Conservancy. Scientists at TNC used eBird data to determine pacific flyway stops in the California central valley and targeted private landowners within this flyover pathway to compensate them for flooding their fields in order provide temporary “pop-up” habitat for these birds.

eBird data may also be used by governmental agencies to inform their (5) regulatory decisions, (6) standard setting, and (7) enforcement activities relating to protection of migratory birds under the Migratory Bird Treaty Act. However, these are not primary goals of the program. Public agencies intending to make regulatory or enforcement decisions will always gather their own data subject to their own strict evidentiary requirements in order to ensure a sufficient legal foundation for regulatory and enforcement activities.

Pollution/Public Health



Volunteers using a “bucket” for sampling air near an industrial plant.
Photo Credit: Global Community Monitor

Some community science efforts are aimed at collecting data to determine whether problematic conditions exist that should warrant a governmental response, and to provoke accountability. For example, started in Richmond, California, the **Global Community Monitor** and its affiliate the **Louisiana Bucket Brigade**, provide training and resources to communities seeking to use scientific techniques to evaluate the impacts of fossil fuel industry pollution on local and community health. They focus on communities which border industrial zones, using an EPA approved “bucket” for sampling air quality. Data collection and advocacy by these groups have led to the relocation of communities (paid for by industry), enactment of local and state laws reflecting tighter regulatory limits, closure of industrial facilities, and utilization of more stringent monitoring equipment by industry. Data have led to scrutiny and to federal court cases by governmental entities against violators of the Clean Air Act. These projects have used data (collected with simple technical tools) as a way to drive governmental responses. The primary policy domains affected are (2) public awareness, (5) regulatory decisions, (6) regulatory standard setting and revision, and (7) enforcement actions. These projects are not primarily seeking to add to the sum of human knowledge or to provide a repository of accessible information for general use, but rather to provoke governmental responses to deal with environmental conditions – conditions that were already subject to governmental regulation. In each case, the governmental response ultimately taken was not based directly on the citizen science data, but upon new governmentally-generated data (and review of company-generated data required by government rules and permit conditions). Citizen science acted as a driver of accountability.

Ocean Resource Management



Citizen scientists collect species to record using the platform iNaturalist from Pillar Point in Northern California during a BioBlitz run by the California Academy of Sciences and Nerds for Nature. Photo Credit: Nerds for Nature.

Understanding the conditions of land, water, and biodiversity over time can present a human resources and management challenge to government agencies charged with overseeing these areas. A number of groups in California, involving over 30 different projects including LiMPETS and MPA watch, are doing citizen science with the aim of

improving public management of the ocean environment. An organization that serves a bridging function among these projects and participants, the California Ocean Science Trust (OST), has issued a white paper describing best practices for using citizen science to inform management of ocean and coastal resources in California. The OST white paper lists strategies for ensuring and demonstrating credibility and rigor, including focus on the initiation of the project and volunteer instruction (prior expertise, training requirements, scientific advisors to support the project); data collection practices (ranking systems to ensure increasingly skilled volunteers do the more complex tasks, in-person oversight by professionals, retraining, and technology aids to standardize practices and/or reduce errors); and practices after data collection (validated observations, cross-comparisons with data generated by professionals, publication in peer-review journals, management use of data for decision making, and quality assurance protocol applied to verify methods).¹

Many of the groups are aimed at facilitating implementation of California's Marine Life Protection Act, and specifically supporting scientific management of the Marine Protected Areas (MPAs) designated by the state. For example, California's Central Coast region comprises 29 MPAs. Partnerships between responsible state agencies and citizen science groups have generated monitoring data on these areas. Citizen science projects inform different decision makers, ranging from the region's city and county governments, to the California Department of Fish and Wildlife and the National Oceanic and Atmospheric Administration (NOAA). The California Department of Fish and Wildlife has specifically reviewed and endorsed the data gathering performance of the Ocean Science Trust's MPA Monitoring Enterprise in the central coast region, and has committed to continued collaboration with this citizen science network for monitoring and displaying monitoring information to assist fisheries management.² The public policy domains most addressed by these coastal and ocean monitoring efforts are (1) information and data generation, (2) raising public awareness, (3) planning for activities and management, and (4) affecting the management of public resources. The data partnerships are specifically intended to inform and assist in management of MPAs and to support governmental management decisions. The projects also inform some (5) regulatory decisions, primarily related to management of public resources and fisheries in MPAs, but not entirely related to grants and denials of permits and licenses. While the projects also provide information useful in (6) standard setting, and have the potential to inform targeting of (7) enforcement activities, they do not serve as the primary basis for these activities.

¹ Ocean Science Trust, Citizen Science & Ocean Resource Management in California: Guidance for forming productive partnerships (2014), available at http://oceanspaces.org/sites/default/files/ccsi_guidance.pdf.

² Charles Bonham to Sonke Mastrup, Monitoring Results and Management Review for Central Coast Marine Protected Areas (Oct. 1, 2013).

LAWS THAT INVITE CITIZEN SCIENCE INTO PUBLIC DECISIONS

Where a citizen science project is aimed at, or known to be relevant to, a specific set of government activities, it is useful for the project organizers and volunteers to be aware of any specific provisions that define how such scientific information may be used. This section identifies a few environmental programs that include specific practices and standards that exemplify these kinds of provisions, and what they say about the relevant standards for using such information in making a decision. This section looks at:

- an EPA program that requires states to solicit and use scientific information generated by the public and nongovernmental organizations;
 - a requirement under the Endangered Species Act for federal agencies to launch species listing evaluations based on credible external scientific evidence; and
 - requirements under some federal laws for the commencement of program revocations and/or government inspections triggered by information submitted by the public.
- the potential to prompt or motivate government investigations

The following examples are offered for illustrative purposes. Many other programs and regulatory provisions solicit and expect consideration of citizen science-type information. Citizen science program designers and organizers should examine legal requirements covering government decisions that their programs seek to influence, to determine whether they contain specific provisions and opportunities.

CLEAN WATER ACT



The federal Clean Water Act includes provisions that direct each state to determine the quality of its waters, to identify water bodies and segments that do not meet state-defined water quality standards, and to undertake regulatory and other activities

to bring those waters into compliance.¹ Waters that a state identifies as impaired by a pollutant must be placed on the state's CWA 303(d) list of impaired waters, which in turn requires the state to develop a total maximum daily load (TMDL) for the listed waters. A TMDL identifies the maximum amount of the pollutant that can come from point sources (the “waste load”) and from nonpoint sources (the “load”), along with a margin of safety, which is consistent with restoring water quality.

Under the EPA regulations, states must engage in a “continuing planning process” in which they must identify their impaired waters, set priorities, and determine the limits to be met.² EPA regulations expressly require the states to solicit public participation and comment on state impaired waters listing proposals, as well as on the TMDLs they propose to set for any impaired waters.

EPA regulations specifically provide for citizen-submitted information throughout the process. The regulations require each state developing and updating its list of impaired waters to “assemble and evaluate *all existing and readily available water quality-related data and information.*” These include information and data about waters “for which water quality problems have been reported by local, state, or federal agencies; members of the public; or academic institutions.” EPA regulations state that “These organizations and groups should be actively solicited for research they may be conducting or reporting.”³

States must further document their development of the lists. EPA regulations require states to provide a written “rationale for any decision to *not use* any existing and readily available data and information” (which may include flaws in analysis, more recent or

accurate data, etc.).⁴ Thus, if citizen science projects have developed relevant data and information, the state must use it or explain why it is not doing so.

States report to EPA on their impaired waters every two years as required under sections 303(d), 305(b), and 314 of the Clean Water Act. The combined reporting process is governed by EPA's “Integrated Reporting Guidance.” This Guidance document (updated and/or supplemented every two years) further explains how externally generated data and information (such as citizen science) should be used to inform the state's activities.

EPA's 2006 Integrated Reporting Guidance, which is still substantially in effect for current reporting cycles, provides the most detail on how states must develop their “assessment methodology” for identifying and prioritizing their impaired waters. This includes what sort of data should be obtained from outside sources and what data quality standards will be applied by the state:

The [assessment] methodology should: 1) explain how the state identifies, considers (evaluates) all existing and readily available data and information; 2) articulate the basics of the quality assurance and quality control (QA/QC) criteria used to evaluate data submitted by outside entities to determine what weight, if any, should be assigned to said data and information; and 3) explain the analytical approaches, including statistical analyses, used to infer true segment conditions from all valid existing and readily available information. The decision processes the states describe

in the methodology should provide all stakeholders with the opportunity to understand exactly how assessment decisions are made.⁵

The Guidance also directs states, “to the extent practicable,” to solicit data and information “from a wide variety of organizations and individuals” such as “conservation/ environmental organizations” and “citizen monitoring groups,” among others, and advises: “if the state has specifications for data and information, these specifications should be included in any requests for information.”⁶ Furthermore: “Data quality criteria should be published along with any solicitations of data and information.”⁷

The Guidance recommends that states work with data-generating organizations, and suggests that states “may wish to encourage such organizations to develop QAPPs [Quality Assurance Project Plans] and submit them to the state for review and comment, and even perhaps formal approval by the state.”⁸ It notes that **states may choose to create presumptions in favor of data generated in accordance with such plans, but warns that “lack of a State-approved QAPP should not...be used as the basis for summarily rejecting data and information submitted by such organizations, or [for] assuming it is of low quality,”** as the actual QA/QC protocols applied to the data really should determine its utility.⁹

Each state’s adopted assessment plan will substantially affect the terms under which it will consider and use the products of citizen science in the TMDL process. In practice, then, the ability of citizen science projects to affect state decisions will vary from state to state based on the contents

of these plans and the state’s regulations and protocols on data quality, verification, timeliness, etc.

For example, Florida regulations establish a sequence whereby the state first develops a planning list of waters for assessment, and then a “verified” list for TMDL development following assessment. The state regulations apply different data sufficiency and quality requirements to each of the phases. Florida can require that older data be disregarded under specific circumstances, and may require minimum numbers of samples (e.g., for aquatic life-based water quality assessments, a minimum of ten samples for a ten-year period, with spatial and temporal distribution requirements).¹⁰ These limitations mean that citizen science programs aimed at satisfying listing assessment or verified listing requirements must meet the data standards for each of these phases (either alone or in combination with other data).

Virginia’s Department of Environmental Quality has established differing levels of required data quality depending upon the intended use of the citizen-science monitoring data. It requires the highest level of quality assurance and control for regulatory listing decisions for impaired waters and for TMDL development, a middle level of assurance for monitoring of performance under existing TMDLs and for follow-up monitoring, and the lowest level of data quality assurance for public education, local land use decisions, and notification to DEQ of possible pollution events.¹¹ Virginia DEQ identifies three levels of data protocols, depending on the intended use of citizen-science data:

Virginia Department of Environmental Quality Levels of Data Protocols

Level	Appropriate Data Uses	QA/QC Protocols
III	<ul style="list-style-type: none"> List or delist waters on the 303(d) Impaired waters list Assess waters for 305(b) Report Use with DEQ data for TMDL development All uses listed in Levels I and II 	<ul style="list-style-type: none"> DEQ-approved Quality Assurance Project Plan (QAPP) and field or lab Standard Operating Procedures (SOP). Field and/or laboratory audit required. Group provides calibration and quality control associated information to DEQ when submitting data. This information must meet the specific criteria stated in the QAPP.
II	<ul style="list-style-type: none"> Identify waters for DEQ follow up monitoring Track performance of TMDL implementation All uses listed in Level I 	<ul style="list-style-type: none"> DEQ-approved Quality Assurance Project Plan and approved field or lab SOPs. At this level, there may be deviation from an approved method if it can be demonstrated that the method collects data of similar quality to an approved method.
I	<ul style="list-style-type: none"> Education Baseline Conditions Notification of Possible Pollution Events Local Land Use Decisions Special Studies 	<ul style="list-style-type: none"> No Quality Assurance Project Plan or SOP required by DEQ. Uniform methodology recommended. QAPP, SOPs and/or lab methods do not meet DEQ quality assurance/ quality control requirements There is no Virginia Water Quality Standard for the parameter (e.g., nitrates, suspended solids, orthophosphate, turbidity).

In its most recent Integrated Guidance for 2016, EPA has advised states to seek public input on establishing their “long-term priorities” for water quality through FY 2022. This means that citizen science may be able to influence priority setting activities, as well as the specific regulatory

activities, which typically require a higher level of quality assurance. EPA says:

States are expected to engage their general public and stakeholders in the establishment of CWA 303(d)-related priorities [for restoration and protection activities].

EPA also expects States to articulate how input from the public was considered and addressed as part of their rationale supporting the prioritization.¹²

Thus, citizen science projects may have an opportunity to influence (through these public engagement commitments) the approach a state will use in developing its long-term priorities for addressing impaired waters.

EPA has encouraged volunteer water quality monitoring across many of its programs, but has recognized that the utility of such monitoring will depend on the credibility of the data. In 1996, EPA issued *The Volunteer Monitor's Guide to Quality Assurance Project Plans*,¹³ noting both that “potential users are often skeptical about volunteer data,” and that EPA-funded monitoring projects actually require “an EPA-approved QAPP before [they] can begin collecting samples.”¹⁴ States’ willingness to use and integrate citizen science and monitoring information into the TMDL process will depend substantially on their recognition of quality assurance and related protocols. **Typically, these programs will best succeed if the state or other governmental actors endorse and support the project in advance, including by verifying project methodologies and the training of citizen science participants** (e.g., the Delaware Nature Society’s Technical Stream Monitoring, recognized by the Delaware Department of Natural Resources and Environmental

Control; Texas Water Resources Institute Carter’s Creek Stream Team at Texas A&M, recognized by City of College Station and City of Bryan;).

ENDANGERED SPECIES ACT



Many decisions under the federal Endangered Species Act (ESA) are driven by scientific information submitted to the federal agencies by outside researchers and nongovernmental organizations. The law and regulations recognize that data suggesting the need to list a species as threatened or endangered may be, at least initially, more available outside the government than within it because of the diversity of interest and wider knowledge and geographic perspective of persons with potential interests in various species. The law provides for action to be taken by the federal agencies on the basis of rigorous science, but for their attention to be directed to particular species by the submission of information sufficient to trigger a response. Specifically, section 4 of the ESA provides for petitions by any person to list a species as threatened or endangered. The regulations require substantive information for a valid petition. They give the U.S. Fish & Wildlife Service

(or NOAA for some species) ninety days to determine whether the petition presents “substantial scientific or commercial information” indicating that the petitioned-for action “may be warranted.”¹⁵ This begins the listing process. Thereafter, the listing determinations are to be made “solely on the basis of the best scientific and commercial data available.”¹⁶ In recent times the vast majority of listing petitions have been supported by citizen science and academic science submitted by citizen organizations. The “best scientific and commercial information” standard is one that informs the organizations preparing the support for these petitions.

STATE ENVIRONMENTAL PROGRAM REVIEW AND INSPECTION TRIGGERS

Some federal environmental laws operate with the states implementing the regulatory program once the federal government has approved the adequacy of the state’s program, subject to federal oversight and back-stop enforcement. In most EPA programs, for example, the law and regulations also provide for a citizen petition process for withdrawal of state program approvals.¹⁷ Citizen science data may be useful in providing evidence that would lead to EPA initiating the process that can lead to revocation of a program. Some federal laws also provide for citizen-triggered inspec-

tions. For example, the federal law that regulates surface and underground coal mining, the Surface Mining Control and Reclamation Act (SMCRA), provides for federal inspections when there is reason to believe there is an imminent danger, or after notice to the state and state failure to act that there is a possible violation of law. The trigger for inspection is information provided by any person,¹⁸ and any person may request an inspection by furnishing a “signed written statement” giving cause to believe that a violation exists.¹⁹ These provisions were created in recognition that citizen informants might provide an important trigger for inspections in areas where federal and state resources might be limited or not frequent enough to identify serious problems. The federal Office of Surface Mining has created a form (with Office of Management and Budget certification under the Paperwork Reduction Act) on which the request may be made, including the information that meets the standards of that Act.

PROMPTING GOVERNMENTAL INVESTIGATION

Apart from formal standards in laws and regulations that solicit citizen science or establish standards, often citizen science can be used to motivate or stimulate governmental action. A citizen science project

may prompt a government agency to launch its own investigation that may in turn support governmental action. For example, a citizen science water quality sampling project identified elevated radioactivity in stream samples near resource extraction areas in Pennsylvania; the state followed up with its own testing to determine levels and sources of the material.²⁰ EPA's Office of Water, which for many years has advocated for citizen monitoring, advocates modest objectives. Its 2012 publication "Starting Out in Volunteer Monitoring" contains this advice:²¹

Chances are slim that your data will ever be used in court to stop a polluter. Data

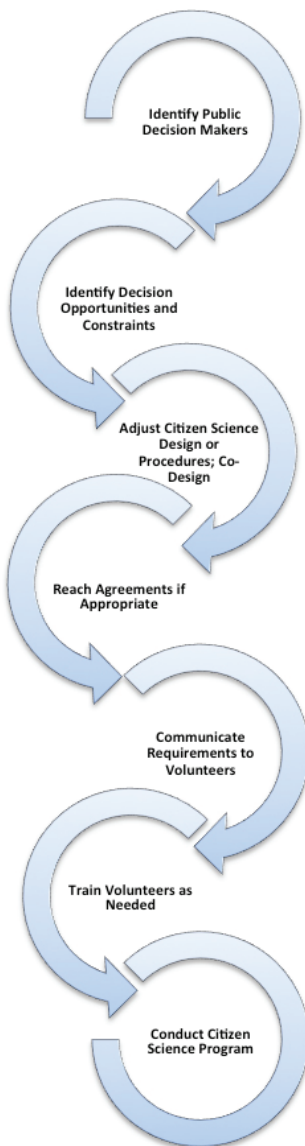
collected for such regulatory purposes requires a very high degree of quality assurance. Most volunteer data is used to educate the community and to screen for potential problems.²²

In brief, while there are both formal and informal endorsements of the use of citizen science to trigger and inform governmental processes, the primary sanctioned use is to prompt governmental action, in which the relevant governmental entity will expect to do its own data collection, science, and interpretation before a decision is made.



Collecting water samples to test for pollution near an industrial complex.

FOLLOWING THE PATH



Citizen science programs offer substantial opportunities to improve the quality of public decision making, and to call government attention to issues and problems that might otherwise escape government notice.

In designing citizen science programs to affect public decision making, organizers should consider who the relevant public decision maker(s) may be. This should then prompt consideration of any provisions of law or policy that may invite or constrain the decision makers' use of citizen science outputs. In turn, the citizen science program may be structured or designed in order to take advantage of these opportunities and avoid any constraints. Citizen science program designers can work with agencies or other data end-users in the initial stages of program development. Part of this process may include entering into formal or informal agreements with relevant public decision makers for provision of data and expectations with regard to data quality and timeliness. Co-design can align aspects of the project with the appropriate regulations and institutional requirements. Finally, the interaction of the citizen science program with decision makers should be communicated to volunteers including, where necessary, training to meet any requirements or expectations that can affect the influence and utility of the outputs on public decisions.

APPENDIX: LEGAL CONSTRAINTS AFFECTING CITIZEN SCIENCE IN FEDERAL, STATE, AND LOCAL PUBLIC DECISIONS

The Appendix to this report identifies a substantial number of legal provisions that suggest areas for attention by the designers of citizen science programs

that seek to influence and improve public decisions. In particular, these include legal requirements that affect:

Human Subjects
Institutional Review Boards
Timing and Process
Comment periods in rulemaking Environmental Impact Assessments
Evidence and Tribunals
Record Review Expert Testimony (Daubert) Filing Court Cases Motions
Advisory Committees
Federal Advisory Committee Act State/Local Advisory Body Requirements
Data Quality
Information Quality Act Peer Review Agency Guidelines State and Local Requirements
Survey Methods
Paperwork Reduction Act
Privacy
Privacy Act Children's Online Privacy Act Freedom of Information Act Public Records Laws

This appendix identifies and explains legal constraints that may apply to particular interactions of citizen science programs with governmental entities. It uses a question and answer format to discuss some of the more important issues that citizen science program designers may need to consider if they anticipate their results being used and relied upon in public decision processes.

WHAT INFORMATION OR DATA QUALITY REQUIREMENTS APPLY TO GOVERNMENTAL USE OF CITIZEN SCIENCE?

In general, persons may present citizen science outputs to elected officials and governmental agencies in the same manner as any other communication. However, presenting this information in a way that governmental agencies will be inclined or able to use it may require additional attention to methodology and quality assurance. Typical limits or constraints come in two types: one, methodological or data quality assurance requirements that apply broadly to almost any governmental dissemination of information, and two, specific requirements that prescribe quality standards for use of science in individual programs. This section addresses the first of these.

Information Quality Act

For citizen science activities that are intended for use by federal agencies, it is important to recognize the data quality requirements that apply if a federal agency is itself expected to disseminate the citizen science information to the public or to targeted non-governmental users. In 2000, Congress passed the Information Quality Act (sometimes called the Data

Quality Act) to encourage development of procedures to ensure and maximize the “quality, objectivity, utility, and integrity of information (including statistical information) *disseminated by* Federal agencies.”²³

The Act directed the Office of Management and Budget (OMB) to adopt guidelines for federal agencies to address these goals. It further directed the federal agencies thereafter to issue their own quality guidelines and to establish administrative mechanisms allowing affected persons to seek and obtain correction of any information disseminated by the agency that does not comply with the OMB guidelines. Thus, if a citizen science project is directed at a specific federal agency, it will be worthwhile to examine the guidelines issued by that agency under the Information Quality Act.

The key terms defining applicability of the Information Quality Act are “information” and “disseminated by the agency.” If citizen science information is provided to an agency but will not be disseminated by the agency, then the OMB and agency-specific guidelines will not apply to it.

- **Information** is defined by the OMB guidelines broadly as “any communication or representation of knowledge such as facts or data, in any medium or form.”²⁴ It includes “information that an agency disseminates from a web page, but does not include the provision of hyperlinks to information that others disseminate.”²⁵
- **Dissemination** means “agency initiated or sponsored distribution of information to the public.” Dissemination does not include sharing of government information within or among government agen-

cies. It does not include correspondence between a federal agency and persons or individuals. Nor does it include information that the agency discloses simply in response to external requests under the Freedom of Information Act or similar laws. Dissemination also does not include information that the agency possesses simply because it is contained in public filings or adjudicative processes administered by the agency.²⁶

Data quality guidelines of OMB and the federal agencies under the Information Quality Act may be of interest to citizen science participants, particularly if they expect the agency to take responsibility for disseminating the results of their projects. However, the guidelines and the requirement of the Act *do not apply* to information that participants in citizen science supply voluntarily to agencies simply to inform agency activities, priorities, or agency research programs.

If a citizen science project is funded by a federal agency, the project must comply with whatever terms are in the funding agreement, but if the agency provides funding and leaves it up to the researcher to decide how or whether to disseminate the results and in what form, then the agency is not deemed the initiator nor the sponsor of the information and the guidelines do not apply.²⁷

Where the guidelines do apply, OMB instructs federal agencies to adopt a basic standard of information quality. This includes criteria for objectivity, utility, and integrity. The OMB guidelines further direct federal agencies to develop a *process* for reviewing the quality of information before it is disseminated by the agency.²⁸ Thus,

if a citizen science project is intended to generate information for dissemination by a federal agency, participants should be aware of agency review processes. The OMB guidelines create a presumption of objectivity if data and analytic results have been subjected to formal, independent, external peer review; but the guidelines do not require peer review for all information. In general the OMB guidelines direct the agencies to apply stricter quality standards to dissemination of information that is likely to be “influential” (viz. information that “will have or does have a clear and substantial impact on important public policies or important private sector decisions.”)²⁹

With respect to analysis of “risks to human health, safety, and the environment” the OMB guidelines direct the agencies to adopt “or adapt” the data quality principles enacted by Congress in the Safe Drinking Water Act Amendments of 1996,³⁰ including best available peer-reviewed science, and use of data collected using accepted methods or best available methods; however, OMB allows even these standards to be waived temporarily under urgent situations such as imminent threats to public health or homeland security.³¹ Again these standards apply to agency-initiated or sponsored dissemination of information, as opposed to information received from the public. But they do suggest sensitivities that agencies will have when using (or seeking to replicate) citizen science products in their own work and outreach activities.

Peer Review

In 2005, the OMB released an addition to the OMB guidelines, primarily focused on scientific information. **This OMB “Peer**

Review Bulletin” states that federal agencies must apply peer review to influential scientific information prior to its dissemination to the extent permitted by law; and it further directs that “highly influential scientific assessments” (defined as information whose dissemination could have a public or private sector economic impact greater than \$500 million, or be novel, controversial, or precedent-setting) must be peer reviewed applying rigorous forms of independent peer review. Scientific assessments are defined as evaluations of a body of scientific or technical knowledge synthesizing multiple inputs and research products.³²

However, “an information product is not covered by the [Peer Review] Bulletin unless it represents an official view of one or more departments or agencies of the federal government.” Specifically, the Bulletin excludes even research produced by government-funded scientists “if that information is not represented as the views of a department or agency.”³³ **Thus, in general, the peer review bulletin will rarely apply directly to citizen science products unless they become part of a synthesis of work and are released as the agency’s own views.**

Agency Guidelines

The Environmental Protection Agency has issued extensive guidelines under the Information Quality Act. These emphasize the agency’s respective roles as: a collector and generator of information, a recipient of information (that external parties volunteer or provide under statutory and other mandates), a user of information, and a conduit for information.³⁴ EPA

specifically states that it applies quality assurance requirements to information that is collected and submitted by others if it is:

- Collected through contracts with EPA;
- Collected through grants and cooperative agreements with EPA; or
- Submitted to EPA as part of a requirement under a statute, regulation, permit, order or other mandate.

EPA applies detailed quality requirements to information generated or collected by contractors by including these in the contract; and “although EPA has less control over grantees than contractors, EPA can and does include conditions in grants and cooperative agreements requiring recipients to meet certain criteria.” In 2012 EPA published a “Scientific Integrity Policy” which states that “all contractors, grantees, collaborators and student volunteers of the Agency who engage in scientific activities are expected to uphold the standards established by this policy and may be required to do so as part of their respective agreements with the EPA.”³⁵ EPA’s Quality System web page further identifies quality standards that should be applied by external organizations working for EPA.³⁶

Data that must be submitted under regulatory requirements (permits, certifications, reporting requirements) are subject to regulatory and statutory quality standards of the individual regulatory programs and permit requirements. These may establish sampling protocols and Quality Assurance/Quality Control (QA/QC) standards.

In its Information Quality Act Guidelines, EPA defines a fourth category of information “submitted by others”:

- Information that is either voluntarily submitted to EPA in hopes of influencing a decision or that EPA obtains for use in developing a policy, regulation, or other decision.

This category may fit many citizen science efforts aimed at changing agency policy, producing a desired outcome, or providing support for a new agency action. EPA notes that for this category it intends to develop factors in the future to assess the quality of these voluntary submissions or information that the Agency gathers for its own use,³⁷ however, the Agency has not published additional guidelines in this area for voluntarily submitted information.

As with the OMB Guidelines, the EPA Guidelines note that they do not apply to information distributed by recipients of EPA grants, cooperative agreements, or contracts where the recipient (rather than EPA) determines the type and manner of communication or publication and disclaims that the results represent EPA's official position. The Guidelines do apply if EPA distributes information submitted by an outside party in a manner that reasonably suggests that EPA endorses or agrees with it, indicates that the information supports or represents EPA's view, or if EPA in the course of its distribution proposed to use the information to support a regulation, guidance, policy, or other Agency decision or position.³⁸ **In short, citizen science products submitted to the agency do not trigger the guidelines, but if the agency adopts or endorses them in the context of an agency-initiated dissemination, then the EPA must apply its quality standards.**

The Department of Interior's Information Quality Guidelines largely follow the OMB Guidelines. However the Department further notes that if it "relies upon" technical, scientific, or economic information "submitted or developed by a third party," that information will be subject to "the appropriate standards of objectivity and utility."³⁹ Where the information provided by third parties "can be verified" the Department will apply the data quality standards; where it is relied upon (e.g., reports of wildlife sightings) but "is not verifiable" the Department must make the source "transparent to the public" but the original information will not be subject to the Guidelines.⁴⁰

Even when the Information Quality Act applies, in general the OMB and agency guidelines do not create legal obligations enforceable by third parties (other than the requirement to have a procedure for data correction).⁴¹ The Act and guidelines are intended to guide the agencies themselves, but not to allow third parties to sue agencies for dissemination of information that does not meet these standards. However, it should be noted that challenges to agency actions (permit denials, rulemakings, etc.) that can be filed under the Administrative Procedure Act (APA) may allege that failures to follow the Information Quality Act make the governmental action "arbitrary and capricious," an "abuse of discretion" or lacking in "substantial evidence" in violation of the APA.⁴² Thus, federal agencies have every incentive to apply quality standards whenever possible if they intend to rely on externally-submitted data to support a decision that affects persons or property.

STATE AND LOCAL DATA QUALITY REQUIREMENTS

Broad state requirements addressing data quality are not typical. More often states have statutory requirements that relate to data needed by particular regulatory programs. Numerous states also have statutes relating to rulemaking activities that require reviews by legislative bodies; and these review processes may themselves give rise to de facto data quality requirements. Some states, for example, impose requirements that state regulations cannot be more stringent than comparable federal requirements without specific findings being made.⁴³ These requirements may effectively drive demand for data quality even though the laws themselves do not specify the standards. Thus, citizen science projects attempting to drive the state regulator to adopt more stringent standards may need to meet high standards in order to show the need for action.

Local governments rarely impose data quality requirements by ordinance. However, when data are used for decisions regulating land use and development decisions, local governments may require some greater level of quality for data leading to denial of an application, as they may expect to be challenged in court by a developer-applicant regarding the basis for their decision.

WHAT LIMITATIONS APPLY TO CITIZEN SCIENCE EFFORTS THAT COLLECT INFORMATION BY SURVEY OR STANDARDIZED INSTRUMENT?

In general, citizen science may use methods such as surveys, interviews, and standardized requests for data and information from individuals or institutions. However, under some circumstances of governmental sponsorship, the Paperwork Reduction Act may influence the scope or design of these methods.

Paperwork Reduction Act

The Paperwork Reduction Act of 1980, as amended, includes provisions that expressly limit the ability of a federal agency to collect the same information from 10 or more persons.⁴⁴ The form of collection does not matter, so the Act applies to agency-sponsored requests for records or reports, questions, survey instruments, voluntary surveys or websites seeking submission of information. The law applies whether the agency itself collects the information or funds the collection through a contract or cooperative agreement with a third party.⁴⁵ The OMB rules implementing the Act make it clear that the limitation applies even if the collection and submission of information is entirely voluntary.⁴⁶ However a federal grant recipient (as opposed to a cooperative agreement cooperator) may not be subject to the Act if in the terms of the grant the agency did not specifically request collection of the information, nor

did it maintain any ability to approve the collection or collection process.⁴⁷

For information collection subject to the Act, only those requests that have been approved in advance by OMB are authorized. OMB will only approve requests where a federal agency has demonstrated that the request is the least burdensome request necessary for performance of the agency's functions, is useful, and is non-duplicative. OMB will not approve a request until after it has been reviewed by the agency, subjected to the agency's overall information collection budget, subjected to notice and at least 60 days opportunity for comment in the Federal Register, revised by the agency as needed, further described in a second Federal Register notice with 30 days available for public review, and submitted to and "cleared" by OMB (which has up to 60 days from the latter submittal). The entire process may require as many as six months or more. The OMB "clearance," when granted, is for a specific period of time and will expire unless renewed. The clearance will only be granted where the approved data collection instrument includes certain public disclosures, including: reasons for collecting the information; how it helps further the performance of the agency; an estimate of the average time burden of collection (e.g., hours to complete); whether responses are voluntary, required to obtain or retain a benefit, or mandatory; and the nature and extent of confidentiality provided the responses, if any. The OMB control number must be displayed on the information collection document.⁴⁸

Citizen science projects, including voluntary crowd-source projects supported by the federal government, have had to go through this process. For example, the U.S. Geological Survey operates a voluntary citizen reporting project called "Did You Feel It" (DYFI) for people to report earthquakes and their perceived intensities as a way of crowd sourcing data that would otherwise be unavailable. The DYFI online reporting form was required to receive OMB clearance and to bear the OMB control number and expiration date, and to include required Paperwork Reduction Act disclosures.⁴⁹

A 2010 OMB Memorandum on scientific information reminds agencies that the Act does not apply to collections of scientific data that are neither "sponsored nor conducted" by the agency. It also notes that OMB can provide clearance for a "generic" agency-sponsored information collection request as part of a plan for collecting successive instances of differing information using "very similar methods;" however the generic clearance must undergo the full clearance process and the subsequent individual data collection efforts are reviewed on an expedited basis.⁵⁰

OMB issued a Memorandum in early 2010 to address social media and interactive technologies,⁵¹ which was supplemented in 2014 by a Memorandum on web-based data search tools and calculators.⁵² These memoranda explain that certain uses of data search tools and calculators on agency websites are not subject to the Paperwork Reduction Act, where the information momentarily being collected

from the user is only in order to make the agency's provision of information more immediately useful. This includes tools that allow users to select or customize agency data by submitting parameters (information) to enable the website to organize the data. This exception applies only if the information supplied by the user of the database for improved access is not otherwise being solicited or used by the agency.

WHAT PROCEDURAL CONSTRAINTS ARE THERE ON USE OF CITIZEN SCIENCE BY PUBLIC DECISION MAKERS?

It will be important for those interested in science-based decisions to become familiar with rules of procedure that govern rulemakings, public hearings, appeals, parties, intervention, and timing. **These formal rules are extremely important in determining what information can be considered, when it can be considered, and for what purposes it can be considered. These concerns are not always apparent to those driven by a scientific point of view, who seek primarily to discover the right answer (by testing a hypothesis and producing a statistically significant, reproducible result), only to find that the result is of no interest to the decision maker because of these formal rules.**

Many federal, state, and local government actions are subject to specific procedural and legal requirements. These may affect their ability to take into account results

from citizen science. They include, among others, rules on timing, procedure, and evidence.

Timing

Most governmental actions that require decisions have some associated timing limitation. For example, rulemaking subject to the federal Administrative Procedures Act⁵³ provides for periods of time when public comments may be considered and times when the comment periods are closed and the agency is not receiving new information. Information that is submitted out of time must be excluded by the agency, or if it wishes to consider such information, it may need to reopen a formal comment period in order to provide procedural fairness to all potentially interested parties. Similar timing and procedural issues apply to environmental impact review under the National Environmental Policy Act⁵⁴ and its state equivalents (such as the California Environmental Quality Act, or New York's State Environmental Quality Review Act).

Record Review

Other limitations may apply where there is an initial decision that is then appealed to an administrative body or to a court. In general, reviewing tribunals (administrative boards or appellate courts) may not consider evidence that was not presented in the initial decision under review, nor may they consider evidence offered by entities or persons who did not participate in the original proceeding. **Thus, citizen science results will not generally be considered if they are presented for the first time in the context of an appeal.** They are excluded by the rules that

govern such appeals in order to ensure finality and procedural fairness.

However, courts reviewing appeals may have discretion to allow submission of useful information on matters of public interest and importance by *amici curiae* (“friends of the court”). But they have no obligation to allow anyone to participate as an *amicus*, nor can they rely on representations in an *amicus* brief as though they were evidence considered by the trial court and subjected to cross-examination. They are, in sum, sometimes allowed as a way to provide context for a decision of law.

Admissibility of Expert Testimony

Scientific evidence presented in court is usually interpreted by an “expert witness.” Rule 702 of the Federal Rules of Evidence (applicable to presentation of evidence in criminal and civil trials in federal courts) provides certain limits on who may present such testimony and under what circumstances. The current form of the Rule was shaped by a U.S. Supreme Court decision in 1993 known as *Daubert v. Merrell Dow Pharmaceuticals*⁵⁵ and by several subsequent cases interpreting the *Daubert* standard. In brief, the federal judge must make a determination to allow or disallow the presentation of the expert testimony, by making threshold findings that ensure its basic credibility (viz. its basis in a reliable scientific methodology). Rule 702 provides:

A witness who is qualified as an expert by knowledge, skill, experience, training, or education may testify in the form of an opinion or otherwise if:

- a. The expert’s scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue;
- b. The testimony is based on *sufficient* facts or data;
- c. The testimony is the product of *reliable principles and methods*; and
- d. The expert has *reliably applied* the principles and methods to the facts of the case.

This determination of relevancy of the evidence and reliability of the method and its application to the facts makes the judge a gatekeeper for what expert evidence may be heard. This in turn determines what scientific evidence may be presented and interpreted for the jury (or the judge if the judge is presiding without a jury). The rules governing federal court practice allow counsel to file a motion in advance of or during trial to exclude testimony based on the Rule 702 (*Daubert*) standard.

Daubert does not apply to presentation of data when not presented by an “expert witness,” **but in practical terms an expert is generally needed to interpret scientific data and its meaning persuasively. An expert may use citizen science data, but the expert’s interpretive method(s) must meet the requirements of Rule 702 or the testimony will be excluded.** This means that the method of collecting as well as interpreting the data may well be particularly important for the testimony to be allowed. (Even if testimony is allowed, the finder of fact may, of course, find it unpersuasive.)

Many states have adopted the *Daubert* standard, although others continue to allow a more lenient standard, or use an alternative standard that bases admissibility of expert testimony on whether the technique used by the expert has gained general acceptance in the field to which it belongs.⁵⁶ In general, *Daubert* is believed to have erected a somewhat higher barrier to admission of expert testimony in federal courts by emphasizing the court's role as guardian of reliability of the methods used.

Some lawyers have advocated that administrative agencies apply *Daubert* to their own rulemaking, fact-finding, and other decisions; and also suggest that federal courts apply this standard to their record review of agency decisions. However, this position has not taken hold. Administrative agencies, as experts in their own right (as opposed to juries and courts of general jurisdiction), have been free to consider a broad range of scientific evidence within their own rules and practices.⁵⁷ **Users of citizen science information should consult agency rules and procedures to ensure that evidentiary standards can be met.** Most agencies do not specify standards for scientific information for their development of rules, but some may do so for hearings and trials before administrative law judges. The agency trial rules do not precisely track the federal rules of evidence and may allow greater leeway in presentation of scientific evidence.⁵⁸

Filing court cases and supporting motions and affidavits

Citizen science may have been conducted with the expectation that it could be used to support the filing of litigation in court to

remedy a wrong identified by the project. There are standards that relate to the filing of lawsuits that are designed to weed out frivolous claims and that impose stringent obligations on attorneys and their clients. One such standard is Rule 11 of the Federal Rules of Civil Procedure (FRCP), which applies to suits filed in federal court. The rule applies to anyone filing a complaint in federal court (whether citizen group, company, individual, or governmental entity). It also applies to pleadings, motions, and other papers related to a civil suit.

Rule 11 requires the attorney (or unrepresented party if there is no attorney) who files a complaint, pleading, motion or other paper to certify (by the act of signing it) that it is not filed for an improper purpose, and that, among other requirements, the factual contentions made in the document have evidentiary support or will likely have evidentiary support after reasonable opportunity for investigation and discovery. **This means that a citizen science effort that is to be used as the primary basis for initiating or maintaining a court case in federal court must be sufficiently sound to serve as a rational basis to bring the case or file the pleading.** The standard, as explained in the notes to the Rule, is "evidentiary support for the allegation, not that the party will prevail with respect to its contention regarding the fact."⁵⁹

Thus, haphazard and inconsistent scientific data conducted without a QA/QC protocol may not serve as a sufficient factual basis for filing a suit; and it will be the attorney's (and the plaintiff's own) obligation to inquire diligently into the factual basis before undertaking to file the case (or a material affidavit in an ongoing case).

If the Rule has been violated the court may impose an appropriate sanction on any attorney, law firm, or party (including the client) that violated the rule or is responsible for the violation. The Rule also provides that an opposing party may request that the court impose sanctions. The moving party first serves the motion on the offending party, but if the challenged paper is withdrawn or appropriately corrected within 21 days, the motion is not presented to the court for action (although the court may award reasonable expenses and attorney's fees for the successful motion, if warranted).

State courts and administrative tribunals have their own equivalents to FRCP Rule 11. For citizen science efforts, this means that they should be well-designed to generate evidentiary support for the claims that may be made. Thus, they should use recognized methods, reasonably rigorous and reproducible techniques, and support the claims that are being made. Legal claims connected with citizen science must actually be supported by evidence available to the attorney or party filing the documents.

Motion to dismiss/motion for summary judgment

Both federal and state courts have procedures for lawsuits to be terminated without the need for a trial on the merits under certain circumstances. These may be a motion to dismiss the case (e.g., FRCP Rule 12) often for failure to state a claim on which relief may be granted, or a motion for a decision for one side or the other on summary judgment without trial (e.g., FRCP Rule 65). The latter motion may be granted when there are no material facts at issue; the case can be decided on the

law given the facts available (by affidavit or other submittal) and by interpreting any potential factual issues, for purposes of the motion, in favor of the non-moving party.

A party may oppose a motion to dismiss by adducing evidence that shows the legal validity of the claim. Summary judgment practice frequently involves affidavits from each side presenting evidence that supports or opposes the grant of summary judgment. Citizen science efforts may, for example, be designed to demonstrate an issue of material fact and thus withstand a summary judgment motion and allow a case to go to trial (for example by showing evidence that pollution may have resulted in natural resource damages to biological resources). Or citizen science may present a complete enough uncontestable set of facts to allow a summary judgment motion in the absence of contrary evidence (for example, by showing that a numerical discharge limit in a permit has repeatedly been exceeded).

Key concerns are the ways in which evidentiary results are documented so that they can be used in motions practice. This will require preparation of sworn affidavits collecting the relevant evidence and interpreting it in a rigorous way, even though not subject to cross-examination. Evidence submitted in support of a motion for summary judgment must be presented by affidavit – a legal document sworn to by a witness under oath and subject to legal penalties for falsity. **Thus, if citizen science is to be presented in support of a motion, a suitable witness must be identified who can attest to the validity of the evidence, how it was collected, and what fact or facts it demonstrates.** Persons attesting to such

affidavits may be subject to subsequent questioning by the opposing party (the “discovery” process, discussed later), if a decision on the motion is deferred or if the motion is denied.

CAN CITIZEN SCIENCE PROJECTS COLLABORATE DIRECTLY IN PROVIDING ADVICE TO GOVERNMENTS?

Federal Advisory Committee Act (FACA)

Congress enacted FACA in 1972 to control the ways in which federal agencies could convene and utilize outside non-governmental committees for the purpose of providing advice to the President and executive agencies.⁶⁰ **FACA requires the agencies to engage in a public process for establishing or utilizing such committees.** This includes making findings of need, adopting a charter, providing for a balanced membership, giving advance public notice of their meetings, and providing ongoing disclosure of their records (including data and information). The law does not apply to committees not established by, or managed or controlled by, the executive branch. Thus, organizations that assemble outside the federal government, but which on their own seek to provide advice to federal agencies, are not subject to the law. The regulations specifically state that groups “assembled to exchange facts or information” are not FACA committees.⁶¹ Nor are groups established to advise or make recommendations to state or local officials or agencies.⁶²

Citizen science projects or programs not organized by the federal govern-

ment for the purpose of providing advice will not likely be subject to FACA.

However, if a federal agency proposes prospectively to rely upon the advice of an ongoing citizen science project that serves the agency’s needs, this may constitute a FACA committee if there is “actual management or control” by the federal agency over its operation. Committees created by non-federal entities, such as contractors or private organizations, are not subject to FACA provided that they are not actually “managed or controlled” by the executive branch.⁶³

Citizen science committees that are not in the business of rendering consensus advice to federal agencies are not subject to FACA. **Citizen science components may be integrated into federal activities without triggering FACA where the federal agencies neither established the group nor manage or control its activities.** Thus, federal agencies may rely on citizen science reports for condition assessments and to support federal decisions on adaptive management; this will not trigger FACA unless the agency can, in effect, direct the activities of the committee and determine when it will convene and what it may consider. FACA regulations also contain an exemption for committees established to perform primarily operational rather than advisory functions, where the operational functions are those created by law or executive order.⁶⁴

State and Local Advisory Bodies

Few state and local governments have laws or requirements that resemble FACA,

although some do have advisory committees or boards established by statute that specify the professional or representative qualifications of the members (e.g., one professional engineer, two local government elected officials, one water resources specialist, etc.). The fact that these entities exist and have qualification requirements, and possibly requirements related to record keeping and meetings, does not, in general, limit in any way the ability of any other entity also to organize a citizen data-generating or analyzing effort and to provide such information to the state or local government or to the designated advisory body.

Local governments present perhaps the greatest opportunity for direct impact on public decision making by citizen science. In many cases, local governments have chartered local task forces and advisory bodies to assist their decision making (particularly where they may lack funding for a dedicated scientific capacity). Citizen science efforts have helped support or develop noise ordinances, local wildlife conservation plans, and public health impact assessments. In general, the only limits on local government use of such information are the federal and state constitutional requirements of due process and equal protection of the laws (typically requiring decisions to have a “rational basis” and not to impinge on fundamental rights nor to discriminate among persons using suspect classifications such as race, sex, or national origin). **Citizen science often provides a key initiator and feedback mechanism for local conservation and management of parks, recreation areas, school lands, and habitat.**⁶⁵

ARE THERE PRIVACY CONCERNS THAT WE SHOULD TAKE INTO ACCOUNT IF CITIZEN SCIENCE OUTPUTS ARE CONVEYED TO GOVERNMENTAL AGENCIES?

Participants in citizen science that are interacting with public decision making must give some consideration to privacy issues: both for persons whose data and information may be collected and compiled as part of the project, as well as for the volunteer participants themselves.

There are a few relevant laws and requirements to consider at the outset of any citizen science project that may have a governmental connection or intended use. And it is important to be aware of issues related to activities that may involve minors in data collection that may reveal any information about them. In general, creation of records that reveal personal information may raise some privacy and confidentiality concerns that need to be addressed during project design.

Privacy Act

The Privacy Act applies to federal agencies and controls certain agency records, but does not apply to agency grantees or fund recipients. It controls “systems of records” maintained by federal agencies from which information is retrieved by use of an individual identifier (name, number, etc., designating that individual). Thus if any agency is registering volunteer citizen scientists by phone number or address or name, it may be creating a system of records subject to

the Act. Collection of information subject to the Privacy Act requires the agency to provide a Privacy Act notice (similar to the Paperwork Reduction Act notice). The agency must provide safeguards for the data/records. Agencies must document and describe each “system of records” in the Federal Register and must identify all anticipated “routine uses” of the information in disclosures outside the agency and policies and procedures.⁶⁶

Children’s Online Privacy Protection Act

The Children’s Online Privacy Protection Act regulates collecting and use of individually identifiable personal information about children under 13. It applies to commercial websites and under OMB policy to federal websites as well. In general it requires notice on the website providing information for parents, verifiable parental consent, and a right of parental access and removal of personal information.⁶⁷ This law can affect citizen science projects that may involve minors and that may result in the correction of individual identifiable records, so some citizen science projects have limited participation to individuals that are 13 or older.⁶⁸

Freedom of Information Act and State Public Records Laws

The Freedom of Information Act (FOIA) makes federal government records subject to disclosure, unless an enumerated exemption applies.⁶⁹ Exemptions include records such as those protected by the

Privacy Act, and those that would constitute a clearly unwarranted invasion of personal privacy. Citizen science results may, under some circumstances, become government records.

Some states have their own freedom of information acts or public records laws. These typically apply to governmental agencies, including to local governments, and in some cases to activities of state-funded public universities. These disclosure provisions frequently have numerous exemptions, but where an activity is state, local-government, or public-university-sponsored, citizen science organizers should determine whether and to what extent the records concerning their volunteers and the data they obtain are (1) considered to be public records, and (2) fall within any of the exemptions provided by law.

Institutional Review Boards and Human Subjects

Federal regulations require researchers to obtain approval from an Institutional Review Board for certain human subjects research that receives support, directly or indirectly, from the federal government, or which is subject to regulation by a federal department or agency.⁷⁰ This applies to research involving human subjects, including instances where the research includes the asking of questions or conducting surveys. These requirements may affect citizen science projects where federal funding is involved, as well as those involving academic institutions where IRB requirements may apply to all such research activities. Human

subjects research includes “any systematic investigation, including research development, testing and evaluation, designed to develop or contribute to generalizable knowledge” and which involves living individuals about whom an investigator obtains “data through intervention or interaction with the individual” or “identifiable private information.”⁷¹ Research involving only publicly available data does not require IRB approval. The IRB requirement applies not only to medical and biological science but also to social science research (sociology, psychology, history, education, political science) activities which produce generalizable results through interaction with persons. Subjects must provide informed consent for their own participation. Special requirements apply where there may be risks or exposures for the human subjects.

Discovery

Every form of civil and criminal litigation (cases in court, and often in administrative tribunals) provides for some form of “discovery” where one party can discover the evidence, data, witnesses, and testimony that will be relied on by the opposing party. Where a citizen group files suit, the information upon which it intends to rely will

be subject to discovery. Such discovery may include access to all of the records generated in the citizen science project, and opportunities to interview potential witnesses and others with information under oath (depositions).

Such discovery may also apply if a governmental entity brings a case and intends to rely on or use citizen science data as part of the case, or where the citizen science effort is relevant and material to the case the government decides to bring. Witnesses can be compelled to appear for depositions (oral examinations) and to bring with them materials on which they will be examined.

Data Use and Privacy Policy

Given all of these concerns, it is most often wise to establish policies and train citizen science participants on the key issues (legal, ethical, and technical) that may affect privacy interests, disclosure, and handling and maintenance of data. Note that even if the data themselves do not involve privacy issues, the volunteer participants need to know what their rights and obligations may be with respect to others.⁷²

ENDNOTES

- 1 A detailed description and examples of the constraints and opportunities can be found in the Appendix
- 1 33 U.S.C. § 1313.
- 2 40 CFR 130.5.
- 3 40 CFR 130.7(b)(5).
- 4 40 CFR 130.7(b)(6) (emphasis supplied).
- 5 EPA, Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d), 305(b) and 314 of the Clean Water Act (July 29, 2005), at 29.
- 6 *Id.*, at 31.
- 7 *Id.*, at 32.
- 8 *Id.*, at 33.
- 9 *Id.*, at 33.
- 10 Fla. Admin. Code 62-303.320(3),(4) (standards for planning list for aquatic life-based water quality criteria assessment).
- 11 Virginia Department of Environmental Quality Citizen Water Quality Monitoring Grant Program Application – Appendix A: Data Use Form, available at <http://www.deq.virginia.gov/programs/water/waterqualityinformationtmdls/waterqualitymonitoring/citizenmonitoring/grantopportunities.aspx>.
- 12 EPA Office of Water, Memorandum: Information Concerning 2016 Clean Water Act Sections 303(d), 305(b), and 314 Integrated Reporting and Listing Decisions (August 13, 2015).
- 13 EPA Office of Wetlands, Oceans and Watersheds, The Volunteer Monitor's Guide to Quality Assurance Project Plans, EPA 841-B-96-003 (September 1996), <http://water.epa.gov/type/rsl/monitoring/qappcovr.cfm>
- 14 *Id.*, cover memo, and at 3.
- 15 16 U.S.C. § 1533(b)(3)(A), 50 CFR 424.14(b)(1).

- 16 16 U.S.C. § 1533(b)(1)(A), 50 CFR 424.11.
- 17 E.g., 40 CFR 123.64(b) (“The Administrator may order the commencement of [program] withdrawal proceedings on his or her own initiative or in response to a petition from an interested person alleging failure of the State to comply with the requirements of this part as set forth in § 123.63 ... The Administrator will respond in writing to any petition to commence withdrawal proceedings. He may conduct an informal investigation of the allegations in the petition to determine whether cause exists to commence proceedings under this paragraph. The Administrator’s order commencing proceedings under this paragraph will fix a time and place for the commencement of the hearing and will specify the allegations against the State which are to be considered at the hearing. Within 30 days the State must admit or deny these allegations in a written answer. The party seeking withdrawal of the State’s program will have the burden of coming forward with the evidence in a hearing under this paragraph.”)
- 18 30 CFR 842.11.
- 19 30 CFR 842.12, 842.14.
- 20 E.g. “Radiation found in Greene County stream near water supply,” WTAE News (July 16, 2015) (citizen sampling finds radioactivity in stream samples near resource extraction areas in southwestern Pennsylvania; state conducts its own testing to determine levels, if any, and source)
- 21 Environmental Protection Agency Office of Water, Starting Out in Volunteer Monitoring, EPA 941-F002-004 (September 2012).
- 22 *Id.* at 3.
- 23 Consolidated Appropriations – Fiscal Year 2001, Pub. L. No. 106-554, § 515, (44 U.S.C. § 3516 note) (emphasis supplied).
- 24 Office of Management and Budget: Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by Federal Agencies; Notice; Republication [hereinafter Guidelines], 67 Fed. Reg. 8452 (2002), at 8460, para. V.5.
- 25 *Id.*
- 26 *Id.*, para. V.8.
- 27 *Id.*, at 8454.
- 28 *Id.*, at 8458-8459.
- 29 *Id.*, at 8460, para. V.9; *Id.* at 8455.
- 30 42 U.S.C. § 300g-1(b)(3)(A) & (B).
- 31 67 Fed. Reg. 8452 (2002), at 8460, para. V.3(b)(ii)(C).
- 32 70 Fed. Reg. 2664 (2005). (OMB, “Final Information Quality Bulletin for Peer Review,” Dec. 16, 2004).
- 33 *Id.*
- 34 Environmental Protection Agency, Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by the Environmental Protection Agency (2002), at 6-7.

- 35 Environmental Protection Agency, Scientific Integrity Policy (2012), at 2. 44 44 U.S.C. § 3502.
- 36 Environmental Protection Agency, Doing Business with EPA: Quality Specifications for non-EPA Organizations, <http://www.epa.gov/quality/exmural.html>. 45 5 CFR 1320.3.
- 46 5 CFR 1320.3(c).
- 47 5 CFR 1320.3(d).
- 37 Environmental Protection Agency, Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by the Environmental Protection Agency (2002), at 7. 48 5 CFR 1320.8.
- 49 <http://earthquake.usgs.gov/research/dyfi/>
- 38 Environmental Protection Agency, Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by the Environmental Protection Agency (2002), at 16, 17. 50 Office of Management and Budget, Memorandum for the Heads of Executive Departments and Agencies, and Independent Regulatory Agencies: Facilitating Scientific Research by Streamlining the Paperwork Reduction Act Process (Dec. 9, 2010).
- 39 U.S. Department of the Interior, Information Quality Guidelines Pursuant to Section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Section V. 51 Office of Management and Budget, Memorandum for the Heads of Executive Departments and Agencies, and Independent Regulatory Agencies: Social Media, Web-based Interactive Technologies and the Paperwork Reduction Act (April 7, 2010).
- 40 *Id.*
- 41 See, e.g., *American Petroleum Institute v. EPA*, 684 F.3d 1242 (D.C. Cir. 2012) (decided on other grounds); *Mississippi v. EPA*, 744 F.3d 1334 (D.C. Cir. 2013) (IQA does not create cause of action). 52 Office of Management and Budget, Memorandum for the Heads of Executive Departments and Agencies, and Independent Regulatory Agencies: Web-based Interactive Technologies: Data Search Tools, Calculators, and the Paperwork Reduction Act (Sept. 5, 2014).
- 42 5 U.S.C. § 706.
- 43 E.g., J. McElfish, "Minimal Stringency: Abdication of State Innovation," 25 *Env'tl. L. Rep.* 10003 (Jan. 1995); ELI, *State Constraints: State Limitations on the Authority of Agencies to Regulate Waters Beyond the Scope of the Federal Clean Water Act* (May 2013). 53 5 U.S.C. § 551 et seq.
- 54 42 U.S.C. § 4321 et seq.
- 55 509 U.S. 579 (1993).

- 56 *Frye v. United States*, 293 F. 1013 (D.C. Cir. 1923). The Frye test was superseded by Daubert in federal courts.
- 57 David E. Bernstein, "What to Do About Federal Agency Science: Some Doubts About Regulatory Daubert," 22 *Geo. Mason L. Rev.* 549 (2015).
- 58 Many administrative hearing rules simply provide for the taking of testimony and for objections, but do not set standards for scientific or expert evidence. E.g. 43 CFR 4.452-6 (Interior Board of Land Appeals).
- 59 FRCP Rule 11, Revisors Note – 1993 Amendment.
- 60 P.L. 92-463, 5 U.S.C. App.
- 61 41 CFR 102-3.40(f).
- 62 41 CFR 102-3.40(j).
- 63 41 CFR 102-3.40(d).
- 64 41 CFR 102-3.40(k).
- 65 See, J. McElfish, *Nature-Friendly Ordinances* (Envtl. L. Inst. Washington, DC, 2004).
- 66 5 U.S.C. § 552a.
- 67 15 U.S.C. § 6501 et seq.; 16 CFR Part 312.
- 68 E.g., Project BudBurst, as described in Anne Bowser, et al., "Sharing Data While Protecting Privacy in Citizen Science," *Interactions* (Jan.-Feb. 2014), pp. 70-73. Another project, iNaturalist, which provides for direct interaction among users as well as submittal of data, restricts participation to those 18 and older. *Id.*
- 69 5 U.S.C. § 552.
- 70 45 CFR Part 46.
- 71 45 CFR 46.102(d), (f).
- 72 <http://www.birds.cornell.edu/citscitoolkit/toolkit/design/ethics>



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