QUICK GUIDE FOR

Planning Your Community-Based Citizen Science Monitoring Project for Dam Removal and Watershed Restoration

Developed by Ryan Meyer, Heidi Ballard, and Chris Jadallah

CENTER FOR COMMUNITY AND CITIZEN SCIENCE

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About this Document

This Quick Guide summarizes the contents of *A Manual for Planning Your Community-Based Citizen Science Monitoring Project for Dam Removal and Watershed Restoration*. **The Manual** was developed by Ryan Meyer, Heidi Ballard, and Chris Jadallah at the UC Davis Center for Community and Citizen Science for the Open Rivers Fund, a program of the Resources Legacy Fund, which is supported by the William and Flora Hewlett Foundation.

The **Center for Community and Citizen Science**, based at the UC Davis School of Education, uses research, teaching, and service to help scientists, communities, and citizens collaborate on science to address environmental problems as a part of civic life. More at **education.ucdavis.edu/ccs**.

Resources Legacy Fund (RLF) works with philanthropists to conserve land, water, and ocean resources while advancing healthy communities and social equity. With support from the William and Flora Hewlett Foundation, RLF launched the Open Rivers Fund in November 2016. Over a ten-year period, the Open Rivers Fund (ORF) is supporting local community efforts to remove obsolete dams, modernize infrastructure, and restore rivers across the western United States. ORF focuses on removing barriers that impair river function and pose challenges, costs, or risks to communities. ORF aims to create significant economic and environmental benefits, but also to build technical knowledge, organizational wherewithal, and public awareness in order to advance the field of dam removal. More at **resourceslegacyfund.org/our-approach/open-rivers-fund**.

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Introduction

Environmental monitoring is an important component of dam removal and watershed restoration. One way to meet the need for environmental monitoring is to involve local communities and organizations through citizen science. Citizen science can help to gather important data about changes in a watershed, while also building and sustaining community engagement in watershed restoration.

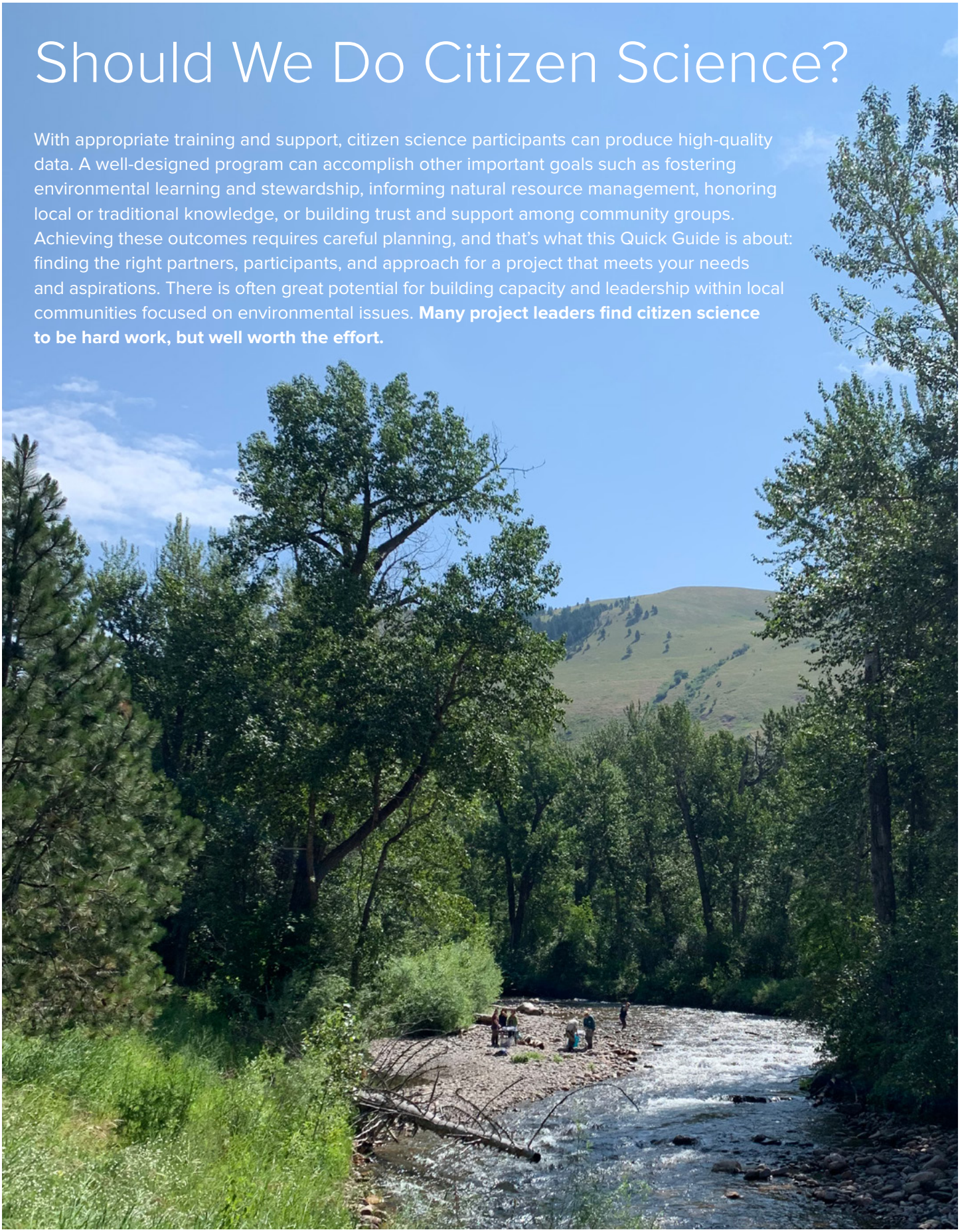
We have developed a comprehensive Manual to support planning and implementation of citizen science activities in the context of dam removal and watershed restoration. This **Quick Guide** summarizes the key recommendations found in the main document. You can use this as a starting point, and then delve in further to explore detailed considerations for the different stages of, and types of, citizen science, and to connect with additional resources that can help you plan a project.

It is important to consider all sections of this guide ***before*** monitoring begins, as each informs the other. It may also be helpful to revisit particular sections as the project gets underway, and as you encounter new challenges and opportunities. The six sections of the Manual, summarized in the following pages of the Quick Guide, are:

- **Should We Do Citizen Science?**
- **When Does Citizen Science Make Sense?**
- **Building a Team**
- **Building a Process**
- **On-the-Ground Implementation**
- **Follow-through and Sustainability of the Project**

Should We Do Citizen Science?

With appropriate training and support, citizen science participants can produce high-quality data. A well-designed program can accomplish other important goals such as fostering environmental learning and stewardship, informing natural resource management, honoring local or traditional knowledge, or building trust and support among community groups. Achieving these outcomes requires careful planning, and that's what this Quick Guide is about: finding the right partners, participants, and approach for a project that meets your needs and aspirations. There is often great potential for building capacity and leadership within local communities focused on environmental issues. **Many project leaders find citizen science to be hard work, but well worth the effort.**



What does citizen science look like?

The following examples are not exhaustive, but show the wide range of citizen science initiatives. The models described below could be organized by professional scientists, nonprofit organizations, or local communities.

Casual independent opportunities require minimal communication, and no training or oversight. For example, with a photo point, passers-by simply use a personal camera to snap a picture from a fixed spot, and submit the photo electronically. This can draw attention to important environmental issues in a given area, while generating useful data with a degree of standardization.

Picture Post at Rock Creek Park in Washington, D.C.[1]

Public events, such as a bioblitz (i.e., surveying all living species within a designated area) or trash cleanup, require minimal training and no long-term commitment from participants. They are often guided by experts, and focused on specific locations. Events can build community and facilitate learning about natural history and other environmental phenomena. They can generate useful presence data, but are generally less systematic than other forms of citizen science.

Participants at a bioblitz in 2018 in San Francisco, California.

Independent citizen science can be rigorous and engage volunteers over many years. Participants in COASST[2] and MPA Watch[3] receive extensive training, and gather data on their own, which offers flexibility for participants. With limited time face-to-face, such programs need to be creative in maintaining oversight and keeping people engaged.

Volunteers with COASST conduct shorebird surveys in Alaska.[4]

Team-based citizen science projects can allow for rigorous, elaborate methods, with corresponding benefits in the scientific results. Such projects require significant coordination. Teams are often overseen by a professional scientist or expert volunteer, and in-depth training is usually required. Team-based projects can facilitate learning, and integrate with a variety of community or environmental stewardship activities.

Stream Team volunteers with Santa Barbara Channelkeeper preparing to monitor water quality on Matilija Creek near Ojai, California.

[1] flickr.com/photos/125029725@N07/49754479838
[2] coasst.org/about
[3] mpawatch.org/about-mpa-watch
[4] flickr.com/photos/54775250@N07/16142335499

When Does Citizen Science Make Sense?

There are many potential benefits of citizen science, but it won't always be a viable option. Take some time to explore **what will and won't work** in your context.

Determine whether **incentives and goals** for collaboration are well-aligned.

Community-based citizen science s inherently collaborative, and collaboration will be more successful with shared goals and mutual understanding. When designing a project, you can create opportunities for stakeholders to discuss and clearly express their personal motivations and goals for involvement in citizen science. Begin with broad vision or mission statements as a means of finding common ground.

Think broadly about **what kinds of citizen science** might be viable.

There is a wide range of structural possibilities in citizen science (how many participants, how often, at what scale, with how much training, etc.). Look for similar projects that can be imported and/or adapted for your purposes. There are also hundreds of citizen science projects focused on water resources, and many digital and analog tools are available (See Section 5.9 of the Manual).

Technology	Pencil & Clipboard	⟷	Mobile App
Volunteers	Single Volunteer	⟷	Thousands
Participant Age	Youth	⟷	Retirees
Audience	Restristicted	⟷	Open
Spatial Coverage	Single Site	⟷	Global
Sampling Effort	Annual	⟷	Daily
Sampling Design	Opportunistic	⟷	Highly Structured
Impetus	Community	⟷	Scientists
Organization	Local Nonprofit	⟷	Global Organization/Network
Activity	Independent	⟷	Large Teams
Training	None	⟷	Extensive with Tiered Roles

Think through the **pros, cons, and barriers** to a citizen science approach.

Making lists of advantages, disadvantages, and barriers can help you refine your project goals. When considering citizen science, ask yourself: "Compared to what alternatives?" Citizen science can potentially integrate with other forms of professional monitoring, which offers the opportunity to narrow down to the data needs that can best be fulfilled with a citizen science approach, leaving other aspects of a comprehensive monitoring plan to be fulfilled through the work of other partners.

Building a Team

Citizen science is typically a collaboration across organizations and groups. To get started, you need to build the team of people that can plan and implement a citizen science project, and figure out how to work together. A major theme throughout this section is **listening to, learning from, and building trust** with your community, participants, and fellow collaborators.

Identify your **stakeholders, collaborators, participants, and sponsors**.

When it comes to dam removal and watershed restoration, there may be a variety of potential collaborators with an obvious interest in a prospective citizen science effort, such as Tribes, conservancies, environmental advocacy groups, educational organizations, or hunting and fishing associations. Ask yourself whose voices you are not hearing, and why. Could these organizations benefit from, and contribute to, a monitoring effort? Take time to understand the concerns and motivations of stakeholders, and what barriers might be in the way of effective collaboration. Feedback mechanisms, such as surveys, can help you learn how people see themselves in relation to the project, so that you can build trust and align goals.

Participants

People with an active role in the project. Roles may vary widely (training, data collection, etc.).

Collaborators

People who manage or administer a project and have some level of decision making authority.

Sponsors

Providers of financial or in-kind support (even if they don't participate otherwise).

Stakeholders

People or organizations with an interest in the project, even if they aren't directly involved.

Consider challenges and opportunities associated with the **project context**.

Section 4.2 of the Manual offers a wide variety of considerations and recommendations related to the project context. Thinking through, and in some cases formally addressing, aspects of the project context can strengthen your process, build a broader base of support, and deepen the impact of your results.

Political Context	Some groups might be averse to participation for political reasons. Citizen science could help build trust and mutual understanding, if opposing groups can agree on what data should be collected in order to understand successes and failures of a project.
Policy, Legal, and Regulatory Context	Laws, policies, and regulations may constrain where and when citizen science can happen, who can participate, and the structure of the activities. There may be opportunities to inform policy and management, beyond the narrow focus of the project.
Organizational Context	Differences across collaborating organizations can be challenging. Also, collaborating individuals may not receive adequate support from their home organization.
Environmental Context	Spatial, temporal, and biophysical considerations will heavily influence the details of a citizen science project.
Community Context	Who supports the dam removal? Who opposes it? There could be opportunities to bridge divides in a community, or address community needs.
Land Tenure Context	Public lands typically have different management goals and constraints than Tribal or private lands. Land tenure may raise issues such as access rights, allowable monitoring procedures, interactions with other land users, and public outreach.
Economic Context	Some individuals may feel a need or entitlement to participate, but are unable to for lack of resources. Compensation can take many forms, including childcare, reimbursed costs, academic credit, or a stipend. It is also important to identify and address economic and other vested interests on the part of collaborators and participants.
Cultural Context	Individuals may have fundamentally divergent understandings of the world, what constitutes valid knowledge, and how humans should interact with nature. Cultural differences can be an asset to a community-based citizen science project. Local Tribal members may contribute valuable traditional ecological knowledge. Others with extensive experience on the land may offer important local ecological expertise as well.

Develop processes for **making decisions, building trust, and communicating effectively**.

Developing and preserving trust among collaborators and participants is important throughout the project, and identifying a clear and systematic decision-making process can help with this. Decision-making within groups can take a variety of forms, such as majority rule, group consensus, or mediated discussions. A neutral facilitator can be helpful, especially in large or diverse groups. Even if some stakeholders disagree with results, prior agreement about decision-making principles and procedures can ensure accountability and acceptance of outcomes.

Transparently record and communicate decisions during planning and implementation. You can use small, short-term decisions as a way to test out your process, and plan to make incremental improvements in the process.

Communication is another important mechanism for building trust. Communication can be more effective if you address the different audiences in your community. For example, some groups might have high levels of formal education and understand the local river ecosystem through scientific training, and others may not. Some may have valuable local, indigenous, or other cultural knowledge of the ecosystem.

Meetings, training sessions, or other events can be designed to consider personal communication styles and needs. This can inform the structure and timing of gatherings, and the resources (e.g., facilitators, interpreters, technology) most helpful to participants.

Identify **high-level goals** that guide your project.

You will need to take into account both the priorities of collaborators and external factors, such as related monitoring efforts that must be integrated, and the broad goals of other stakeholders. Develop a process for revisiting and reinforcing project goals over time.

Identify roles in your project, and who will fill them.

You can begin by developing a list of roles that need to be filled (e.g., training, outreach, recruitment, data management), and laying out the overall organizational structure and leadership of the project. Consider how specific advisory councils or task forces can help in supporting your project, and which roles are crucial, and which are just desirable.

Building a Process

What will you monitor, and why? How will you build credibility and buy-in? This section will help you design the technical aspects of your citizen science project, while balancing crucial goals. There are important feedback loops between scientific **rigor, feasibility, and participation**. These priorities sometimes appear to be in tension, but through careful planning, they can be mutually reinforcing.

Determine what to monitor by starting with **key questions and hypotheses**.

Key questions and hypotheses will drive your selection of monitoring indicators – the variables you measure periodically to reveal trends. Dam removals are typically motivated by expected environmental and other outcomes, so these can be a useful starting point. Exploring historical data in the area can help determine what indicators might be most sensitive to change. Coordinating with existing monitoring efforts can avoid duplication of effort and ensure that your results can be integrated with other key data about the watershed. Look for indicators with pre-existing baseline information. You should always field-test methods before you make final decisions about indicators and measures. Your participants can also play a valuable role selecting indicators, and developing and testing methods.

Methods and sampling schemes need to be **feasible, valid, and trusted**.

Methods should align with your goals, work with your resources and capacity, and fit in the particular physical context where you will be monitoring. For example, some methods may be feasible, but involve prohibitive equipment costs, or require too much field time to align with volunteer availability.

Borrowing methods and practices that have been implemented successfully elsewhere can save time and bolster credibility. But take the time to ensure that they are applicable in your watershed. And, make sure that participants have the needed knowledge, skills, or training, so that they can implement the methods consistently.

Outside experts can be useful in designing methods and sampling schemes, and they can serve as critical reviewers once your plans have been drafted.

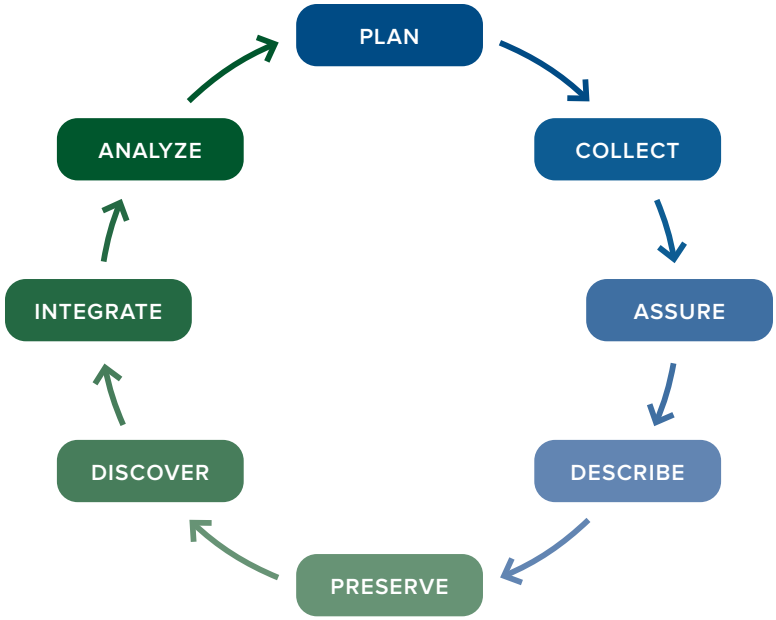
Data quality and credibility are enhanced with policies and practices that occur before, during, and after data collection.

Data quality is dependent on the rigor of the monitoring, achieved through, for example, training, field guides, expert oversight, and valid protocols. It is also related to processes for reviewing or assessing the results of that work, such as expert review or automated checks in the data management system.

Credibility is achieved by showing clear evidence that you are gathering high-quality data. This means using rigorous methods, as well as communicating clearly to participants, stakeholders, and other external audiences about policies and practices that ensure data quality in your project. Section 5.4 of the Manual includes a series of guiding questions on data quality, which can help with project design.

Plan for **data management** early on.

Without proper data management, you may be unable to analyze your data and produce results, which has both internal and external implications. Data management is crucial for linking project participants' efforts with the overall project objectives, and the outcomes that motivate participation. Working through the data management lifecycle (see Section 5.5 of the Manual) can help you make key decisions about your methods and sampling scheme, and the overall scope of your project. There are many existing tools and platforms you can use to keep your data secure and conveniently available.



Thoroughly **document your project**.

Good documentation, such as a project plan, training manual, or meeting notes, can be valuable to collaborators and participants in your project. Some kinds of documentation can also bolster credibility with key external audiences. Think early on about the kinds of documentation you will need, and who should be responsible for developing and periodically updating these resources.

Consider **bringing participants into the planning process**.

Local participants may be familiar with locations, the local watershed ecosystem, specific organisms, or practical considerations that managers, specialists, or scientists have less experience with. Local knowledge can be useful in identifying indicators, developing sampling schemes, avoiding mistakes, planning logistics, efficiently using time and resources, and maintaining safety.

Develop strategies to **encourage and sustain participation**.

The structure of your project dictates who can participate, and this in turn impacts how you will recruit participants. Local news sources, email lists maintained by collaborators, and word-of-mouth campaigns can all be used for recruiting. You may find "win-win" collaborations, through which participants meet multiple goals (e.g., merit badges, STEM learning, fishing opportunities) through their involvement. There are many kinds of benefits that might keep people engaged, such as academic credit, or building a resumé. You can also motivate participants by creating roles beyond data collection (e.g. coordination, reporting), and meaningful opportunities for leadership and advancement within the project. Section 5.8 of the Manual discusses considerations for specific audiences: formal and informal education; Tribal groups; and recreational users.

Leverage **existing tools, resources, and other projects**.

Avoid reinventing the wheel. There are many online project platforms, and other tools that can help with recruitment, project management, data collection and processing, and other important tasks. Many of these are freely available, or very low cost. Some commonly used online platforms are described in Appendix C of the Manual.

Section 5.9 of the Manual links to resources that can help with methods and other aspects of your project. Some are specific to watershed monitoring, and even dam removal. Many of these come from other projects that have made their materials available so that others can avoid a time-consuming development process.

On-the-Ground Implementation

What will your project look like in practice? This section considers ways of **supporting, preparing, and protecting your participants** as they carry out monitoring activities. While these may seem like primarily logistical or practical problems, remember that the outcomes of the project – high-quality data, environmental learning, community building, etc. – rely on sound planning for implementation.

Train your participants.

With some creativity and planning, training can accomplish multiple goals. Proper data collection is an obvious focus of training, but these sessions can also be opportunities for establishing project culture, gaining feedback from participants, and building trust within a group of participants and project leaders.

Training is crucial for data quality. Make sure to focus on the *what* and the *why* of the monitoring tasks, so that participants understand the importance of each step. Design trainings around specific, testable learning goals, such as proficiency with a specific measuring tool or content knowledge needed for proper species identification. In addition to developing a knowledge base, you should provide opportunities for participants to practice important skills. Documenting these skill-building activities can help to establish the credibility of the project for outside audiences.

Training sessions should also address the project's broader learning goals (e.g., science and environmental learning, appreciation for local knowledge), and engagement goals such as building community relationships.

Classroom, field-based, and online trainings have advantages and disadvantages, and Section 6.1 of the Manual provides guidance and considerations for these different approaches. You may need multiple types of training, such as initiation and refresher courses, or an online course, completed before a field-based training. Section 6.1 and Appendix E of the Manual provide tips and examples for designing a successful training session.

Develop **safety and emergency plans**.

Safety and emergency planning are important for any field-based project, and there are particular considerations when working in or near rivers and streams. Safety plans outline policies and practices aimed at preventing harm to those involved in the citizen science project. Emergency plans explain what to do when unexpected problems arise.

Everyone involved in the citizen science project should have easy access to emergency and safety resources, and these should be thoroughly covered during participant trainings. There are particular concerns associated with working in freshwater streams and rivers, such as site safety, weather, appropriate attire, and equipment.

Plan and coordinate **fieldwork**.

Your implementation plan should carefully describe the steps involved in successful fieldwork, and the systems in place to support those efforts. Important questions include:

- How will you schedule field activities, and communicate that information?
- How many people are needed, and how will they reach the field site?
- How long will field activities last?

These plans should balance participants' needs and the project's needs. You will also need clear communication channels, and contingency plans for fieldwork that take into consideration weather conditions and other external factors. Make sure you have the right team for the job, with clear roles, and that they are well-supported while conducting fieldwork. There may also be important supporting activities to cover, such as equipment preparation before fieldwork, and data entry after fieldwork.

Follow-through and Sustainability of the Project

This section helps you think ahead and offers practices and recommendations for ensuring your project meets expectations and evolves over time. These **longer-term considerations are worth thinking about right from the onset of the project**.

Plan for **data analysis** early on.

Starting early helps ensure that sampling methods and protocols are well-aligned with the ultimate use of the data, and that the right expertise (e.g., statisticians, scientists from relevant disciplines) and tools (e.g., analysis software) are available.

Bringing project participants into the process can improve analysis and interpretation, and build community. Gatherings to discuss data and findings with participants can provide moments of celebration and opportunities for learning. Even if you do not include participants in the data analysis, make sure to communicate clearly to them about how the process works, and when to expect results.

Plan to **reach important audiences** with your results.

You can share results in a variety of formats, from technical reports to periodically updated websites or newsletters. Sharing results regularly with participants can help maintain motivation. Think about what will work best for key audiences, such as local landowners or resource management agencies.

Technical review by external experts can be time-consuming, but it can also bolster credibility and improve the project over time.

Consider authorship: Who should be credited for the work, and how?

Evaluate and evolve your project based on lessons learned.

Evaluation can improve the project over time, and communicate the value and impact of the program for a variety of audiences (e.g., participants, funders, practitioners, Tribes, local communities, and government). An evaluation plan should start with priority questions about the project (e.g., are our results being used? Are participants benefitting from their involvement? Are protocols being implemented consistently?), methods for addressing those questions, and processes for adapting the project based on results.

For more in-depth evaluation plans, you can bring in one or more independent reviewers, and draw from existing resources to avoid duplicative efforts (see Section 7.3 of the Manual).

Honor and **celebrate participation** in your project.

Celebrating the project regularly can build momentum and continuity, and help participants feel like they are contributing to an important cause. You can focus public rewards and celebrations on individual participants, or on the group as a whole. Official acknowledgement, such as plaques, certificates, or letters of recommendation, can both celebrate and support participants. Another simple but significant way to honor participants and help them see the impact of their work is simply by working hard and following through on analyzing data and delivering results.

Develop creative strategies for **securing funding** and other resources.

With clear communication about funding needs, collaborators will have realistic expectations and can support each other. You can expand fundraising potential through “win-win” collaborations with, for example, educators and schools, nonprofit organizations, or Tribal groups. Such collaborations can allow you to pool resources, and expand the range of funders that might be interested in supporting your work.

Next Steps

Dig Deeper.

For more detailed information and guidance on the contents of this Quick Guide, access the full-length Manual and other resources at **education.ucdavis.edu/ccs-manual**. The Manual also includes a list of references, organized under each of the major sections, to help you learn more and avoid reinventing the wheel.

Join the Growing Field.

There are many ways to engage with practitioners, researchers, and participants in the rapidly growing field of citizen science. The Citizen Science Association (**citizenscience.org**) is a great starting point. The group maintains an active listserv, supports working groups on a wide range of topics, publishes a journal focused on citizen science, and hosts a biannual conference. Many professional associations related to environmental science, such as the American Geophysical Union (AGU), have developed citizen science themes in their conferences, and other programming to support capacity building.

We welcome your feedback on this Quick Guide and the Manual, and would love to hear about your experiences. Contact us at **ccs@ucdavis.edu**.

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