Department of the Interior
Bureau of Land Management

# BLM Crowdsourcing and Citizen Science Action Plan

## Public Science for Public Lands

**Fiscal Years 2023–2028**


IB2024-009 att1

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## Fiscal Years 2023–2028


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United States Department of the Interior
BUREAU OF LAND MANAGEMENT
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Grand Junction, CO 81506
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May 18, 2023

Dear Reader,

I am pleased to present the Bureau of Land Management (BLM) Crowdsourcing and Citizen Science Action Plan: Public Science for Public Lands 2023–2028. This action plan underscores the BLM's commitment to the concept of shared stewardship. We know that the health and productivity of the public lands depend on citizens who are informed and willing to assist in protecting and restoring America's natural and cultural legacy. Strong public engagement is essential to the work the BLM does on behalf of the American people.

Management decisions supported by sound, current science are essential to efforts to manage lands for multiple use and sustained yield in challenging and changing conditions. Citizen science and crowdsourced data programs help foster meaningful connections between people and their public lands, expand understanding of the BLM's multiple-use mission and the use of science in accomplishing this mission, and inspire conservation stewardship and service.

The BLM has traditionally engaged volunteers and other members of the public as part of the way we do business. The goals and objectives outlined in this action plan can help the BLM strengthen those partnerships and reach out to new and diverse audiences. This will be particularly important as we seek to expand awareness of management challenges, use up-to-date science to support management decisions, and continue to engage the public in public land management. By pursuing the goals outlined in this action plan, the BLM is making an investment in public science to support the management of public lands.

States and field offices should feel empowered by this action plan to build on their successes and their existing programs. The public, stakeholder groups, and scientists can use this plan to better understand how BLM is using citizen science and to identify new opportunities for collaboration on our public lands. I urge all BLM staff to review the goals and objectives and to consider steps that can be taken at your organizational level to achieve them. Raising the profile of crowdsourcing and citizen science demonstrates our commitment to using these programs as important management tools. This action plan will help to ensure that the health, diversity, and productivity of the public lands are sustained for present and future generations.

Sincerely,

Thomas Heinlein
Assistant Director, National Conservation Lands
and Community Partnerships

# Contents

# List of Acronyms

| | |
|---|---|
| **AIM** | Assessment Inventory and Monitoring |
| **BCNM** | Browns Canyon National Monument |
| **BFO** | Buffalo Field Office |
| **BLM** | Bureau of Land Management |
| **CANM** | Canyons of the Ancients National Monument |
| **CCA** | Colorado Canyons Association |
| **CCNM** | California Coastal National Monument |
| **CSSP** | Cultural Site Stewardship Program |
| **DOI** | Department of the Interior |
| **FLPMA** | The Federal Land Policy and Management Act of 1976 |
| **GIS** | geographic information system |
| **HEM** | Human Ecology Mapping |
| **HSU** | Humboldt State University |
| **NCA** | National Conservation Area |
| **NCSPN** | North Coast Seabird Protection Network |
| **NEEF** | National Environmental Education Foundation |
| **NHPA** | National Historic Preservation Act |
| **NLCS** | National Landscape Conservation System |
| **PIT** | Passport in Time |
| **RMP** | Resource Management Plan |
| **SPN** | Seabird Protection Network |
| **SRMA** | Special Recreation Management Area |
| **STEM** | science, technology, engineering, and math |
| **TCLT** | Trinidad Coastal Land Trust |
| **USDA** | U.S. Department of Agriculture |
| **USFS** | U.S. Forest Service |
| **USGS** | U.S. Geological Survey |
| **VaMPIRE** | Values Mapping for Planning in Regional Ecosystems |

# Introduction

The Bureau of Land Management (BLM) uses high-quality science to inform multiple-use land management decisions. According to "Advancing Science in the BLM: An Implementation Strategy," the BLM ensures effective and consistent science integration into the BLM's core work processes (Implementation Strategy, Goal 1) and ensures that relevant, timely scientific information is accessible to BLM staff and managers (Implementation Strategy, Goal 2). Further, this strategy states that the BLM seeks to "Strengthen BLM scientific engagement with the public by piloting a citizen science program with the NLCS [National Landscape Conservation System], with the aim of instilling citizen science as standard practice across the BLM." This Action Plan sets out specific actions to address how the BLM can instill citizen science as a standard practice across the BLM, thus moving the BLM towards accomplishing this action identified in the strategic plan.

## What is Crowdsourcing?

"Crowdsourcing" is a method to obtain needed services, ideas, or content by soliciting voluntary contributions from a group of individuals or organizations, especially from an online community.

## What is Citizen Science?

Citizen science involves the voluntary contribution of time, effort, knowledge, and/or experience to scientific research.

As defined in the Crowdsourcing and Citizen Science Act (Public Law 114–329, 15 U.S.C. 3724), "citizen science" means a form of open collaboration in which individuals or organizations participate voluntarily in the scientific process in various ways, including (A) enabling the formulation of research questions; (B) creating and refining project design; (C) conducting scientific experiments; (D) collecting and analyzing data; (E) interpreting the results of data; (F) developing technologies and applications; (G) making discoveries; and (H) solving problems.

Crowdsourcing and citizen science can also be recognized by other names, for example, community science, volunteer monitoring, or participatory science.

## Purpose

Managing public lands is complex in a world of rapid environmental change and significant challenges. The Federal Land Policy and Management Act of 1976 (FLPMA) in part establishes public land policy and guidelines for its administration and provides for "the management, protection, development, and enhancement of the public lands . . . ." FLPMA directs the BLM to manage the public lands for multiple use and sustained yield to ensure the health, diversity, and productivity of public lands for the use and enjoyment of present and future generations.

To accomplish the purposes specified in FLPMA, the BLM uses science to inform management decisions on public lands. It is essential for the BLM to engage the public and make science-informed decisions. Crowdsourcing and citizen science can help accomplish both goals.

This plan aligns with the Crowdsourcing and Citizen Science Act, which states that:

> Crowdsourcing and citizen science projects have a number of additional unique benefits, including accelerating scientific research, increasing cost effectiveness to maximize the return on taxpayer dollars, addressing societal needs, providing hands-on learning in STEM [science, technology, engineering, and math], and connecting members of the public directly to Federal science agency missions and to each other; and granting Federal science agencies the direct, explicit authority to use crowdsourcing and citizen science will encourage its appropriate use to advance Federal science agency missions and stimulate and facilitate broader public participation in the innovation process, yielding numerous benefits to the Federal Government and citizens who participate in such projects.

This plan also addresses goals, strategies, and actions identified in the BLM's 2015 "Advancing Science in the BLM: An Implementation Strategy." The National Science Committee coordinates the implementation of the Science Action Plan portion of the strategy and has tasked the National Conservation Lands and Community Partnerships directorate with leading the citizen science effort within the BLM. Items that directly address crowdsourcing or citizen science from the Science Action Plan portion of the strategy are specifically addressed in this action plan and are as follows:

> **Goal 2:** Ensure that relevant, timely scientific information is accessible to BLM staff and managers.
>
> **Strategy 2.2.** Strengthen communities of practice, employ skills, and partnerships.
>
> **Action 5.** Strengthen BLM scientific engagement with the public by piloting a citizen science program with the NLCS, with the aim of instilling citizen science as standard practice across the BLM.

Crowdsourcing and citizen science programs and projects addressed by this action plan support management decisions through providing data, developing scientific questions to better understand resources, using new methods to monitor or manage resources, or other ideas that have not yet been considered or incorporated into public land management. The BLM benefits from public participation in and contributions to the stewardship and management of public lands. Public participants benefit by gaining a deeper understanding of issues on public lands and of BLM efforts to use high-quality information in decision-making processes. Engaging individuals and communities in scientific inquiry focused on and about the nation's public lands can promote better understanding and engagement of the public in management of public land and the science that supports this management. This action plan identifies actions furthering the practical use of crowdsourcing and citizen science to meet BLM goals.

This plan is intended to complement other BLM programs and is not meant to discourage programs or projects. For example, an elementary field trip may observe birds and collect

species seen on a field trip. A project such as this may have elements of crowdsourcing or citizen science, but the intent of the project may be education and engagement with little intent to use collected data in management decisions. This plan should encourage organizers to consider if their project can contribute in a meaningful way to research, data, monitoring, or other scientific endeavors that can complement management or support management decisions but should not discourage meaningful engagement projects where this outcome is unlikely. Citizen science projects are one specific type of project that can occur within the BLM's community engagement programs by providing support to management decisions while educating and engaging participants.

This action plan is intended for all BLM employees and potential partners. From ensuring high-quality information is publicly available and informs BLM decisions, to weaving Indigenous knowledge into BLM processes, to data management, to environmental justice, to inspiring the next generation of public land stewards; no single BLM program addresses all facets of crowdsourcing and citizen science. While the BLM National Conservation Lands and Community Partnerships Directorate is responsible for coordination and communication of this action plan in cooperation with the BLM National Science Committee, successful implementation requires sustained engagement by all BLM programs.

# BLM's Goals, Objectives, and Actions for Crowdsourcing and Citizen Science

The BLM supports the use of citizen science to sustain the health, diversity, and productivity of public lands for the use and enjoyment of present and future generations. Citizen science projects engage individuals and communities in scientific endeavors focused on and about the nation's public lands, encourage diversity, equity, inclusion, and accessibility from research design through to conclusion, and promote cross-program collaboration. The BLM will benefit from public participation in the stewardship and improved management of public lands. The public benefits by gaining a better understanding of the management of public lands and the science that supports this management, and from opportunities to actively engage in the management and care of public lands.

This plan identifies four main citizen science goals, along with associated objectives and specific actions that support the mission of the BLM. Implementing these actions will harness the strength of individuals and communities to support the BLM mission and improve stewardship of public lands.

## Goal 1 – Enable and Support Citizen Science Efforts in the BLM

Leadership at all levels of the BLM support the appropriate use of citizen science to improve science-informed management and public engagement in stewardship of public lands.

**Objective 1.1 – Assess crowdsourcing and citizen science efforts within the BLM.**

**Action 1.1.1 – Identify ongoing citizen science projects.**

Gather data (see actions 1.1.2 and 1.2.1) about ongoing citizen science projects to inform the status of citizen science within the BLM. Data about projects which have occurred or are ongoing should be consulted to document the scope and scale of citizen science use, highlight key partnerships, and identify how citizen science is used and supported in the BLM. Certain projects may be added to the https://www.citizenscience.gov/ database in order to generate interest in the project and increase awareness of citizen science opportunities in the BLM.

**Action 1.1.2 – Identify meaningful categories of citizen science projects in the BLM.**

Identify education or outreach-focused, research-focused, and management-focused citizen science projects. This does not imply that projects address only education and outreach, research, or management needs. Most citizen science projects will have elements of all three of these focus areas. However, the initiation of a citizen science project may be driven by one of the three. For example, a science, technology, engineering, and math (STEM) project, called Greening STEM, that is based on school curriculum and engaging a K–12 class may be driven by education goals; a project initiated by a research university to collect data for a study may be driven by research goals; a wild horse and burro group may develop

new techniques for monitoring animals to improve range management; and a project initiated by a local BLM field office to gather data about an ongoing management concern may be driven by management goals. All projects will likely address education, research, and management goals and needs, and provide outreach to the public.

Identify thematic labels for citizen science projects that allow BLM Headquarters directives to engage and be informed on the importance of citizen science for their directive. Thematic labels include:

- Forest, rangeland, and vegetation
- Wildlife, including threatened and endangered species
- Aquatics, including fisheries and hydrology
- Recreation
- Geology and paleontology
- Fuels and fire
- Cultural resources
- Conservation land focused (including an emphasis on resources, objects, and values for which National Conservation Lands are designated to protect)
- Other

**Objective 1.2 – Include citizen science activities in reporting processes.**

**Action 1.2.1 – Collect data on citizen science activities as part of an appropriate data call.**

Potential data to be collected:

- Number of citizen science programs
- Number of participants
- Software applications (apps) used in projects
- Number of volunteers engaged
- Key partners
- Project occurring within National Conservation Land units
- Thematic label (see Action 1.1.2)
- Reportable hours for Paperwork Reduction Act (44 U.S.C. 3501 et seq.) purposes
- Other relevant information, such as reporting details in support of the Implementation of Federal Prize and Citizen Science Authority biennial report to congress

**Action 1.2.2 – Analyze, summarize, and report data on citizen science efforts.**

Data collected about citizen science efforts are summarized annually and summary data are made accessible to BLM leadership, as well as local offices engaged in citizen science, partners, and the public.

**Objective 1.3 – Increase staff capacity and expertise.**

**Action 1.3.1 – Reduce administrative burdens.**

Reduce administrative burdens which limit staff time available to devote to citizen science. Work with U.S. Department of the Interior (DOI) partners to obtain Paperwork Reduction

Act generic Information Collection Review clearance for citizen science and eliminate or reduce other administrative burdens where allowed.

Work with staff to increase understanding of requirements for volunteer work and ability to work with volunteers in the context of citizen science.

**Action 1.3.2 – Identify internal and external training opportunities and needs.**

Engage with interagency training opportunities when possible and relevant to BLM citizen science. Provide volunteer administration training with a focus on citizen science. Engage with appropriate external training opportunities. Provide other pertinent internal trainings as appropriate and relevant to citizen science.

**Action 1.3.3 – Develop a community of practice.**

Develop and sustain a community of practitioners that share successes, challenges, best practices, and other relevant topics for the BLM citizen science community.

**Action 1.3.4 – Identify and encourage use of public-facing or external funding opportunity announcements for citizen science.**

BLM Headquarters science, education, and other program leads identify and disseminate internal and external funding opportunities to staff interested or engaged in citizen science projects, for example through the education newsletter, education or citizen science community of practice meetings, program staff meetings, emails, or other appropriate means.

## Goal 2 – Integrate Crowdsourcing and Citizen Science into the BLM

Staff time is limited and should be used to support citizen science projects that help the BLM reach management goals and address scientific questions. Headquarters, state, or other level coordination and support of projects during key phases of developing crowdsourced or citizen science projects can provide needed support and greatly improve probability of success. For example, sites may need support early if they lack pre-existing programs, or support may be needed at data integration or analysis phases for projects working with national datasets such as Assessment Inventory and Monitoring (AIM). Access to staff time at key stages can greatly improve probability of success. Integration of data, techniques, ideas, and other citizen science outcomes into BLM management processes will ensure that citizen science projects are valuable to managers, partners, and the public. Collaboration across BLM program areas and incorporation of citizen science into BLM decision making will maximize the collective impact of BLM actions.

**Objective 2.1 – Collaborate across BLM programs.**

**Action 2.1.1 – Ensure citizen science is recognized and active in working groups (see Action 2.1.2)**

Citizen science program representatives regularly report to the BLM National Science Committee, communities of practice, and relevant BLM programs.

**Action 2.1.2 – Identify and engage BLM programs that could benefit from citizen science**

Identify programs that lack data, could benefit from additional data, could benefit from other scientific resources, have needs that could be crowdsourced, could engage volunteers, have interested publics, or could otherwise benefit from citizen science projects. Examples include:

- Forest, rangeland, and vegetation
- Wildlife, including threatened and endangered species
- Aquatics, including fisheries and hydrology
- Recreation
- Geology and paleontology
- Fuels and fire
- Cultural resources
- Conservation land focused (including an emphasis on resources, objects, and values for which National Conservation Lands are designated to protect)
- Other

**Objective 2.2 – Integrate citizen science projects into BLM processes.**

**Action 2.2.1 – Encourage use of the internal budget or project approval programs or systems and other existing systems to identify citizen science needs and opportunities.**

Identify and track references to citizen science in NLCS Management Studies and other relevant BLM funding and/or fund tracking activities.

**Action 2.2.2 – Encourage the use of program element reporting of accomplished targets by citizen science projects.**

For example, use appropriate program elements (BS - inventory acres of habitat for invasive species, MR – monitor species populations) to report targets accomplished by citizen science projects.

## Goal 3 – Promote Information and Data Quality and Access

Crowdsourcing and citizen science projects must be held to the same high standards as any BLM science endeavor. Projects should have a plan for ensuring data quality and for communicating results to participants, managers, and the public.

**Objective 3.1 – Ensure data and information quality and integrity standards are met.**

**Action 3.1.1 – Ensure and maintain data and information quality.**

Data and information collected must follow guidelines set out in the DOI Information Quality Mission Statement or comply with the most up-to-date guidance.

https://www.doi.gov/ocio/policy-mgmt-support/information-and-records-management/iq

Data and information collection must follow BLM or other relevant program or process specific policy and guidance on collection methods and quality assurance.

**Action 3.1.2 – Ensure scientific integrity standards are maintained.**

Citizen science activities must follow guidelines in the DOI Integrity of Scientific and Scholarly Activities policy or the most up-to-date guidance.

https://www.doi.gov/scientificintegrity

These scientific integrity standards apply to all citizen science activities, whether it be project design, conduct of experiments, data collection, analysis and interpretation, development of new technologies, or other forms of scientific innovation.

**Action 3.1.3 – Identify software applications that have appropriate data quality standards.**

Encourage use of apps with known appropriate data quality standards when the use of (public) apps are part of a citizen science project.

**Objective 3.2 – Data and information integration.**

**Action 3.2.1 – Ensure citizen science data, information, and products can be used in BLM decisions and/or processes and when appropriate in conjunction with data, information, and products collected or produced by BLM staff.**

Data or information crowdsourced or collected by citizen scientists can be informative and supplement what is collected by BLM staff, for example from the AIM program, BLM recreation, BLM wildlife, or other BLM programs.

Data or information collected by citizen science volunteers may be informative for context, as one line of evidence towards a decision, or to directly support management decisions. However proper procedures and policies should be followed (Action 3.1.2).

Ensure that citizen science volunteers are adequately trained in the relevant processes and follow the procedures and steps in any relevant agency policy or guidance. Citizen science data or information may be combined with data or information collected by the BLM, other scientific or management agencies, or other partners.

**Objective 3.3 – Make data and information accessible to the public.**

**Action 3.3.1 – Identify and use publicly accessible applications when appropriate.**

Data should be shared through BLM public datasets, state heritage programs/databases, or apps that are publicly accessible (e.g., iNaturalist, Nature's Notebook, eBird, CitSci) when possible and appropriate.

**Action 3.3.2 – Provide training or support on app use or relevant technology or tools.**

Identify internal or external trainings or opportunities for staff and partners to learn about new tools relevant to citizen science, for example for data collection, analyses, and sharing. This may be accomplished through presentations at community of practice meetings, external workshops with partners or other agencies, or internal trainings.

**Action 3.3.3 – Promote awareness of existing public BLM information.**

Awareness of and opportunities to interact with existing public data and information is an important aspect of transparency which promotes better science and decision making. The BLM should make information regarding opportunities and existing information available to the public, for example through a BLM or other existing website (e.g., https://www.citizenscience.gov/).

**Action 3.3.4 – Promote awareness of existing information that can inform BLM management.**

Identify citizen science apps or other existing sources with appropriate quality control that can be used to inform BLM management of public lands.

## Goal 4 – Leverage Partnerships

Management of public lands depends on public stewardship of this shared resource. Building strong partnerships will ensure citizen science projects have utility and longevity.

**Objective 4.1 – Identify and increase partnership opportunities.**

**Action 4.1.1 – Support local initiatives for citizen science.**

Support Greening STEM, BioBlitz, and other existing local projects through funding and training for local BLM offices or partner organizations when possible.

**Action 4.1.2 – Support national citizen science opportunities.**

Support national initiatives that are relevant across many BLM sites and offices with funding, training, and Headquarters staff time when possible.

**Action 4.1.3 – Encourage partners to identify citizen science opportunities and apply for BLM funds.**

Work with nonprofits, other agencies, state or local governments, schools or universities, or other partners to identify funding opportunities and develop projects that are beneficial to multiple partners.

**Action 4.1.4 – Engage and retain partners.**

Identify and implement best management practices for working with partners and volunteers. For example, identifying common goals between all partners and holding kickoff and closeout events or presentations to benefit partners and participants (volunteers, students, community members, or others) involved in citizen science projects.

Utilize and recognize specialized partners (e.g., Indigenous organizations, herpetological specific partners, eBird, Public Lands Council) when appropriate.

**Objective 4.2 – Promote diversity, equity, inclusion, and accessibility.**

Ensure diversity, equity, inclusion, and accessibility are considered in project design and implementation to maximize the benefits of citizen science. Citizen science activities in the BLM should pay close attention to issues of diversity, equity, inclusion, and accessibility, and to the processes for engagement recognizing that collaboration and partnership are important for success.

**Action 4.2.1.- Headquarters leads for citizen science engage with BLM working groups addressing environmental justice, Indigenous knowledge, diversity, equity, inclusion, and accessibility.**

Citizen science leads, and other involved BLM staff, should work with internal BLM groups to determine how additional steps towards more inclusive citizen science projects can be achieved and aligned with other ongoing efforts within the BLM.

**Action 4.2.2 – Engage with local communities near BLM-managed public lands.**

Work with communities, especially underserved communities that may be otherwise left out or are not usually represented, by developing long-term relationships. Engage with communities in project identification, conceptualization, development, and implementation when possible. Work to limit barriers. For example, translate materials, provide equipment for projects, or ensure projects are as accessible as possible with appropriate accommodations to maximize participation.

**Action 4.2.3 – Encourage work with partners that reach diverse audiences.**

Engage with partners that reach diverse audiences such as local schools or universities, Indigenous organizations, social or other community groups (e.g., Outdoor Alliance for kids, Latino Outdoors, Outdoor Afro, Disabled Hikers, Queer Nature, Green Muslims, Unlikely Hikers, Indigenous Women Hike, Outdoor Asian), or other partners to increase participation, especially of underrepresented groups.

**Action 4.2.4 – Provide opportunities for user groups without local access to BLM-managed public lands.**

Work with communities that are physically distant from BLM-managed public lands or lack easy access to public lands. Provide virtual citizen science projects, for example species identification on game camera data, developing species lists for defined areas (e.g., National Monuments or National Conservation Areas [NCAs]) from eBird or iNaturalist, or other opportunities.

# Conclusion

This action plan will guide the use of citizen science within the BLM. Thoughtful implementation of citizen science within the BLM will increase public participation in science and science-informed management on public lands. Citizen science project engagement can be a powerful tool to increase public participation and engagement in management, increase stewardship of public lands, and provide needed information to managers.

# Acknowledgements

We would like to recognize support from BLM leadership in BLM HQ420 (Division of Education, Cultural and Paleontological Resources) and HQ410 (Division of National Conservation Lands), crowdsourcing and citizen science community of practice, education community of practice, and other BLM staff for their helpful comments and suggestions.

We would also like to thank Casey Burns, Tyson Finnicum, Ardy Hahn, Vincent MacMillan, Dani Ortiz, Leiskya Parrot, Karla Rogers, Larry Ridenhour, Kate Sorom, Alicia Styles, and Geoff Walsh for contributions of project example writeups and all their work in citizen science.

This outline draws on the experience shared in the National Oceanic and Atmospheric Administration's "NOAA Citizen Science Strategy"; the National Aeronautics and Space Administration's "Science Mission Directorate Policy, Citizen Science"; and U.S. Forest Service (USFS) citizen science website resources.

# Example Project Summaries

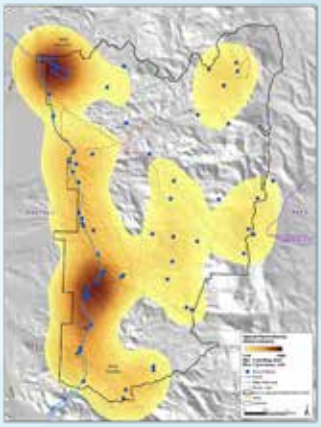
The following example project summaries showcase management, education and outreach, and research-focused citizen science projects in the BLM. These studies highlight projects that have engaged the public, addressed data gaps, and complemented existing BLM data. These projects, and the lessons learned from them, can be leveraged to foster additional citizen science projects at local, regional, and national levels within the BLM.

## Management-Focused Example Projects

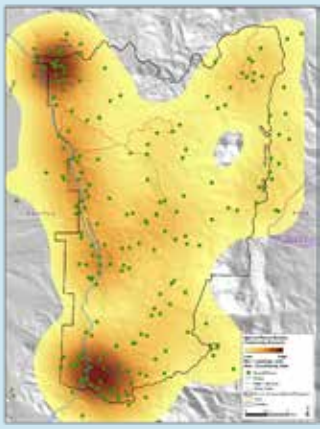
### Engaging Members of the Public with Professional Scientists to Achieve a Collaborative Assessment of Browns Canyon National Monument (BCNM), Colorado

#### Project Overview

The Browns Canyon National Monument (BCNM) Human Ecology Mapping (HEM) effort was prework to the BCNM's Resource Management Plan (RMP). The HEM effort coupled collaborative methods (stakeholder analysis, situation assessment, facilitated meetings, and public verification) with social science methods (study of human-land relationships) through a public participatory geographic information system (GIS) approach. The purpose of this effort was to gain public perspective about the social, economic, environmental, and resource conditions of the area designated as BCNM. The approach fostered federal-state-public relationships of trust while improving understanding about existing ties between people and the monument landscape.



Online listening sessions



Community listening sessions

**Map from BCNM HEM report.**
https://eplanning.blm.gov/public_projects/lup/69924/119445/145750/Executive_Summary_Browns_Canyon_Combined_Report_FINAL_9.1.17.pdf

## Project Description

President Barack Obama established BCNM in 2015. The designation is an area of 21,604 acres of scenic and diverse natural resources along the upper Arkansas River of Colorado. The monument encompasses lands managed by both the DOI's BLM and the U.S. Department of Agriculture's (USDA's) USFS. The proclamation directed the two agencies to develop a joint management plan.

Together, at the earliest stage of land-use planning, the BLM and USFS embraced an innovative approach that combined methods of public engagement common to Collaborative Action and Dispute Resolution and scientific study common to social sciences to meet both agencies' planning rules (the Forest Service Handbook 1909.12 and the BLM's Planning 2.0 that was nullified in 2017). The approach primarily employed stakeholder analysis, situation assessment, facilitated meetings, and open public engagement using participatory mapping to capture knowledge. The participatory mapping vehicle was available online 24/7 for three months and at six in-person public meetings held in proximity of BCNM and the broader Colorado Front Range. The project took 16 months to complete. During that time, Colorado Parks and Wildlife and two local nonprofit groups worked with the federal agencies to get the word out. Also, 311 members of the public voluntarily shared information about how the area of BCNM was important to them.

The results were directly applicable to the USFS assessment of the planning area and the BLM's analysis of the management situation; enabling a better understanding of what is important to individuals, local communities, and other stakeholders.

## Challenges

The key challenge had three parts:

- The BCNM is comanaged by the DOI's BLM and the USDA's USFS. The BCNM management team needed to figure out an efficient approach to carry out the RMP prework needed by both agencies. Prework included early public engagement and assessment of the ecologic, social, and economic conditions.
- The second part of the challenge was to figure out how to motivate participation when there wasn't a "problem" or management action on the table.
- A third part of the challenge was to identify a functional and meaningful approach to achieve the social goals of building trusting relationships, and the information goals of understanding the social, economic, and ecological conditions.

## Benefits and Outcomes

This effort demonstrated how to combine existing methods of public engagement and scientific study in a unique way to meaningfully engage the public at an earlier stage of the federal land planning cycle than is typical. The effort fostered positive federal-state-private relationships which continued through the plan development process. These relationships still hold today with implementation of the resulting plan. The public recognized that planning staff had incorporated the knowledge they had shared into the planning process and final plan.

Based on the lessons learned at BCNM, BLM Headquarters is working with the U.S. Geological Survey (USGS) to develop a participatory GIS tool called Values Mapping for Planning in Regional Ecosystems (VaMPIRE). That tool will build on the HEM model of exploring human-land relationships to also explore concepts of substitutability and tradeoffs based on different management scenarios. The VaMPIRE tool is currently under development.

## Tips

Three "aha" moments:

- There is something neutralizing about putting a map on a table and letting people speak of their experiences and knowledge of place. Every response adds a valid human-land interaction that doesn't take away from anyone else's response. It makes it easier for all to listen with empathy and hear the diversity of ways that the same shared landscape is meaningful.
- Pointing to a map and telling how interaction with that place occurs and why it is important facilitates deeper understanding of human-land ties that can be displayed using GIS alongside other spatial data. The mapping method is a good way to hear diverse accounts that ascribe value to public lands. It also holds professional scientists accountable for hearing and recording input.
- Mapping can be a neutral and interactive method of public engagement. It creates evidence of public input and facilitates stronger federal-state-private relationships of trust.

# Buffalo Field Office (BFO) Passport in Time (PIT) Project

**PIT volunteers and BLM archaeologists record a prehistoric campsite.**

## Project Overview

Since 2010, the BLM's Buffalo Field Office (BFO) has hosted Passport in Time (PIT) archaeological projects annually. Volunteers have contributed more than 4,000 hours dedicated to site recording and testing, metal detection, pedestrian survey,

artifact curation, and more. PIT is a volunteer cultural heritage program that works with federal agencies to match volunteers to projects. Agencies have used information gathered through PIT projects for the following: analysis and implementation of the BFO's RMP; designation of a lithic landscape, an archaeological landscape designation in Wyoming, in the southern Bighorn Mountains; site interpretation of the Middle Fork of the Powder River Special Recreation Management Area (SRMA) and Crazy Woman Battlefield; a basis for the Welch Ranch SRMA tribal outreach and management discussions.


**Volunteers record a historic inscription.**

## Project Description

In June 2022, seven PIT program volunteers contributed a combined time of 270 hours to assist the BFO with the Crooked Creek I project in southern Johnson County, Wyoming. The group aided the BLM during the course of a week to record historic inscriptions and artwork, prehistoric rock art, and a large prehistoric campsite. Volunteers also updated site recordings for six other previously recorded sites and accomplished an extensive survey of rock faces for rock art and inscriptions.

## Challenges

Project locations are often remote and difficult to access. Additionally, many of the BFO's PIT projects have included crossing private lands to reach public land, adding an additional layer of coordination and complexity. Working with adjacent private landowners early in the process to consider their concerns has addressed these issues.

## Benefits and Outcomes

PIT volunteers get to work and camp in scenic, remote areas of public lands that are often inaccessible to the public. They also have the opportunity to work alongside and learn from professional archaeologists and historians on public lands throughout the country and experience a diversity of archaeology-related activities.

The benefits to the BLM are numerous. The cost to the BLM is relatively inexpensive, covering mainly equipment, supplies, and BLM labor. Further, the amount of work the group accomplishes is exponentially more than the BLM can do within the same time frame, allowing the BFO to update site recording information for more than 150 cultural sites, designate an area of cultural importance, develop a management plan for the southern Bighorn Mountains, and curate artifacts.

## Tips

Communicate early with the PIT Clearinghouse. Their staff are very helpful and can answer questions about the program and how best to use it to meet your project needs. Additionally, when submitting budget requests to use the program, factor in funding for the PIT Clearinghouse fee and equipment needs.

# Chronolog Use in Red Rock Canyon National Conservation Area (NCA)

**Red Rock Canyon Dedication Overlook.**



## Project Overview

The desert landscape at Red Rock Canyon National Conservation Area (NCA) is part of the Mojave Desert. One of the hottest and driest deserts in North America, the Mojave receives only 4 to 6 inches (10–15cm) precipitation annually. Elevations at Red Rock Canyon range between 2000 to 5000 feet (600–1500m), which allows for diverse wildlife such as desert tortoises, Gila monsters, bighorn sheep, phainopeplas, and much more. All these species are at home in the Mojave Desert and rely on this habitat for survival.

From 2005–2007, Red Rock Canyon suffered from multiple thunderstorms and lightning strikes, causing wildfires in sizes Red Rock Canyon had not seen before. The desert is not well adapted to wildfire, and it does not have a long history of large wildfires that are 300 acres (1.2 $km^2$) or larger. Mojave vegetation may take generations to recover, and many plants are not capable of resprouting after a fire. Invasive grasses, such as red brome and cheatgrass, contribute to the spread of wildfires in the Mojave Desert. Habitat restoration is being heavily researched by many government agencies, nonprofits, and universities.

## Project Description

Two chronology stations have been installed in the Red Rock NCA, High Point Overlook and Canyon Dedication Overlook. These stations use multiple photos taken by visitors from a fixed location to help monitor the overall regrowth of vegetation in fire scars larger than 300 acres (1.2 $km^2$). Photos look out onto fire scars from the 2005 Loop Fire (920 acres; 3.7 $km^2$), 2006 Scenic Fire (1500 acres; 6.1 $km^2$), and 2007 Bonnie Springs Fire (392 acres; 1.50 $km^2$).

## Challenges

BLM staffing changes have limited opportunities to explore possible uses of the images and data. One site, the Red Rock Dedication overlook, has received limited photos.

## Benefits and Outcomes

These sites are relatively new, established in 2020, and have received more than 1000 photos at the High Point Overlook site and more than 100 photos at the Red Rock Canyon Overlook. Staff have used photos for social media posts.

# Hovenweep Debris Field Citizen Science Project: Cultural Site Stewardship Program (CSSP) for the Tres Rios Field Office / Canyons of the Ancients National Monument (CANM), Managed by Southwest Colorado Canyons Alliance

## Project Overview

The Cultural Site Stewardship Program (CSSP) has been an ongoing volunteer project since the early 2000s. It currently includes 65 volunteers who monitor 120 cultural resources on Canyons of the Ancients National Monument (CANM) and Tres Rios Field Office lands. In addition to monitoring the cultural resources for impacts due to humans, livestock, wildlife, and other causes, the volunteers engage in additional education and volunteer activities.

## Project Description

Vince MacMillan, CANM Archaeologist, located a seven-acre secondary trash deposit on the edge of Hovenweep Canyon within CANM. Though largely modern trash, the presence of apparently historic debris necessitated compliance with the National Historic Preservation Act (NHPA) prior to removal. MacMillan enlisted the assistance of CSSP Program Manager Diane McBride and her team of trained cultural volunteers to record the site, allowing for an assessment of the location's historic significance. Diane acted as team leader for the project, bringing in a group of site stewards and a few others with archaeological survey and site recording experience.

All but two of the volunteers are site stewards, and all have participated in survey and cultural resource recording through the Colorado Archaeology Society's Hisatsinom Chapter survey

team. This team has been recording sites on private property since 2008. Most of the recorded sites are Ancestral Pueblo with only a few historic sites.

Prior to the field project, the team gathered for 2-hour meetings (for a total of 28 hours of meetings) via Zoom and in person to review historic artifact typologies and documentation procedures. The group of surveyors then spent two days in the field recording the site.

The survey began at the northeast edge of the canyon to identify distinct concentrations of debris (loci) within the area. One team of three people began by numbering each locus and recording its dimensions. Teams identified six different locations, both on and below the canyon rim. This group continued to locate areas along a two-track road leading into the area and to record dimensions of three additional loci. Other teams of two or three surveyors moved from locus to locus tallying artifacts, leaving Locus Four for last. It was the largest and most dense of the trash piles. All team members worked together to tally those artifacts. Meanwhile, the team leader used a global positioning system on the Avenza app to record the entire site perimeter and the center of each locus. She took photographs of various loci and specific artifacts of interest.

On the second day, volunteers returned to the site to conduct additional intensive survey transects through the area. They began on the west side of the project area and moved west to east, revealing 3 additional areas of trash for a total of 12 distinct loci, all with different categories of artifacts from different, definable time periods.

## Challenges

Dates of the trash ranged from an early estimate of the 1880s to the present day. Trash types ranged from cans and bottles to tires and automobiles parts. Shoes, clothing, household goods, and construction materials were also present. The secondary nature of these cultural deposits and the absence of additional information potential preclude the site's listing on the National Register of Historic Places, allowing for the agency's future cleanup of this uniquely beautiful location on southwest Colorado's BLM-managed public lands.

## Benefits and Outcomes

On the first day of the field project, 13 volunteers spent 4 hours each in the field, for a total of 52 hours. On the second day, 5 volunteers returned for 3 hours to transect the rest of the area and record an additional 3 loci, a total of 15 hours. The team leader spent approximately 100 hours to compile the information, create maps, and complete NHPA forms. In total, this trained group of devoted avocational archaeologists spent 195 people-hours to assist the BLM in recording this site in preparation for this important cleanup project on the national monument.

Volunteers included: Bill Aldorfer, Chris Barns, Ross Gralia, Maiya Gralia, Cindy Gray, Tom Hahl, Irene Komadina, Diane McBride (team leader), Susan Montgomery, Marcie Ryan, Kathleen Stachowski, Barbara Stagg, Kim Sturm, and Barb Terrell.

# Education-Focused Example Projects

## Greening STEM in McInnis Canyons NCA

### Project Overview

The BLM and the National Environmental Education Foundation (NEEF) work together to advance STEM education goals through mission-based Greening STEM projects. BLM Greening STEM projects seek to educate students on public lands while addressing a real-world management challenge.

### Project Description

Staff from BLM McInnis Canyons NCA identified an area of heavy Russian knapweed (an invasive plant) infestation along the Colorado River with biological control (Russian knapweed gall wasp) as a potential treatment method. In May of 2021, the BLM partnered with Colorado Canyons Association (CCA), a local nonprofit friends group, the Palisade Insectary, and Central High School for a NEEF-supported Greening STEM project. As part of the project, students recorded data on invasive species density and vegetation and reported data to the BLM. Central High School students complete an educational river trip annually and perform this monitoring with support from CCA, the BLM, and the Palisade Insectary. This project provides hands-on experiential learning for students, meets community goals of CCA, and provides consistent monitoring data about the Russian knapweed infestation and progress of biological controls for the BLM and Palisade Insectary.


**Partners for McInnis Canyons NCA Greening STEM project.**

### Challenges

The infested site is difficult to access, therefore an overnight river trip by students is a consistent way to access the site for ongoing monitoring. Funding and logistics (especially with the COVID-19 pandemic) for student trips are challenging. NEEF support helped begin the project and community support for the CCA nonprofit friends group allowed it to continue.

## Benefits and Outcomes

The benefits to the students are tremendous. It is a meaningful experience for them and a chance for them to see their classroom lectures used in a real-world situation. They also provide consistent and meaningful data to the BLM and Palisade Insectary. Further, the project provides a compelling project and story for CCA.

## Tips

Build meaningful partnerships where all partners' goals are understood and clearly addressed. Check in often and divide up work between partners.


**Students collect data.**

# Research-Focused Example Projects

## Basin and Range National Monument BioBlitz 2021

### Project Overview

Basin and Range National Monument held its first BioBlitz, a community and partnership citizen science event, June 4–6, 2021. Approximately 100 participants (mix of agency staff, volunteers, and families) recorded 1,728 observations of 406 species using the iNaturalist app during the three-day event in remote eastern Nevada. Groups inventoried during the BioBlitz included small mammals, birds, reptiles, amphibians, insects, and plants.

### Project Description

In 2017, Eastern Nevada Landscape Coalition and the BLM entered into a cooperative agreement to inventory plants within Basin and Range National Monument. In 2018, the BLM and the USGS entered into an interagency agreement to model and map habitat for wildlife species listed in the proclamation that created Basin and Range National Monument. These efforts and the lack of plant and wildlife inventory data within the area led the BLM and its partners to begin planning a BioBlitz in February of 2021. As planning efforts continued, more partners joined, and scientists and subject matter experts offered to serve as group leaders for the BioBlitz.

**Nevada Department of Wildlife lead the small mammal trapping group.**

### Challenges

Logistical challenges during the BioBlitz included lack of cell service in the monument, dirt roads (some in poor condition), unusually warm weather, the sheer size of the 704,000-acre monument, and participants collecting data throughout the day and night.

### Benefits and Outcomes

Partnerships built and strengthened through this effort will benefit Basin and Range National Monument into the future as more researchers and citizen scientists gain knowledge and interest in the monument. Partners at the 2021 event included: USGS, National Park Service, Friends of Basin and Range, Nevada Department of Wildlife, Nevada Division of Natural

Heritage, Eastern Nevada Landscape Coalition, Southern Nevada Water Authority, University of Nevada, Reno, Desert Research Institute, Conservation Lands Foundation, and Great Basin Institute. Since the BioBlitz, the BLM has entered into new cooperative agreements with three of the entities that participated in the event. These partnerships spurred new funding proposals and projects, which will result in a better understanding of the resources, objects, and values in the monument. Data collected at the BioBlitz helped to further inform and refine the USGS habitat models for wildlife within the monument.

Positives for the event included several planning meetings months before the event, excellent scientist/subject matter expert group leaders, diversity of plants and animals for participants to inventory, t-shirts courtesy of Conservation Lands Foundation and Friends of Basin and Range, large amounts of information collected, camping in a fun learning family atmosphere, building/strengthening partnerships, getting people out to explore the monument, and an increased interest in science.

**T-shirts by Conservation Lands Foundation and friends group.**

## Tips

Begin planning citizen science events approximately six months in advance. Consider some of the fiscal year data calls that information from your event might inform (such as volunteer, education and youth, and special status species). Prepare photo release forms and volunteer agreement forms ahead of time. Keep volunteers busy and engaged and provide plenty of staff and friends group folks available to help if your event involves volunteers. Most importantly, be safe, have fun, and collect valuable data to inform management decisions on public lands.

**Volunteers check small mammal traps.**

**Volunteers learn about lizards.**

# Alaska Bee Atlas Community Science Overview

**Pollinator surveys at BLM's Campbell Tract in Anchorage, Alaska.**

## Project Overview

The Alaska Bee Atlas is a collaborative program run by the BLM and the Alaska Center for Conservation Science at the University of Alaska Anchorage to collect bees and associated habitat data in Alaska. Participating scientists are filling data gaps on Alaska's insect pollinators. Protocols for bee sampling include netting, pan traps, and blue vane traps, as well as collection of associated habitat and weather data. Agency participation has been broad, with individuals representing ten different state and federal agencies. Opening the Alaska Bee Atlas to community scientists expands the sampling efforts across Alaska to fill in more data gaps. It also provides opportunities to educate the public about the importance of Alaska's pollinators and to engage the public in meaningful science. Community science has been performed by individuals associated with the Alaska Native Plant Society, Jensen-Olson Arboretum, Backcountry Hunters & Anglers, and Alaska Science Teachers summer camp. Training and supplies are offered to all participants.


**Alaska Bee Atlas community scientists sample bees in the Brooks Range of Alaska.**

## Challenges

- Delivering training to the public, supporting priority survey site selection, follow through with surveys and submitting specimens.
- Consistent data collection following the protocol.
- Unease of the public with recommended lethal sampling methods (non-lethal option is available).
- Administration of the community science portion of the Alaska Bee Atlas is time consuming.

## Benefits and Outcomes


Lisa Hupp, USFWS

- Increased information to document potential impacts of proposed actions and inform land management decisions that can maintain bee populations, habitat, and pollination services.
- Increased knowledge of species ranges, habitat associations, floral associations, and threats to inform threatened/endangered species concerns (Endangered Species Act listings) and conservation initiatives.
- Efficient use of funds to gather information over a large area.
- Public engagement to increase understanding of pollinators' ecological role and conservation importance.

## Tips

- Selectively promote the opportunity through specific channels to attract appropriate individuals (people traveling to or living in more remote parts of Alaska).
- Identify aligned organizations and community science leaders to attract more appropriate individuals.
- Create and share documents with detailed information to minimize the administration time for volunteers.
- Have a dedicated community science project point of contact.

# Community Science Seabird Monitoring Program

## Project Overview

The North Coast Seabird Protection Network (NCSPN) is one of many projects funded by the Kure/Stuyvesant Restoration Fund. The fund was a response to oil spills in the Pacific Ocean near Humboldt Bay. The vessels Kure and Stuyvesant spilled thousands of gallons of oil in 1997 and 1999, respectively. Strong winds pushed the oil out to sea and north, to Trinidad, California. The oil affected wildlife and coastal beaches in Humboldt County. People collected and documented wildlife that the spills injured or killed, including seabirds between Humboldt Bay and Trinidad.

The state and federal trustees of the natural resources injured by the Kure and Stuyvesant spills prepared Damage Assessment and Restoration Plans to restore, rehabilitate, replace, or acquire the equivalent of the affected natural resources injured as a result of the discharge of oil into the environment. The selected restoration projects included implementing a human disturbance reduction program, enhancing seabird nesting habitats and recolonization efforts, and implementing education and outreach efforts. These projects created the NCSPN.

The BLM's Arcata Field Office and the California Coastal National Monument (CCNM) are spearheading the NCSPN in cooperation with the United States Fish and Wildlife Service, California Department of Fish and Wildlife, Humboldt State University (HSU), and other agencies, tribes, and non-governmental organizations.

## Project Description

An important part of the NCSPN program is the development and implementation of a community science seabird monitoring program (formally known as citizen science). The BLM's CCNM collaborated on this program with HSU, Point Blue Conservation Science, and the Trinidad Coastal Land Trust (TCLT). In 2017, the NCSPN adapted these protocols to fit objectives and coordinated with Point Blue Conservation Science to ensure standardized data collection from community science seabird monitoring programs along the California coast and as part of the Seabird Protection Network (SPN). The TCLT recruits volunteers, organizes outreach efforts, and helps develop outreach materials.

## Volunteer Requirements

Volunteers commit to one survey per month (3 to 4 hours) or contribute 3 to 4 hours per month helping with NCSPN outreach events. The program also requires that volunteers make their own schedule by signing up for a survey in a shared Google calendar that the TCLT created and managed specifically for the program. Lastly, the program required that volunteers enter their own data into the data portal which shared the data directly with the NCSPN biologist.

The success of the community science program is due to all the hard work the NCSPN and TCLT staff put in to recruit, train, and support volunteers. Also, a great deal of credit has to be given to the incredible volunteers. The volunteers are passionate about the work they are doing, and eager to sign up for multiple surveys and help with outreach events. The NCSPN has created a wonderful community of communication in which people are excited to share what they have learned about seabirds, excited to be involved, and speaking up for seabird-safe behaviors.

## Challenges

Changes in leadership at both the BLM and TCLT have made it challenging to continue the program. The program lacks funding for someone to oversee it.

## Benefits and Outcomes

Benefits and outcomes include field trips, products, and outreach.

## Field Trips

The NCSPN coordinated with multiple partners and community groups to host outreach opportunities as well as a series of field trips that focused on program awareness and accomplishments, promoted seabird-safe behaviors, taught seabird identification and advertised for the NCSPN community science program and training. For each field trip, the NCSPN highlighted their many partners and provided participants with SPN handouts and SPN stickers.

Several field trips with local schools in and around Trinidad Head reached more than 250 students. Field trips focus on the CCNM and the habitat it provides to seabirds and marine mammals. Students are taught seabird species identification, seabird adaptations, and how to be seabird safe in Trinidad.

## Volunteers

The TCLT trained volunteers to assist with TCLT and CCNM education programs including seabird outreach. Training included a seabird lecture, seabird watching with Professor Dan Barton from HSU, and a kayak tour on Trinidad Bay (18 community volunteers participated). The CCNM developed an ambassador program to train volunteers to assist with outreach events, tabling opportunities, walks, and school education programs to help the public understand and appreciate the natural resources and significance of the CCNM. Ambassadors earned a Trinidad Naturalist Certificate, lead walks, assisted with seabird monitoring, and assisted with educational and outreach activities. Many of the CCNM ambassadors were also community scientists for the NCSPN. The program asked the ambassador training participants to commit to a minimum of 6 hours of volunteer service.

## Products

The TCLT developed, in collaboration with local specialists, the TCLT Naturalist Guidebook that includes information about seabirds. This guidebook is distributed to CCNM ambassadors and volunteer seabird monitors.

## Outreach

NCSPN staff had a table at the HSU volunteer fair. At the volunteer fair staff had the opportunity to talk to hundreds of students and community members about the NCSPN and interested volunteers signed up for the community science program and/or seabird outreach opportunities.

NCSPN partnered with Trinidad School, in a Seabird Aware-themed student art contest. Students had Seabird Aware education in the classroom before the art contest began. In addition, they had field trips to either Trinidad Bay or Patrick's Point and had the opportunity to see some of the species through a spotting scope. The student artwork will be used on outreach materials in the future.

NCSPN staff expected potential seabird disturbances and recreational human-use activities to increase during busy holidays in Trinidad, therefore they conducted additional survey and outreach efforts during holidays and large events in Trinidad. They conducted additional outreach and monitoring at the recreational fishing opener, HSU graduation weekend, Memorial Day, Trinidad Fish Festival, and the Fourth of July weekend. Outreach at each of these predicted high-use days consisted of a table at a popular overlook with a spotting scope and at least two volunteers and/or NCSPN staff to help visitors see the nesting birds in Trinidad Bay.

## Other Partnerships and Projects: North Coast Otters

NCSPN partnered with another community science project, North Coast Otters, to bring a seabird-themed otter to the TCLT site highlighting seabirds and the CCNM. North Coast Otters is a public arts initiative, which integrates river otter citizen science led by HSU students.

## Tips

Collaborating with the university was key in this project. It is important to have academia oversee the scientific integrity of the data collected.

# Santa Rosa and San Jacinto Mountains National Monument Desert Tortoise Monitoring

**Surveyors find a live desert tortoise in a desert wash.**

## Project Overview

One of the pillars of the volunteer program at the Santa Rosa and San Jacinto Mountains National Monument is community science. Friends of the Desert Mountains, a nonprofit partner, supports community science at the monument. The community science program is led by monument staff, BLM and/or USFS, with support from various partners and volunteers. One of the monument's longest-running programs is the desert tortoise (Gopherus agassizii) project focused on the Santa Rosa Mountains. In the early 2000s, people believed that any tortoises sighted were released pets from residents in the Coachella Valley. This resulted in numerous tortoises being "rescued" from the mountains and taken to the local zoo. Now, because of this ongoing study, more and more areas within the monument have been documented with desert tortoise populations and these wild tortoises are no longer being taken from their home in the Santa Rosa Mountains.


**Game camera image of a desert tortoise active after dark in the summer.**

## Project Description

Staff and volunteers at the Santa Rosa and San Jacinto Mountains National Monument have been collecting data on desert tortoise populations in the Santa Rosa Mountains since around 2008. As part of the project, volunteers help monument staff record data on signs of desert tortoises (scat, burrows, carcasses, and live individuals) as well as record information on habitat conditions, including invasive species presence. In addition to field surveys, staff and volunteers are also using game cameras to passively observe desert tortoise behavior near burrow locations. Through this method, volunteers review the camera data and can record locations where tortoise pairing occurs in the breeding season and sometimes observe predators stealing tortoise eggs from nesting sites. This project provides critical baseline data about this unique population of desert tortoises that have not had any formal studies conducted on them to date.

Data and findings have been shared with USGS biologists that are able to visit confirmed tortoise locations and gather genetic information and track movement patterns of a few individuals. Additionally, baseline data is also being shared with University of California, Riverside researchers who are refining models for the species that are much more precise with more species data collected during the years. Overall, this study is shedding a lot of light on this tortoise population, as well as providing a great educational outreach opportunity to share information about this population with the local community while out monitoring.

## Challenges

One of the biggest challenges is limited dedicated staff to fully support these projects. To set up these studies, staff need time to develop research projects so volunteers can collect good scientific data, and staff need time to train volunteers on monitoring. It is also important to take the time to train volunteer community scientists and share why they are collecting data on the project.

Another challenge is not having volunteer support available to assist with the study during the summer months, as most of the monument's volunteers are only available seasonally from November–April. The summer is an important time of year for monitoring desert tortoise activity, so recruitment of local, year-round volunteers will be important aspect to expand on to keep this project active when the tortoises are active.

## Benefits and Outcomes

Engaging with and developing volunteer skills to participate in this study takes time but is well worth the effort. The project provides a meaningful and adventurous experience for volunteers to explore some unique areas of the monument that most visitors don't get to experience, while also making them better stewards of the resources on public lands. And it provides the BLM and USFS with important data that would not be collectable due to limited staffing resources.

## Tips

It is important to include a local community public outreach component for active science, as it shows support for the BLM's National Conservation Lands being living laboratories. Sharing project outcomes within the local area with the community and visitors is important for engagement, it may bring in more volunteer support/interest, and it provides an opportunity to acknowledge contributions of partners involved in the research.

# Desert Avicaching

## Project Overview

In 2018, a joint citizen science program called "Desert Avicaching" started in California and Nevada's Mojave Desert. The Cornell Lab of Ornithology and eBird created Avicaching in 2016. Like geocaching, Avicaching's goal is to use citizen science to gain specific data from certain locations. Desert Avicaching was a joint effort by the Bureau of Land Management, Cooper Ecological Monitoring, Inc., eBird, the Great Basin Bird Observatory, Point Blue Conservation Science, and the Sonoran Joint Venture to gather data on bird species and migration.

For more information, see Point Blue Conservation Science's Desert Avicaching Report on the Sonoran Joint Venture's website: https://sonoranjv.org/wp-content/uploads/2020/06/DESERT-AVICACHING-REPORT_2018.pdf

**All uncredited photos are from the BLM.**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