

Citizen Science:
A Tool for Better Preserving Backcountry Infrastructure at Paul Smith's College.

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Contents

Introduction and Background	2
A History of Life and Stewardship in The Adirondacks	2
What's Wrong at Paul Smith's College and How Can Citizen Science Remedy It?	3
Research Project Objectives.....	5
Encouraging Stewardship and Backcountry Ethics.....	6
Citizen Science	8
The Role of Citizen Science in Backcountry Infrastructure	8
Evidence Supporting Citizen Science	9
Methods Used	13
Application of the Research Project	16
Conclusion.....	17
Maintenance of a Legacy	17
Works Cited	19

Introduction and Background

A History of Life and Stewardship in The Adirondacks

Long have the Adirondacks been a place where humans have lived and visited. Tribes such as the Mohicans, the Oneida and the Mohawk lay claim to these lands being a part of their clans' history as far back as 4,000 years ago (1). According to Dr. Tim Messner, an archeologist with SUNY Potsdam, tribes may have been settled in this region as early as 7,000 years ago (3). In an archeology study conducted by SUNY Potsdam near Tupper Lake on the Racquet River, Dr. Messner and a team of students found evidence of such truths beneath their very feet. While they found no indication of structural development, they did find fragments of arrowheads and other tools such as pots and sharpeners which dated back to what is known as the Archaic period (8000 BCE – 2000 BCE). It's understood that these native people likely lived in the region seasonally. Retreating from the harsh conditions that the winter months brought. It was these tribes and communities of natives which first began documenting and recording their surroundings. They collected information, or data if you will, to better understand the environments they relied upon. In a way, they were not just the Adirondack's first stewards but more than that; they were its first scientists. It was not until the turn of the 19th century did people begin living in the Adirondacks year-round. With the influx of European pioneers, the Adirondacks began to see traffic upon its land like never-before-seen. With them, the pioneers brought livestock, farming equipment, and homesteads. It was places such as Paul Smith's, St. Regis, and Old Forge which saw this influx first. With the region's rich concentration of resources such as timber and iron ore, these developing towns paved the way for roaring capitalists to stamp their claim. With this came different values and thus much of the native's

previous culture of stewardship became lost as a result. With a plethora of reasons for which individuals have come to the Adirondacks, it was Apollos (Paul) Smith himself who played a significant role in reimplementing that culture's ideals.

In 1852, the building blocks of Paul Smith's meteoric successes took place in the form of a hunting cabin located near Loon Lake on the Saranac River (8). Here, he began his life as a hunting guide and exciting others about the beauty of the outdoors and the value in preserving it. These values and his well-known reputation were later, mirrored in his son, Phelps Smith when he developed Paul Smith's College in 1946 to continue the practice of this legacy in outdoor stewardship. The first of its education focused on two-degree paths: the management of hotels and outdoor guiding services. The school has since grown into what it is today, all the while retaining this legacy in several degrees focused on the stewardship and maintenance of outdoor resources. It has also developed an extensive number of resources such as a high ropes course, lean-tos, and trail systems across its campus to better encourage these values. However, as we learned in our 2022 Parks and Rec. capstone project, the school suffers from an inability to maintain many of these assets. While our project aimed to fix this, this method of quality control could become far more efficient for the institution and more interactive for its community.

What's Wrong at Paul Smith's College and How Can Citizen Science Remedy It?

Paul Smith's College is located in a region which has traditionally been used for recreational purposes by communities of Eurocentric culture and heritage, as detailed in the above address. This means that the region has seen the steady increase in the development of

infrastructure since the early 19th century when European pioneers first began to visit the area with more frequency, remaining for longer periods of time. Paul Smith's College follows similar values by encouraging its students to explore the area and often marketing its enticing 14,000 acres of property. In addition to this, Paul Smith's College began constructing lean-tos as a means of creating safer and more centralized spaces for students to explore this property. In doing this, the school committed to practicing a high impact recreation technique to concentrate the influence its adventurous students might have in its backcountry. This technique similarly mirrors the 95-5 methodology practiced by organizations that oversee recreation spaces across the world. The 95-5 rule states that, "... about 95% of the visitors are confined to just 5% of the protected area" (6). This rule has effectively shown an overall decrease in impact on environments that practiced this technique properly. In centralizing the impact of recreationists in the backcountry, the maintenance of trails and backcountry infrastructure becomes more efficient and effective. The use of concentrated recreation spaces is important to an institution such as Paul Smith's College because it allows said institution to practice more efficient means of maintenance. This allows possibilities such as the saving of time, money, and the prolonged period of these assets' functionality.

At the height of Paul Smith's College's backcountry infrastructure, the institution oversaw a total of 22 lean-tos constructed. Because of overuse and a lack of attention to maintenance, many of these lean-to's forgotten, fell into disrepair. The overarching intention of the Parks and Recreation Capstone project in the Spring semester of 2022 was to locate, identify and assess the state of the lean-to's which remain. The intention of this year's capstone class project was the first of its kind practiced by the school in attempt to clarify the wellbeing of its

already standing structures instead of replacing or constructing new ones. A project with goals such as this is beneficial to the school because if utilized correctly, it may preserve the use of these resources over a longer period of time. However, the school's approach in collecting this data could become more efficient in the coming future. Because we found that the state of the infrastructure in the backcountry shows degrading quality and integrity; I wish to propose a more efficient response to better record the conditions of these resources and ultimately preserve them longer. My proposal is to implement an assessment tool utilized by student volunteers (or otherwise) to record the condition of these lean-to's. This method of data collection is known as citizen science. By implementing a citizen science model and using the schools wide and ever-growing community as helping hands in collecting these data, the school will have all the necessary information to better assess and prioritize its backcountry with none of the effort involved in organizing such a project. In implementing a practice such as this, backcountry maintenance initiatives on campus could have access to a databank that's updated regularly and frequently. This will in kind increase the school's familiarity with their assets and the condition of them for years to come.

Research Project Objectives

The intent of this research project and the subsequent application of my survey tool is in a way to develop this relationship between Paul Smith's College and its backcountry users. By using a citizen science led model, the project which I developed would provide a record of the condition and maintenance of the school's lean-tos in an easy to access and valuable data base which displays the information accumulated in an easily digestible format. This paper will

investigate and explain cases of citizen science implemented in spaces to improve and maintain the vitality of the associated environment. While some cases may be geographically unrelated to the Adirondacks, the focus of this research will be in highlighting the effectiveness of using citizen sciences to record or document observations of those given environments. The following are bullet points that this project will fulfill: 1.) the identification of characteristics in effective citizen science programs which fulfilled the given projects' scope, 2.) replicate a citizen science program which participants can use effectively and valuably with little or no knowledge of backcountry infrastructure.

Encouraging Stewardship and Backcountry Ethics

Prioritizing the maintenance of backcountry structures such as lean-tos in turn prioritizes the legacy of Paul Smith's College. The school maintains that each of its students should serve as a steward of the outdoors and actively preserve their surroundings both in and out of the classroom. Every incoming Freshman student is required to take general education courses which introduce them to a plethora of potential professional avenues under the school's 30 Bachelor's and 5 Associate degrees. These general education courses also introduce incoming students to the school's culture and the values upheld by the legacy of Paul Smith. Some of these courses such as Bethany Garretson's SOC 115: Adirondacks Studies introduce concepts such as the 7 principles of Leave No Trace (LNT). These 7 principles are laws followed by backcountry recreationists who perform as stewards of their natural surroundings. It's ethics such as these that may often become forgotten throughout a student's 2- or 4-year career at the school. This is a

value that every student could be reminded of, especially when indulging in the school's backcountry assets.

In the conducting this capstone group's overarching project, we have found that there has been a great deal of damage and vandalism dealt upon the Paul Smith's lean-tos over the years. It has been found that the groups and individuals committing such vandalism and damage to these historic and utilized sites are not strictly students at Paul Smith's College but additionally community members or visitors to the area. It is my belief that by including and encouraging not just students but all visiting communities to participate in a program that is concerned with the wellbeing and integrity of these structures, the level of care and concern for them will also increase. Thus, decreasing the frequency of vandalism and damage done to them. I propose that the implementation of this survey project will encourage this need for participation and will in turn develop a new community of those who care for the maintenance of these structures.

Citizen Science

The Role of Citizen Science in Backcountry Infrastructure

To better understand the role of citizen science in the backcountry, we must first familiarize ourselves with it. The term, “citizen science” became popularized by professors Rick Bonney and Alan Irwin. As noted by Darlene Cavalier and Eric B. Kennedy in The Rightful

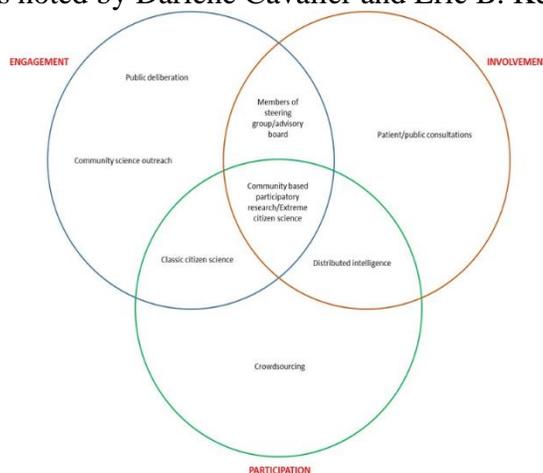


Figure 1: (9) a representation of the three concepts which make up valuable citizen science contributions.

Place of Science: Citizen Science, “Irwin sought to reclaim two dimensions of the relationship between citizens and science: 1) that science should be responsive to citizens' concerns and needs; and 2) that citizens themselves could produce reliable scientific knowledge.” (2). These two coined the term to address what they saw to be an increasing enthusiasm for participation in public spaces from public stakeholders in both the United States and the United Kingdom in the late 1990’s. This enthusiasm is what led to the conceptualization of organizations such as the Audubon Society, CARES (Conservation, Awareness, Recognition, Encouragement, and Support), and Zooniverse to name a few. Organizations such as these encourage and stimulate citizens to work with one another and develop volunteer-based research programs to better the environments and resources which they care about most. Communities such as these who

voluntarily conduct their own research provide a great deal of valuable data to accredited institutions and funded scientific communities for review.

Paul Smith's College is an institution which holds its science related fields in high regard as they contribute much to the school and its extensive community. Following guidelines such as those outlined in Fig. 1 (9), this school has already shown an ability to practice effective citizen science in clubs such as the fish and game club, the newly instituted birding club and the school's relationship with the Adirondack Raptors based out of Tupper Lake. Each of these clubs retrieves its data using techniques that utilize citizen science. The successes and benefits which these communities provide to the school already enforce the proposal to install a program with similar structure that concerns itself with the maintenance of the school's already standing backcountry infrastructure. The successful relationships between these organizations and their communities of volunteers show local victories with the application of citizen science. The construction of similar relationships between Paul Smith's College and the users of its backcountry infrastructure could yield similarly positive results.

Evidence Supporting Citizen Science

Masters' student Emily Ann Reynolds of the University of Arizona in 2016, conducted the implementation of a citizen science program intended to record and identify jaguars and ocelots in the Southwest mountain ranges of Arizona State (7). The purpose of her study was to compare the quality of work retrieved from volunteers to that of a team of field experts. She determined that the two groups' quality in performance would best compare by their

demonstration to correctly identify the species of interest through game-cam footage recorded by the volunteers throughout the course of a year. The volunteers consisted of 9 total individuals who exhibited no prior practice or extensive knowledge of the species in question prior to the beginning of the study. Over the course of their year working together, this group recorded a total of 28,637 photos, 327 hours of field work and 109 hours of data organization.

To lessen the curve in knowledge between the two groups, Emily Reynolds used the second group of field experts as instructors to the volunteers regarding the identification of jaguars and ocelots. It is worth addressing that this was a crucial aspect of her experiment. This is specifically important because the value of data collected by volunteers can easily become undermined by the misunderstanding or lack of knowledge and detail in a study. A citizen's ability to have an equal to similar grasp on a subject to that of an expert's is effectively the determining factor of the legitimacy in a volunteer led study. This point of her study directly correlates to the impact and the conclusion of her experiment. Had she not implemented this education into the program outline, the outcome could have been drastically different. Not having received this instruction prior to commencing their data collection and organization, the quality of the volunteers' data could have nullified itself.

In a separate study published in 2019 conducted by Parker Hopkins of the University of Colorado at Boulder, a similar study found like results with the implementation of citizen science techniques (4). Parker makes specific note in his abstract of the importance of money and its role in science. Often, the conduction of the scientific process in any regard can have burdensome implications concerning the funding and budget of a project. Parker Hopkins saw this as a hurdle worth tackling and brought a proposal to the National Park Services (NPS). His proposal sought

to remedy the increasing numbers and influence of invasive species in a wide array of ecosystems across the greater United States. The NPS had begun to investigate less cost-effective options to mitigating and recording this trend, Hopkins proposal was one of these. This particular project led by Hopkin's was specifically concerned with the observation and documentation of plant species recorded by volunteer scientists with the help of tools such as iNaturalist which I'll explain further later on.

Citizen science can of course infer negative perceptions. It's reasonable to question the legitimacy of unpaid volunteers to provide reliable data. However, in an effort to show whether

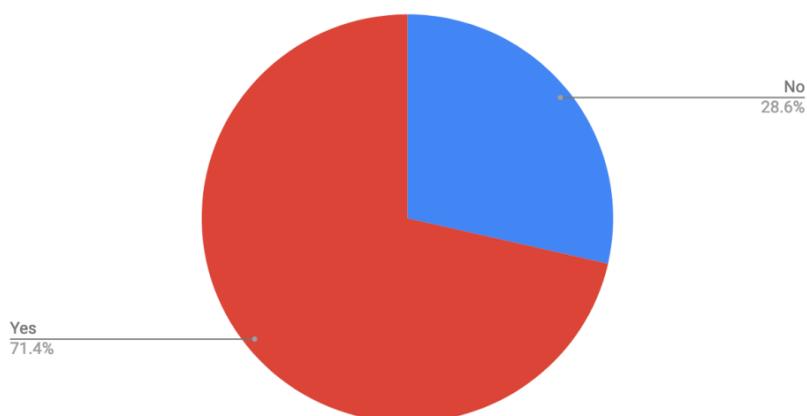


Figure 2 (4) A visualization indicating experts (employees of the NPS) favorability of data collected by volunteers.

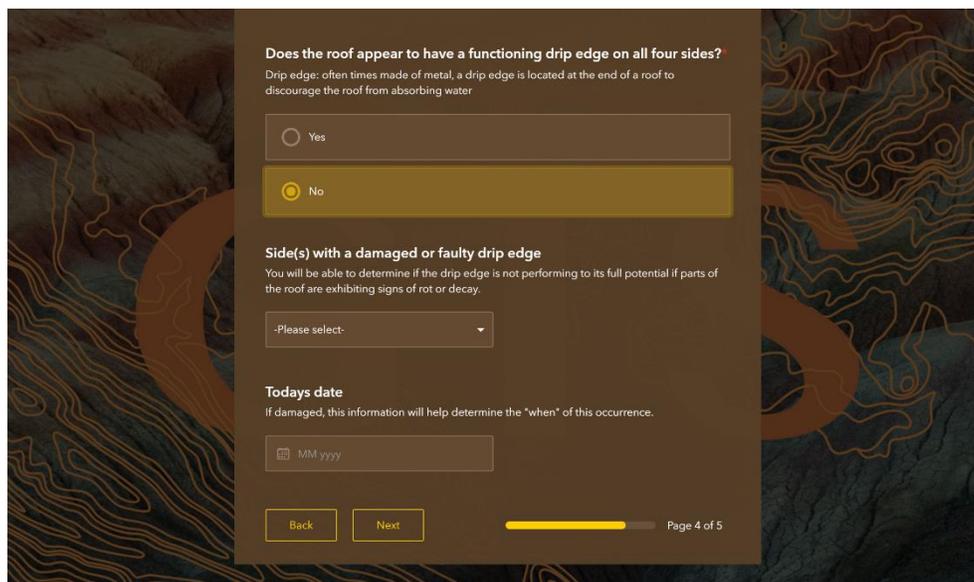
experts trusted the data collected by volunteers, Hopkin's took a pole from employees of the NPS. In this survey, employees of the NPS were asked whether they considered the information collected by volunteers yielded valuable data that could be used further by experts. Over 70% of experts stated that the data collected from volunteers was in their opinion considered reliable. These experts support in the validity and usefulness of citizen science displayed that an overwhelming majority of scientists did in fact support the use of volunteer led data collection initiatives. This suggests that citizens who exhibit interest in a field or subject can be trained to

provide reliable data at a substantially lower cost to organizations such as the NPS. With this interface between citizens and professionals, service sectors such as the NPS could also see a rise in interaction and interest from volunteers. This alone could lead to a higher revenue stream to the parks as well as increased levels of interest in education; thus, encouraging a more holistic approach to preservation and maintenance programs of any nature.

In this study, Hopkins relied heavily upon data collected through a third-party organization: iNaturalist. iNaturalist is an organization which has partnered with other organizations such as National Geographic and the California Academy of sciences to promote citizen science and the outreach between validated scientists and casual recreationists who just want to offer a helping hand. In this organization's lifetime, it has effectively developed a program and subsequently a community which truly encourages everyday people with free time and the interest to be productive members of a greater society of scientific research across the nation. This organizations effort to develop paths between scientists with degrees and the casual backyard scientist have had tremendous impacts too. In 2021, National Geographic wrote an article about the declining rates in over 450 butterfly species across the greater United States (5). Much of the data in this study was collected by unpaid volunteers using apps such as iNaturalist. Butterflies are a key species in their ecosystems and losing them could result in drastically negative outcomes. It is because there are people who care and are willing to go out of their way that trends such as this could be noticed and addressed by the greater scientific community. Because companies such as iNaturalist are so successful in their mission, I believe it is a realistic goal to build similar frameworks in Paul Smith's College that will benefit the longevity of this schools' infrastructure but more importantly, its legacies too.

Methods Used

Each of the above examples demonstrates the effectiveness and accepted nature of citizen science. One key feature that each of these examples makes specific mention of because of its importance is the education of volunteers in each respective project. The understanding and where-with-all to know how to identify useful information so as to best document it appropriately is maybe the most important aspect of volunteer science. The data retrieved in any of these examples could be easily soured by a lack of information or understanding and that is why each paid so close an attention to this factor. With my project, I cannot educate the participants directly. This is why for each question on the data collection survey, I explicitly explain what it is that they're looking for and how to determine the integrity of the structure in question.



Does the roof appear to have a functioning drip edge on all four sides?
Drip edge: often times made of metal, a drip edge is located at the end of a roof to discourage the roof from absorbing water

Yes

No

Side(s) with a damaged or faulty drip edge
You will be able to determine if the drip edge is not performing to its full potential if parts of the roof are exhibiting signs of rot or decay.

-Please select-

Today's date
If damaged, this information will help determine the "when" of this occurrence.

MM yyyy

Back Next

Page 4 of 5

Type of shingles used for roof
 Asphalt: black or dark green with gritty texture
 Wood: characterized by their woody appearance
 Other: if it is other, please mark other and proceed with the associated prompts

Asphalt

Wood

Other

What is the "Other" type of shingle used for the roof?

Condition of "Other" type of shingle used for roof

1 = missing or damaged beyond repair
 2 = structural integrity is so severely damaged it poses potential hazards in use
 3 = damaged and in need of repair but performs function to satisfaction
 4 = shows signs of age or wear-and-tear but is otherwise in good condition
 5 = like new condition, superb

☆☆☆☆☆

Photo of "Other" type of shingle used for roof

Select image file

The two photos provided above are examples of the survey which I plan for participants to interact with. As you will see, each question demonstrates a step-by-step process explaining itself and how best to observe the structure. Each question has been carefully tailored so that even the most novice of visitors will not only assess the structure correctly but also subject themselves to probability of learning something new about lean-to structures.

In making this survey, I wanted to be careful with how it comes across. I didn't want the potential participant to feel as though it's a chore but rather an exciting and helpful thing to do. It was important to me while making this survey to remember that the potential participant is there because they enjoy the woods and being outdoors, not because they were looking for a survey to complete. So, I approached my project as a resource that was an added and optional feature to their experience. Therefore, I tried to make it as appealing and appropriate to the subject as

possible. Firstly, the likelihood of their finishing the survey is increased if it is comfortable to look at. Another aspect I took into consideration, was their span of attention. Because of this, I took the length of the survey into consideration. The length is crucial because this aspect determines how specific the information recorded will be. To get a rounded understanding of how the structure is holding up, I did make each main question a requirement to submit the form. While I acknowledge this may decrease their likelihood to complete the survey, it will encourage more thorough and valuable data. These required questions are denoted by the red star to the right of a question. In total, the survey is a 65 questions, but this is because of added sub-questions used to gain more specific information. These sub-questions on the contrary are not required to be filed to complete the survey. Not including these sub-questions, the survey is a total of 19 required questions divided into three sections (3-15-1). I did this because I wanted the user to differentiate between the introduction to the survey; where this lean-to is located and what its name is, the body of the survey; what is the integrity of specific structures, and finally the conclusion; the identification of potential hazards which may threaten the future of this structure's integrity.

Having taken participants' education and interest level into consideration as well as the value of the data; the survey takes on average a total of 16 minutes to complete with varying differentiations of answered sub-questions. While this may be more like work than fun, I maintain that with the right attitude and interest in preserving backcountry infrastructure for future generations, 16 minutes isn't too much of a burden to ask of visitors.

Application of the Research Project

To best reach consumers, I will locate the link to this survey in each of the 16 lean-tos' located on Paul Smith's College property. To do this, I will create a QR code linked to this survey's web address to best streamline the accessibility of it. This link will be printed on a 8.5 x 11 inch piece of laminated paper. The intention of the lamination is to decrease weathering effects on this resource. This survey was made with the survey123arcgis software. I used a preformatted survey and modified its questions, style, and format to my liking. As I described in earlier in this paper, I made a total of 19 base questions, each with their own sub-questions. This was done by linking the base question to other added questions in the developer page. The application is very intuitive, and the site has embedded demonstrations to assist beginners. There is also an ample amount of content related to developing surveys using this software on YouTube. The image below is the same link located in the lean-tos. This will take you to the survey if you wish to see it.



In the future, I would like to see greater attention and framework for this resource but considering my time constraints and scope, I felt my execution and implementation was appropriate for the time being. In the future I would hope that this initiative becomes expanded

upon. My wish would be that this project serves as a baseline example for how to better improve methods for maintenance both in the backcountry and on the college campus. My goal in this effort was to provide a means by which Paul Smith's College can better monitor its backcountry infrastructure, however, I believe it shouldn't just stop there. The maintenance of resources such as the V.I.C. and trails in the Adirondack State Park can be better observed via the implementation of programs that utilize the citizen science framework.

While the education of principles such as the 7 laws of Leave No Trace is important to this effort, I was unable to implement their inclusion into this project in a way that felt seamless and relevant. I had originally planned to provide links to resources concerned with the education of these principles however, their inclusion on my flyer placed in the lean-to's appeared abstract and the additional links appeared to denote its importance. I would urge future projects to find a way to include this education in some way that does not deter from the project's continuity. The value of stewardship must be learned and passed down if we wish to continue this regions heritage of stewardship.

Conclusion

Maintenance of a Legacy

Like the Adirondacks, Paul Smith's College holds a great legacy worth preserving and it is projects such as those from the 2022 Parks and Recreation Capstone class that wish to do exactly that. My individual contribution to this project seeks to record the wellbeing of this schools' backcountry assets through a means of utilizing volunteer led data collection. This is an

emerging but accepted scientific process that holds the potential to save organizations like the NPS's or Paul Smith's College's assets and wallets while simultaneously encouraging the participation and education of the volunteers who wish to help. This research project of mine has a realistic potential to garner great things from this school's communities and their enthusiasm for the outdoors. It will benefit the school, but it just as importantly attempts to encourage the education of these volunteers to make them more than just that. This project encourages the stewardship and taking care of our outdoors and the infrastructure we wish to place in it.

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