

## **Citizen Science Engagement Project**

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Final Report, Sample Interview Questions

By: Serena Karevich

Completed for: Friends of the Muskoka Watershed

Supervising Professor: Dr. Paul Shaffer

Trent Community Research Centre Project Coordinator: Brittany Finigan

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Suite 3.10, Trent University Student Centre

1600 West Bank Drive

Peterborough, ON K9L 0G2

Phone: [\(705\) 748-1093](tel:(705)748-1093)

Email: [tcrc@trentu.ca](mailto:tcrc@trentu.ca)

Website: [trentu.ca/tcrc](http://trentu.ca/tcrc)

# The Friends of the Muskoka Watershed's Citizen Science Engagement Project

IDST 4220Y Assessment of Development Projects

Serena Karevich

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Supervised by Dr. Paul Shafer

Coordinated by the Trent Community Research Centre

**Abstract:** The Friends of the Muskoka Watershed (FOTMW) is a non-profit organization whose vision is “the protection of Muskoka’s freshwater ecosystems forever”. With this goal in mind, FOTMW created the AshMuskoka program which addresses the depletion of calcium in the Muskoka watershed. To expand upon the knowledge gained in the AshMuskoka program, FOTMW created their Citizen Science program. This project aims to understand factors that influence engagement in FOTMW’s Citizen Science program drawing on a literature review and semi-structured interviews. The literature review looks at factors influencing engagement in the citizen science-type model and assesses the communication and outreach strategies of similar organizations. The semi-structured interviews were conducted with three individuals who participated in the program and three others who were initially interested but who did not follow through. The findings were organized into three broad categories, namely: motivations, factors mitigating participation/challenges faced, and engagement recommendations. These findings, alongside an engagement survey previously conducted by FOTMW, help inform the development of new outreach activities and communication strategies.

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## **Executive Summary**

In response to the acid rain depleting the calcium levels of the Muskoka region, the Friends of the Muskoka Watershed (FOTMW), developed the AshMuskoka program that would sprinkle residential wood ash at the base of the trees in order to increase calcium in the soil. In order to expand this project, FOTMW created its Citizen Science Program. This report works to understand the factors contributing to differing degrees of participation in the Citizen Science Program and the implications of those factors for future communication and outreach materials. A literature review on the factors influencing engagement in citizen science-type models was conducted. Following the literature review, other citizen science programs' outreach materials were assessed and an engagement survey was conducted by the FOTMW. Six semi-structured interviews were then conducted. Three interviews were conducted with participants who followed through with the Citizen Science Program, and three interviews were conducted with

participants who were initially interested in the program but who did not follow through. The findings were categorized into motivations, factors mitigating participation/challenges faced, and engagement recommendations. The motivations consisted of generational considerations, environmental concerns, and growing knowledge. The factors mitigating participation/challenges faced consisted of time and accuracy concerns. The report concludes with recommendations for outreach materials and communications based on the findings of this analysis.

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## **Introduction**

The Friends of the Muskoka Watershed (FOTMW) is a Canadian non-profit organization whose vision is the “protection of Muskoka’s freshwater ecosystems forever”. With their vision in mind, the FOTMW identifies the most severe threats to the watershed that are not being adequately addressed, fosters the knowledge needed to address the threats, and works to motivate the public and policymakers to act on that knowledge. In 2022, FOTMW focused on three main programs: environmental impacts of road salt, AshMuskoka which addresses the nutrient levels in forests, and a citizen science project that aims to expand upon the AshMuskoka project. The Citizen Science program aims to expand the AshMuskoka project throughout Muskoka (and beyond) and to involve volunteers to a greater extent where they assist in researching the benefits of ash application as it relates to tree vitality, growth, and climate change mitigation.

The purpose of this project was to gain an understanding of the differing degrees of engagement with the Friends of the Muskoka Watershed’s Citizen Science Program in order to inform future outreach and communication materials. Following a literature review, six semi-structured interviews were conducted. The findings were categorized into motivations, factors mitigating participation/challenges faced, and engagement recommendations. The information gathered in this report will be used to inform the development of new outreach activities and communication materials.

## **Background**

Following decades of acid rain, calcium and other important nutrients have leached from the soil in Eastern Canada (Kim et al. 2022, 1) In order to address the depletion of calcium in the

Muskoka watershed, the Friends of the Muskoka Watershed, along with community and academic partners, has been developing a scientific understanding of the application of residential wood ash to increase calcium, along with other nutrients in the soil (Azan et al. 2019, 69). The AshMuskoka program was created in order to address this environmental issue. By spreading wood ash throughout forests, the nutrients in the soil are replenishing (Kim et al. 2022, 7). With the replenishment of the soil comes the possibility for an increase in carbon capture, which may help in the mitigation of climate change (Kim et al. 2022, 8). The FOTMW's Citizen Science program was created to expand upon the knowledge gained in the AshMuskoka program and to spread awareness of calcium decline (Paroschy & Sinclair 2023, 1). The research in the AshMuskoka program mainly focused on sugar maple trees which left room for more research on the use of wood ash on other tree species (Paroschy & Sinclair 2023, 1).

The FOTMW's Citizen Science program, launched in April 2022, requires participants to have safe access to two trees that are the same species, similar in size, and growing in similar conditions on their private property (FOTMW Personal Communications 2022). One tree had ash applied to its base while the other tree remained a control (Paroschy & Sinclair 2023, 1). Over the period of at least one year, the citizen scientists recorded measurements and observations of the two trees (Paroschy & Sinclair 2023, 1). The citizen scientists were "...provided with a training video, instrumental kit, personal protective equipment, sampling equipment, as well as filtered, homogenized residential wood ash" (Paroschy, K. & Sinclair, S. 2023, 1). Around 50 citizen scientists participated in the FOTMW's Citizen Science program.

## **Research Questions and Methodology**

This research project aims to gain an understanding of the differing degrees of engagement with the Friends of the Muskoka Watershed's Citizen Science Program in order to inform future outreach and communication materials.

The main research question for this project is the following:

What factors explain different degrees of engagement with the FOTMW's Citizen Science Program and what are the implications of these factors for the FOTMW's information and communications materials?

The research project has two subsequent questions:

1. What are the factors contributing to, and militating against, full participation in the FOTMW's Citizen Science Program?
2. What are the implications for the information and communications materials of FOTMW?

With this purpose in mind, I conducted six semi-structured interviews. Three of those interviews were with participants who completed the full Citizen Science program discussed above. The other three were with participants who were initially interested in the Citizen Science program but who did not complete the program. To prepare for the interview process, I conducted a literature review of factors influencing participation in the Citizen Science-type model and assessed the communication and outreach strategies of similar organizations. Following the literature review, participants were selected by the Friends of the Muskoka Watershed. I developed a list of semi-structured interview questions (see Appendix A). The interviews took place over Zoom.

Interviews were transcribed and coded. The findings were divided into three main categories: motivations, factors mitigating participation/challenges faced, and engagement recommendations. I also assessed previous engagement data collected by FOTMW. Finally, I assessed the Friends of the Muskoka Watershed's outreach activities and communications materials in light of the literature review and findings from the semi-structured interviews.

This report has some limitations. First, the interviews were conducted over Zoom and required access to the internet, which may have excluded some potential participants. Second, and more fundamentally, a majority of the participants who were interviewed had either a background in the sciences or a partner in the sciences. This may have led to potential biases given their greater familiarity with data collection, measurement, and analysis with implications for program engagement. Lastly, when the participants were asked about the training materials, none of the participants who completed the training materials provided any criticisms of them. Rather, the participants expressed ease of completion. This may point to a need for increasing the reach of the current materials rather than adjusting existing materials. This will be discussed further in the recommendations section.

## **Literature Review: Engagement in Citizen Science**

### ***Introduction***

While there is still debate over an exact definition, the Friends of the Muskoka Watershed generally defines citizen science as “the involvement of nonprofessional and amateur scientists – the average citizen - in scientific research efforts” (Dickinson et al. 2012, 291). The FOTMW, in the creation of their Citizen Science program, wanted to generate new knowledge “...in a

democratic way to educate the public and scientists and FOTMW” in order to mobilize the public to act (Paroschy & Sinclair 2023, 5). Citizen science plays a crucial role in bridging the gap between the public and the sciences. In bridging that gap, many citizen science programs work to inform policy creation. As citizen science is mainly volunteer-based, citizen science programs need to ensure that they are understanding the motivations of their participants as well as addressing the factors that inhibit/discourage participation (Rotman et al. 2014, 110). Increasing engagement and retention in citizen science programs is vital to continuing to bridge that gap between scientific knowledge and the public.

### ***Importance of Citizen Science***

As the world is facing an ecological crisis and extensive social challenges, the development of scientific knowledge needs to involve wider participation and information sharing. Currently, there are gaps between scientific knowledge and public knowledge that make it difficult for scientists to communicate findings critical to addressing these crises (Hecker et al. 2018, 446). Citizen science is a way to not only bridge the gap between scientists and the public but also to have the public play a role in the production of scientific knowledge (Hecker et al. 2018, 445). As the concept of citizen science is based on individuals without a background in science participating in the scientific process, participants need to attend training and receive information about the scientific issue. Through the development of training sessions and education materials, scientists learn better ways to communicate with the public about complex issues (Hecker et al. 2018, 448). With an ecological crisis at our doorstep, sharing scientific findings with the larger public in a way that will allow the majority of society to understand is integral. Additionally, citizen science programs aim to make their projects mutually beneficial (ECSA 2015). In other words, both scientists and non-scientists should benefit from the program

rather than only scientists benefiting from additional data collection (ECSA 2015). Citizen science programs need to align with their participants' motivations in order to benefit the non-scientists (as discussed further below).

As citizen science programs help to bridge the gap between science and the public, awareness around complex issues grows (Hecker et al. 2018, 453). As more of the public becomes informed of issues directly impacting their communities, there is more of an initiative to address these issues to a greater degree. Increases in public awareness of issues impacting their community can lead to influencing policymaking (Nascimento et al. 2018, 219). Citizen science "...has the potential to impact local and national decision-making, empower citizens and lead to better, more transparent government" (Nascimento et al. 2018, 219). As citizens are more informed of both the issues and the proposed solutions, they are able to advocate for informed changes and work to democratize science (Nascimento et al. 2018, 219). Citizen science allows the public to not only raise awareness of issues but also to play an active role in the scientific knowledge that is used to inform political decisions.

### ***Motivations in Citizen Science Programs***

As volunteers are the main citizen scientists, engagement and retention within citizen science programs are integral for the continuation of said programs. Understanding what motivates individuals to participate in citizen science programs can help to retain participants and increase engagement (Rotman et al. 2014, 110). Citizen science programs can differ in what is required of participants. Some programs may require more measurements, longer periods of time, and overall, more dedicated participation. In order to maintain retention while also increasing engagement, the motivations of participants should be interwoven throughout the

whole program (Rotman et al. 2014, 110). While participants will have program-specific motivations, there are common reasons why individuals are inclined to participate.

Motivations in volunteering are often categorized as intrinsic or extrinsic (Geoghegan et al. 2016, 27). Intrinsic motivations are motivations based on "...the desire to volunteer because it is in some way inherently interesting or satisfying" (Geoghegan et al. 2016, 27). Extrinsic motivations are motivations based on "...the willingness to volunteer because it leads to some other outcome..." (Geoghegan et al. 2016, 27). Short-term participation in citizen science programs tends to be based on extrinsic motivations while long-term participation tends to have more intrinsic (Rotman et al. 2014). As citizen scientists participate for longer, participation starts to change from extrinsic to more intrinsic (Geoghegan et al. 2016, 34). These motivations are also overlapping and do not stand in contrast with one another but can indicate the need for citizen science programs to adapt to the changing motivations of their volunteers.

### Main Extrinsic Motivation

#### *Develop new skills/gain experience*

Participants often seek opportunities that would allow them to gain experience in their field (Rotman et al. 2014, 115). Citizen science programs often provide a way for individuals to develop skills as well as network within their field that may help them in their future careers (Rotman et al. 2014, 115).

### Main Intrinsic Motivations

#### *Social Responsibility*

Arguably, the most common motivation is the sense of social responsibility. In relation to either environmental or social issues, individuals often participate in citizen science programs as a way to actively address issues in their communities. Depending on what the program addresses, participants with this motivation feel a moral duty to protect their communities (Geoghegan et al. 2016, 27).

### *Personal Knowledge*

Participants are often motivated by the desire to increase their own knowledge (Rotman et al. 2014, 115). Either to enrich their knowledge of the subject or to explore their hobbies, participants see citizen science programs as a learning opportunity (Rotman et al. 2014, 115). Participants often become involved through their curiosity on the subject and want to learn more through the citizen science program.

### *Contribution to the Production of Scientific Knowledge*

As citizen science programs often allow for an increase in data collection, participants value their contribution to the production of scientific knowledge (Rotman et al. 2014, 120). Citizen scientists' contributions to scientific research go beyond that individual project but could provide knowledge that is used by the broader scientific community.

### *Factors Inhibiting Engagement*

Citizen science programs also need to understand factors that inhibit engagement both externally from the program as well as internally. If these factors can be addressed without compromising the purpose of the citizen science program, there may be more room for an increase in engagement. The factors inhibiting engagement also differ between programs as well as between regional areas. The factors discussed below are more broadly identified but should be

understood within the context of the specific citizen science program. For the purpose of this report, I will discuss external factors through FOTMW's Citizen Science program as internal factors can be subjective and often depend on the nature of the program/organization.

### External Inhibiting Factors

#### *Demographics*

Aspects of one's identity can influence their decision to participate in a volunteer-based program such as gender, income, education level, familial responsibilities, and cultural understandings of communal responsibilities (Rotman et al. 2014, 112). Age is one of the most examined factors in relation to participation in citizen science programs (West et al. 2021, 4). Younger participants are often motivated by extrinsic motives such as enhancing their careers while older participants are often motivated by intrinsic motives such as nature conservation (West et al. 2021, 4). Additionally, cultural beliefs of Western science can influence participation. Western science has a long history in colonialization. While the practices have changed, there continues to be a dismissal of Indigenous knowledge within Western science (Leach & Fairhead 2002, 301). Citizen science programs, done respectfully and in collaboration with Indigenous communities, can involve Indigenous knowledge and practices that will further conserve the environment (Tengo et al 2021, 507). That being said, the legacy of colonialism is still experienced to this day and gaining trust in Western science will not happen overnight. While most of these factors are unlikely to be addressed within the context of a citizen science program, understanding the demographics of a science program site may allow for the creation of more suitable and more flexible programs to enhance participation.

In the Muskoka region, a majority of the population is over the age of 50 (Statistics Canada 2016). Consequently, in FOTMW's Citizen Science program, 88% of their participants were over the age of 51 according to data collected in a phone survey on engagement (Paroschy & Sinclair 2023, 38). This suggests that intrinsic motives were highly met and should continue to be met to retain engagement. The Muskoka region is situated on the traditional territory of the Anishnaabe which includes the Ojibwe, Odawa, and Potawatomi Nations, collectively known as the Three Fires Confederacy (District Municipality of Muskoka 2021, 5). Today, Muskoka is home to three sovereign nations: Wahta Mohawks First Nations, Moose Deer Point First Nation, and the Moon River Metis (District Municipality of Muskoka 2021, 5). Understanding the history of the land in which citizen science programs are conducted is crucial in creating a respectful, culturally appropriate program.

### *Time*

Even with participants having clear motivations behind signing up, participants may not be able to keep up with what is required from the program (Rotman et al. 2014, 118). Citizen science programs are often volunteer positions. Many times, individuals do not have the capacity to donate their time to citizen science programs even if they so desire.

In FOTMW's Citizen Science program, the participants were only required to complete three main steps over the course of a year once collecting their citizen science kit. In Spring 2022, they collected tree information and soil samples, spread ash around ½ of the study trees, and submitted data and soil samples. In Summer 2022, participants collected and submitted tree information, and soil and foliage samples. In Spring 2023, participants will collect and submit tree information and soil samples. The first step is estimated to take an hour while the subsequent steps should take no more than 30 minutes (Paroschy & Sinclair 2023, 39).

### *Technology*

Technology can be a useful tool in conducting research, but it can also pose challenges to populations who do not have much experience with technology (Rotman et al. 2014, 118). If participants need to log data using technology but do not have internet access or experience in using technology, they may become discouraged from participating. Citizen science programs need to understand the technological capabilities of their communities and should consider offering an alternative.

The FOTMW's Citizen Science program offered a webform on their website through which the participants could submit their data. In a phone survey, some participants cited slow internet and limited experience in technology made this form of submission difficult (Paroschy & Sinclair 2023, 39). Participants who did not use the webform could submit their data via email or in person at the FOTMW's office (Paroschy & Sinclair 2023, 39).

### *Internal Inhibiting Factors*

#### *Communication/Feedback*

Slow and inconsistent feedback can deter participants from continuing to participate (Geoghegan et al. 2016, 47). Feedback that is personalized, detailed, quick, and appreciates the work the citizen scientist puts in encourages participation (Geoghegan et al. 2016, 47). Participants can also be discouraged from participating by only having one-way communication that is inaccessible (Geoghegan et al. 2016, 47). Communication that is both online and in-person caters to more demographics (Geoghegan et al. 2016, 47). Additionally, good communication regarding research findings increases attention and participation (Geoghegan et al. 2016, 47).

### *Training/Education*

Training and education of citizen scientists are some of the most important aspects of citizen science. If the training leaves participants feeling unprepared and unsupported, participants are likely to be discouraged (Geoghegan et al. 2016, 47). With adequate training sessions and skills development, participants can feel better prepared to begin their research (Geoghegan et al. 2016, 47).

### *Creation of a Community*

A way in which citizen science programs can encourage participation as well as maintain retention is by creating a community (Geoghegan et al. 2016, 47). Creating a community around citizen science programs allows for greater involvement. Participants who are conducting their research alone may feel discouraged from participating again as there was no chance for social connections (Geoghegan et al. 2016, 47).

### ***Conclusion***

During a global ecological crisis, citizen science provides a much-needed bridge between scientists and the public. Citizen science allows the public to play a key role in the development of scientific knowledge that has the potential to inform the creation of policies. As citizen science relies mainly on volunteers, citizen science programs need to understand the motivations of their participants in order to better address these motivations through their programs. Additionally, being able to address the factors that inhibit or deter participation will help increase engagement. Citizen science programs allow the public to not only gain knowledge about critical issues but also play an active role in that knowledge creation.

## **Outreach Strategies from Citizen Science Programs**

In order to understand where there are areas for improvement in the FOTMW's outreach and communications materials, assessing other organizations' strategies will show opportunities for more outreach. I assessed mainly Canadian-based citizen science programs. While some organizations are on a larger scale, the outreach strategies could be applied to FOTMW's Citizen Science Program. One opportunity to increase outreach could stem from the creation of programming that is targeted to certain groups such as schools and workplaces. For example, EcoSpark developed a curriculum that educators could implement in their classrooms (EcoSpark 2023). EcoSpark also has a program that provides volunteer opportunities for corporate teams and places of work (EcoSpark 2023). Additionally, the United States Forestry Service has a program called the Youth Forest Monitoring Program which is a summer citizen science program targeted at high school students (USDA 2023). This program allows students to present their research to their parents, the public, and the organization at the end of the program (USDA 2023). Many high schools require students to volunteer, and a citizen science program allows students to learn more about what they are interested in, build useful skills, and conserve their environments while completing their volunteer hours.

Another strategy applied by many citizen science programs is the creation of an app. iNaturalist, for example, developed an app where people can scan the natural environment in order to identify different organisms (iNaturalist 2023). Apps could provide a platform for easier data collection, quicker communication, and a more connected community of citizen scientists. Additionally, apps can provide a way to track how much an area is impacted by certain issues. Loss of the Night is an app in which users can measure light pollution from certain areas of the world (Scientific American 2013). Users select visible stars from their location and contribute to

an overall mapping of light pollution (Scientific American 2013). Additionally, the creation of apps for citizen science programs can be a form of volunteering itself. While not a citizen science project itself, the Cyber Citizens project undertaken by a team of university students and professors at Michigan Technological University developed apps for citizen science programs (Smcrisma 2013).

Another strategy is knowledge sharing. For example, Healthy Forest Partnership hosted a lecture series that raised awareness of Budworms (Healthy Forest Partnership 2019). In turn, citizen science programs can be highlighted to more communities by showcasing their impact and importance. Key Biscayne's Citizen Scientist Project hosts a lecture series that highlights citizen science programs that discuss issues impacting their community and environment (Key Biscayne CSP 2023). This lecture series allows citizen science programs to explain the issues they are addressing to increase awareness of said issue and increases peoples' desire to participate. Across the board, the use of social media was quite common among citizen science programs. The social media accounts often highlighted both data collected as well as photos of citizen scientists participating.

### **Results of FOTMW Engagement Survey**

In August 2022, the FOTMW conducted brief phone interviews to better understand the interests of citizen scientists. Notes were taken during the survey and were analyzed in another report published by FOTMW: "Citizen Science: Supporting Ecological Restoration in Muskoka's Forests with Wood Ash" (Paroschy & Sinclair 2023). Two questions posed are of particular

relevance for the present purpose. First, “why did you sign up for the Citizen Science program?”

The answers were summarized into 6 key motivations:

1. *Consistent with values.* Many participants highlighted that their desire to participate was rooted in their values to conserve their environment and care for their community.
2. *Better or no different than the previous use of ash.* Participants explained they had already been donating or spreading their ash so participating would not create a substantial behaviour change.
3. *Have something to offer to the program.* Participants expressed a desire to contribute and be involved in citizen science programs.
4. *Positive perception of program features.* Participants highlighted how great the FOTMW’s programs have been and said they enjoyed their production of research reports.
5. *Connection to Muskoka.* Many participants noted their ties to the Muskoka region were through the environment and family and, therefore, said they wanted to conserve the Muskoka region.
6. *Effective communication campaign.* Many participants expressed that their decision to partake came after hearing about the program through the outreach campaign.

Additionally, the citizen scientists were asked, “was there anything that wasn’t clear in the instructions or advice you have as the program moves forward?” There were two main areas of concern:

1. Difficulties in data collection initially, mainly regarding measuring tree height.

2. Concerns regarding the submission of the collected data on a webform. This form of submission did not work well for rural citizen scientists or citizen scientists with limited experience with technology.

## **Overall Findings**

Following the literature review, six citizen scientists were interviewed. Three citizen scientists fully participated in the FOTMW's Citizen Science program while three were initially interested but did not follow through. The findings from these discussions are organized into three main categories: motivations, factors inhibiting engagement, and engagement recommendations.

### **Motivations**

As discussed in the literature review, understanding the motivations behind participating in a citizen science program lies at the centre of increasing engagement and retention.

#### *Environmental concerns*

The most discussed motivation for participating in the FOTMW's Citizen Science program was a concern for the environment. Half of the participants discussed being able to see a noticeable difference in the weather this winter. One participant explained her search for more environmental conservation was prompted by the question: "what more can we do to embed our ideals and our goals to make it sustainable?" This citizen science program allowed them an individual, tangible way to address their concerns about the environment. Many of the participants either grew up in or grew up visiting the Muskoka region so their concern to

preserve the landscape was deeply rooted. Additionally, on a more specific note, the preservation of trees was highlighted. The trees "...define the Muskoka landscape so it would be really catastrophic to lose them". Additionally, the participants were asked if their desire to preserve the region was driven by monetary considerations. All of the participants said no and more than half laughed.

Multiple participants recognized that while the Citizen Science program may not be actively mitigating climate change at its present scale, it has the potential to do so. The impact of this program will take longer to become more noticeable. One participant noted the need to preserve the health of the forest in order to protect against environmental catastrophes such as forest fires. One participant raised the concern over whether spreading ash did more harm than good on a large scale. This participant noted that there needed to be more research done and this program was the first step. The FOTMW's Citizen Science program is a "piece of hope" for preserving the Muskoka region.

### *Generational connections*

One of the commonly discussed motivations concerned generational connections to the Muskoka region. Generational connections often go hand-in-hand with environmental concerns. Many participants noted that they had grown up in the Muskoka region or would visit often in their youth. A majority of the participants expressed their desire to preserve their surroundings so their children could enjoy them as well. One participant even expressed wanting to participate in this program to involve her children in the conservation of the environment. Additionally, many of the participants noted how they developed their concern for their environment from their family members. One participant stated that preserving the environment was almost a duty because of the actions of his generation. They explained, "This is like the boomer's legacy to

your generation and the generation following that is not good”. It is interesting to note that while almost all of the participants noted generational/familial connections, only one participant noted their desire to involve their family. The majority of the individuals completed the projects on their own.

### *Knowledge growth*

Another motivation discussed was the ability of participants to learn and gain knowledge about the project. A notable number of participants appreciated the presentation and communication of data surrounding the project. One participant discussed enjoying being able to present information supported by data. Additionally, a few participants noted the importance of developing and sharing knowledge, especially regarding the environment. One participant noted their skepticism about the benefits of ash spreading on a larger scale but affirmed the need for additional research. The participant noted how they valued the production of a scientific-based approach to addressing environmental concerns. With the knowledge gained through this program, two participants continued to sprinkle their residential wood ash at the base of other trees in their yards.

### **Factors inhibiting engagement/challenges faced**

In the interviews, the only two concerns raised about the program were time and accuracy.

### *Time*

One of the main factors inhibiting full participation was time. One participant noted that they did not have enough time initially to clear a path to the base of their trees while another participant noted that due to travelling for work, they were not sure if they would have enough

time or be in Muskoka when needed. Additionally, the Muskoka region has a large population of people who live there seasonally. Discussion around the need to connect with seasonal cottagers came up frequently, noting that the program would not be possible for households that spend limited amounts of time in Muskoka.

### *Accuracy*

Accuracy concerns were also discussed throughout. It is important to note here that more than half of the participants were either scientists themselves or had family members who were. As someone without a science background, one participant found the measurements daunting and was afraid that the measurements they gathered would ‘pollute the information’. This participant did make it clear that their reluctance was not due to the quality of the training materials. Another accuracy concern discussed by all the individuals who fully participated regarded tree height and leaf collection. They all noted their selections of trees were very tall which created challenges in ensuring the accuracy of tree height and the collection of leaves. The participants were unsure how to guarantee that the leaves on the ground were the leaves of the same tree.

### **Recommendations**

Almost all of the participants provided unprompted ideas on how to increase engagement. The participants saw the importance of the Citizen Science program as well as FOTMW in conserving the Muskoka region. A unique challenge to increasing engagement and awareness about programs is that the Muskoka region has seasonal and full-time residents and is quite spread out. This can pose challenges to increasing community engagement. Many participants

noted the need for increases in awareness on social media sites. One participant recommended posting about the program on Facebook community boards. Additionally, another participant recommended trying to foster a community around the Citizen Science program through the use of discussion boards and events that would allow citizen scientists to interact with one another. Another suggestion was to provide incentives, such as rewards, to participate in the program. Specifically, one participant suggested providing participants with native seedlings to encourage engagement. Making connections with youth was also discussed. Including people from all age groups is important in addressing environmental issues that will last generations. Lastly, one participant recommended the use of automated text messages to ensure people do not forget about certain tasks.

Informed by the findings of this report, the FOTMW, within their capacity, should take into consideration what motivates its participants and what it can do to meet those motivations. It is important to note that the FOTMW have been actively addressing the motivations of most of their participants and all of the data reviewed strongly affirmed that participants thought highly of FOTMW's programs and activities. In their report, "Citizen Science: Supporting Ecological Restoration in Muskoka's Forests with Wood Ash", FOTMW have highlighted many suggestions to improve their program for subsequent sessions such as increasing technology usage to attract younger participants and creating a less time-demanding citizen science program that allows people who spread ash on their woodlots outside of the program to collect data and submit it to FOTMW. As none of the participants expressed a critique of the training or communications materials, the need for increasing engagement comes from a possible gap in outreach. These are some possible recommendations that will hopefully increase engagement and retention in the FOTMW's Citizen Science program.

One recommendation for increasing retention of the citizen science program is through more community-based, social events as well as online platforms that would allow citizen scientists in the program to meet one another. This could also provide a space for the citizen scientists to present their research to each other as well as discuss their experiences. For example, all of the participants who are completing the program noted that the tree they selected was too tall and expressed concerns about ensuring that the leaves collected were from the correct. Creating a platform, such as a Facebook group, may help citizen scientists connect and also discuss common issues.

Recognition is also a beneficial tool in motivating participants to participate again. People enjoy being acknowledged for their hard work. A possible idea may be a social media campaign that highlights the ‘Citizen Scientist of the Week’ where a citizen scientist, with their consent, can be acknowledged for their hard work while at the same time increasing attention around the program. People enjoy being recognized and often enjoy sharing their recognition with others, which may increase awareness of this program.

As FOTMW already created a less time-consuming program, they could also create programs targeted at certain groups. A few times throughout the interviews, participants recognized the need for youth involvement in citizen science programs. The FOTMW has already started to visit schools to involve classes in spreading the ash and in becoming young citizen scientists. The importance of continuing to visit schools to specifically campaign for citizen science to youth could help to develop their interest in science and preserving the environment from an early age. Additionally, schools are good opportunities to get more community involved and to establish more concrete programs that can occur every school year. Many high schools also require volunteer hours, and a citizen science program is a great

opportunity for high school students to complete their hours while building their awareness of their environment. Reaching out to other groups aimed towards youth, such as Girl Guides or Scouts Canada, may be beneficial as well.

Another suggestion regarding participants' concerns about accuracy regarding data collection may be the creation of an optional progress survey. This survey could be given to the participants when they receive their citizen science kit or emailed to them. After completing their first data collection, they could complete the survey if they choose. The survey would aim to see where the participants may need additional guidance.

Lastly, developing an app could be a useful tool in engaging younger participants as well as creating a space for quick communication and collecting data. Developing an app could be done through another community-based research project where a university student helps to develop an app that will address the needs of the FOTMW's Citizen Science program. Additionally, the FOTMW want to understand how the use of wood ash impacts the forest and to what extent. The creation of an app may allow for more engagement around Eastern Canada more broadly. The app could also create a space for a discussion group that connects citizen scientists with each other.

## **Conclusion**

Citizen science programs are an integral tool to address the climate crisis. These programs help to raise awareness of environmental and social issues that have the potential to change policies. The Friends of the Muskoka Watershed's Citizen Science program allows Muskoka (and beyond) residents to address a tangible environmental concern in their own yards.

To better address this environmental concern, the FOTMW needs to understand the motivations of their participants: environmental concerns, generational considerations, and the production of knowledge. FOTMW also needs to understand what factors inhibit engagement: accuracy concerns and time. The information gained in this report may help to develop more outreach and communication materials for the FOTMW to increase engagement and retention in their Citizen Science program.

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## Appendix

### **Appendix A**

#### Semi-Structured Interview Questions

##### Full participants

1. How did you hear of the AshMuskoka Citizen Science Program?
2. What were the main reasons that you signed up for the Citizen Science Program?
  - a. How long have you lived in the Muskoka region? Do you live there year-round?
  - b. Do you own the property where the AshMuskoka Program was implemented?  
And if so, how do you feel connected to your property?
  - c. Do you believe the AshMuskoka Program is helping mitigate climate change?
3. Did you feel the training and communication was sufficient or is there room for improvement?
  - a. What forms of communications would have been useful?
  - b. What, if any, aspects of the training were particularly useful?
  - c. What, if any, trainings were unhelpful?
4. If the FOTMW organized another Citizen Science Program, would you participate? If yes, why? If no, why not?
  - a. Was everyone connected to the property (family, co-workers, etc.) on board with the program or not?
  - b. Did you feel the work you did made an impact, or not? If so, how?
5. What draws you to wanting to preserve your trees, land, or Muskoka?

##### Participants who did not follow through

1. How did you hear of the AshMuskoka Citizen Science Program?
2. What were the main reasons that you signed up for the Citizen Science Program?
  - a. How long have you lived in the Muskoka region? Do you live there year-round?
  - b. Do you own the property where the AshMuskoka Program was implemented?  
And if so, how do you feel connected to your property?
  - c. Do you believe the AshMuskoka Program is helping mitigate climate change

3. What were the reasons that you were unable to fully participate in the program?
  - a. Did you feel that you did not have enough time to complete the project or was time not a factor?
  - b. Are there factors unrelated the program (such as other commitments, lack of easy accessibility to the trees) that deterred you from completing the program, or not?
4. If the program was to run again, would you participate fully, or not? If yes, why? If no, why not?
  - a. If you would, what draws you to wanting to preserve your trees, land, or Muskoka?
5. Are there any changes in the program, or the information and communication provided be the program, that would make you more likely to participate fully or not?