Designing Diversity into Citizen Science

Supplemental Materials

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A: Contributions

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Primary Author for Data Analysis Writing			Primary Author for Infographic
Primary Author for Guidelines	Primary Author for Guidelines	Primary Author for Guidelines	Primary Author for Guidelines
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Secondary Booklet		Primary Booklet	
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B: Sponsor Description

The Leibniz-Institute of Freshwater Ecology and Inland Fisheries, also known as IGB, is a leading international institute that strives to learn more about the preservation and management of freshwater and to open-source all found information. It is one of 96 independent research institutions under the Leibniz Association, which is funded by the German government. In addition to a location in Stechlin, known as the Neuglobsow site, IGB has three locations in Berlin.

IGB was founded in 1992 by merging the Institute of Inland Fisheries (IfB) with parts of the Hydrology Department of the Institute of Geography and Geoecology (IGG) in Leipzig and the Department of Experimental Limnology Neuglobsow of the Central Institute for Microbiology and Experimental Therapy (ZIMET). At its start, IGB only had 103 scientists, and now the number has climbed to 320 total employees, 140 of which being scientists. IGB's structure consists of three tiers. At the top there is the director, the scientific advisory board, and the managing director research association Berlin. IGB's current director is Luc de Meester, a biologist with extensive experience in evolution and ecology research. Underneath these, the middle tier consists of a number of administration positions, the scientific advisor, PR and knowledge transfer, and career development. At the final tier, there are six research departments which focus on only one discipline and three "cross cutting research domains" that work across departments. They have a €20.8 million budget annually, €8 million of which is from external funding. The rest of the budget comes from both national and state government funding.

The mission of IGB is "Research for the Future of our Freshwaters". The belief is that by providing evidence-based research, they will not only be able to enable decision-makers to make informed decisions, they would also educate society about the current state of freshwaters and how they can help. As a leading institute, IGB works sponsors from both within and outside Germany. They acknowledge that innovative cross-disciplinary research can be imperative in learning about the issues of today. Therefore, by expanding the boundaries of science and working with a diverse group, IGB works to educate the population about how and why they should make a difference in the context of freshwaters.
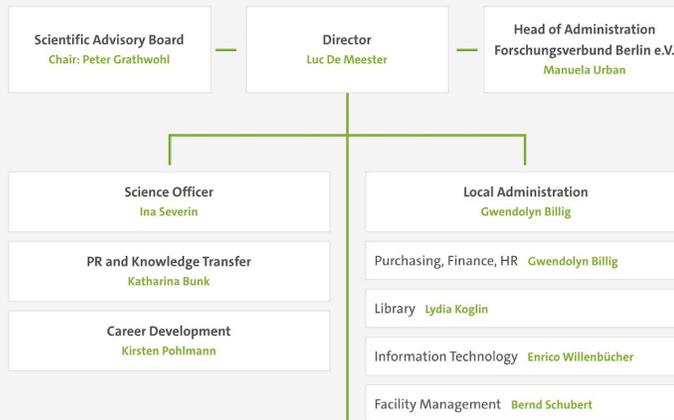
Within their project program, IGB has created 10 themes in order to better organize and define their projects. These themes are angling, aquaculture and aquaponics, behavior technology and swarm intelligence, biodiversity, dialogue and transfer, environmental change, freshwater ecosystems, multiple stressors and pollutants, use and management, and water and matter ecosystems. Each of these themes represents an area that IGB focuses their research in.

Among the many programs run by IGB, there are several citizen science projects. The company currently supports five citizen science case studies addressing pollution, and will have five more by the end of January. IGB is a large proponent of these citizen science programs. They believe citizen input is a crucial aspect in solving the complex pollution problems impacting Germany. However, IGB has found these recent teams of citizen scientists to be of little diversity. It is now their goal to increase the diversity of people that participate in these programs, whether they be immigrants, elderly, or of any alternate background to the usual volunteers.
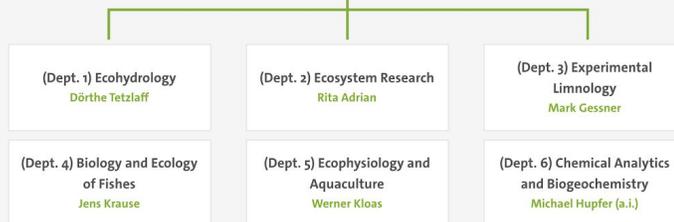
Increasing diversity in citizen science can have great benefits for IGB. The tasks that IGB takes on are very complex, and the solutions are never clear. Having a diverse team of citizen scientists may make it easier to reach the best possible solution. It would allow for many different perspectives to be heard while approaching these complex problems. With greater diversity, this can result in having more areas where data is taken and collected from.

By making citizen science more accessible to the public, IGB would continue to further promote the idea that by working with a diverse group over multiple disciplines, people can collectively come up with innovative solutions to the problems of freshwaters. As students, we hope to evaluate the already existing citizen science program and come up with recommendations and tools that can be used by IGB to succeed in their goal. The more people this information reaches, the more informed individuals there are to help improve the earth and keep it sustainable for generations to come.

Structure

Scientific Advisory Board — Chair: Peter Grathwohl	**Director** — Luc De Meester	**Head of Administration Forschungsverbund Berlin e.V.** — Manuela Urban

Science Officer — Ina Severin	**Local Administration** — Gwendolyn Billig
PR and Knowledge Transfer — Katharina Bunk	Purchasing, Finance, HR — Gwendolyn Billig
Career Development — Kirsten Pohlmann	Library — Lydia Koglin
	Information Technology — Enrico Willenbücher
	Facility Management — Bernd Schubert

Research Departments

(Dept. 1) Ecohydrology — Dörthe Tetzlaff	**(Dept. 2) Ecosystem Research** — Rita Adrian	**(Dept. 3) Experimental Limnology** — Mark Gessner
(Dept. 4) Biology and Ecology of Fishes — Jens Krause	**(Dept. 5) Ecophysiology and Aquaculture** — Werner Kloas	**(Dept. 6) Chemical Analytics and Biogeochemistry** — Michael Hupfer (a.i.)

Cross-cutting Research Domains

(CCRD 1) Aquatic Biodiversity — Hans-Peter Grossart and Jonathan Jeschke

(CCRD 2) Aquatic Boundaries and Linkages — Tobias Goldhammer (a.i.) and Sabine Hilt (a.i.)

(CCRD 3) Human-Aquatic Ecosystem Interactions — Christian Wolter

A visual of the structure, research department, and cross-cutting research domains in IGB.
Taken from (Organigram, (n.d.).)

C: Articles from Literature Review

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D: Consent Form

Informed Consent Agreement for Participation in a Research Study

Investigator: WPI IQP Team: Designing Diversity in Citizen Science

Contact Information: gr-citizen-science-diversity@wpi.edu

Title of Research Study: Diversity in Citizen Science

Sponsor: Leibniz Institute of Freshwater Ecology and Inland Fisheries

Introduction: You are being asked to participate in a research study. Before you agree, however, you must be fully informed about the purpose of the study, the procedures to be followed, and any benefits, risks or discomfort that you may experience as a result of your participation. This form presents information about the study so that you may make a fully informed decision regarding your participation.

Purpose of the study: Our goal is to develop methods and recommendations for citizen science programs to use to expand their volunteer base. We want to look into ways to increase inclusion and grow citizen science programs overall.

Procedures to be followed: The interview will last between 30 and 60 minutes, and will include questions about operating their respective citizen science programs. The interview will be recorded and transcribed for informational use by the group in the final report.

Benefits to research participants and others: The benefits of participation is assisting in the study of diversity within citizen science programs. With the interviewee's expertise, we can further learn how citizen science programs function and get an insider look of how diversity if viewed. With this information, strategic methods can be formed to grow citizen science programs and reach out to further communities to gain participation.

Record keeping and confidentiality: With sufficient consent, the recordings will be stored safely by the team to a shared drive for reference to look back upon, and for use in an educational video for citizen science programs. The only ones with access to these files will be group members who conducted the interview, and no other parties. The final product with the edited clips will be used in a final video for the public's viewing. The information available from the interviewee will be their name and their respective citizen science program if applicable.

Records of your participation in this study will be held confidential so far as permitted by law. However, the study investigators, the sponsor or it's designee and, under certain circumstances, the Worcester Polytechnic Institute Institutional Review Board (WPI IRB) will be able to inspect and have access to confidential data that identify you by name. Any publication or presentation of the data will not identify you.

For more information about this research or about the rights of research participants, or in case of research-related injury, contact: See study contacts at the top of the page in addition to the contacts listed below.

IRB Manager: Ruth McKeogh, Tel. 508 831- 6699, Email: irb@wpi.edu

Human Protection Administrator: Gabriel Johnson, Tel. 508-831-4989, Email: gjohnson@wpi.edu

Your participation in this research is voluntary. Your refusal to participate will not result in any penalty to you or any loss of benefits to which you may otherwise be entitled. You may decide to stop participating in the research at any time without penalty or loss of other benefits. The project investigators retain the right to cancel or postpone the experimental procedures at any time they see fit.

Interview Recording

OPTION 1: Video and audio recording: The video and audio from the interviews will be recorded. The footage may be used in one of our project deliverables, a short video that will be published online

> **Risks to study participants:** The footage we record for the interview may be used for a video we produce at the end of our project that will be uploaded for the public to see. This means that the interviewee's face and name will be shown. If the interviewee is uncomfortable with this, they should select one of the options below.

OPTION 2: Audio recording and usage: The audio from the interview will be recorded, and may be used as a voice over in video. The name of the interviewee will be shown on screen.

> **Risks to study participants:** The audio from the interview may be used in our video. The name of the interviewee will be shown on screen. The video will be published online, and accessible to anyone. If the interviewee is uncomfortable with this, they should select one of the options below.

OPTION 3: Audio recorded, unused: The audio for the interview will be recorded, but will not

be published in any form. It will only be used as reference for the researchers. The interviewee will be kept anonymous.

> **Risks to study participants:** There is no risk for the interviewee in selecting this option. The recorded audio will be kept confidential, and the files will be kept safe as described above. The findings of the interview will be used rhetorically in a booklet. The interviewee will be kept anonymous.

OPTION 4: No recording: No video or audio will be recorded in the interview. Notes will be taken by the interviewers, and kept confidential. The interviewee will be kept anonymous.

> **Risks to study participants:** There is no risk for the interviewee in selecting this option. The transcribed notes will be kept confidential by the interviewers. The interviewee will be kept anonymous.

Please make a selection between the four options. The descriptions are shown above.

☐ OPTION 1: I acknowledge that audio and video will be recorded and may be used in an informational video published online.

☐ OPTION 2: I acknowledge that audio will be recorded and may be used in an informational video published online.

☐ OPTION 3: I acknowledge that audio will be recorded, but will not be published in any form, and my name will be kept anonymous.

☐ OPTION 4: I am not comfortable with any recording.

IGB Consent:

For data collecting managed by Awardees (pilots)
- Recipients of personal data

Worcester Polytechnic Institute, in partnership with the IGB, is bound by an agreement with the ACTION Consortium, a research project operating under the EU Horizon 2020 framework. This data collection is conducted within the scope of the consortium activities, for research purposes as described by art. 89 of the GDPR. It will include several activities for which hereby ask you to give your consent:

[ ] survey on motivations in participating in activities
[ ] survey related to the impacts of activities

The results of this data collection may be shared with the aforementioned Action Consortium as a whole, or with single partners in the consortium, for scientific and research purposes, after an anonymization / pseudonymization process as required from art. 89(1) of the GDPR. This process will be completed by [this organization, insert organization name]. For any requests regarding this issue, please contact the ACTION Consortium contact at gefion.thuermer@kcl.ac.uk.

By signing below, you acknowledge that you have been informed about and consent to be a participant in the study described above. You also acknowledge that you are aware of how the interview will be recorded and used. Make sure that your questions are answered to your satisfaction before signing. You are entitled to retain a copy of this consent agreement.

_____ Date: _____
Study Participant Signature

_____ Study Participant Name (Please print)

_____ Date: _____ Signature of
Person who explained this study

E: Interview Guide

Thank you for agreeing to be interviewed for our study! Through this interview, we will investigate the state of diversity in citizen science programs around the world. The goal is to create guidelines to promote diversity in citizen science so that it is easier for programs to form and evolve.

Option 1: We would like to remind you that we will be recording the video and audio from our interview and storing it in a secure location. The recording will later be used to generate a transcript. This may also be used in media we generate to communicate the results of this study.

Option 2: We would like to remind you that we will be recording the audio from our interview and storing it in a secure location. The recording will later be used to generate a transcript.

Do you have any questions before we start?

Background Qs

1. How would you describe your organization?
   a. What are your priorities as an organization?
2. How many citizen science programs does your organization have?
   a. Is there a coordinator for all programs?
   b. Do all programs run independently from each other?
   c. What have been some significant outcomes from these programs?
3. Do you have values, guidelines, or principles that your programs must follow?
   a. Who sets these guidelines?
4. What do participants do in your program?
   a. What do they need in order to participate? (ex. an app, a field kit)
5. How do you recruit participants into your program?

Diversity

6. What is your definition of citizen science?
7. What is your definition of diversity within the context of citizen science?
8. Does your program consider diversity when recruiting participants?
9. Do you feel the diversity of the participants is an important factor to consider in citizen science programs? Why?

Barriers

10. During the program formation, did you work to identify all the stakeholders and how best to involve them?
    a. Could you describe the process?

       b. Is there any written documentation that we can view?

11. How do you feel you portray/brand your organization to the public?
       a. If there were 5 words you could use to describe your citizen science program, what would they be?
12. What work do you expect the participant to do for your program?
       a. Are there specific methods and processes they need to follow?
       b. How do you communicate it to them?
       c. Are there any informal expectations from the participant? (ex. show up to workshops)
13. How do you make programs relevant and engaging to participants?
14. What do you feel are the primary motivations for participating in your citizen science programs?
15. What level of commitment is required to participate in your program?
       a. Is any special training required?
16. Does your organization provide any workshops for participants to learn more about the project subject matter?
       a. What are some examples?
       b. How are these workshops formatted?
       c. How effective do you think these workshops have been?
17. Does your organization make information on the project publicly accessible?
       a. How do you communicate your findings to the public?
18. How is the work of your organization perceived by the scientific community?
19. Does your program inform participants about how the data they gather will be used?

Is there anything that we have not asked you that you think is important to consider with regards to diversity and inclusion in citizen-science initiatives?

Thank you so much for participating in our study! We are extremely grateful for the information you have provided us. Again, if you have any questions or would like to have a copy of the results of our study and our IQP project as a whole, feel free to email us at gr-citizen-science-diversity@wpi.edu.

F: Survey Questions

1. Do you know what citizen science is?

If no: Move straight to demographics

If yes:

2. Are you involved in any programs, or have you been in the past?
    If yes:
    a. What programs are you involved in?
    b. What do you do for these programs?
    c. Why were you motivated to get involved in these programs?
    d. Have you continued since your first involvement?
        i. If yes:
        ii. Why did you continue participating in these programs?
    If no:
    a. Is there a reason as to why you don't participate in any citizen science programs.
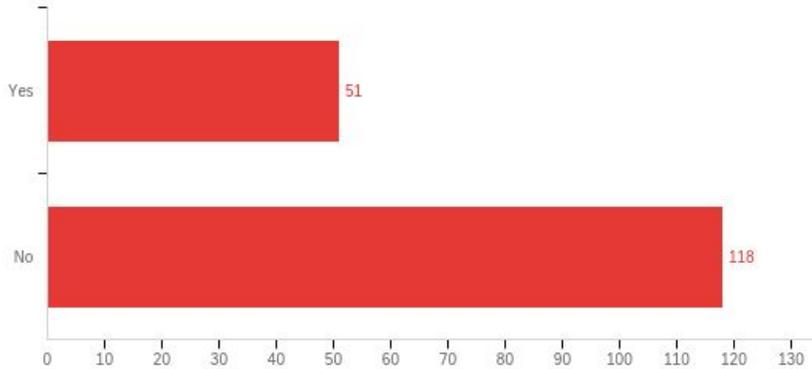   b. Was there anything specific that has prevented you from participating

Demographics

1. If you are comfortable with sharing:
    a. Age
    b. Country/Region/State
    c. Gender
    d. Highest Education level
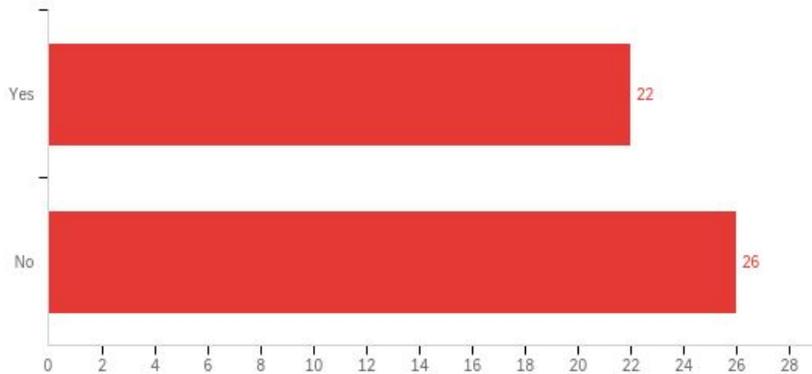   e. Disabilities
    f. Ethnicity

G: Survey Responses

169 total responses

Q2: Do you know what citizen science is?

Q4: Are you currently involved in any citizen science programs or have been in the past?


Q5/6/7/9

Q5: What programs are you involved in?	Q6: What do you do for these programs?	Q7: Why were you motivated to get involved in these programs?	Q9: Why did you continue participating in these programs?
Story Gathering for Resilience (towns impacted by natural disasters); environmental education for townspeople on	I teach workshops to students who are interviewing those who are impacted by natural disasters. I also have helped with	A care for environment, dedication to teaching, and commitment to community	Commitment to education and environment

issues such as radon, open space, and composting	story gathering and awareness raising on natural disasters, climate change, and weather cycles. Create infographics for newsletters, table sitting at community festivals.		
COVID symptom tracker, INaturalist	relay my health once a day/take photos of plants, insects etc to be mapped	I like helping and I like science. :)	to help people gather useful data
COVID-19 National Scientist Volunteer Database	Offered to provide services for COVID-19 testing	I am a PhD scientist working in a pharmaceutical company. I have skills that could be used to help others.	They're important for the community and a way to give back
The Ladybug Project	Take a photo of a ladybug that you see, and send a photo with information on location (latitude/longitude), date, and time that it was found.	Local author Loree Griffith Burns told us about it (she has a book called Citizen Scientists, that my kids read).	
Frog watch usa	Monitor frog calls	Love frogs	Helping collect data helps environment
My IQP was a citizen science project	I interviewed the public and restaurant owners/managers to get their opinions/knowledge regarding reusable containers	Getting a good grade	
I participated in collecting tidal data	measure high/low tide marks	It was part of my graduate program	

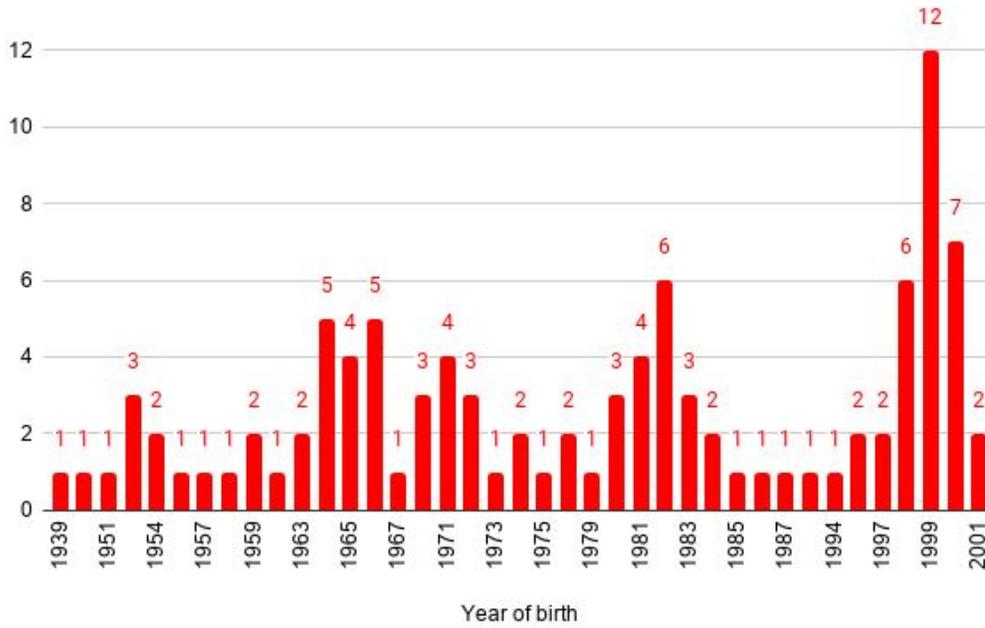| for RI beaches			
bird counts	report species	interesting and fun to do	it was a fun hobby
ACTION project, DIY Hack the Panke	I am the Accelerator Lead for ACTION and a founder of DIY Hack the Panke collective	I believe in democratising science	Because I can bring value to the programmes and contribute to making citizen science more inclusive and participatory
DIY Hack the Panke, Mind the fungi, Science Hack Day Berlin	organizer of the first two, participants and judge for the latter	I work with artists whose work is connected with science, especially Biology. CS and DIY science offer new modes of practice and outreach	I is involved in organizing them. Also I found the actions and resulting networks wonderful
inaturalist, World Community Grid, iSpot, UK Ladybird survey and creating different projects	Both as participants and as coordinator, designer, and funder	This is the area of research that I'm committed to, so I'm also contribute to different projects to learn about them	Because I find them useful and I like to contribute to science
Art science research	Artistic research	Collaboration and new knowledge and access to laboratory	Because they are fruitful and open up opportunities. To engage with public and get feedback on my work
"Hear How You Like To Hear"	Project Management	Personally affected	See great potential in it. Tech development is open source
Top Lab Berlin, Biothinkering, UR Institute	art and science collaboration	Knowledge production, art, research	same reasons I started

Q8: Have you continued since your first involvement?
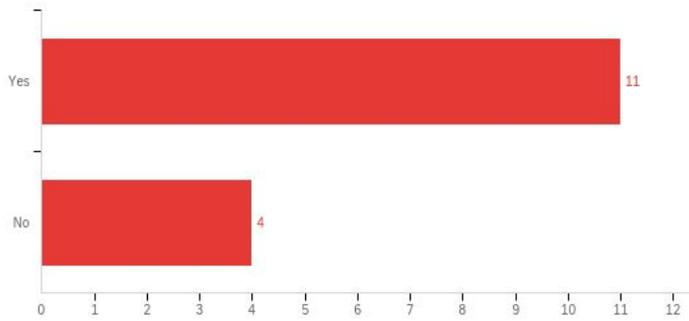
Q10: Are there any reasons as to why you don't participate/continue to participate in any citizen science programs?

| |
| --- |
| I've never had the opportunity presented! |
| Idk much about which programs are available around my area and also not enough free time as a college student |
| no |
| Not learning about new ones, and not hearing about others who are into it as well. |
| not really seeing the opportunity placed in front of me. Or at least things that look interesting and legitimate. |
| The project ended |
| Time |
| Lack of knowledge of options, lack of exposure |
| No |
| never had the opportunity |
| Lack of time-working on many other projects. |
| I actually don't know of any around me, although I do actively participate in supporting ecology initiatives such as planting wildflowers and letting dandelions grow for pollinators |
| No |
| No |
| I have not been presented with specific opportunities where I live. |
| Not aware of any available |

Q11: Was there anything specific that prevented you from participating?

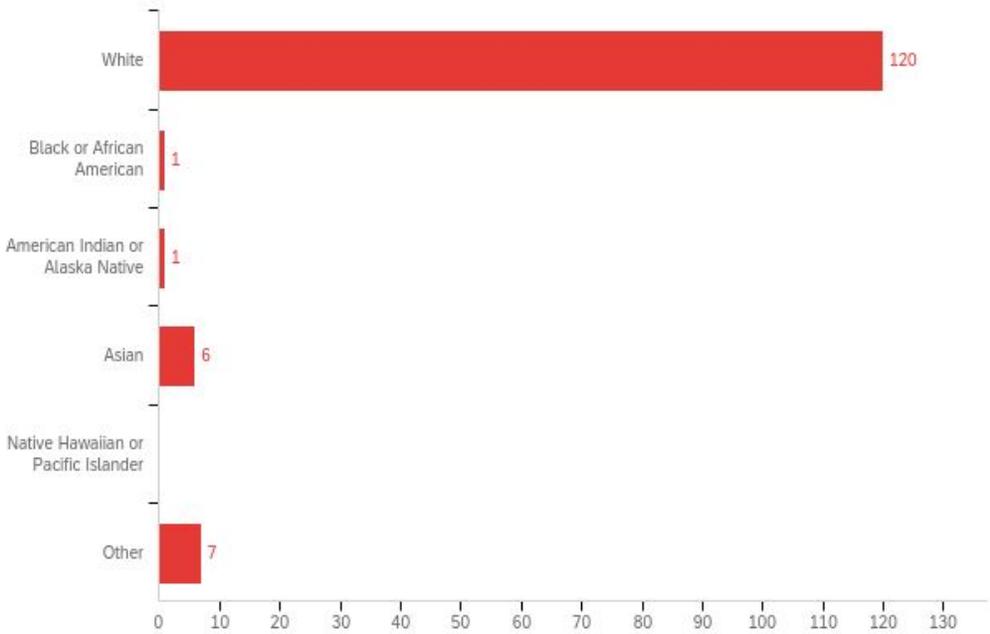| |
|---|
| I know what they are but I feel like I don't know how to contribute. Like I only hear about them once they are done kinda thing |
| Not having whole lot of free time as a college student |
| no |
| Looking up the latitude/longitude for the ladybug project was a little onerous, as we were finding several a day. |
| Well it would have to look legitimate, explicitly explain it was 'citizen science' and of specific benefit and would need to be easy to do. If that answers the question in a roundabout way, |
| No |
| Time |
| Time!! |
| No |
| no |
| No |
| I haven't been aware of things going on |
| No |
| Not really. |
| Privacy concerns |

Q12: What is your year of birth?

Q14: What is the highest level of school you have completed or the highest degree you have received?
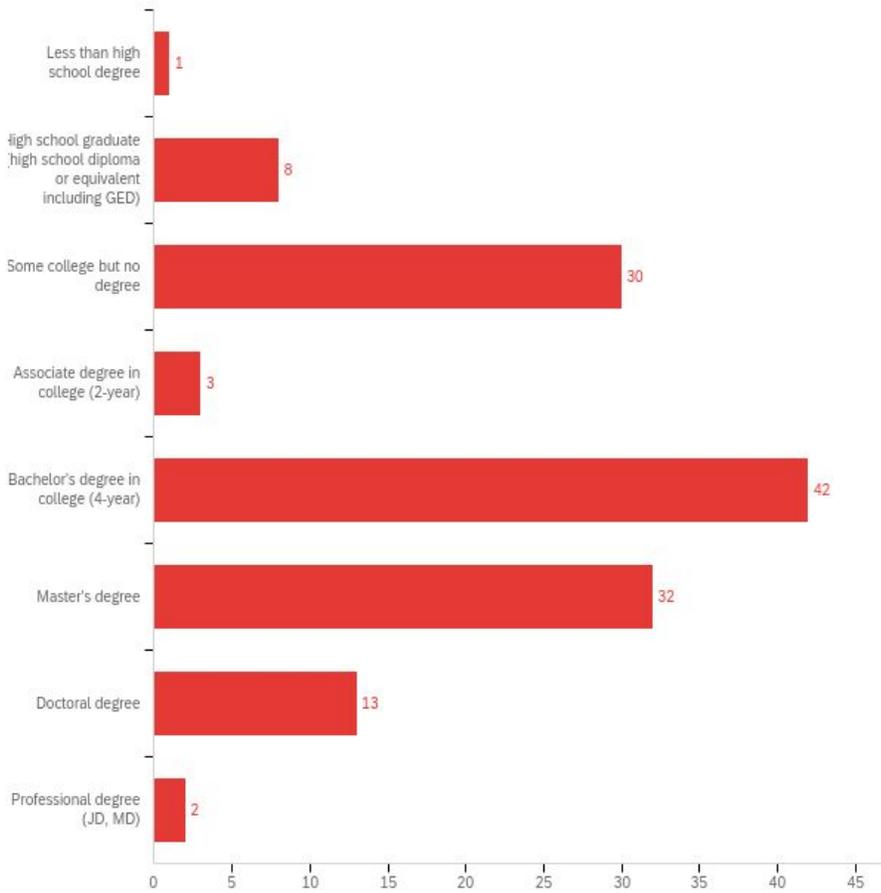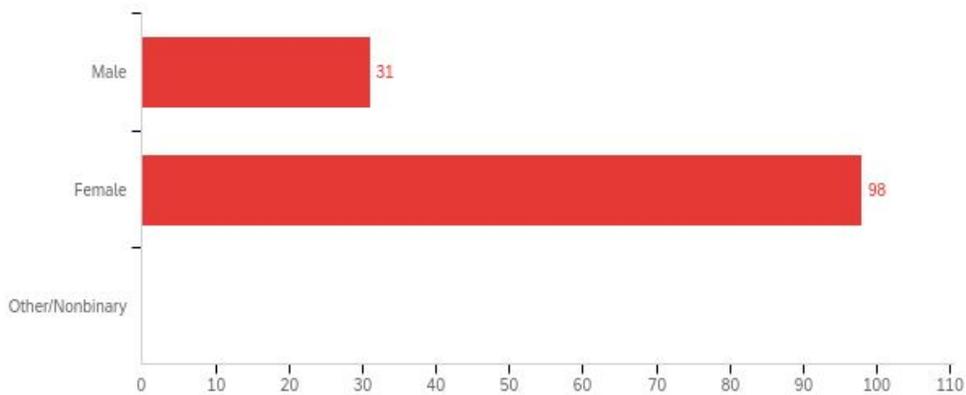
Q16: Choose one or more races that you consider yourself to be:

Other:

Latino
Indian
Hispanic/Latino
Hispanic
I don't consider race but ethnicity as my main identification. I am white within the above definition

Q20: What is your sex?

Q21: What is your zipcode?

Zip Code	Amount
00000	1
01060	1
01450	1
01451	1
01453	1
01506	1
01515	1
01532	1
01562	4
01581	15
01590	1
01609	6
01720	1
01748	1
01749	1
01879	1
02128	1
02176	1
02364	1
02453	1
02474	1
02909	1
02915	1
03038	1
03431	1
03743	2
03885	1
04074	1
04330	1
05465	1
06033	1

06238	1
06333	1
06351	1
06360	1
06371	18
06372	1
06417	1
06423	1
06439	1
06472	1
07005	1
07081	1
07439	1
07821	1
07836	1
07844	1
07848	1
07874	2
07878	1
07885	1
07930	1
07960	1
08619	1
10115	1
10245	1
10970	1
11554	1
11782	1
18017	1
18020	1
18045	2
18049	1
18062	1
18644	1

18954	1
18966	1
19001	1
19468	1
21704	1
32963	1
34987	1
55408	1
60640	1
70611	1
80027	1
80503	1
92037	1
97402	1
98374	1

Other:

I live in EU
UK based
Who cares

H: Guidelines

The use of the term "*citizen science*" can cause discrepancies in the professional world between the different forms of this type of scientific research. When we began researching citizen science, we discovered many types of programs that did not define themselves as "citizen science" but identified closely with it. In the case of these guidelines, we use citizen science as an umbrella statement for simplicity. We believe any scientific program that utilizes community involvement could benefit from these guidelines.

These guidelines are intended to aid in increasing diversity within citizen science programs. In this context, diversity is defined in terms of participant demographics: for example, age, health status, location, ethnicity, sexual orientation, socio-economic status, religion, and education level. Within our research we have found that diversity is incredibly valuable for citizen science programs. It allows for diverse sets of ideas to be brought to projects, it gives projects a further reach among more communities, and several other reasons. The guidelines contain five sections: structure, recruitment, volunteer resources, communication, and relevancy. Each section contains recommendations as to how to foster diversity and provides resources and examples for programs to start the process.

Structure

The structure of a citizen science program and/or project must be considered when attempting to foster diversity in citizen science. A program structure that emphasizes effective management of stakeholders and provides participants with options for involvement encourages different demographics to participate in citizen science.

1. The program analyzes and manages stakeholders to ensure that every stakeholder benefits in some way from the project.
   *Stakeholders: We define stakeholders as anyone with an interest in a project, or could be affected by the project. It is important to understand that stakeholders might not be directly involved in the project. The motivations of any potential volunteer, or anyone that could be affected by the research conducted, should be considered when conducting stakeholder analysis.
   Recommendations:
   - Conduct an effective stakeholder analysis
     - Identify all stakeholders for a program
     - Identify what roles all stakeholders play within a program
     - Investigate the motivations of each stakeholder in the project

- Establish which stakeholders to target that would allow for a complete representation of the community surrounding a program
- Implement the motivations of stakeholders into the project
- Continue to manage stakeholders throughout the project

Resources:
- http://conferinta.management.ase.ro/archives/2015/pdf/82.pdf
- https://www.tandfonline.com/doi/full/10.1080/14615517.2016.1176413

2. The program offers various options for participation in order to accomodate for the different levels of commitment participants will have.
Recommendations:
- Provide several options for participation. Citizen science programs generally involve participants in data collection, project formation, and/or management.
- Provide training workshops for volunteers to learn about the different roles they may take as citizen scientists and the skills they would need for each.
- Partner with other organizations to provides resources for citizen scientists
- Allow more dedicated volunteers to take up leadership roles

Resources
- https://thrivingearthexchange.org/how-it-works/

3. The program accommodates for the various languages/cultures of the community to ensure the project is accessible to all.
Recommendations:
- Identify the demographics of the target community
- Hire a diverse staff that speak the language(s) and understand the cultures of the target communities
- Output media captioned in multiple languages
- Accommodate for cultural differences through understanding a community's values and incorporating them into the project. This can be achieved by co-designing programs with community members.
- Provide workshops in multiple languages either online or in-person.

Resources:
- EcoCentre

4. The program assigns a "point of contact" for volunteers to maintain communication
Recommendations:
- The point of contact is a representative of the community in terms of language and culture
- The point of contact is reliable and communicates with both the volunteers and organization in a timely manner
- The point of contact is able to balance organization and community interests

Resources:

● Baltimore Mosquito Study

Recruitment

Keeping the diversity of the community in mind when recruiting participants helps citizen science programs design their efforts towards including everyone or targeting specific, underrepresented communities.

1. The program both educates and advertises what citizen science is to potential volunteers.
   Recommendations:
   ● In advertisements, include a brief overview of what citizen science is
   ● Work with community leaders and organizations (schools, nursing homes, religious groups) to educate groups on citizen science
   ● Provide volunteers a simple definition or infographic on citizen science to use when introducing the topic of citizen science to others
   ● Dedicate a heading on your website to describing what citizen science is and how it is used in your program

   Resources:
   ● SciStarter's information page for citizen science: https://scistarter.org/citizen-sciencehttps://scistarter.org/citizen-science

2. The program recognizes the assets and needs of the community to determine the most effective recruitment strategies.
   Recommendations:
   ● Contact community leaders and members to identify what the community wants/needs are and how the program can help them.
   ● Incorporate community goals into the goals of the study.
   ● Design the study to take advantage of and leverage particular community strengths or cultural assets
   ● Open source findings from the study
   ● Provide the affected communities with resources on how the results can be used for advocacy or policy purposes
   ● Include family oriented projects to include all age groups and encourage group participation

   Resources:
   ● Baltimore Mosquito Study: "Aligning research and education with community priorities" and "Planning for co-management of the project and engaging the community at every step"
   https://theoryandpractice.citizenscienceassociation.org/articles/10.5334/cstp.170

- "Braiding Science together with Indigenous Knowledge": https://blogs.scientificamerican.com/observations/braiding-science-together-with-indigenous-knowledge/
- Thriving Earth Exchange: https://thrivingearthexchange.org/how-it-works/

3. The program uses multiple forms of advertisement for its citizen science programs to target a variety of potential participants

   Recommendations:
   - Ask current volunteers to recruit people they know
   - Put ads through social media and news outlets
   - Reach out to community leaders to spread word through their community
   - Advertise through organizations with existing networks in diverse communities (ex. Universities, religious groups, associations)

   Resources:
   - Baltimore Mosquito Study: "Planning for co-management of the project and engaging the community at every step" https://theoryandpractice.citizenscienceassociation.org/articles/10.5334/cstp.170 Marketing strategies for online large-scale citizen science programs:
   - https://jcom.sissa.it/sites/default/files/documents/JCOM_1601_2017_A01.pdf

4. For sensitive projects, programs work to educate their community and reduce stigma in order to attract participants who may have had previous misconceptions.

   Recommendations:
   - Ask current volunteers to spread the word about the positive aspects of the work they are doing
   - Have community and project leaders host workshops/talks to educate the public on how the program can benefit them and if applicable the misconceived notions about the project topic
   - On social media and website pages, dedicate a portion of the platform to educate interested individuals on the topic
   - Make research about the topic readily available to the community
   - Emphasize the importance of the topic to underrepresented communities

   Resources:
   - The following study focuses on reducing stigma surrounding mental health, but the techniques such as education and literacy campaigns surrounding your issue may be applied to many different topics: https://www.ncbi.nlm.nih.gov/books/NBK384914/

5. The program considers its public image and works to highlight itself as an all-inclusive organization.

   Recommendations:
   - Conduct brand analysis to better understand how your program is viewed

- Include as many demographics as you can in imagery representing your program
- Incorporate the values of diversity and inclusion into the program mission statement
- Provide brand/image training to project leaders
- Be transparent, intentional about program participation – for instance, collect demographic information to assess progress (COASST does this)

Resources:
- Given here is an example of how to conduct a brand analysis: https://www.cdgi.com/2018/01/conduct-brand-analysis/. Brand analysis is most commonly used by businesses, but can easily be adapted to a citizen science program through interviewing volunteers rather than clients. Rather than a "competitor" analysis, it might be helpful to observe practices used in other citizen science programs.
- The Port Phillip EcoCentre works to recruit diverse individuals in both their staff and citizen scientists. In their values, they also list respect for people's cultures: https://ecocentre.com/vision.

Volunteer Resources

When programs work to identify the resources that volunteers may need to participate in their projects, potential participants gain more opportunities to be involved in citizen science.

1. The organization provides clear instructions and guidelines on data sharing practices. The organization informs participants about how their data will be used in the project and strives to use secure connections and data platforms. In doing so, the organization makes the data collection process simple and intuitive to all participants and reduces reservations about sharing data.
   Recommendations:
   - Clearly state policies on data collection on the program website and any distributed media
   - Ensure that there are standard data sharing practices set in place so participants can efficiently and safely transfer their data
   - Ensure that there are multiple means of sharing data both online and in person. Programs can provide pre-stamped envelopes for participants to mail in data.
   - Provides documentation, help services, and/or workshops to educate participants
   - Limiting data sharing/giving options

2. The organization works to accommodate for its participants various disabilities/health related issues
   Recommendations:

- Make sure the sites used for events are wheelchair accessible
- Work with the volunteer to determine various ways they can be involved without compromising their health

3. The program provides workshops/training for participants to learn the skills needed.
   Recommendations:
   - Provide opportunities for participants to be involved in the formation of workshop structure
   - Implement participants' interests and values into the workshops to make them more engaging
   - Provide in person training for complex skills to engage participants and ensure understanding
   - For more simple skills, provide online workshops to make education more accessible and less time consuming
   - Being flexible with workshop location and encouraging staff to travel if needed
   - Ex. giving workshops at schools/nursing homes/community centers

   Resources:
   - Designing effective workshops: https://www.nap.edu/read/25183/chapter/8#127
   - At the Port Phillip EcoCentre, volunteers are required to contact the volunteer coordinator and go through an "induction" where they learn about the EcoCentre and all their projects before choosing a program they would like to participate in. https://ecocentre.com/volunteer

Communication

Encouraging effective and meaningful communication amongst participants and program leaders leads to citizen science projects with a larger impact on the target communities and the scientific community.

1. The program educates its program leaders about the benefits of citizen science at every level and includes volunteers at various levels to reduce stigma against involving non-professionals in scientific research.
   Recommendations:
   - Programs can hold workshops or lectures to educate professionals on the structure and impact of citizen science
   - Programs can provide incentives for professionals participating in citizen science
   - Encourage more interactions between professionals and non-professionals

   Resources:
   Here are some publications describing the benefits of citizen science in research and how it is growing as a tool:

- Irwin, A. (2018). *No PhDs needed: How citizen science is transforming research.* Retrieved from: https://www.nature.com/articles/d41586-018-07106-5
- Springer Nature. (n.d.). *Publishing open access offers a number of benefits.* Retrieved from: https://www.springernature.com/gp/open-research/about/benefits
- Follet, R. & Strezov, V. (2015). *An Analysis of Citizen Science Based Research: Usage and Publication Patterns.* Retrieved from: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0143687
- Hecker, S. et al. (2018). *Citizen Science: Innovation in Open Science, Society, and Policy.* Retrieved from: https://discovery.ucl.ac.uk/id/eprint/10058422/1/Citizen-Science.pdf

Here is a study describing how citizen science programs can take steps to ensure their projects remain credible and accepted by the scientific community:
- https://theoryandpractice.citizenscienceassociation.org/articles/10.5334/cstp.6/print/

2. The program clearly defines roles and responsibilities of both the project leaders and participants and communicates this from the beginning to clear any misconceptions or reservations potential participants may have.
   Recommendations:
   - Ensure that potential participants have a clear understanding of their deliverables and the time commitment involved
   - Ensure that project leaders have a clear understand of their responsibilities
   - Project leaders and volunteers work together to determine a list of expectations from each other
   - Make a list of expectations readily available on the website, social media, flyers, and any other marketing materials
   - Continuously updates its participants on what is expected of them at each stage of the project

   Resources:
   iNaturalist serves as an example of a citizen science program that defines criteria for participation:
   - https://www.inaturalist.org/projects/city-nature-challenge-2020-north-east-england?tab=about

3. The program provides open communication strategies between professionals and non-professionals.
   Recommendations:
   - Provide multiple methods for Professionals and Non-Professionals to communicate, both in person and online
   - Ensure that these conversations are bidirectional
   - Programs can set up an online forum on its website

- Dedicate a community liaison to communicate with participants online and/or in person. They can also highlight milestones in the project in newsletters sent out to the community.
- Programs can set up online workspaces for each project using a tool like Slack
- Programs can set up workshops for professionals and non-professionals to share information mutually
- Encourage professionals to speak in less technical terms during workshops and when engaging with volunteers
- Encourage relationships between leaders and volunteers through community events

Resources:

Here is a study describing the importance of communication in citizen science:
- https://theoryandpractice.citizenscienceassociation.org/articles/10.5334/cstp.136/
Here is a guide to improving communication strategies in citizen science programs:
- http://www.scivil.be.dev1.minsky.be/sites/default/files/paragraph/files/2020-01/Scivil%20Communication%20Guide.pdf

4. The program recognizes its volunteers in both its publications and media and continuously gives its participants feedback to give volunteers a sense of appreciation. Recommendations:
   - Recognize citizen science as a method used in all publications and media
   - Specifically recognize participants who may have been more heavily involved in various stages of the project
   - Continuously provide feedback to the participants on their contribution and praise their accomplishments
   - Program leaders and/or professionals can use channels of communication to provide individual feedback to volunteers
   - If the project is on a large scale, programs can set up a visualization tool for participants to see their individual contributions and milestones
   - Provide challenges to to incentivize more participation
   - Inform participants about how their contribution was used in the project

   Resources:

   Here is a study on the value of giving feedback to volunteers for large-scale projects:
   - https://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.3000357
   Here is a study on the effects of automated feedback on citizen science volunteers:
   - https://conbio.onlinelibrary.wiley.com/doi/pdf/10.1111/cobi.12705

The Baltimore Mosquito Study serves as an example of a smaller scale citizen science project that continuously provided feedback to its volunteers:

- https://theoryandpractice.citizenscienceassociation.org/articles/10.5334/cstp.170/

Relevancy

By keeping projects relevant to prevalent issues in the target communities, programs can generate interest from previously underrepresented groups and encourage them to participate in citizen science.

1. The organization actively works with the community to make the programs relevant to community values and interests.

   Recommendations:
   - Identify the motivations of the community to make the program relevant to participants
   - Involve members of the local community in every stage of the project, especially the formation and planning stages
   - Advertise the issue and importance of the topic the project is trying to solve
   - Seek out community leaders to involve them in citizen science projects
   - Encourage these community leaders to bring in volunteers they believe would contribute valuably to the project

   Resources:

   The Baltimore Mosquito Study serves as an example of a successful inclusive citizen science initiative. This study is a reflection on the program, especially its design:
   - https://theoryandpractice.citizenscienceassociation.org/articles/10.5334/cstp.170/
     Thriving Earth Exchange is a community science program that strives to create a local impact through its projects:
   - https://thrivingearthexchange.org/how-it-works/

I: Contributors to Guidelines

Following the principles of citizen science, our guidelines were created and reviewed through collaboration with citizen science program leaders and volunteers, experts in citizen science, and our sponsor. We would like to thank everyone for providing feedback and helping us create guidelines that are applicable to citizen science programs around the world. The full list of contributors is listed here:

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Sha Alias, Port Phillips EcoCentre

J: Video Link
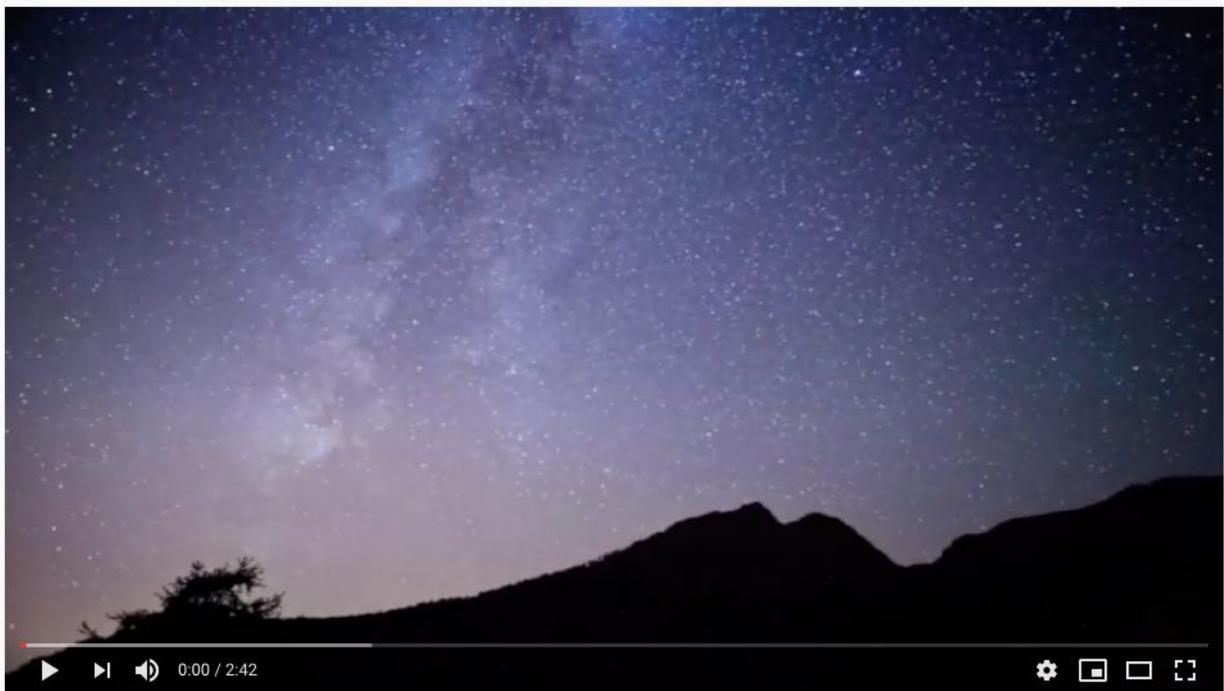
https://www.youtube.com/watch?v=0of_YIv9OHE

K: Video Script

Script:

Voiceover (1): Citizen science is changing the way science is being performed all around the world. It has led to an increased participation in research, massive data sets, and influence on policy. However, there is an observed lack of diversity in citizen science programs around the world.

---Clip From Diversity Expert---

Voiceover (3): In the context of citizen science, diversity is defined in terms of demographics. This includes, age, location, education level, ethnicity, and gender.

Voiceover (4): This helps programs focus on issues that are relevant to nearby communities, increase participation, and influence local policy.

Voiceover (5): However, action must be taken to foster diversity in citizen science programs. Often, projects are keen to encourage diversity but lack the specific knowledge or resources to connect to underrepresented groups.

Voiceover (6): Based on our research, we have come up with a set of guidelines that evaluate and encourage diversity. Many of the guidelines can be used during any stage of a project's life cycle.

Voiceover (7): These guidelines are split into 5 main sections that identify areas where barriers to diversity may occur: Structure, Recruitment, Volunteer Resources, Communication, and Relevancy. Within each section, we highlight recommendations on how to reduce these barriers.

Voiceover (Example 1) (8): Even making assumptions about the tools citizen scientists can use can unintentionally sideline someone who might be able to contribute to your project. For example, Herman lives in the woods where he spends his time birdwatching.
As a result, he wants to share his findings with a local program that collects bird data through an app. However, Herman doesn't have a smartphone and is unable to send in his valuable data.

Voiceover (Example 1) (9): Having read our guidelines, the organization implements alternate methods of data collection through mail and telephone for people with similar issues, and Herman writes off to receive pre-stamped envelopes.

Voiceover (10): Our guidelines provide a starting point for programs to address specific concerns, like Herman's lack of resources to participate in his local program. We also provide references for programs to better understand the problem and steps that they can take.

Voiceover (11): Our guidelines can be accessed through the link displayed below. Diversity is an important principle in citizen science, and we hope you will take the necessary actions to design diversity into your programs.