Using Citizen Science Projects to Increase Student Interest and Perceptions of Relevance in AP Environmental Science: An Inquiry Study

Renee Andrews
P. K. Yonge Developmental Research School

Abstract

Teacher inquiry was completed to determine how Advanced Placement (AP) Environmental Science student participation in citizen science projects would influence students' perception of relevance of my course. I collected baseline data through a questionnaire that surveyed student interest, course relevance, and views regarding their contributions to the scientific community. Students selected a project that allowed them to engage in citizen science. They completed journal entries about the process and their attitude toward their citizen science study. I provided guided questions for the journaling process. I also kept a journal that included possible evolution of student attitudes. After the students completed their projects, they took the same questionnaire to see if there had been an attitude shift. Results indicated that most students found the work to be interesting and relevant, and that citizen science projects encouraged a belief that students can and should think of themselves as valuable contributors to the body of scientific knowledge.

Keywords: citizen science, high school, environmental science, student research, student inquiry, curriculum relevance, authentic curriculum

Background Information

A meta-analysis of K–12 science interest, motivation, and attitude by Potvin and Hasni (2014), as well as common sense, indicate that students are more likely to internalize information deeply if the topic is something that they care about, and something that they feel is relevant and authentic. Though students who sign up for my AP Environmental Science course generally indicate that the material is interesting, I have sometimes had comments about its utility in real life as well as how the lab and field science would look if it were real. One of the challenges of teaching an AP course is that there is a great deal of content, and often we merely skim the surface of a field or lab study, while actual studies might take weeks, months, or years. A further challenge inherent to the course is the idea of applicability. Students often see laboratory or field studies as isolated incidents that illustrate concepts unrelated to the work of professional scientists.

In thinking about how to address these challenges, I wondered how I could make the work that students do seem more authentic and meaningful. I hypothesized that one way in which this could be accomplished would be by engaging students in citizen science studies. Citizen scientists are volunteers who collect and analyze data as part of a scientific inquiry (Silvertown, 2009). According to Silvertown (2009), "Projects that involve citizen scientists are burgeoning, particularly in ecology and the environmental sciences, although the roots of citizen science go back to the very beginnings of modern science itself" (p. 467).

Use of citizen science in the classroom is not new. Abundant studies cite successful use of such projects in university laboratory courses, and occasionally, in K–12 classrooms. Corwin, Graham, and Dolan (2015a) describe course-based undergraduate research experiences (CUREs), in which students “do the very real (legitimate) but more peripheral work of collecting and analyzing data” (p. 14) to answer questions that professional researchers are asking. Though these course-based undergraduate research experiences are not formally identified as citizen science, that is what they are at their core. Students participating in the courses are not scientists, but rather, undergraduates in core-level natural science courses. Another study by Corwin, Runyon, Robinson, and Dolan (2015b) investigated the inclusion of CUREs in laboratory course design, and its impact on student outcomes. Both of these studies indicated that these research experiences resulted in an increase in research self-efficacy in students, as well as a more positive perception of science, and the likelihood that students will engage in scientific studies in the future. Shah and Martinez (2016) suggest that the use of citizen science projects in the K–12 classroom improves critical thinking and problem-solving skills. However, they do not discuss its role in improving attitudes or motivation. Studies by Bonney et al. (2014), and Trumbull, Bonney, Bascom, and Cabral (2000) look at current and future use of citizen science in all arenas, both academic and non-academic.

If my AP Environmental Science students could actually contribute to the body of scientific knowledge by collecting and contributing data to real scientific studies, how would this change their perception of the relevance of the course? In what ways would data collection and student contributions to existing studies affect overall student attitudes about the applicability of AP Environmental Science? My hypothesis was that, after students had collected and contributed data to real scientific studies, they would take a more personal interest in the environmental sciences, and attribute greater relevance to their AP Environmental Science work.

Inquiry Design

Before embarking on an exploration of the potential benefits of utilizing citizen science studies as a part of my curriculum, I needed to collect baseline data. Prior information that I gleaned regarding such attitudes was merely anecdotal, so a systematic survey would provide data that are more reliable. I collected these data by means of a questionnaire that surveyed student interest, student opinions regarding course relevance, and student views with regard to the possibility of them contributing to the scientific community at large (see Figure 1). I utilized a number of resources in creating this survey, most notably a publication from Harvard University’s Program on Survey Research (Harrison, 2007), which assisted me with survey design, and an environmental awareness survey for students (Simpson, 1998), which provided subject inspiration. I administered this survey to all of my AP Environmental Science students.

At the beginning of second semester (January 2018), after the baseline survey was completed and disaggregated, I asked students to choose a project that included rubrics for assessment, which allowed them to engage in citizen science. In order for this to occur, I researched avenues that they could follow to engage in such projects. One consistent challenge, both with regard to curricular and extracurricular pursuits is that, due to liability, many organizations and research facilities will not allow minors (under the age of 18) to participate in citizen science projects, especially if these are on-site field studies. Since one of the most important aspects of this inquiry study was to include student choice (thus keeping the idea of relevance in the forefront), I sought several citizen science studies that would welcome high school scientists into their ranks.

After a great deal of background research, I selected the following citizen science project choices:

1. FeederWatch (with Cornell Laboratory of Ornithology)—observe and identify birds at feeders on campus; enter data into Cornell's site (Cornell University, n.d.).
2. FrogWatch (with Santa Fe Teaching Zoo, a member of the Association of Zoos and Aquariums)—listen for frog calls; enter data into online site (AZA, n.d.).
3. Community Collaborative Rain, Hail and Snow Network (founded by Colorado Climate Center, the project is now administered through NOAA)—record readings from a campus rain gauge; share data online (CoCoRaHS, n.d.).
4. Meteorological Phenomena Identification Near the Ground (with NOAA)—using an app on either iPhone or Android device, record current weather conditions on a regular basis (NOAA, 2014).
5. Native Flowering Dogwood Project (with USA Phenology Network)—observe leaf and flower budding of native dogwoods; share data online (USA Phenology Network, 2017).
6. Globe at Night (with National Optical Astronomy Observatory)—observe light pollution and note how well you can see various constellations; uses "loss of the night" app on iPhone or Android devices (NOAO, 2018).

Due to student interest as well as complications inherent to some of the projects (especially FrogWatch, for which students had to take a time-consuming online course and post-test in frog call identification), all students selected either FeederWatch (six students), Meteorological Phenomena Identification Near the Ground (12 students), or Globe at Night (nine students). Students did not select any of the other three projects.

Previous research studies suggested successful ways to integrate citizen science into the curriculum. Corwin et al. (2015a) outlined course design models that connected CUREs and outcomes. Shah and Martinez (2016) offered valuable insights into methodology and curriculum development at the secondary level. I turned to these studies for guidance in designing curriculum to embed citizen science research in my AP Environmental Science course. It seemed important that students moved beyond passively submitting data, best done by designing and implementing inquiry studies in which their data and/or other data generated by their chosen citizen science project was utilized.

Thus, I asked students, as summative assessments for their projects, to design and implement such inquiry studies. Students developed questions and associated hypotheses that were appropriate for their citizen science projects. They downloaded and analyzed data in support of their research questions, created graphs and tables to display relevant data, and drew conclusions based on their findings (and/or findings from the larger database).

As students collected and contributed data for their chosen projects, I asked them to journal about the process, as well as about their attitude toward the study in which they were participating. I provided guiding questions for them to use in the journaling process. As I read their journal entries and watched the process evolve, I too kept a journal regarding the ongoing process, including evolution of student attitudes. The hope was that I would see an increase in understanding of the relevance of our day-to-day laboratory and field work and how the studies that we do are a cog in the greater wheel of scientific knowledge. Finally, in May 2018, after the students' citizen science projects were completed, I provided students with the same questionnaire that I used in the baseline, this time to see if there had been a shift in attitude.

Sharing the Learning and Supporting with Data

In disaggregating the baseline data (see Figure 1), I was surprised to see that the results of the questionnaire did not align with anecdotal accounts of interest and relevance from previous years. All students found the content interesting, and 97% of students found labs to be interesting. The vast majority of students found content, including lab and field activities to be relevant, or at least, were neutral on this subject. I considered abandoning the project at that point, but data points related to the last two questions (items 9 and 10) dissuaded me from doing so. While students in this cohort found AP Environmental Science to be interesting and relevant to their lives, they still did not believe that they could, as high school students, contribute to the overall body of scientific knowledge. Fifty-six percent of students were either neutral or disagreed with the statement that their data "may be of interest to members of the scientific community." Seventy-seven percent were either neutral or disagreed with the statement suggesting that they could, as a high school student, "contribute to research that will make a difference in the world."

My first journal entry, written shortly after I disaggregated the initial set of data, stated, "I'm very surprised with the results of my baseline survey. Previous cohorts of students would probably not have been this positive, based on anecdotal discussions. But then, this is why we collect data: because, scientifically speaking, anecdotal discussions are garbage, and don't accurately reflect the entire cohort of students. Like voluntary feedback on a website, anecdotes reflect the extremes, especially people who are dissatisfied."

As students began their citizen science projects, I asked them to reflect weekly on their progress. Prompts included things like what was going well, what challenges they had found with regard to their studies, and whether they thought that the data they had collected were useful (and in what ways). Several trends emerged, and I will discuss these, project by project, and my journaling process on these, instead of providing lengthy notes regarding the work and thoughts of each citizen scientist.

Six students selected the FeederWatch program coordinated by Cornell Laboratory of Ornithology. Because our observation site was a feeder placed in the science quadrangle at P. K. Yonge, we were considered to be a single site for the purposes of the study. Cornell asked that participants observe for two days, compiling the maximum number of each species of bird seen at (or near) the feeder during the observation period, then skip five days before making the next set of observations. This methodology required students to collaborate and compile a single data set to submit online. This, and the inconvenient habits of the birds themselves, proved to be the greatest challenges. Students preferred to be independent operators, but that was not the way in which the study was designed. Instead, they needed to either meet as a group (and two different class periods were involved in the study) or have a group text-message by phone (which was the agreed-upon method of communication) to create a compilation of observed species and individuals. Though this taxed the patience of more than one student, it is, in fact, truer to the way a scientific study is really organized—scientists today often collaborate in groups. I noted this in my journal entries with what amounted to a chuckle.

The habits of the birds were also trying to students, because they did not necessarily appear at times convenient to the student observers. To make the study feasible with their varied schedules, students had split the observation times between them so that, for example, one student observed from 7–8 a.m. (his choice!), while another observed from noon until 1 p.m. Others observed at times after or in-between, so that observations were spread out over the course of each observation date. Our mid-day observer noted, in almost every prompt, some variation of the following: "Challenges of the study: NO BIRDS! The contents of the feeder are disappearing, yet

<u>APES Pre-Survey (Baseline Data)</u>

***N*=27**

This survey is designed to gather data about your opinions about APES. Please check the box that corresponds most closely to your opinion about each statement.

Statement to which you are responding	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
1. The content of APES is interesting to me.	10 (37%)	17 (63%)	0 (0%)	0 (0%)	0 (0%)
2. The course material in APES relates to my life outside of school.	10 (37%)	14 (52%)	3 (11%)	0 (0%)	0 (0%)
3. Labs make this course more interesting.	15 (56%)	11 (41%)	1 (4%)	0 (0%)	0 (0%)
4. I enjoy doing labs in APES.	7 (26%)	13 (48%)	7 (26%)	0 (0%)	0 (0%)
5. APES labs are relevant to life outside of school.	5 (19%)	15 (56%)	7 (26%)	0 (0%)	0 (0%)
6. Field activities (including field trips) make this course more interesting.	18 (67%)	7 (26%)	2 (7%)	0 (0%)	0 (0%)
7. Field activities (including field trips) are relevant to life outside of school.	13 (48%)	10 (37%)	3 (11%)	1 (4%)	0 (0%)
8. I would recommend APES to other PK students.	12 (44%)	15 (56%)	0 (0%)	0 (0%)	0 (0%)
9. Data that I collect in APES may be of interest to members of the scientific community.	3 (11%)	9 (33%)	11 (41%)	4 (15%)	0 (0%)
10. While in high school, I can contribute to research that will make a difference in the world.	1 (4%)	5 (19%)	12 (44%)	9 (33%)	0 (0%)

Figure 1. Baseline data showing students' interest and attitudes toward the course's relevance and their contributions to the scientific community at large.

I never see a single one!" This differed greatly from our early morning observer, who saw numerous birds daily, prompting me to write in my journal, "The 'early bird' does, indeed, get the proverbial worm!" This, also, is very realistic in terms of data collection. Scientists may need to adjust their schedules to fit the optimal methodology, rather than the converse. In the end, students had positive evaluations of this study, as well as interesting conclusions that they reached when using the nationwide database available to them. At the conclusion of the project, one student wrote, “This project was fun enough that I got a bird feeder for my house because of how enjoyable it was. I’d like to say that this citizen science project was one of the most engaging and enjoyable projects I’ve done in my high school career, and I hope it keeps being done in APES.” Though this was only one data point in my study, to me, that constituted success.

Meteorological Phenomena Identification Near the Ground (MPING), coordinated by the National Oceanic and Atmospheric Administration (NOAA) was the most popular of the citizen science projects, probably because data collection was extremely easy and not at all time-consuming. Students simply needed to download the application on their phones, then at the same time each day, submit data to NOAA. MPING tracks temperature and precipitation at locations across the country. This provides NOAA with data through crowd sourcing, and in places other than the usual weather stations, which are most often found at airports in various cities. Not only did this study require the least time and attention for data gathering, it was also the project in which students were less interested and engaged in the results. As I noted in my journal, “I’m not sure whether the more dispassionate students chose this project, since data collection is really a ‘gimme’ with cell phones, or whether the lack of involvement in data collection breeds indifference. Either way, this is not my favored project for a repeat performance in the curriculum. It doesn’t really exemplify the effort needed to ‘do’ science, nor does it generate the enthusiasm that I would like to see.”

In student commentary about MPING, some students did note difficulties with the app, posting comments like, “The recording MPING app was being glitchy this morning, but I think it still recorded all my data,” and, “I feel like the app doesn’t work very well. I’ve been submitting reports every day, but I feel like they don’t always go through because I check the website and I only see it [my data] sometimes.” Still, many of the twelve students who selected this project did come away with interesting studies, such as looking at the heat island effect in Gainesville, Florida, versus surrounding rural areas (yes, it is real and measurable), or looking at record high and low temperatures, as well as rainfall patterns, over time.

Nine students pursued the Globe at Night project, sponsored by the National Optical Astronomy Observatory. This project required students to look at a specific constellation (constellation maps were included in the “Loss of the Night” application on their phones) and note how many of its stars were visible. Greater visibility indicated less light pollution. This project allowed students to become more familiar with the stars and constellations common in the night sky, as well as to learn a bit about them (magnitude of the star, for example). Students designed a number of different studies to investigate with this project, including comparison of constellation visibility of a city-dweller versus a rural resident (looking at light pollution in different areas), and a longitudinal look at light pollution in their particular area (using online data).

This project generated some excitement, with students making comments such as, “It made me go outside and pay attention to the stars instead of just staying in the house and watching TV.” However, the project had its shortcomings, mainly with regard to prompts in the app—no allowances, for example, were made for cloud cover. If a student said they could not see any of the stars in the Pleiades, the app kept asking them to try another angle or constellation. It never gave data recorders an opportunity to discuss presence of cloud cover obscuring all constellations in their area. Two other interesting observations that students made (not necessarily complaints, but of interest, as they indicated an improvement in their observations of the natural world) were, “I had the best window of viewing between 8–10 p.m. before the moon came up”—noting moonrise and its impact on the visibility of stars; and “I eventually stopped doing observations in late April. It just stayed light too long with Daylight Savings Time.” As I looked at the journals for this particular project (more than the two others), I noticed an increase in the detail and sophistication of commentary as the project progressed, signs of productive learning taking place.

In early May, after the citizen science projects were completed and final studies had been submitted, I administered a post-survey (see Figure 2), in the form of the same questionnaire that I had administered to gather baseline data. In terms of participation in the citizen science projects, I must note that there were two students who, though they said that they had participated, did not submit any paperwork to document their participation (neither journals at benchmark deadlines, nor a final inquiry study at the end of the project). Both of these students signed up to complete the MPING study. I should also note that, since I was dealing with graduation deadlines, I did not accept late project submissions. Therefore, though the sample size is 27 students in both surveys, I only had documented evidence that 25 students completed the project. This is relevant, because the two students from whom I received no paperwork were the two students who provided the most negative feedback in their post-survey about the course. I strongly considered omitting their data from the survey results. However, since they claimed to have participated in the projects, and since they were part of the baseline data, I left their responses in the post-survey.

Several trends were apparent in the post-survey. First, there was a continued positive response regarding interest in and relevance of AP Environmental Science content. Response to field activities and field trips improved slightly, minimally in terms of interest, and in a more pronounced way in terms of relevance. This could be attributed to the citizen science project, but could also be a result of the APES unit on water, which included several field studies and a field trip to the local waste-water treatment plant.

Attitude toward doing laboratory studies actually worsened. There could be a number of causes for this; first, some of the laboratory assignments that occurred between November and May were not as much "fun" and hence, less popular, than the earlier labs (for example, there was a required Lethal Dose experiment in which students had to look at brine shrimp mortality when exposed to toxins). Second, laboratory report fatigue often ensues closer to the end of the year, especially when seniors have already been accepted (or not) to their chosen colleges and are ready for a break. All of these data could have any number of interpretations, but more discussion with the cohort of students would be needed to tease out causative factors.

As in the pre-survey that informed the baseline data, questions 9 and 10 are probably most directly relevant to the citizen science projects. Here, there was a significant difference in the data between the pre- and post-surveys. While a majority of students responding to the baseline questionnaire were neutral or disagreed that student-collected data would be of interest to the scientific community (56%), that number declined significantly in the post-survey, to 26%, with 74% of respondents stating that they agreed or strongly agreed that student-collected data would be of interest. Likewise, students were much more likely to agree that, as high school students, they could contribute to research that makes a difference in the world. Baseline data indicated that only 23% of students agreed (strongly or otherwise) with this statement, while in the post-survey, this number almost tripled, to 66%. Clearly, citizen science projects provided convincing evidence to this cohort that students could and did make a difference in the real scientific community.

Conclusions

Did this study using citizen science in my AP Environmental Science course have the desired effect? Did it, as hypothesized, make the work that the students accomplished seem more authentic and relevant to them? Did it foster a greater interest in science in general and environmental science in particular? My conclusion would be a resounding "probably." Survey results and student journals indicated that the vast majority of students found the work to be interesting and relevant, but that was true even before the project began. However, the data do clearly indicate that the citizen science project encouraged a belief in this cohort of students that

APES Post-Survey

***N*=27**

This survey is designed to gather data about your opinions about APES. Please check the box that corresponds most closely to your opinion about each statement.

Statement to which you are responding	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
1. The content of APES is interesting to me.	13 (48%)	12 (44%)	2 (7%)	0 (0%)	0 (0%)
2. The course material in APES relates to my life outside of school.	13 (48%)	11 (41%)	3 (11%)	0 (0%)	0 (0%)
3. Labs make this course more interesting.	12 (44%)	14 (52%)	1 (4%)	0 (0%)	0 (0%)
4. I enjoy doing labs in APES.	5 (19%)	15 (56%)	5 (19%)	2 (7%)	0 (0%)
5. APES labs are relevant to life outside of school.	7 (26%)	17 (63%)	2 (7%)	1 (4%)	0 (0%)
6. Field activities (including field trips) make this course more interesting.	18 (67%)	8 (30%)	1 (4%)	0 (0%)	0 (0%)
7. Field activities (including field trips) are relevant to life outside of school.	14 (52%)	12 (44%)	1 (4%)	0 (0%)	0 (0%)
8. I would recommend APES to other PK students.	14 (52%)	11 (41%)	1 (4%)	1 (4%)	0 (0%)
9. Data that I collect in APES may be of interest to members of the scientific community.	8 (30%)	12 (44%)	5 (19%)	2 (7%)	0 (0%)
10. While in high school, I can contribute to research that will make a difference in the world.	6 (22%)	12 (44%)	8 (30%)	1 (4%)	0 (0%)

Figure 2. The post-survey, administered after students completed their citizen science projects, showed the greatest positive changes for questions 9 and 10.

they can and should think of themselves as scientists—valuable contributors to the overall body of scientific knowledge. It also gave them a more authentic perception of what "doing science" meant beyond the high school campus. It meant collaborating to collect, assimilate, and post data. It meant adjusting your schedule to the natural order of things, whether to watch birds or stars. It meant thinking about where your data fit in the greater world of science. It is my hope that many of these students will take away a thirst for more knowledge-making, and will continue to look for ways to contribute, either as citizen scientists, or through pursuit of a STEM degree.

How can other educators utilize these findings? High school science teachers can integrate citizen science to pique the interest of their students as they make real-world contributions to the scientific fields while still in high school. Though my results were specific to AP Environmental Science, there is no reason that citizen science studies cannot be used in other science courses. Environmental science is an integrated course of study, meaning that it includes physical, life, and earth sciences in its curriculum. Hence, I offered a broad range of project choices. In physics, earth science, or other courses, the project choices would obviously need to be more focused to correlate with the standards for those specific fields of study. A simple online search provides a plethora of choices for student participation. A caveat that I would offer is that some of these studies are better designed than others. I have provided a preliminary critique of the studies that my students pursued. In looking for relevant citizen science projects to offer them, I reviewed dozens of possibilities, a process that is time-consuming for busy teachers.

I argue that the benefits justify the time commitment. Student participation in citizen science does provide an authentic avenue for inquiry. As previous research has shown us (Shah & Martinez, 2016), if utilized in conjunction with individualized student research projects, it improves critical thinking and problem-solving abilities. Of equal importance, it provides relevance by allowing students to participate in genuine research processes and products. There is much good that we can do, both in small ways, through contribution of data points, and in much more significant ways, by providing inspiration for the development of new scientists to continue the tradition. That is, after all, a worthy goal for all science educators.

References:

Corresponding Author: Renee Andrews
Author Contact Information: randrews@pky.ufl.edu

Association of Zoos and Aquariums. (n.d.). FrogWatch USA. Retrieved from https:www.aza.org/frogwatch.

Bonney, R., Shirk, J. L., Phillips, T. B., Wiggins, A., Ballard, H. L., Miller-Rushing, A. J., & Parrish, J. K. (2014). Next steps for citizen science. *Science*, *343*(6178), 1436–1437.

Community Collaborative Rain, Hail and Snow Network (CoCoRaHS). (n.d.). Retrieved from https://cocorahs.org.

Cornell University. (n.d.). Project FeederWatch. Retrieved from https://feederwatch.org.

Corwin, L. A., Graham, M. J., & Dolan, E. L. (2015a). Modeling course-based undergraduate research experiences: an agenda for future research and evaluation. *CBE-Life Sciences Education*, *14*(1), es1.

Corwin, L. A., Runyon, C., Robinson, A., & Dolan, E. L. (2015b). The laboratory course assessment survey: A tool to measure three dimensions of research-course design. *CBE-Life Sciences Education*, *14*(4), ar37.

Harrison, C. (2007). Program on Survey Research Questionnaire Tip Sheet. *Harvard University Program on Survey Research*. Cambridge: MA.

National Oceanic and Atmospheric Administration (NOAA) (2014). *mPING Fact Sheet.* Retrieved from https://www.nssl.noaa.gov/news/factsheets/mPING_Fact_Sheet_2014.pdf

National Optical Astronomy Observatory (NOAO). (n.d.). Globe at Night. Retrieved from https://www.noao.edu/education/gan.php.

Potvin, P., & Hasni, A. (2014). Interest, motivation and attitude towards science and technology at K–12 levels: A systematic review of 12 years of educational research. *Studies in Science Education*, *50*(1), 85–129.

Rotman, D., Preece, J., Hammock, J., Procita, K., Hansen, D., Parr, C., & Jacobs, D. (2012, February). Dynamic changes in motivation in collaborative citizen-science projects. In *Proceedings of the ACM 2012 Conference on Computer Supported Cooperative Work* (pp. 217–226). New York, NY: ACM.

Shah, H. R., & Martinez, L. R. (2016). Current approaches in implementing citizen science in the classroom. *Journal of Microbiology & Biology Education*, *17*(1), 17.

Simpson, B. (1998). Environmental awareness survey. *Global Issues in Language Education*, *30*, pp. 12–14.

Silvertown, J. (2009). A new dawn for citizen science. *Trends in Ecology & Evolution*, *24*(9), 467–471.

Trumbull, D. J., Bonney, R., Bascom, D., & Cabral, A. (2000). Thinking scientifically during participation in a citizen-science project. *Science Education*, *84*(2), 265–275.

USA Phenology Network. (n.d.). Flowering Dogwoods Campaign. Retrieved from https://www.usanpn.org/nn/dogwoods.