Stream of Consciousness





dickinson.edu/allarm

blogs.dickinson.edu/allarm

allarm@dickinson.edu

@allarmwater



Dickinson

The publication Stream of Consciousness is made possible by the generous support of the Charles Merrill Kurtz Fund, which was established by Betty Puzak in memory of her father, Charles M. Kurtz, Dickinson Class of 1907.

Alliance for Aquatic Resource Monitoring

© 2021 Alliance for Aquatic Resource Monitoring. Stream of Conciousness is licensed under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International license. http://creativecommons.org/licenses/by-nc-nd/4.0/ If you would like to use this content in other ways, please contact us.

All pictures are property of ALLARM unless otherwise noted.



Table of Contents

| Bridging the Gap Between Students and Local Communi- ties in Pennsylvania through the ALLARM Experience By: Nhu Truong '22 | 4 |
|---|----|
| ALLARM's COVID Story By: Isabel Ruff '21 | 5 |
| Meet Our New Community Science Specialist (CSS)! By: Kyra Lerner '23 | 8 |
| Citizen Science and Civic Engagement By: Grace Messimer '23 | 9 |
| Coming Together in a Pandemic-Shaped World: Reflection on my Work with OCCA By: Phoebe Galione '21 | 11 |
| Science Communication By: Olivia Spildooren '21 | 13 |
| JEDI in the Chesapeake Bay By: Shante Toledo '21 | 17 |
| Environmental Justice and Coal Mining in Greene County, Southwest PA By: Hiba Aoid '21 | 18 |
| Chesapeake Bay Stewardship Fund: National Fish and Wildlife Foundation (NFWF) Stream Restoration Program | 20 |
| By: Angelo Tarzona '21 | |
| Senior Reflections | 22 |
| ALLARM in Pictures | 24 |



Watershed Coordinators Angelo Tarzona '21 (left) and Nhu Truong '22 (right) practice lab methods while wearing their PPE.

Bridging the Gap Between Students and Local Communities in Pennsylvania through the ALLARM Experience

By: Nhu Truong '22

Alliance for The Aquatic Resource Monitoring (ALLARM) has been facilitating a strong relationship between Dickinson students and local communities in Pennsylvania and New York for thirty-five years, through its communitybased approach. As a new ALLARM staff member and an international student. I was curious to learn about ALLARM and the values that it brings to both the community and the Dickinson College students who are employed as Watershed Coordinators. To further understand this, I prepared and conducted a survey among returning student workers at ALLARM during my first week as a Watershed Coordinator!

By the end of the survey, I discovered interesting insights from student staff at ALLARM. Students come from many different states across the country. Most watershed coordinators did not know much about the local communities surrounding Dickinson College in their first year. However, they all agreed that ALLARM supported them in connecting with communities and creating meaningful experiences to the local area during their time in college.

ALLARM is viewed as a special opportunity where students can merge their interests in

their courses with non-profit experiences while engaging with local communities. ALLARM has been building relationships with many communities throughout the region. Thanks to the decades of rapport-building, students can interact with local community members in diverse activities including stream monitoring workshops and community meetings with diverse stakeholders. Events like these are mutual learning opportunities for both the students and the volunteers. During these meetings, the students apply what they learn at Dickinson and ALLARM and assist local volunteers to learn water quality monitoring techniques and interpret the collected data. Furthermore, students also have the chance to get to know more about community members, their work, and their motivation for stream monitoring through their stories.

To all student workers, the experience at ALLARM is considered to have a lifelong impact. The students have broadened their understanding in diverse areas, such as civic engagement and local organizations, which helps shape their future career goals. It makes the students feel included and feel like a part of the communities in the region. Beyond that, these connections bring meaningful lessons about civic engagement and its importance. their time at Dickinson.

"I loved listening to volunteers and their individual experiences and deep knowledge of their site. The connections they made between their results and location-based impacts on their site were fascinating and I loved their enthusiasm."

-Isabel Ruff '21

Learning about ALLARM from the Learning about ALLARM from the experience of returning students is indeed fascinating and inspiring. They have also shared some advice with newer folks like me on how to make our experience at ALLARM exponentially meaningful. In the upcoming time working at ALLARM, I aim to participate as much as I can in events that spark my interests and are of service to the. Simultaneously, I will continue reaching out and exploring ways that can integrate my passions

ALLARM's COVID Story

By: Isabel Ruff '21

When the world shut down in March of 2020 due to the emergence of a global pandemic, ALLARM made the quick decision to suspend monthly Stream Team monitoring to prioritize the safety of all volunteer monitors and employees. With this change, the spring season of events, including chemical monitoring workshops and macroinvertebrate trainings, had to be postponed and reenvisioned. ALLARM had to quickly pivot and find new ways to keep volunteers involved and engaged while still being safe.

The first thing ALLARM created after pausing monthly Stream Team monitoring were Creek Courses, which were webinars offered during lunch hours in the early months of the pandemic to be an additional resource for volunteers during the time. These courses focused on educational topics related to water quality that were not able to be covered in as much detail during workshops or other stakeholder

through research opportunities with ALLARM. Lastly, I am looking forward to working with local volunteers and hope to see how my work will contribute to the environmental well-being of the communities in Pennsylvania.

> "I would definitely recommend taking any opportunities you can that interest you! I've learned a lot about some topics that I didn't think I would enjoy/understand." -Grace Messimer '23

"My one advice is to always put your heart and wonderful ideas when working on a project. Julie, Suzanne, Stephanie, and Hayat are there to guide you." -Angelo Tarzona '21

meetings, which provided more context for volunteers by focusing on topics such as an introduction to water quality and policy in the Chesapeake Bay watershed, clean-up efforts in the watershed and the role of monitoring, land use and its connection to water quality, and a deeper dive into water policy. With these courses, ALLARM wanted to continue fostering a strong community during this time of transition by offering an opportunity for learning and continued supportive connections.

Stream Team open calls began to create more connections within and across Stream Team cohorts while also creating space for ALLARM to check-in with volunteers. Going into 2020, ALLARM had the goal to increase connectivity between Stream Teams volunteers. The pandemic created the opportunity to pause and reflect and focus on relationship building while promoting volunteer-to-volunteer connections. In her response to an end-of-

2021 5

year survey, one volunteer said that she "like[s] the open meetings and learn[ing] more from everyone sharing their experiences." These meetings were also helpful when looking forward and planning to start monitoring again because volunteers who had found ways to continue monitoring safely were able to share their experiences and techniques. Feedback like this helped guide ALLARM's new COVID monitoring guidelines. Tips like avoiding people outside their household and passing off equipment between team members month to month were then combined with state regulations as well developed by colleagues such as Trout as Unlimited. These new guidelines were debuted as an infographic during a monitoring refresher meeting in July.

While also acting as a space to introduce the new monitoring safety guidelines, the refresher meeting was also created to remind volunteers of tricky monitoring protocols that could have been forgotten during the 5-month monitoring break. The highlight of this meeting was an interactive jeopardy review game featuring questions about water quality monitoring parameters like pH, nitrate-nitrogen, conductivity, temperature, and also COVID safety. It was a fun night with volunteers racing to "raise their hands" on Zoom and answer the questions.

This meeting also marked the next phase

of virtual Stream Team interaction as ALLARM began adapting workshops to an online format. I was most excited about the chemical monitoring workshop for the Lackawanna-Luzerne Stream Team that had been planned for April but was rescheduled to the end of August. This team was supposed to be my first group of volunteers to train, so when August came, I was just as excited as the volunteers who had been waiting to begin monitoring. This is was one of the more difficult things to adapt to because the chemical training workshop hinges on providing hands-on experience with the monitoring equipment as a way to learn and practice. In August, each monitoring team received their box of equipment they would use, and we hosted a virtual workshop to demonstrate how to measure each parameter as the volunteers followed along. As volunteers learned how to use the equipment, we learned how best to teach and demonstrate the use of different parameters in a virtual format. The evening went smoothly, and all volunteers and staff were very patient and did a fantastic job! Taking lessons learned from the workshop in August, we were ready for our next chemical monitoring workshop, this time for the third York County Stream Team group. One lesson learned from the first workshop was to orient the volunteers to the conductivity meter and the testing materials ahead of time. We were able



Assistant Director Suzanne Hartley introduces Stream Team Jeopardy during the summer refresher meeting.



Isabel Ruff '21 demonstrates the nitrate-nitrogen test during a chemical monitoring workshop.

to prepare them beforehand by teaching them how to reset the LaMotte Tracer PockeTesters which measure water temperature and conductivity when we met up (socially distant and in person) to provide them with their monitoring equipment. This workshop followed a similar format to the previous one, but this time I had the opportunity to demonstrate how to do the tests in addition to reading instructions while others demonstrated, so I was excited about this new aspect of training. Again, the evening went smoothly, and everyone was full of enthusiasm. Both workshops were successful because volunteers from each cohort passed quality control checks at rates similar to Stream Teams cohorts who had been trained in-person, and this was exciting to see because hosting virtual workshops was new to ALLARM, which has now opened up even more possibilities and accessibility by having a recording for volunteers to reference later or if they weren't available for the workshop itself.

The pandemic pause pushed ALLARM to rethink data communication, which provided the opportunity for a greater emphasis on volunteer data interpretation. Data interpretation workshops were transitioned to a virtual format, with a presentation to provide context about potential influences of water quality, and time to walk through the results of each site before comparing the all sites across watersheds or Stream Team cohorts. This was a

wonderful opportunity for volunteers to visualize their data and see how their data compare to others in their county. These were my favorite workshops; I was able to support the workshops by making Geographic Information Systems (GIS) maps and I was able to facilitate site analysis. I had the opportunity to get to know volunteer sites and the landscape from an aerial view (making maps) it was refreshing to hear the volunteers describe their site and include details that can only be seen from an intimate, on-theground point of view. The passion Stream Team members have for their sites and for monitoring was apparent through their observations, and I enjoyed drawing conclusions alongside each aroup of volunteers.

As we've reached a year living in this historic moment, it has been encouraging to overcome challenges by finding ways to continue monitoring and emphasizing different experiences such as data interpretation. The connectivity from open calls and the flexibility of virtual chemical monitoring workshops will continue to be used moving forward from this time. We've found new ways for volunteers to build community and feel connected across Stream Team cohorts and created training videos that can be used to supplement workshops or as a reminder of techniques months later. Through this all, our adaptability has shown the strength and resilience of our staff and volunteers. I'm grateful to be a part of this community.

2021 7

Meet Our New Community Science Specialist!

By: Kyra Lerner '23

In October of 2020 the Alliance for Aquatic Resource Monitoring welcomed Stephanie Letourneau as the new Community Science Specialist. She immediately hit the ground running with enthusiasm and has already become an incredibly valuable member of the ALLARM team.

Stephanie is a graduate from Juniata College with a major in Environmental Science. From Frederick, Maryland, Stephanie participated in many environmental-based programs such as a field station set up on Raystown Lake. In addition, she gained lots of community science experience in her work outside of college with the Reef Environmental Education Foundation, a citizen science program, during the summer of 2020. There, she had the opportunity to work with volunteers and data surrounding fish populations, both locally and around the world. Her experience and enthusiasm for environmental water community-based work led her to finding ALLARM. When asked about what attracted her to ALLARM, Stephanie responded "being able to apply all the knowledge that I gained in my undergrad with the new skill set that I had in understanding of community science program was a very valuable opportunity for me, it just naturally fit that I was going to be able to move into this place and have this watershed mindset embraced in my full-time job." Stephanie's robust work has been proven a natural fit with ALLARM and she has settled comfortably into her responsibility as the Community Science Specialist.

The role as the Community Science Specialist includes a wide variety of services. One of the biggest aspects of her work is being the main contact for ALLARM's Stream Team program, which includes assisting volunteer monitors with their questions and concerns. In addition, she is the ALLARM liaison to the Chesapeake Monitoring Cooperative (CMC), where she promotes our volunteer monitoring work and which integrates data from different community groups into the Chesapeake Data Explorer. She also assists in ALLARM's lab alongside other student Watershed Coordinators who work on quality control. While these are some of Stephanie's concrete roles as the Community Science Specialist, she will continue to define this role and

take on new responsibilities. Stephanie says her first months have been an incredible professional experience.

When asked about some of her favorite moments she has had working with ALLARM, she mentioned two stories where she formed connections with her colleagues during road trips. She emphasized how grateful and amazing it felt to be able to have such experiences to immediately dive into. When asked about what she was looking forward to the most, she talked about leading the Chesapeake Data explorer data training for the Lackawanna-Luzerne and York counties. She stated "This is the training that I am leading... I get to be the one to show them the ropes and I am really excited!" Stephanie has undoubtedly stepped into her new role with ALLARM exuding confidence and showing amazing leadership!

Outside of ALLARM, Stephanie is an avid hiker and a certified scuba diver who hopes to begin exploring the waters closer to Pennsylvania. During the COVID pandemic Stephanie can be found cooking some of her favorite snacks and trying new types of vegetarian cooking. Stephanie is truly a kind and passionate person who is a treat to work with. There is no doubt that she will continue to excel and help ALLARM reach new goals!



CSS Stephanie Letourneau enjoys a hike in the area.

Citizen Science and Civic Engagement

By: Grace Messimer '23



Left: Volunteer monitoring is a form of citizen science that gives volunteers the opportunity to impact their community through data collection and chemical water testing. Photo: Nate Bacon Right: Citizen science connects community members to each other as well as to their environments

Citizen science has been a fast-growing field over the past few decades. It works to help educate volunteers and provides opportunities for involvement while also benefitting scientists and specialized research fields. Work in citizen science also helps to create connections between volunteers and their communities, which can inspire volunteers to continue helping in their community. Volunteer monitoring and other forms of citizen science can increase civic engagement and action from volunteers to create positive changes within a local community.

Citizen science bridges the gap between professional scientific research and the general public by offering an opportunity for volunteers to work with scientists and perform scientific work. This can be done in several ways including community-based volunteer monitoring, research, and environmental collaborative monitoring. Citizen science helps both the scientists as well as the volunteers scientists can better understand the community while citizen scientists are able to grow their knowledge on the scientific process. Volunteers who have less prior knowledge about scientific research can increase their understandings of ecosystems and become able to have informed concern about ecological problems based on knowledge rather than preconceived fears and connections to ecological issues (Haywood et. al., 2016, 483). This "informed concern" helps

volunteers as well as specialists prioritize issues that are most prevalent to local communities. Meanwhile, volunteer monitoring can help specialists through increasing "the amount of information about the ecological condition of the resource" and can "support data sharing for community education" (Overdevest et. al., 2004, 178). Volunteer monitoring connects volunteers to each other as well as to organizations that help the local environment. It also gives volunteers more insight into issues that are personal to their community, which can inspire them to get involved in efforts to work with the community to focus on these problems.

Civic engagement is vital to the wellbeing of a community. Without community members and organizations working to improve problems, there would be far less of a push for civic responsibility or the improvement of issues. Members of any community have a personal understanding of issues within the community that even state and local government members may not understand. Citizen science can also inspire volunteers to become involved in civic engagement programs. Citizen scientists who may decide to participate in volunteer monitoring; through this process they will learn about ecological concerns specific to their environment. Volunteer monitoring engages volunteers in a project related to their community, which in turn will help to create more connections for them. In fact, citizen science volunteers were found to be more likely to attend political action events after volunteering than they were before (Overdevest et. al., 2004, 182). Having these connections can lead to work in other civic engagement processes, such as political activism. Having local volunteers work in citizen science projects can be used in "place-based learning" as well, which connects issues of conservation based on individual experiences within a community (Haywood et. al., 2016, 476).

Volunteer work in citizen science is likely to result in more civic engagement within a community. Work in citizen science will increase networking, connections within a community, and political participation (Overdevest et. al., 2004, 177). Volunteering for citizen science projects is helpful within a local community because of how the residents of the community can make sense of data due to their personal understanding of problems that scientists outside of the community would not otherwise. Citizen science offers a chance at collaborative work between professional scientists and local community members with projects that are generally designed by scientists and for which members of the public contribute the data (Shirk et. al., 2012, 5). Being able to fill gaps between the data collected by scientists and the information about the data that the public provides helps to give a better understanding of problems within the community. This data can then be used to see what may be wrong with the environment within a community which can lead to working towards a common goal of how to move forward. This is especially true when considering place-based learning and how the location of monitoring affects the outcomes. Place-based learning allows individuals to see problems that they want to prioritize in an ecosystem and engage in action to fix these problems. Citizen science can impact volunteers' behaviors, which can lead to action-oriented change (Haywood et. al., 2016, 477).

Implementing citizen science programs a community can create more civic in engagement and a push for positive change within a community. Long term participation in citizen science programs can foster more connections between volunteers and other community members, which means that they are more likely to want to participate in other civic engagement programs. Focusing on local issues that a community's environment faces rather than broad issues can lead to better changes that are tailored to the community's needs, and gives individuals with an invested interest in their community's problems the ability to personally affect them.

Works Cited

Shirk, J.L., Ballard, H.L., Wilderman, C.C., Phillips, T., Wiggins, A., Jordan, R., McCallie, E., Minarchek, M., Lewenstein, B.V., Krasny, M.E., & Bonney, R. 2012. Public participation in scientific research a framework for deliberate design. Ecology and Society, Vol. 17, No. 2. Resiliance Alliance Inc. https://jstor.org/stable/26269051.

Haywood, B.K., Parrish, J.K., & Dolliver, J. 2016. Place-based and data-rich citizen science as a precursor for conservation action. Conservation Biology, Volume 30, No. 3 p. 476-486. Society for Conservation Biology.

Overdevest, C., Orr, C.H., & Stepenuck, K. 2004. Volunteer stream monitoring and local participation in natural resource issues. Human Ecology Review, Vol. 11. Madison, WI. Society for Human Ecology.



Members of ALLARM and OCCA practice the collection of macroinvertebrates from their stream.

Coming Together in a Pandemic-Shaped World: Reflection on my Work with OCCA

By: Phoebe Galione '21

I can hardly believe it was over two years ago that I sat in anticipation through the four hour drive from Carlisle, Pennsylvania up to Otsego County, New York for my first workshop experience as an ALLARM watershed coordinator. I started working only a few weeks earlier and recall running through the list of macroinvertebrate identifying facts - "mayflies have three tails, stoneflies have two... mayflies have obvious gills, stoneflies usually don't" - during the drive, which I would soon be reciting to the members of the Otsego County Conservation Association (OCCA). Unbeknownst to me, this first workshop would become one of the most influential memories of my ALLARM experience, sealed the deal on my love for working with others, and sparked an interest in the field of citizen science which would carry through my remaining time at ALLARM despite varying circumstances.

The goal of the initial OCCA workshop was to refresh the tips and tricks of water testing based on the protocol they had previously learned, and to troubleshoot any issues they

had experienced in the field. We covered conductivity, turbidity, pH, nitrate-nitrogen and orthophosphate, and then took a small dip into a local stream for a macroinvertebrate field test (of course complete with a Macro Shuffle the trendy dance of kick-net sampling). Talking with the volunteers during this training process helped me understand the importance of citizen science and why someone would be interested in taking part. With the precarious state of the Chesapeake Bay and its implemented pollution diet, monitoring locations throughout the watershed are essential in pinpointing pollution sources for monitoring improvements. I remember leaving the workshop excited that a new branch of science was open for me to experience over the upcoming semesters at ALLARM.

Usually, after the initial training process, volunteers would test their local waterway once a month, sending their findings to ALLARM for QAQC (Quality Assurance, Quality Control). ALLARM staff would then review their findings



Members of OCCA and ALLARM meet virtually to discuss stream monitoring updates, goals, and address any questions they may have about the monitoring of their headwater streams.

and write letters back with whether or not the sampling was successful. After around a year of successful monitoring, volunteers would have an opportunity with ALLARM to review findings and to discuss what stories their data hold about the health of their streams. Flash forward two years to a very different world where plans have been disrupted and meetings have been put on hold "until the foreseeable future." OCCA patiently waited for their data interpretation workshop, but with no indication of how long into the future pandemic conditions would persist, ALLARM took the initiative to keep active ties with community partners and to revamp the data workshop series to cater to this new virtual world. If anything, this guarantine period has given ample time for reflection.

In early November of 2020, I had the opportunity to work with OCCA once again in preparation for the long-awaited data interpretation meeting. The Chesapeake Data Explorer, where volunteers upload their data, allowed me to access all of the data gathered from 2017-2020 by the OCCA group. As I went site by site organizing the cumulative work of the volunteers, I had to sit back, smile, and appreciate the power of citizen scientists. Over 170 data entries were gathered over the approximately two and a half year span (despite most of 2020 being in pandemic conditions) and when presented visually through graphs,

the data told stories of high water levels due to melt, construction interferences, dry periods and more. With all the prep work done, during the virtual meeting I had the opportunity to listen to the volunteers explain additional observations they had made. The volunteers' interpretations helped build up the story their water was telling which araphs alone could not fully inform. After spending a couple semesters in the ALLARM lab, and a couple semesters working on outreach materials, this was the first time I was able to see the "final" result of volunteer work. And this final step was all done, successfully, from the comforts of our own homes - ALLARM situated in Pennsylvania, the volunteers in New York, and myself in Pennsylvania. There was something bittersweet, sitting now at the start of my last semester at ALLARM, about watching familiar faces work through the entire water monitoring process and to have had the opportunity to assist throughout.

No one could have predicted the numerous disruptions that occurred in 2020, but virtual training, while perhaps not the preferred method, is another tool that can be used once we leave the pandemic behind. Distance is not as daunting when volunteers are only a video call away. Who knows how many more future citizen scientists ALLARM will now be able to reach!

Science Communication

By: Olivia Spildooren '21

When you hear the well-known phrase, "a picture is worth a thousand words", what probably comes to mind is a photograph. It might be a photo of something like a bustling city or a portrait of a person, regardless of the subject they each hold within them stories.

However, I think this phrase does not have to only be constricted to the artistic context or photography realm. It also has a lot of truth when thinking about science, specifically science communication. The internet, social media, and news media flood us with a deluge of images day to day, and recently, minute to minute. Maps and graphs are commonplace on news media, especially today, with so many pressing topics, like elections or COVID-19, because they can disseminate a vast amount of information quickly and in a way non-science people will understand.

Maps have existed for thousands of years (smithsonianmag.org), the oldest map known dates back to 700 BC and many early maps were carved into natural resources like clay (history. com). Maps have helped people make sense of the world and the individual's sense of place from a global scale to a local scale. Fortunately, we are lucky to live in this digital world where maps can go from being static paper maps, to interactive digital maps available on all sorts of devices that can be used to tell compelling narratives. Static maps can communicate a great quantity of data in a meaninaful and accessible way. Interactive online maps take the instinct to search for patterns a step further by allowing users to explore a map by clicking, zooming, or querying to search for one's own answers to questions. Moreover, modernized maps allow people to potentially stumble upon something they had not known before or thought to look for. Finally, it has been within the last eight years or so that a concept called "Story Maps" was created that allows people to integrate maps, both static and interactive into a narrative, acting akin to the illustrations in a book that add depth and life to a story (ESRI.com).

These maps and graphs are images that contain countless data that have been analyzed and arranged into a pictographic form so that a common understanding may be made from them. As humans are hardwired to search

for patterns in images, analyzing pictures comes intuitively to most



Ancient Babylonian map of the world.

people (Mattson, 2014; psychologytoday.com). That is what makes maps and graphs such useful, essential tools for data interpretation, analysis, and communication.

We must not forget about another powerful type of scientific imagery- charts and graphs. While these images can be less intuitive to understand than a map, they are still another critical tool for data interpretation and science communication. Data visualization with graphs or charts is relatively contemporary. The gaining of popularity in the late 18th century to early 19th century towards graph making perpetuated the increased publication of extensive collections of data about weather, economics, or population (smithsonianmag.com). One notable graph maker was Joseph Priestly who made a "Chart of Biography", in 1764, where he graphed the lives of many famous figures along a horizontal line, he is guoted saying that this timeline was good for conveying information "with more exactness, and in much less time, than it [would take] by reading" (smithsonianmag.com).



Joseph Priestly's Chart of Biography, 1764

ALLARM has harnessed both the story telling technique of GIS maps and compelling data visualization tool of graphing to help people find the stories in their water bodies and watersheds. A suite of GIS maps is used in data interpretation workshops which are held for watershed partners after a few years of data collection and Stream Team volunteers after they have collected at least one year of stream chemical monitoring. Before even lookina at the chemical monitoring data, maps are shown that have been tailored to the area the Stream Team monitors to help demonstrate the environmental factors that contribute to water health. Maps produced and shared by ALLARM typically show the underlying geology, land use, and delineations of watersheds because these are three major influences on water quality.

Once Stream Team volunteers have been introduced to their locations from a new perspective and have an understanding of the biggest influences on their watershed from the GIS maps, more detailed graphs are introduced to continue the data analysis. The graphs brought into data interpretation workshops foster a holistic and local view of water quality, as some are broken down by parameter, while others provide a general snapshot of data collected over a 12-month period.

This imagery is helpful for interpretation because it shows what happened month to month but also can uncover trends that happened throughout the year. Volunteers can go about understanding possible reasons for these trends based on what they learned from the geology, land use, and watershed GIS maps. Data can seem inaccessible when it is in its raw form, however, it can be made more accessible and tell a compelling story when packaged and organized in a visual format.



Allegheny Stream Team Land Use

Works Cited

"Babylonian Map of the World" by oooOOC is licensed with CC BY-NC-SA 2.0. To view a copy of this license, visit https://creativecommons.org/ licenses/by-nc-sa/2.0/

ESRI. (2019). ArcGIS StoryMaps: The Next Generation of Map-Based Storytelling. ersi.com. https://www.esri.com/about/newsroom/arcnews/arcgis-storymaps-the-next-generation-of-map-based-storytelling/

History. (2018). 8 Remarkable Early Maps. history.com. https://www.history.com/news/8-remarkable-early-maps

Mattson M. P. (2014). Superior pattern processing is the essence of the evolved human brain. Frontiers in neuroscience, 8, 265. https://doi. org/10.3389/fnins.2014.00265

Psychology Today. (2018). See the World Through Patterns. psychologytoday.org. https://www.psychologytoday.com/us/blog/singular-perspective/201801/see-the-world-through-patterns

Smithsonian Magazine. (2017). Where to See Some of the World's Oldest and Most Interesting Maps, smithsonianmag.com. https://www.smithsonianmag.com/travel/where-see-some-worlds-oldest-maps-180963855/#:~:text=More%20commonly%20known%20as%20 the,town%20called%20Sippar%20in%20lraq.

Smithsonian Magazine. (2016). The Surprising History of the Infographic, smithsonianmag.com. https://www.smithsonianmag.com/history/surprising-history-infographic-180959563/

Spence, Ian. (2006). William Playfair and the Psychology of Graphs. Proceedings of the American Statistical Association, Section on Statistical Graphics, 2426-2436. https://www.researchgate.net/publication/228091928_William_Playfair_and_the_Psychology_of_Graphs

JEDI in the Chesapeake Bay

By: Shante Toledo '21

Does your environmental organization have a workplace that is equitable, diverse, and inclusive? Are your efforts in environmental protection or conservation based on justice, equity, diversity, and inclusion (JEDI)? There is an ongoing need for environmental organizations to do more in adopting JEDI practices. This includes internal changes within the organizations and their roles with stakeholders. Groups that have been historically left out of these kinds of organizations due to their race, gender, educational level, economic background, citizenship status, or disability need to be a part of our efforts to have a healthy Chesapeake Bay. Local communities are affected by water quality and as environmental organizations, we must take steps to ensure that everyone is able to live in a healthy environment no matter who they are.

In the United States, there have been local disadvantaged communities in the past that have fought to be free from harmful practices and substances used in relation to the environment. Examples of environmental justice movements organized by communities of color would be Dolores Huerta and the Nation Farm Workers Association who helped Latino farm workers to gain workplace rights in California starting in the 1960's. Farm workers were able to secure disability insurance, now had the right to unionize, were able to negotiate better wages and working conditions- they were then protected from using pesticides harmful to their health. Another example is the community of Afton, North Carolina, a predominantly Black community protested the dumping of soil infused with toxic PCBs in their waste landfill by the state government. They were worried about the risk of the PCBs contaminating their drinking water. Despite their efforts in preventing this soil to be dumped in their community, it was soon put in their landfill. Today in the Chesapeake Bay there are many organizations dedicated to the protection of the Bay and its watershed. In 2014, the Chesapeake Executive Council signed the Chesapeake Bay Watershed agreement, where many representatives from all over the watershed established goals to protect and restore the Bay by working with local citizens and local government. In order to minimize pollutants entering the Bay and strengthen the resiliency of the Bay against climate change, they aim to increase the number and diversity of individuals engaged to help achieve Bay goals.

With racial justice being at the forefront of our minds because of the events of last year with the murders of George Floyd, Breonna Taylor, and the uncountable protests calling for the protection of Black life, many environmental organizations are increasingly questioning if they are adding to the harm that Black, Indigneous, and people of color (BIPOC) face in their lives among their employees or those in their community. This is a first step in the right direction. It is important to take real and well thought out actions to achieve diversity, equity, inclusion, and justice in everyone's daily life. In connection with this, you cannot put the responsibility on one staff member who is Black, Indigenous, or a person of color to solve racial inequality in the organization when this work was not what they were brought in to do. To help environmental organizations become more inclusive and justice-orientated, there has been a document produced by big stakeholders in the Chesapeake Bay to start them off. In 2017, the Chesapeake Bay Trust, the Chesapeake Bay Funder Network, and the Choose Clean Water Coalition created a guide that lays out the steps an organization can take to formulate how environmental organizations can improve their efforts in JEDI and for how their funders can provide assistance in this work. One of the recommendations is that there needs to be a review of your organization with the help of an outside perspective. Creating partnerships with local groups can help an organization provide the needed support to connect with many dimensions of diversity. The JEDI guide has many strategies lined out for organizations to follow. Is internal work what's most needed? Does your engagement with members of the public need be improved? Is your programming accessible to a variety of people a range of people?

Today the Chesapeake Bay Program has a diversity work group that discusses ways to improve JEDI efforts. This is very important to keep in mind that this work needs to be continually renewed, because the processes of racism and economic inequality will not end themselves.

Works Cited

[&]quot;Dolores Huerta." Delores Huerta Foundation. www.doloreshuerta.org/ dolores-huerta

Skelton, Renee and Vernice Miller. "The Environmental Justice Movement". Natural Resources Defense Council, 17 Mar. 2016, www. nrdc.org/stories/envrionmental-justice-movement

Environmental Justice and Coal Mining in Greene County, Southwest PA

By: Hiba Aoid '21

The history of coal mining and extraction in Pennsylvania dates to the mid-1700s. To this day, Pennsylvania is still one of the largest coal producing states in the nation. In 2016, Pennsylvania was ranked fifth out of the top coal-consuming states, consuming 33.4 million tons of coal. The following year, the state moved up on the rankings as third in top coal-producing states. As is common with development, the extraction of this energy resource does not come without its problems.

There are diverse community and environmental impacts associated with coal extraction and its processes, including longwall mining, coal ash, and coal refuse and slurry. Longwall mining is a technique used in which a long wall of coal is extracted underground in a single continuous operation. This process can cause the earth above to collapse causing Longwall Mine Subsidence (LWMS). Over time, this can cause structural damage to overlying buildings and roads as well as affect the surface and ground water in contact with it. Studies investigating the effects of subsidence also identify loss or interruption of streams and aquifers as a major issue with coal extraction. Beyond this, coal ash is another issue impacting adjacent communities and their environment. Coal ash is the leftover waste from coal. The Environmental Protection Agency (EPA) identified that communities living next to coal ash disposal sites have a higher risk of developing cancer and other diseases. Pennsylvania is one of the top producing states of coal ash. The Center for Coalfield Justice (CCJ) identified the consequences of coal extraction as a major problem with multiple massive disposal sites and ash dumps clustered in the southwestern part of the state, totaling 103 waste storage and disposal sites. Another waste product of coal production is coal refuse and slurry. Coal refuse is the unrecoverable solid coal waste, while coal slurry is a waste product produced by a mixture of coal ash and other liquids. These waste products pose a public and environmental threat as they contain hazardous chemicals such as heavy metals. The potential for spills and releases that can contaminate aroundwater beds and streams is also big concern.

There are many indicators for defining healthy communities. CCJ has developed several reports that examine potential environmental injustice in Pennsylvania's southwest counties examining extraction rates as well as social dimensions. When reviewing demographic, social, economic, and landscape parameters in this area can highlight the existence of inconsistencies with environmental justice. According to the Pennsylvania Department of Environmental Protection (PADEP), an Environmental Justice (EJ) area is "An EJ area is any census tract where 20 percent or more individuals live in poverty, and/or 30 percent or more of the population is minority." Greene county for instance, is largely an EJ area. It is ranked 60th out of the 67 Pennsylvania counties ranked per capita income according to the US census data (2010), posing the region as more susceptible to environmental catastrophe. Greene county is also the largest coal producing county (2016), and one of the top counties in the state bearing its environmental and health issues. This highlights a clear contradiction between the richness in energy resources and the high levels of poverty and unsafe water and air quality in Greene county. When the issues associated with coal extraction largely fall on the underprivileged population, it draws a clear picture of the kind of environmental injustices taking place in southwest PA.

Moving forward, highlighting the environmental injustice from coal extraction is important to the residents of Greene county, especially for volunteers who are directly impacted by it. Coal is an important parameter to keep in mind while monitoring local waterways and interpreting data. Volunteer data collected coupled with their local knowledge is a critical combination that can highlight the health of waterways as well as voicing community injustices. Ultimately, organizing with local environmental justice organizations such as the Center for Coalfield Justice empowers the community while increasing the influence residents have in policies and decision making that directly affects them.

DISTRIBUTION OF PENNSYLVANIA COALS

Pennsylvania coal distribution map by the Pennsylvania Department of Environmental Protection

Works Cited

American Geosciences Institute (AGI). Which states are the largest producers and consumers of coal? Retrieved February 2021, from https://www. americangeosciences.org/critical-issues/faq/which-states-are-largest-producers-and-consumers-coal

Center for Coalfield Justice. Issues. Retrieved February 2021, from https://www.coalfieldjustice.org/issues.

Community Indicators of Environmental Justice: A Baseline Report Focusing on Greene & Washington Counties. Center for Coalfield Justice. Resources. Retrieved February 2021, from https://www.coalfieldjustice.org/resources

Danielle Nyland. Mining in Greene. Greene Scene Community Magazine. July 16 2019. Retrieved from https://greenesaver.com/mining-in-greene/ Greene County PA. History. (n.d.). Retrieved February 2021, from https://www.co.greene.pa.us/history

Li, Yang, Syd S. Peng, and Jinwang Zhang. "Impact of longwall mining on groundwater above the longwall panel in shallow coal seams." Journal of Rock Mechanics and Geotechnical Engineering 7.3 (2015): 298-305.

Physicians for Social Responsibility (PSR). United States Affiliate of International Physicians for the Prevention of Nuclear War. Coal Ash: Hazardous to Human health. Retrieved February 2021, from https://www.psr.org/wp-content/uploads/2018/05/coal-ash-hazardous-to-human-health.pdf

PA Department of Environmental Protection (DEP), PA environmental justice areas. Retrieved February 2021, from https://www.dep.pa.gov/ PublicParticipation/OfficeofEnvironmentalJustice/Pages/PA-Environmental-Justice-Areas.aspx#:~:text=For%20the%20purposes%20of%20 the,data%20from%20the%20U.S.%20Census

U.S. census bureau Quickfacts: Greene COUNTY, Pennsylvania; pennsylvania. (n.d.). Retrieved February 2021, from https://www.census.gov/ quickfacts/fact/table/greenecountypennsylvania,PA/INC910218

Community members stroll and engage with their environment while on the annual LeTort Spring Run walk with ALLARM.

Chesapeake Bay Stewardship Fund: National Fish and Wildlife Foundation's Stream Restoration Program

By: Angelo Tarzona '21

Stream restoration is an active strategy to improve the health of Chesapeake Bay tributaries. With ongoing projects throughout the Bay watershed, it is important to collect data and track progress over time. In 2020, the National Fish and Wildlife Foundation (NFWF) granted funds to the Chesapeake Monitoring Cooperative (CMC) partners to develop a community based stream restoration protocol. This program will also bring together colleagues from the Alliance for the Chesapeake Bay, Izaak Walton League of America, and Dickinson College's Alliance for Aquatic Resource Monitoring (ALLARM) to develop a monitoring protocol that will engage with communities within the watershed and to assess the progress

of stream restoration sites.

This is the first protocol of its kind and as a result the CMC team is using the study design process to conduct research, engage stateholders, and co-create a monitoring strategy. After a strategy is developed the team will test data collection protocols at 2-4 NFWF restoration sites. Based on the progress of the pilot testing and data collection, the program will expand into a multi-year monitoring approach to collect and analyze long term stream restoration efforts at NFWF sites. ALLARM took the lead with preliminary research. Staff conducted research, explored potential tools, and presented findings spring 2021 on the following topics:

| Monitoring Indicator | Parameters or protocols to research |
|-------------------------|--|
| Biological | Macroinvertebrates (Chessie BIBI and CMC Tier 1 protocols) Terrestrial vegetation evaluation Submerged Aquatic Vegetation (recovery) |
| Chemical | Dissolved oxygen, nitrogen, phosphorus |
| Physical | Conductivity, temperature, turbidity/water clarity |
| Visual | USDA Stream Visual Assessment Protocol EPA Rapid Bio Assessment |

 Olivia Spildooren – Riparian benefits, riparian research, research on stream restoration
 Shante Toledo – Invasive plants in buffers
 Hiba Aoid – Documenting site changes over time using photos
 Isabel Ruff – Birds as indicators of riparian/ habitat restoration
 Hayat Rasul and Phoebe Galione – Exploration of the USDA Stream Visual Assessment Protocol as a possible tool

6. Angelo Tarzona – Sediment runoff and assessment techniques

For the study design process, CMC will convene stakeholders to expand on research and explore what is needed to further determining restoration progress. As restoration methods improve over time, it is significant to learn what best practices are effective with streams throughout the Chesapeake Bay watershed. The CMC and its partner organizations for the NFWF project plan to integrate parameters for monitoring indicators such as biological, chemical, physical, and visual assessment to evaluate stream health holistically (Table 1).

According to Liz Chudoba, Water Quality Monitoring Initiative Director of the Alliance for the Chesapeake Bay, baseline observations from monitoring indicators will serve as a standard for the progress of restoration of these restoration sites. In addition, these monitoring indicators open opportunities for engaging with communities throughout the Chesapeake Bay Watershed and recruiting potential volunteer monitors for collecting data that will be recorded through the Chesapeake Data Explorer.

ALLARM is thrilled to be a part of this new program to keep track of stream restoration efforts with communities throughout the Chesapeake Bay Watershed. We are looking forward to learning different methods in assessing stream restoration, how to interpret data from these methods, and creating a connection between the impact of stream restoration projects to local watershed and the Chesapeake Bay watershed.

Works Cited

Developing an Integrated Community-based Monitoring Approach to Track Restoration Progress., Chesapeake Bay Stewardship Fund., 2020.

Chudoba, L., Personal Comm., 2021.

Vastine, J., Personal Comm, 2021.

Senior Reflections from the Class of 2021

Hiba Aoid '21 marks the ALLARM data sheet while monitoring the LeTort Spring Run with other Watershed Coordinators.

Left to Right: Angelo Tarzona '21 leading a session at the Watershed Specialist Meeting in 2019 with Director Julie Vastine; , Shante Toledo '21 assisting Stream Team volunteers with data upload

Olivia Spildooren

I don't think I could have understood how much I would learn or get to experience through ALLARM when I applied in the spring of my sophomore year. My first introduction to ALLARM was when I saw the former Assistant Director (then student), Helen Schlimm, present about ALLARM in a biology class that I was sitting in on as a junior in highschool touring colleges. I was instantly excited and intrigued by the organization and can say it probably was a pretty big factor in my applying and choosing to attend Dickinson, for the hope that I could one day work for ALLARM. I was fortunate enough to join ALLARM fall of my junior year and boy did I get to do a lot in that one semester. I crammed many projects and experiences in since I expected to be studying abroad all of my spring 2020 semester. In Fall 2020, I got to pivot to virtual community science alongside ALLARM and it taught me invaluable lessons in flexibility, patience, and community building even when a community could not meet in-person. Over the three semesters I have worked for ALLARM, I have slowly been able to learn the inner workings and appreciate more fully the mission of the organization. Working for ALLARM helped me focus my interests in environmental science to watersheds and gave me a direction for future career paths. In ALLARM I found an amazingly welcoming and supportive group of people as well as indispensable mentorship from the full-time staff. I feel immensely grateful to have been a part of ALLARM and cannot imagine my college experience without it!

Phoebe Galione

My time at ALLARM has slowly been logged at the start of each volunteer workshop: "Hello, my name is Phoebe Galione, and this is my first semester at ALLARM... second semester at ALLARM... third." I sit now as a Senior with 5 semesters of experience, having worked in the lab, on data organization and on research. I have been able to write blog posts and Water Facts and to illustrate logos and letters and diagrams. I have assisted at numerous initial trainings (one of which involved a road trip to Upstate New York), spoken at data interpretation meetings, and presented about macroinvertebrates at two Chesapeake Bay Forums. It's amazing how quickly the years pass and while I am sure I will lament the end of the semester, I'm sitting here now overjoyed with all I have learned and been able to accomplish. I now have a deep-rooted love of citizen science and even more so with science communication. ALLARM has taught me the importance of taking science from the elite pedestal it is often stuck on and making it accessible to the general public because curiosity is not limited to those with a degree and publications under their belts. Science is a uniting factor that allows for individuals to become more connected to their communities and often to a greater web of individuals with similar questions or concerns. I cannot quantify how much I have to thank ALLARM for the individual I have grown to become these past three years, but I can easily say that turning in that hiring application as a first-year was one of the single most important decisions I have made. From the bottom of my heart, I thank ALLARM senior staff, peers, and volunteers for making these past three years so wonderful.

Isabel Ruff

After years of hearing about ALLARM and the cool experiences my friends were having, my own ALLARM experience began the spring of my junior year. Although my time has been almost completely shaped by COVID, I've still had the opportunity to flourish and grow along with ALLARM's pivot. It was exciting to see and help with the evolution of virtual chemical monitoring workshops and my confidence strengthened with each one. I've also really enjoyed getting to explore deeper into topics and projects that interest me, whether it was learning how to create watershed delineations for each monitoring site within a stream team, or researching about how songbird monitoring can be an effective tool to measure riparian recovery, and it's been wonderful getting to share what I've learned with others. Over the past three semesters, I've gained a strong appreciation of citizen science and I carry the importance these close relationships with community members to my classes and conversations with friends. I've loved seeing ALLARM's mission in action and how it fits into the Chesapeake Bay watershed, and I'm excited to bring what I've learned into my future. I want to thank everyone who has been a part of my time at ALLARM. This has been such a supportive and kind community and I'm so grateful to be an ALLARMie!

Shante Toledo

During my time at ALLARM I had many opportunities to develop my skills as a public speaker, a science communicator, and a watershed coordinator. In my first year at ALARM I saw many aspects of our organization. I started out in Stormwater, where I learned about more policy specific topics. I helped carryout monitoring workshops. I even had the chance to learn new skills in constructing rain barrels. In my research with wild rice, I had a deeper understanding of the obstacles of an Indigneous nation faced in maintaining their traditional food systems from the threat of mining industries. Before I went abroad for my junior year, I was able to spend a summer with my colleagues at ALLARM. We were busy with many Stream team events, and throughout this time I was able to see the growth of this program firsthand. I also had the opportunity to grow my skills in the laboratory. At first, I was not familiar with the testing procedures before or the maintenance of the testing equipment. My time in the lab was definitely of great assistance when I came back in my senior year where I was spending more time in the lab when I was not researching, a part of a community event, or attending community science webinars. I learned a lot about what other professionals in the citizen science field were dedicating their time to. Each time I'm in the office, I continue to learn more about different aspects of this field. There is the human aspect, are there underrepresented people involved with citizen science at multiple levels from volunteers to directors? What can volunteers do with the data they collect? How does ALLARM carry out its mission when we cannot meet with volunteers and colleagues in person? Also, there is of course the science aspect of our work? What does our analysis of water samples say about the water quality of its source? How do invasive plants impact riparian buffers? What is the best protocol for a group to monitor their local streams with? All these experiences have allowed me to grow as a young professional in this field. I am so thankful for the knowledge I gained from these experiences and the friendships I have made in ALLARM! I will miss being here on campus with everyone in the office, but I am looking forward to seeing what my colleagues will be doing in the future.

Angelo Tarzona

ALLARM was a place at Dickinson where I can express my creativity, passion, and ideas freely. My journey with ALLARM started in Fall 2018. Through the years I have been working with different communities throughout Central Pennsylvania to help them understand their water quality concerns through science. Having the opportunity to work with Julie Vastine throughout my years at ALLARM exposed me to the behind-the scenes for establishing connections with volunteers and stream team study-design. These exposures led me to work on research projects through my Earth Sciences major that has an impact to a community in Central Pennsylvania. I want to keep this reflection short, because my connection with ALLARM does not end after I graduate. Finally, I want to thank the ALLARM full-time staff and fellow ALLARMies for all the wonderful memories we shared in my time at Dickinson College.

Hiba Aoid

My two years at ALLARM have been a defining aspect of my time here at Dickinson. When my initial interest in aquatics and freshwater ecosystems lead me to reach out to Julie during my sophomore year to learn more about ALLARM and its role. Back then, I wouldn't have imagined that in my senior year, I was going to look back and reflect on such an amazing experience. ALLARM has taught me a lot about citizen science, community engagement, and about the importance of using science as a tool to empower communities to investigate the health of their streams and produce credible data. Being a watershed coordinator at ALLARM has allowed my confidence to grow in the lab and in engaging with community members and volunteers. It gave me the tools to build my interpersonal and professional skills which in turn have aided me in my transition from undergrad. One of my favorite memories from my time at ALLARM will have to be my first ever community workshop at Craighead House with Julie and Karan Shakya, in which I got to teach girl scouts about macroinvertebrates. As I reflect on the two years I spent at ALLARM, I am truly grateful to have been a part of such a wonderful team of fellow ALLARMies who uplift and support each other and are so dedicated to the quality of their work. I want to thank everyone at ALLARM for making my experience at Dickinson so much more meaningful.

Senior Watershed Coordinators Olivia Spildooren '21 (top left) and Hiba Aoid '21 (top right) facilitate a breakout room discussion on Cumberland County Stream Team data findings with volunteers.

Left: Watershed Coordinator Isabel Ruff '21 practicing the Nitrate-Nitrogen chemical monitoring technique; Right: Watershed Coordinator Phoebe Galione (left) assisting with rain barrel construction

ALLARM in Pictures

Spring 2021 on-campus Watershed Coordinators (Left to Right): Grace Messimer '23, Olivia Spildooren '21 Angelo Tarzona '21, Isabel Ruff '21, Shante Toledo '21, Nhu Truong '22, Hiba Aoid '21, Phoebe Galione '21

The virtual weekly staff meeting experience included laughs, pet appearances, and constructive conversation on ALLARM projects!

Cumberland Stream Team monitor Gregory John testing his site for water temperature for monthly monitoring. Photo: Nate Bacon

Left to right: CSS Stephanie Letourneau, Phoebe Galione '21, Olivia Spildooren '21, Hiba Aoid '21, and Grace Messimer '23 on their way to monitor the LeTort for the first time as a crew in over a year!

Watershed Coordinator Isabel Ruff measuring Dissolved Oxygen levels in the LeTort Spring Run.

CSS Stephanie Letourneau facilitates the York County Equipment Distribution event with Director Julie Vastine and Stream Team volunteers in the Fall of 2020.

Alliance for Aquatic Resource Monitoring PO Box 1773 Carlisle, PA 17013-2896

Dickinson

Non-Profit Organization U.S. Postage **PAID** Carlisle, PA Permit No. 173