

**Field Investigation Project: Harmful Algal Blooms in Red Bud Isle in Austin, Texas
Potentially Caused by Climate Change**

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Abstract

This Field Research Project addresses the harmful blue-green algae blooms that have plagued the Austin lakes since 2019 and supports the claim that climate change is the main cause of these blooms. In order to support this thesis, I found varying sources, including scholarly articles, news reports, and interviews, that brought to light who the stakeholders are in this issue and the far-reaching effects of the harmful algae, including how the algae affects different components of the Austin area (i.e. pets, humans, rental companies, tourist revenue, etc.). The reason why these harmful algal blooms have raised so many alarms is because there have been several dog fatalities associated with drinking the lake water (Perez, 2020).

Even more, a new toxin, Dihydroanatoxin (dhATX), has been found in the lakes that could impair the central nervous systems of any animal, including humans (Manning, 2020). According to my interview with Nivedita Nanda, a lake goer at Red Bud Isle with three dogs, the blooms have changed her daily walks, forcing her to find other safer areas for her pets (Nanda, 2020). Further, shutting down the lakes could greatly affect tourist and water equipment rental company revenue since recreational water activities are an integral part of tourist and resident life in Austin. Seeing that COVID-19 has already caused a steep drop in tourist revenue, the HABs will only aggravate this situation (Manning et. al, 2020).

As the weather is cooling, the toxicity levels of the blooms are declining, according to status reports as recent as December 8, 2020. Although the situation is progressing positively now, just a few weeks earlier when the waters were warmer, status reports stated the dogs should remain away from the water (City of Austin, 2020). According to Dr. Schonna R. Manning, a key researcher on the HAB situation in Austin, specifically at Red Bud Isle, climate change plays

a significant role in the formation of the blooms since warmer waters create the perfect environment for cyanobacteria and algae growth by increasing the salinity of the lake waters. As the climate continues to warm, the windows of bloom growth will only increase. The only way to completely stop the blooms is by changing the course of climate change, but the more short-term solution is through physical removal of the algae from the lakes. Since algae can be repurposed to create all sorts of products from pharmaceuticals to shoes, this seems to be the next step after collection. This process of repurposing an environmental issue, according to Dr. Manning, is called “circular bioeconomy” (Manning, 2020).

Thesis/Problem Statement

Blue-green algae, a very common algae, has the potential to carry harmful toxins, toxins specifically harmful to dogs. In 2019, Austin, Texas had its first toxic blue-green algal blooms at Lady Bird Lake, which resulted in the deaths of several dogs. Now, in 2020, there has been a resurgence of the bloom. The mats of algae are generally dark green and slimy, either floating above water or sinking below. Prior to 2019, there had been no harmful algal blooms (HABs), therefore, environmentalists point to the invasive Zebra mussels that have entered the lakes as one contender, as well as climate change, for the cause of the current blooms (City of Austin, 2020) (Texas Parks and Wildlife, 2020). With growing populations and a rise in global temperatures, which ultimately lead to estuarial pollution, could climate change be the main culprit (Corbett, et. al, 2019)?

Currently, scientists are using the following structure to monitor and predict the algae situation in Austin:

Current Methods of Testing and Monitoring the Algal Blooms in Austin, Texas

Season	Testing and Monitoring
Winter and Spring	Monthly monitoring of temperature, metrics, and water flow. This does not include algae sampling but is meant to identify long-term trends in the lake water's quality and potential for new blooms.
Summer and Fall	Weekly samples of algae at the following locations to test for toxins and species: Red Bud Isle, Barton Creek, mouth of Shoal Creek, Auditorium Shores, and Festival Beach.

Figure 1. Summary of the methods Austin environmentalists are using to monitor and predict the blooms in Austin Lakes. Adapted from the City of Austin, 2020.

Algae breeds in warm waters and with the rising temperatures caused by climate change, these harmful algal blooms may continue to be a problem for summers to come (Karacostas, 2019). Moreover, as the blooms die in the winter, trace amounts of algae will create yet another breeding ground for the next fall and summer seasons (Perez, 2020). With Austin being one of the most pet-friendly cities in the country, blooms such as those described above can significantly affect the day-to-day lives of Austinites. Daily walks at Red Bud Isle can suddenly pose a fatal risk to the many dogs that frequent the area.

Along with this, there are certainly economic impacts of closing lakes that are often used for recreational activities such as paddle boarding and kayaking, which could potentially affect rental companies and tourist revenue (Manning, et. al, 2020). Overall, this environmental issue is imperative to understand and mitigate, for lives beyond the lakes can be affected by the blooms. In this paper, I argue that climate change is the main contributor to the algal blooms that now plague Austin, Texas with the data Austin environmentalists have collected from the lake nearest to me, which is Red Bud Isle.

Annotated Bibliography

City of Austin. (2020, November 6). Watershed Protection Programs: Algae.

Retrieved November 11, 2020 from <https://austintexas.gov/page/algae>. (Article)

This website by the City of Austin gives a brief overview of what the algal blooms are and the risks they pose to humans and dogs. It specifically lists the symptoms of exposure that are to be expected in dogs that interact with the toxic blooms and although there aren't any apparent risks to humans right now, the city recommends that they refrain from handling the algae. It describes the methods of testing Austin environmentalists are using to monitor the blooms, as well as very recent updates on the situation. The last update on this page was made on November 6, 2020, showing that the website is quite up-to-date with the new information being collected on the lakes.

The genre of this article is nonfiction and is meant to be informative and unbiased since the algal blooms are a public health risk in and around the city. Since the city is focused on protecting its residents and visitors, the purpose of the text is to keep both informed about the blooms that seem to be part of a new normal with the ever-changing effects of climate change. This article will give those who read my essay a strong background on what the possible causes and effects are of the algal blooms, along with what is being done to monitor them.

Freeman, L.A., Corbett, D.R., Fitzgerald, A.M. *et al.* (2019, August 12). Impacts of Urbanization

and Development on Estuarine Ecosystems and Water Quality. *Estuaries and Coasts* 42.

Retrieved November 12, 2020 from <https://doi.org/10.1007/s12237-019-00597-z>.

(Scholarly Article)

This scholarly article describes other phenomena that can cause harmful algal blooms (HABs) like increased runoff from infrastructure development (i.e. urbanization and agricultural pollution). It focuses on estuarial pollution, which directly impacts the lives of those who live close to them through decreased water quality. In fact, this article uses Austin's lakes and other estuaries within Texas as case studies. Moreover, it states how critical it is for our society to find more long-term solutions for monitoring and mitigating estuarial pollution. This nonfiction article is extremely scientific and technical in nature, serving as a more in depth study and analysis of harmful algal blooms around the world.

Seeing that the authors were either from universities or research institutes, ranging from Texas A&M to the Naval Undersea Warfare Center Division, the texts seem to be unbiased and informative, most likely to be used by other scientists. This source gives my essay additional technical jargon to increase my credibility in this research paper. It also hones in on pollution and climate change, which directly contributes to my thesis that climate change plays an instrumental role in the creation of harmful algal blooms. Since this article was written in 2019, there may be new developments in the study of the blooms, which is part of what I am investigating. This is similar to some of my other bibliographical resources in the sense that it directly addresses harmful algal blooms, but it is also quite a

unique source in the sense that it takes a very scientific approach to addressing them, instead of providing a surface-level understanding.

Karacostas, Chase. (2019, November 14). Toxic Algae Blooms That Kill Dogs are Becoming More Common. And Climate Change is Making it Worse, Scientists Say. The Texas Tribune. Retrieved November 11, 2020 from

<https://www.texastribune.org/2019/11/14/texas-climate-change-worsening-toxic-algae-blooms/>. (Article)

This article essentially summarizes the information scientists had about the 2019 blue-green algal blooms in Austin, as well as the many questions that have yet to be answered. This is one of the first sources that mentions the many gray areas of this environmental issue, stating that scientists were merely scratching the surface in the study of these blooms. Mentioned in a footnote at the bottom of the article, The Texas Tribune is a nonprofit, nonpartisan organization. Therefore, this article is seemingly unbiased and simply informative.

It brings in direct quotations from professors at the University of Texas at Austin and Texas A&M who are studying these inland blooms and even quotations from residents whose dogs passed away due to the toxins in the algae. Further, this source states that climate change is ultimately making these algal blooms much more prevalent in Austin lakes and other still, warm waters, positively contributing to my thesis. As stated before, this article documents the 2019 blooms, not the 2020 ones. It gives insight into the struggles faced in 2019,

but scientists may have found ways to predict the blooms and mitigate their effects now, which is part of what I am investigating in my thesis.

Manning, S. (2020, December 7). Personal Interview [Personal Interview]

I had the opportunity to discuss the harmful blue-green algae blooms in Austin, Texas with Research Assistant Professor Schonna R. Manning of University of Texas at Austin. Professor Manning, who is a part of the Molecular Biosciences department at the university, has been studying harmful bloom-forming algae for 15 years. She has a masters in Plant Biology from UT Austin, as well as a Ph.D, and oversaw the large scale production of microalgae for bioactives, fuels, and speciality chemicals. She earned the Walter Brown Research Excellence Award for her groundbreaking development in the detection of harmful algae and was actually one of the authors of the scholarly article I reference in my research paper (“Bloom Announcement: First Reports of Dog Mortalities Associated With Neurotoxic Filamentous Cyanobacterial Mats at Recreational Sites in Lady Bird Lake, Austin, Texas”)(The University of Texas at Austin: College of Natural Sciences, 2019).

In summary, she informed me that algae is an imperative part of a lake ecosystem. Therefore, it is important that the solution we use for the bloom problem doesn’t simply wipe out all algae populations in the lakes. She stated that climate change plays a significant role in the formation of the blooms since warmer waters create the perfect environment for cyanobacteria and algae growth, which directly supports my thesis. Further, the blooms now have a new toxin that

could potentially impair the central nervous system of any animal, including humans. To solve the root of this problem, we would obviously need to “solve” climate change, but the best short-term solution is to physically remove the harmful blooms from the lakes.

Since algae can be repurposed to create all sorts of products from pharmaceuticals to shoes, this seems to be the next step after collection. This process of repurposing an environmental issue, according to Dr. Manning, is called “circular bioeconomy.” This interview was extremely informative and used the basis of science to make claims, classifying it as a nonfiction source. Dr. Manning supported the conclusion found in many of my sources, that climate change is the main cause of the algae blooms in Lake Austin. It is also different from my other sources because it is an entire quotation from a researcher studying this exact issue, rather than just a report found on the Internet.

Manning, S. R., Perri, K. A., & Bellinger, B. J. (2020). Bloom Announcement: First Reports of Dog Mortalities Associated With Neurotoxic Filamentous Cyanobacterial Mats at Recreational Sites in Lady Bird Lake, Austin, Texas. Elsevier Data in Brief. Retrieved November 14, 2020 from <https://doi.org/10.1016/j.dib.2020.106344>. (Scholarly Article)

This scholarly article directly addresses the harmful algal blooms in Austin, Texas. It identifies the specific locations of the blooms on Lady Bird Lake and sampling sites on maps of Red Bud Isle, presents pictures of actual samples of the algae, the compositional profile of the algae, toxicity information, environmental and economic impacts of the blooms, experimental design of the

bloom studies, and charts that describe the biomass of the algae. This article was written by two professors at the University of Texas at Austin, both within the Department of Molecular Biosciences, and another scientist from the City of Austin Watershed Protection Department.

Seeing that this is a scholarly nonfiction text, the information seems to be unbiased and meant to give a scientific explanation of the harmful algal blooms in Austin. This source introduced me to two professors that I reached out to for this project since they have had hands on research with the algae that I am investigating. Not only does this paper give a rich scientific explanation of the blooms, but also describes who is affected by the blooms and why, giving a far more in depth analysis of the *far-reaching effects* of the blooms than most of my other sources. This source is extremely useful to my research paper. I consider myself truly lucky to have a scholarly source that directly addresses the environmental issue I am studying.

Nanda, N. (2020, December 10). Personal Interview [Personal Interview]

I had the opportunity to interview someone that frequented the lakes at Red Bud Isle. I asked the following questions: How long have you known about the harmful algae blooms in this area? How have the blooms affected you and your dogs? Have you noticed the warning signs about the blooms in front of Red Bud Isle? Since this lake goer had three dogs, she is clearly disproportionately affected by the blooms since currently the blooms only affect them. She actually

just moved to the Austin area this year and heard about the blooms in her research prior to moving, as well as on CNN in 2019.

She stated that she made note of any hazards in the lakes and walking areas near the houses she was looking at to find safe areas for her dogs. Due to the blooms, she has kept her dogs away from the water, but has seen other dog owners let their pets in the lake, showing that there may be a lack of seriousness people take in this issue. This interview is quite different from my other sources because it provided me with a one-on-one interaction with someone directly affected by the HABs and it also showed me the possible lack of seriousness residents take in this issue, which is not what I was expecting. It's also similar to some sources in the sense that it brought to light the effects of the HABs outside of the lakes (the human/livelihood perspective).

Perez, Patrick. (2020, July 20). 'We Had Hoped it Wouldn't Happen Again This Year' | Deadly Blue-Green Algae Returns to Austin's Lady Bird Lake. KVUE. Retrieved November 11, 2020 from

<https://www.kvue.com/article/tech/science/environment/austin-blue-green-algae-lady-bird-lake-red-bud-isle-festival-beach/269-ac5602e4-af42-453a-92f4-260248b0417f>.

(Article)

This article by KVUE ABC summarizes what the blue-green algal blooms are in Austin, where exactly they occur, what their effects are, who is studying them, the future of the blooms, and what Austinites should do to prevent any harm to their dogs from the toxic algae. This source also brings in direct quotations

from Austin scientists and residents. The genre of this text is nonfiction and seems to be unbiased, simply meant to update residents on the situation of the blooms.

The information is quite brief and certainly not as scientific as my other sources. It mentions how warmer temperatures contribute to the harmful algal blooms, which relates to my thesis that climate change plays an instrumental role in the creation of HABs. This source, with its direct quotations from Austin residents, show how much algal blooms can affect the day-to-day lives of a pet-centered city. This identifies one of the stakeholders in this environmental issue, which is a critical piece of information that I can incorporate into my research paper. The page was published on July 20, 2020 and updated on August 5, 2020, showing that this article is quite up-to-date on the issue, as well as often revised as new information comes out.

Texas Parks and Wildlife. (n.d.). Harmful Algal Blooms (HABs). Retrieved November 12, 2020 from <https://tpwd.texas.gov/landwater/water/environconcerns/hab/>. (Article)

This article gives broad definitions of algal blooms. It describes the different kinds of blooms that occur in Texas, what causes them, what toxins they may hold, their effects on wildlife, and what organizations respond to them. This source also introduces a technical term that is used throughout my essay: HABs or Harmful Algal Blooms. The genre of this text is nonfiction and is meant to be informative and unbiased. Texas Parks and Wildlife is an organization that is meant to inform and educate those who spend time in nature, especially those who fish and hunt, about how to engage safely with wildlife. Even more, the TPW is a

non-profit organization, further emphasizing that it need not publish false or misleading data. This article introduced some technical jargon into my essay and can make my writing more reliable in terms of algal bloom knowledge.

The information in this article is very general and is quite easy to understand for anyone who would like to know about various kinds of algal blooms. It is somewhat different from my other sources, for it does not specifically focus on the blue-green algal blooms in the Austin lakes. The semi-scientific nature of the source better acquainted me to the topic I am researching.

The University of Texas at Austin: College of Natural Sciences. (2019). Directory: Schonna R.

Manning. Retrieved December 1, 2020 from

<https://cns.utexas.edu/directory/item/2743-manning-schonna?Itemid=349>. (Directory)

This directory gave a brief description of who Research Assistant Professor Schonna R. Manning is. Professor Manning, who is a part of the Molecular Biosciences department at the university, has been studying harmful bloom-forming algae for 15 years. She has a masters in Plant Biology from UT Austin, as well as a Ph.D, and oversaw the large scale production of microalgae for bioactives, fuels, and speciality chemicals. She earned the Walter Brown Research Excellence Award for her groundbreaking development in the detection of harmful algae and was actually one of the authors of the scholarly article I reference in my research paper (*“Bloom Announcement: First Reports of Dog*

Mortalities Associated With Neurotoxic Filamentous Cyanobacterial Mats at Recreational Sites in Lady Bird Lake, Austin, Texas”).

This source is nonfiction and simply informative. It also provides Doctor Manning’s contact information. The contact information that is in this directory is what connected me to her. I was able to reach out through email and get a response around a week after my initial contact. Even more, the directory lists Manning’s research, publications, presentations, experience, and personnel, giving a very solid background on her expertise. With this information, I can quote her and give her (and my essay) credibility.

Methods/Analytical Narrative

For this research project, I made sure to find sources that valued input from both scientists and Austin residents alike. It was important to me to paint a very clear picture of what the blooms were, as well as who they affected. To do this, I found scholarly articles that addressed the scientific aspect of this environmental issue and news reports and interviews that brought quotations from key researchers on the algal blooms and Austinites. I interviewed Dr. Schonna R. Manning, a Research Assistant Professor at the University of Texas at Austin, who is studying the blue-green algae blooms (The University of Texas at Austin: College of Natural Sciences, 2019). In this interview, I asked questions that addressed the future of the blooms, what role climate change plays in the formation of the blooms, what technologies would best mitigate this problem, and long-term solutions.

With a root cause analysis, it is clear that the main problem to be solved is climate change, but the short-term solution would be to physically remove the algae. Many people tend to focus more on the symptom of a problem rather than the root cause and Austin's algae blooms are a perfect example of this. In this case, the blooms are a symptom of climate change. Sometimes it takes the mind of a scientist to point out the stark difference between the two. Further, I interviewed a lake goer with three dogs, asking her how the blooms affect her. Her input showed that residents are quite informed on this environmental issue and that people even outside of Austin are well-aware of it, seeing that she heard of the blooms just before moving to ATX this year. Due to this, she made sure to find safe locations to walk her dogs prior to purchasing her house (Nanda, 2020). In this case, the blooms played a significant role in this lake goer's life decision.

Interpretation and Reflection

In this reflection, I will be discussing the group project component of the Field Investigation Project (“Respec de Earf”). Overall, my team worked very well together. We met through Snapchat and Zoom calls to conduct our group meetings, using this time effectively to construct our group thesis and a presentation with a consistent theme and format. We met around five times to work on the project itself and then to complete our group reflection after the presentation. Our goals were as follows:

- Create a cohesive group presentation
- Create a group thesis that ensured that our individual group projects tied together
- Meet as often as possible before the presentation

We were able to meet all of these goals with the conditions of COVID-19. One minor problem was trying to find times when everyone was available, for I am two hours ahead and a couple of my team members have jobs, but once we could find a time, we made the most of it. A strategy we utilized to increase our efficiency was discussing what we wanted to get done in our team meeting in the first five to ten minutes of our Zoom or Snapchat call. This made our group intention clear and ensured we were all on the same page. This group was made of peer-to-peer connections, putting all of us on the same level of authority. We were supportive in hearing each other’s input and truly took note of it. I feel like my contributions and my team’s contributions were effective because we were able to incorporate everyone’s ideas into a working group thesis.