



# The Lady Bird Lake Harmful Algal Proliferation - Update



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# About Cyanobacteria

“Blue-green Algae” is a bit of misnomer – these organisms are photosynthetic *Bacteria*

- Prokaryotic – loose nuclear material, organelles not bound
- Can still find cyanobacteria genetic material within the chloroplasts of other algae and plants

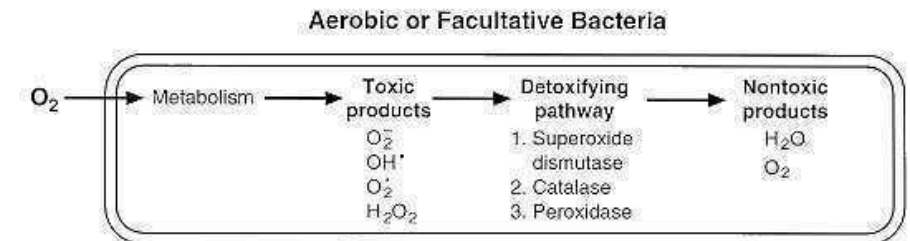
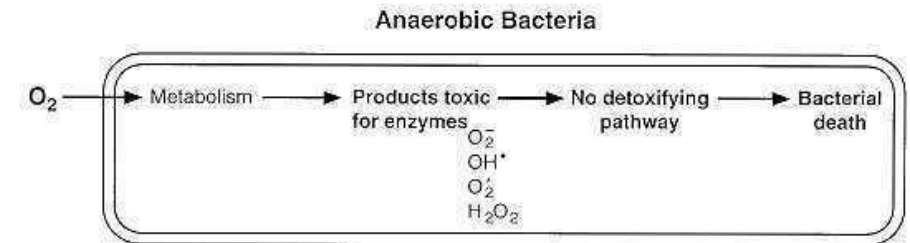
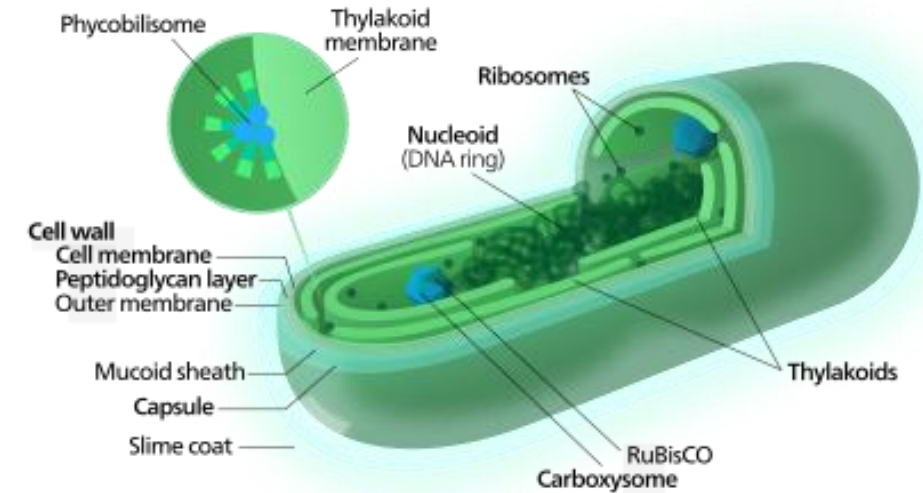
## Primitive!

- Over 3 billion years old

First photosynthetic organisms; changed Earth's atmosphere leading to the first major extinction

## The GREAT OXYGENATION EVENT

Produce a variety of secondary metabolites including a suite of toxins



# Cyanotoxin E(a)ffects



Neurotoxins,  
Hepatotoxins

Economic

Perception

Drinking water

- EPA and State guidelines but they are Limited and Planktonic-focused

## Health Impacts of Cyanotoxins

*Note: Not all cyanotoxins lead to all of these health impacts. These listed impacts are caused by microcystins or cylindrospermopsin, the two cyanotoxins that EPA has issued Health Advisories for.*

### IN HUMANS

#### Brain

**Source:** Ingestion

**Symptoms:**

- Headache
- Incoherent speech
- Drowsiness
- Loss of coordination

#### Respiratory System

**Source:** Inhalation

**Symptoms:**

- Dry cough
- Pneumonia
- Sore throat
- Shortness of breath
- Loss of coordination

#### Digestive System

**Source:** Ingestion, drinking contaminated water, or eating contaminated fish

**Symptoms:**

- Abdominal pain
- Nausea
- Vomiting
- Diarrhea
- Stomach cramps

#### Body

**Source:** Contact, e.g. swimming

**Symptoms:**

- Irritation in eyes, nose, and throat
- Blistering around the mouth
- Skin rash, including tingling, burning and numbness
- Fever
- Muscle aches (from ingestion)
- Weakness (from ingestion)

#### Organs

**Source:** Ingestion

**Symptoms:**

- Kidney damage
- Abnormal kidney function
- Liver inflammation

#### Nervous System

**Source:** Ingestion

**Symptoms:**

- Tingling
- Burning
- Numbness

### IN PETS

**Symptoms:**

- Vomiting
- Fatigue
- Shortness of breath
- Difficulty breathing
- Coughing
- Convulsions
- Liver failure
- Respiratory paralysis leading to death







# Lady Bird Lake Event

In July 2019, dogs became ill and died from toxic *Cohesive Mats*







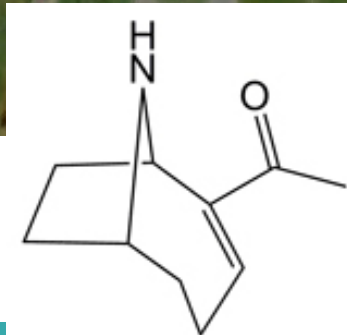
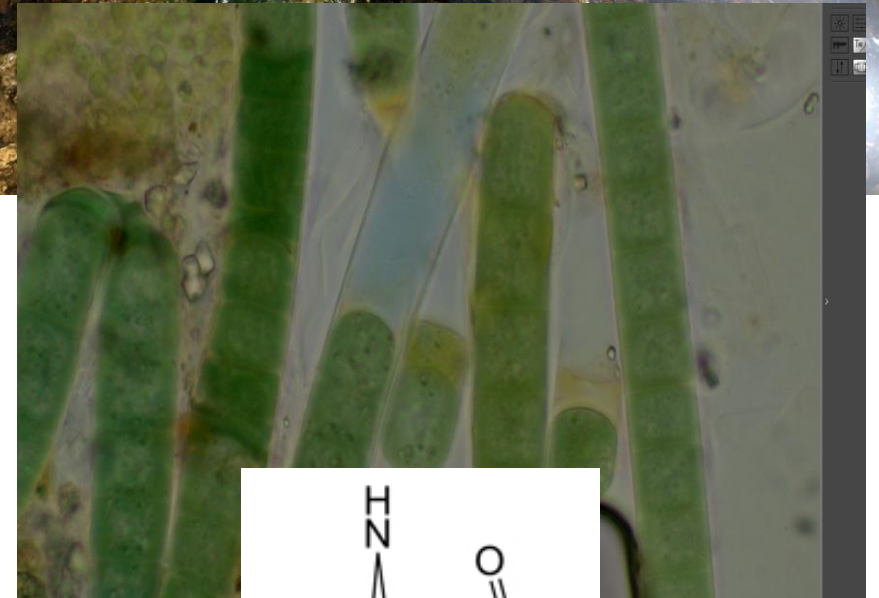
# Who and What

Identified: *Phormidium* and *Geitlerinema*

- Known toxin producers

Within algae mats dihydroanatoxin (dhATX) dominant

- Anatoxin-a (ATX) potent neurotoxin “fast acting death factor”
- dhATX possibly 4x more toxic than ATX ?!?! (Puddick et al. 2018)





# 2020 Toxin Content

- *Red Bud* w/highest contents
- However, visually, extent and biomass appeared lower in 2020 than 2019

| Site              | Range dhATX (mg/kg DW) | Mean $\pm$ Std Dev dhATX (mg/kg) |
|-------------------|------------------------|----------------------------------|
| Red Bud           | 0.0 – 132.7            | 15.1 $\pm$ 34.9                  |
| Auditorium Shores | 0.0 – 5.7              | 1.2 $\pm$ 2.2                    |
| Mouth Shoal Creek | 0.01 – 4.1             | 0.9 $\pm$ 1.8                    |
| Festival Ramp     | 0.0 – 3.2              | 0.3 $\pm$ 0.9                    |
|                   |                        |                                  |



# Nutrients

- Ammonia, TP elevated in 2019 (not shown) and 2020

| Site              | NH <sub>3</sub> -N (µg/L) | NO <sub>3</sub> <sup>-</sup> -N (µg/L) | TN (µg/L)       | TP (µg/L)   | TN:TP         |
|-------------------|---------------------------|--|-----------------|-------------|---------------|
| Red Bud           | 53.3 ± 35.4               | 124.7 ± 126.8                          | 544.8 ± 171.1   | 19.8 ± 14.3 | 91.3 ± 52.1   |
| Barton Creek      | 26.3 ± 28.6               | 1,135.9 ± 457.9                        | 1,538.1 ± 224.9 | 31.2 ± 34.9 | 229.3 ± 167.8 |
| Auditorium Shores | 29.4 ± 11.3               | 230.7 ± 120.8                          | 688.5 ± 185.8   | 15.5 ± 12.5 | 140.6 ± 67.2  |
| Mouth Shoal Creek | 46.7 ± 21.9               | 383.8 ± 336.5                          | 963.8 ± 400.8   | 49.1 ± 52.1 | 85.9 ± 84.4   |
| Festival Ramp     | 33.4 ± 30.9               | 160.0 ± 76.9                           | 630.9 ± 135.8   | 15.7 ± 11.3 | 127.5 ± 65.2  |



# What Caused the Apparent Change in Lady Bird?

Among the drivers, Austin is always hot in the summer, flows are always (relatively) low in July/August

So, it must be the *Nutrients!*

- But not just the concentration (which were elevated) but also types; i.e., more  $\text{NH}_3$  and Phosphorus which cyanobacteria really like

Hypothesize that zebra mussels and large sediment deposition events due to flooding primary drivers of nutrient dynamic changes at sediment-water interface





# The Mitigation Pilot Project

Two-pronged approach to target *Water* and *Sediment* nutrients

Goal: Reduce phosphorus and hopefully ammonia available to cyanobacteria



# Sediment - Phoslock

Requesting Council Approval for  
\$300k contract with SeaPRO

Lanthanum-modified bentonite  
(~clay)

Binds ionic phosphates

“Caps” the sediments,  
sequestering P





# Water - Biochar

Charcoal produced by burning organic matter in absence of oxygen

Works like a Britta Filter

- Shown to reduce nutrient concentrations in ponds

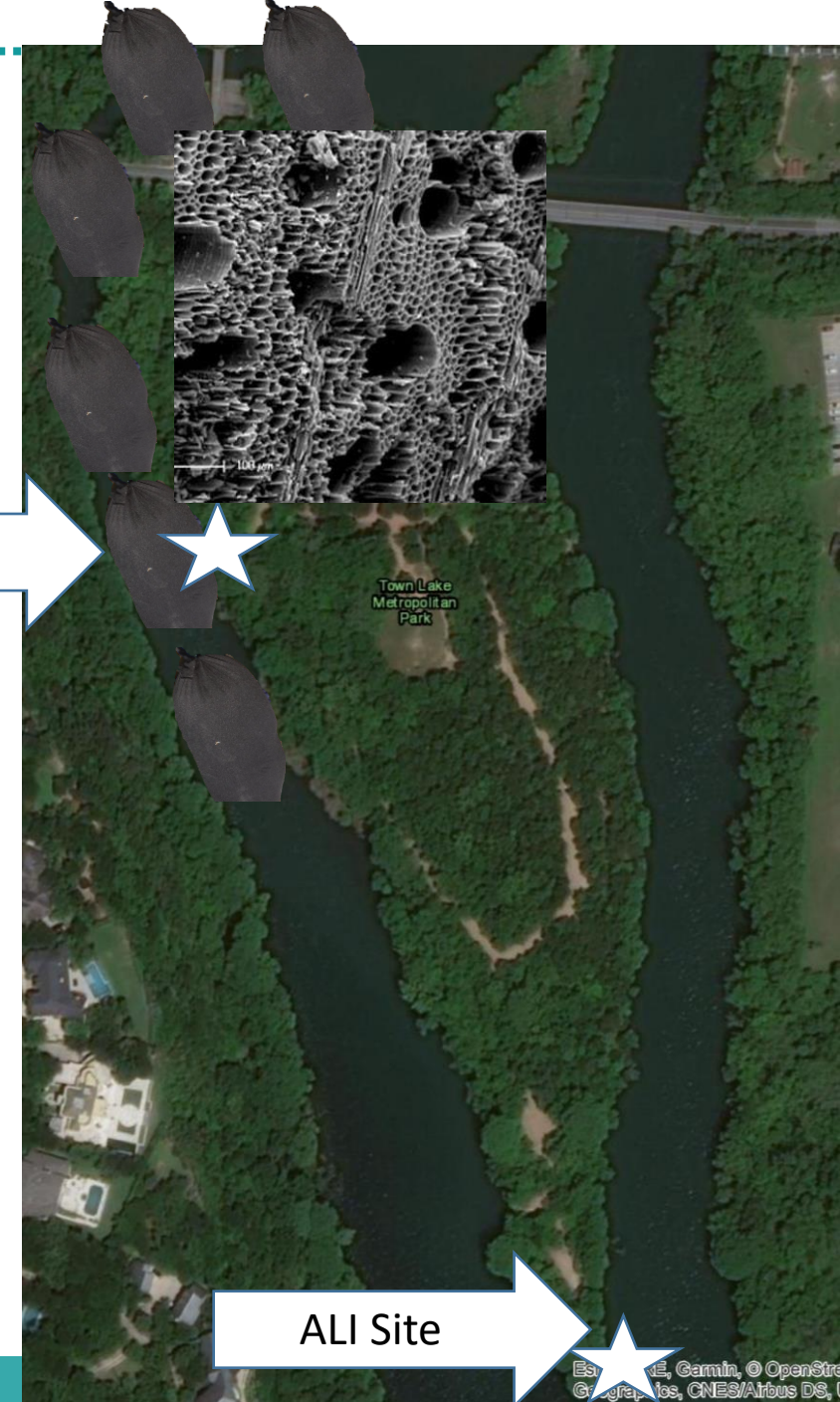
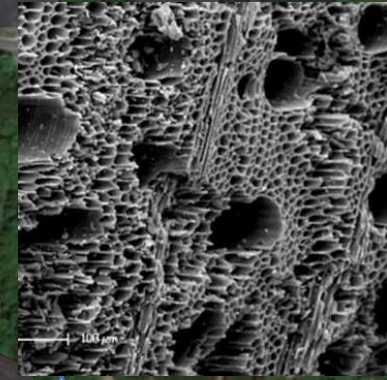
Deploy fifty (50) 2'-long biochar socks on the north and west side of Red Bud Isle

HAP Site

“treatment site”

“control site”

ALI Site





# Monitoring

## Mat toxicity

- **Continue in collaboration with UT**

## Water Chemistry

- **Will compare west side of Red Bud with the main-channel**

## Sediment Chemistry

- **Sequential extraction procedure to verify P has moved from bioavailable to Lanthanum-bound (i.e., unavailable)**

**This is an experimental approach to see if it is possible to reduce extent and magnitude of a toxicity event**

- **Continued presence of mats could still pose a risk**





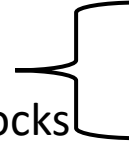
# Calendar of Events



Begin Monitoring

Deploy

Biochar Socks



Phoslock



Treatment #1

Phoslock



Treatment #2

Phoslock



Treatment #3



Environmental Commission, Council



HAP Monitoring



Pre/post Phoslock Monitoring

| Sun   | Mon | Tues   | Wed    | Thurs  | Fri | Sat |
|-------|-----|--------|--------|--------|-----|-----|
| 30    | 31  | June 1 | 2      | 3      | 4   | 5   |
| 6     | 7   | 8      | 9      | 10     | 11  | 12  |
| 13    | 14  | 15     | 16     | 17     | 18  | 19  |
| 20    | 21  | 22     | 23     | 24     | 25  | 26  |
| 27    | 28  | 29     | 30     | July 1 | 2   | 3   |
| 4     | 5   | 6      | 7      | 8      | 9   | 10  |
| 11    | 12  | 13     | 14     | 15     | 16  | 17  |
| 18    | 19  | 20     | 21     | 22     | 23  | 24  |
| 25    | 26  | 27     | 28     | 29     | 30  | 31  |
| Aug 1 | 2   | 3      | 4      | 5      | 6   | 7   |
| 8     | 9   | 10     | 11     | 12     | 13  | 14  |
| 15    | 16  | 17     | 18     | 19     | 20  | 21  |
| 22    | 23  | 24     | 25     | 26     | 27  | 28  |
| 29    | 30  | 31     | Sept 1 | 2      | 3   | 4   |
| 5     | 6   | 7      | 8      | 9      | 10  | 11  |





# Questions?

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