



UNDERSTANDING ALGAL BLOOMS IN FLORIDA ONLINE SERIES

A Presentation for the
South Florida Ecosystem Restoration
Joint Working Group (WG) And Science Coordination Group (SCG) Meeting

June 23, 2020

- CES is a state university research center established in July 1994 by Florida's State University System's Board of Regents.
- Located on the Davie Campus of FAU in Broward County
- Ongoing relationship with USGS for the last 10 years



Following the harmful algal blooms of 2016 and 2018, we set out to create a series of online modules to assist in the understanding of the science and challenges related to algal blooms and improving communication among decision-makers and others.



- Resource managers
- Decision-makers
- Hydrologists
- Modelers
- Restoration planners
- Citizen scientists
- Laypersons



Photo credit: NOAA



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OUR PARTNERS



John Baldwin, Nick Aumen #10



Understanding Algal Blooms in Florida webinar on March 17th, 2020

Out of 356 registered, 220 participants attended from:

- National government agencies
- State government agencies
- Florida counties and cities
- Other state agencies
- Florida colleges and universities
- Other state colleges and universities
- Non-profits
- Native American tribes
- Private companies



UNDERSTANDING ALGAL BLOOMS IN FLORIDA

Video 1: What Are Algae?

Video 2: How Algae Live and Grow

Video 3: What Are Algal Blooms?

Video 4: Impacts and Examples of Harmful Algal Blooms (HABs)

Video 5: What Can We Do About Harmful Algal Blooms (HABs)?

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CONTACT US

PARTNERS

For more information,
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1 - What are Algae?



PREVIOUS

NEXT

Outline

Algae are a large and diverse group of organisms that use the sun's energy to grow through photosynthesis. They occur naturally and are an essential component of a healthy aquatic ecosystem; however, an overgrowth of algae can be harmful. Scientists estimate that there are hundreds of thousands of different algae species. This video introduces six major types of algae that differ in their appearance, where they grow, the production of toxins, and the formation of algal blooms.

Download the  [What are Algae? flyer](#) for a summary of this video.

View the [Resources](#) used in creating this video series.

Algae are the base of the food web in most aquatic ecosystems.

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Charles E. Schmidt College of Science
Florida Atlantic University

Understanding Algal Blooms in Florida

VIDEO 1. What Are Algae?

What are algae?
Algae are a large and diverse group of organisms that use energy to grow through photosynthesis.

Where do algae grow?

- Algae can be found all over the world on land and in water.
- Aquatic algae live in freshwater ecosystems and marine environments.

The importance of algae

- Algae are an essential food source in many ecosystems.
- Algae make up less than 1% of the photosynthetic organisms on Earth but produce 50% of the oxygen in Earth's atmosphere.

Algal blooms

- Algal blooms are a rapid overgrowth of algae under certain conditions.
- Harmful algal blooms (HABs) are especially common in coastal ecosystems.

Types of algae
Scientists estimate that there are hundreds of species of algae. They differ in their appearance, where they live, and how they grow.



Consumers:
snails, frogs, aquatic insects, and fish



Food web in the marsh prairie ecosystem of Big Cypress National Preserve
Photo credit: FAU/CES

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Understanding Algal Blooms in Florida

VIDEO 2. How Algae Live And Grow

What do algae look like?

- Algae can be microscopic to large enough to see with the naked eye.
- Phytoplankton are:
 - Microscopic algae that live dispersed in the water column.
 - Usually buoyant, free-floating, and non-motile.
 - Microscopic, but millions of cells together can be seen.
- Periphyton:
 - Are a mat made of algae, bacteria, and fungi that grow on surfaces under the water.
 - Can be seen as floating mats or grow on submerged surfaces.
- Macroalgae:
 - Are algae made of multiple cells and can be seen with the naked eye.
 - Can grow attached to surfaces beneath the water.

How do algae grow?
Algae require sunlight, water, and select nutrients to grow through photosynthesis.

- Photosynthesis
 - Algae absorb sunlight using chlorophyll and store energy in the form of carbohydrates.
 - Through photosynthesis, algae produce sugars called carbohydrates from the carbon dioxide in the water, giving algae energy to live and grow.
- Some algae have photosynthetic adaptations that allow them to survive in less than optimal amounts of sunlight including:
 - Additional pigments that result in different colors;
 - Gas-filled vesicles in cyanobacteria to maximize light capture;
 - Light-sensing eyespots in some algae that allow them to swim towards the light.
- Nutrients
 - All algae require nitrogen, phosphorus, and silica.
 - Diatoms also require silica.
 - Some cyanobacteria can fix atmospheric nitrogen and convert it to ammonia.

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Understanding Algal Blooms in Florida

VIDEO 3. What Are Algal Blooms?

What are algal blooms?

- Algal blooms are a rapid overgrowth of algae under certain environmental conditions.
- Algal blooms can occur naturally and be beneficial to the ecosystem, but they can also be harmful.
- Harmful algal blooms (HABs) negatively impact human health and the environment.

Causes of algal blooms

- Algal blooms form when environmental conditions are favorable for growth through:
 - Ample levels of nutrients including nitrogen, phosphorus, and silica;
 - Favorable weather conditions.
- The exact conditions that trigger an algal bloom are difficult to pinpoint because they are complex and depend on a combination of natural and human influences that make it difficult to predict when a bloom will occur.
- High levels of nutrients**
 - Algal blooms have been occurring for centuries, but the recent rise in documented blooms may be linked to increased nutrient loading.
 - Sources of nutrient pollution can include:
 - Agricultural runoff;
 - Residential runoff;
 - Septic tanks.
- Favorable weather conditions**
 - Warm temperatures and sunlight stimulate algal growth.
 - Natural variations in climate can influence algal bloom formation.
 - Warmer temperatures predicted in the future may increase the duration, and severity, of algal blooms.
 - Increased extreme weather events provide favorable conditions for algal bloom formation.

Where do algal blooms occur?

- Algal blooms occur in freshwater, estuarine, and coastal environments around the globe.
 - Algal blooms occur throughout Florida, including Lake Okeechobee.

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VIDEO 4. Impacts and Examples of Harmful Algal Blooms (HABs)

What are harmful algal blooms (HABs)?

- HABs are algal blooms that threaten the health of humans and aquatic ecosystems.
- Only some HABs are known to produce toxins that can be considered harmful to humans and animals.

Impacts of HABs

- Health impacts
 - Toxins produced by HABs can have various effects on humans and animals.
 - The type of toxins produced depends on the species of algae and can affect specific systems within the body.
- Economic impacts
 - Increased costs associated with HABs include:
 - Beach closures and loss of tourism revenue.
 - Increased medical expenses and hospitalizations from gastrointestinal illnesses from consuming contaminated shellfish.
 - Declining property values;
 - Loss of revenue when commercial fishing is restricted.
 - Increased cost of water treatment.
- Ecological impacts
 - Algae can clog fish gills and prevent them from breathing during a HAB event.
 - Toxins produced by HABs can kill fish and other aquatic organisms.
 - HABs can also deplete oxygen levels in the water.

Examples of HABs

- Red tide
 - Red tides are caused by a species of dinoflagellates in saltwater.
 - The water can appear red to brown or even purple, green, or have no change in color.
 - Red tides can contain toxins.
 - Karenia brevis is a species of dinoflagellate that causes red tide off Florida's west coast and can produce brevetoxins.

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VIDEO 5. What Can We Do About Harmful Algal Blooms (HABs)?

What can we do?
There are many areas that can be addressed to reduce the frequency and severity of HABs including:



- Reduce nutrient pollution
 - Best management practices (BMPs) can reduce the amount of nutrients entering the water from agricultural runoff.
 - Planting native varieties and properly applying fertilizer can reduce nutrient pollution through residential runoff.
 - Stormwater management techniques can be improved to reduce nutrient pollution.
 - Septic systems can be converted to central sewage to reduce nutrient pollution.
 - Stormwater Treatment Areas (STAs) filter nutrients from water before it enters the Everglades.
- Water management strategies
 - Water management strategies can be implemented to lessen the severity and frequency of algal blooms.
- Continued research
 - Continued research on the causes of algal blooms and how they can be managed is essential to reducing the frequency and severity of future algal blooms.



Cyanobacteria
Photo credit: NOAA



References

Reduce nutrient pollution

- [Water Quality Improvement](#). SFWMD.

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1 - Wh

Frequently Asked Questions

Contact us if you have questions about algae or harmful algal blooms not included below.

What are algae?

Algae are a large and diverse group of organisms that use the sun's energy to grow through photosynthesis, just like plants.

Where do algae grow?

Algae can be found all over the world on land and in the water. Aquatic algae live in freshwater environments like lakes and rivers and saltwater environments like estuaries and the ocean.

What is a harmful algal bloom?

Algal blooms are a rapid overgrowth of algae that cause the water to become discolored and thick with algae. Algal blooms can occur naturally and can be beneficial to the ecosystem. However, harmful algal blooms can have negative impacts on ecosystems and people's health.

What does a harmful algal bloom look like?

What causes harmful algal blooms?

Where do these high levels of nutrients in the water come from?

PREVIOUS

Outline

Algae are a photosynthetic organism; they are part of the aquatic ecosystem; hundreds of thousands of species of algae that form the base of the food chain; formation of

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1 - What are Algae?



PREVIOUS

Outline

Algae are a large and diverse group of organisms that perform photosynthesis. They are found in all aquatic ecosystems; however, some species can form harmful algal blooms (HABs) that cause illness in humans and animals. There are hundreds of thousands of different species of algae that differ in their appearance, size, and the type of information of algal blooms.

Download the [What are Algae?](#)

[View the Resources](#)

Resources

References with a ► icon were used in creating the content for the video. All others are additional references.

Introduction Video. Understanding Harmful Algal Blooms Series

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Types of Algae

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Green Algae

- **Ancestors of land plants revealed.** (2011, April 17). *EurekaAlert!*.

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1 - What are Algae?

Contact Us

Your feedback is important to us. Please use our form for any comments/suggestions.

Name *

First

Last

Email *

Affiliation

Type of comment/suggestion *

Comments/Suggestions *

Submit

PREVIOUS

Outline

Algae are a photosynthetic ecosystem; hundreds of algae that form of algae blooms.

Download the  [What are Algae? flyer](#) for a summary of this video.

View the [Resource](#) [John Baldwin, Nick Aumen #10](#)

- We plan to update the videos and add new content to the series as information and funding become available.
- These updates would be released on an annual basis.



www.ces.fau.edu/usgs/understanding-algae/



Photo credit: Teddy Mara

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