
Photo credit: Teddy Mara

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

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Charles E. Schmidt College of Science
Florida Atlantic University

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CES BACKGROUND AND PARTNERSHIP WITH USGS

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- 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

RATIONALE FOR ALGAL BLOOMS SERIES

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.

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TARGET AUDIENCE FOR ALGAL BLOOMS SERIES

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

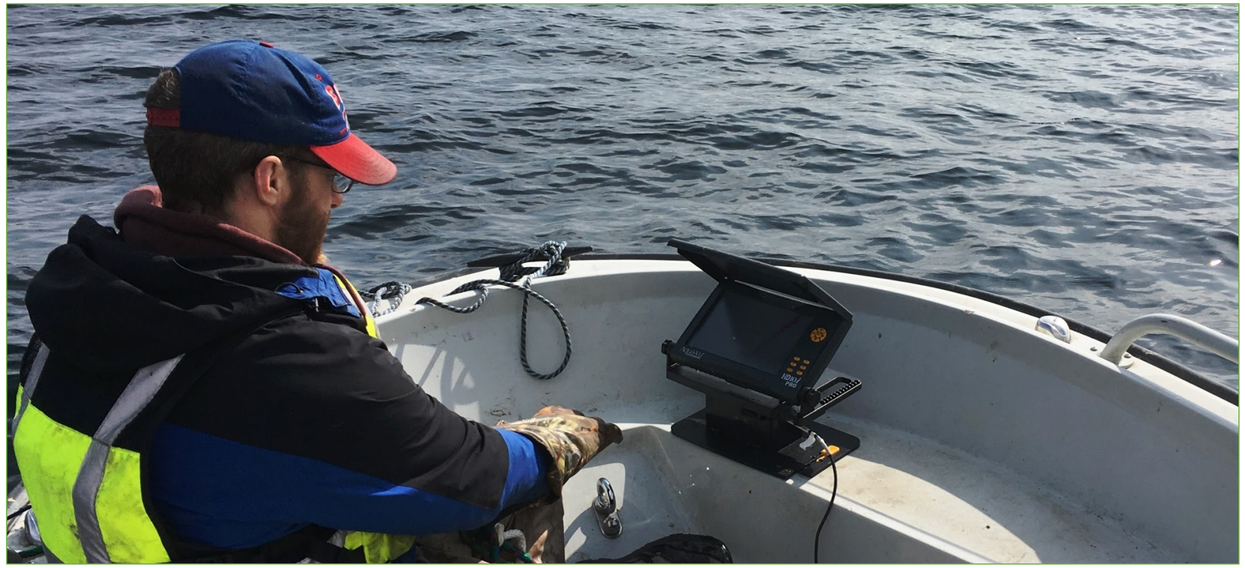

Photo credit: NOAA

PLANNING COMMITTEE

- Nick Aumen - USGS
- John Baldwin - FAU
- Shannon Estenoz - The Everglades Foundation
- Colin Polsky - FAU
- Barry Rosen - FGCU
- Fred Sklar - SFWMD
- Timothy Davis - BGSU
- Evelyn Gaiser - FIU
- Edward Phlips - SFRC IFAS UF
- James Sullivan - FAU HBOI
- Malcolm McFarland - FAU
- Keith Loftin - USGS
- Anna Wachnicka - SFWMD
- J. William Louda - FAU
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- Cindy Diaz - FAU

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OUR PARTNERS

South Florida Water Management District
Protector of the Everglades Since 1949

The Everglades Foundation

UF University of Florida

FIU Florida International University

BGSU

Florida Gulf Coast University

FAU Florida Atlantic University

Harbor Branch
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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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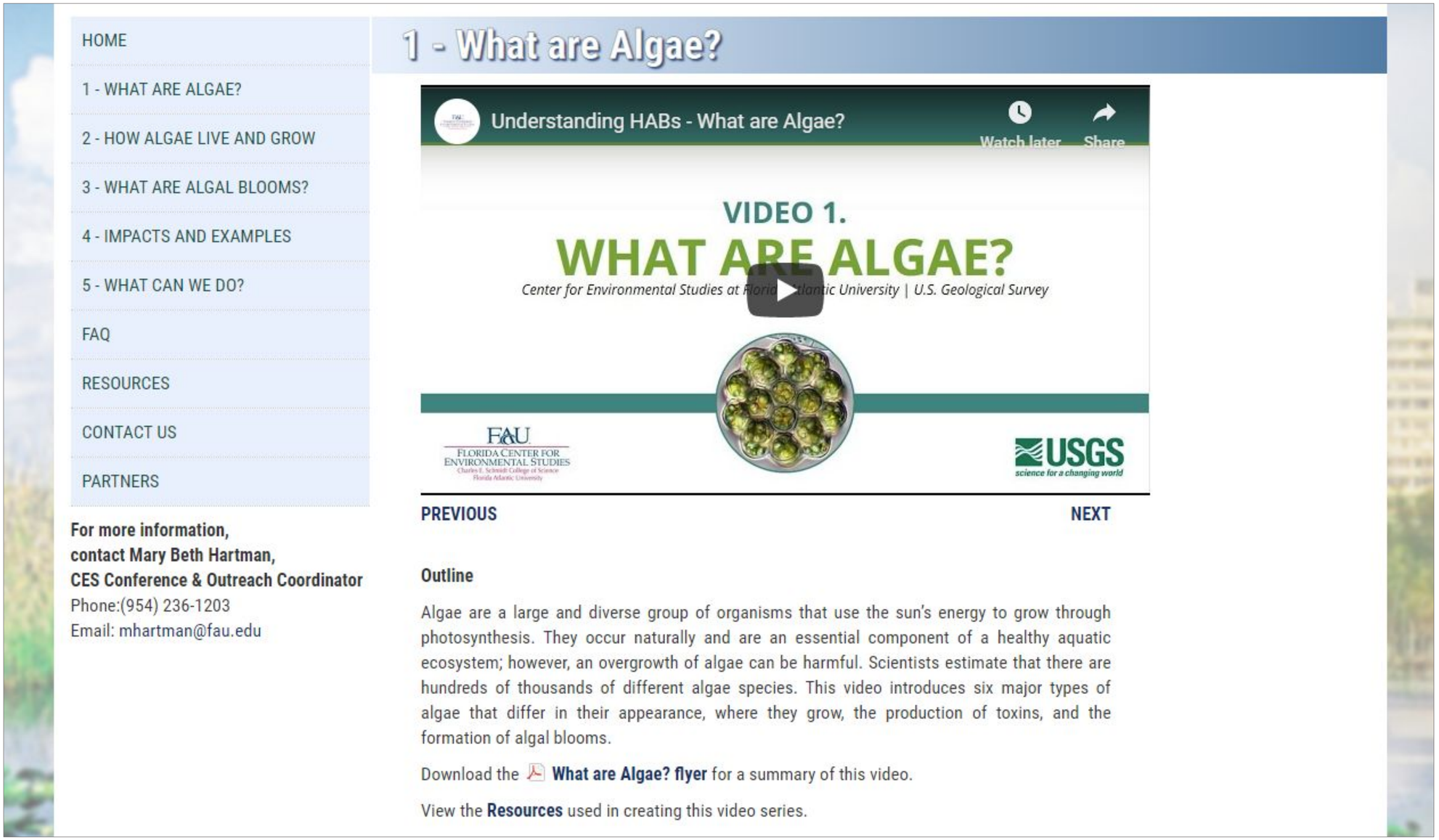

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THE IMPORTANCE OF ALGAE

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

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VIDEO 1. What Are Algae?

What are algae?

Algae are a large and diverse group of organis
energy to grow through photosynthesis.

Where do algae grow?

- Algae can be found all over the world on la
- Aquatic algae live in freshwater ecosystem

The importance of algae

- Algae are an essential food source in many
- Algae make up less than 1% of the photosy
produce 50% of the oxygen in Earth's atmo

Algal blooms

- Algal blooms area a rapid overgrowth of al
conditions.
- Harmful algal blooms (HABs) are especially
ecosystems.

Types of algae

Scientists estimate that there are hundreds of
species differ in their appearance, where they
of HABs.

Consumers:
snails, frogs, aquatic insects, and fish

Food web in the marl prairie ecosystem of Big Cypress Nat

Photo credit: FAU/CES

VIDEO 2. How Algae Live And Grow

What do algae look like?

- Algae can be microscopic to large enough t
eye.
- Phytoplankton are:
  - Microscopic algae that live dispersed
  - Usually buoyant, free-floating, and n
motile;
  - Microscopic, but millions of cells tog
- Periphyton:
  - Are a mat made of algae, bacteria, a
surfaces under the water;
  - Can be seen as floating mats or grow
are microscopic.
- Macroalgae:
  - Are algae made of multiple cells and
  - Can grow attached to surfaces bene
detached.

How do algae grow?

Algae require sunlight, water, select nutrients,
grow through photosynthesis.

- Photosynthesis
  - Algae absorb sunlight using chloropl
stored within the algae. Through ph
sugars called carbohydrates from th
in the water, giving algae energy to li
  - Some algae have photosynthetic ada
optimal amount of sunlight including
    - Additional pigments that resu
colors;
    - Gas-filled vesicles in cyanobac
to maximize light capture;
    - Light-sensing eyespots in som
swim towards the light.
- Nutrients
  - All algae require nitrogen, phosphor
  - Diatoms also require silica.
  - Some cyanobacteria can fix atmosph
and convert it to ammonia.

VIDEO 3. What Are Algal Blooms?

What are algal blooms?

- Algal blooms are a rapid overgrowth of alg
certain environmental conditions.
- Algal blooms can occur naturally and be be
ecosystem, but they can also be harmful.
- Harmful algal blooms (HABs) negatively im

Causes of algal blooms

- Algal blooms form when environmental co
growth through:
  - Ample levels of nutrients including n
phosphorus;
  - Favorable weather conditions.
- The exact conditions that trigger an algal b
pinpoint because they are complex and dr
of natural and human influences that mak
when a bloom will occur.
- **High levels of nutrients**
  - Algal blooms have been occurring fo
but the recent rise in documented c
may be linked to increased nutrients
  - Sources of nutrient pollution can inc
    - Agricultural runoff;
    - Residential runoff;
    - Septic tanks.
- **Favorable weather conditions**
  - Warm temperatures and sunlight su
formation.
  - Natural variations in climate can infl
  - Warmer temperatures predicted in t
duration, and severity.
  - Increased extreme weather events p
conditions for algal bloom formatio

Where do algal blooms occur?

- Algal blooms occur in freshwater, estuarin
country and around the globe.
  - Algal blooms occur throughout Flori
Lake Okeechobee.

VIDEO 4. Impacts and Examples of Ha

What are harmful algal blooms (HABs)?

- HABs are algal blooms that threaten the he
and aquatic ecosystems.
- Only some HABs are known to produce to
to produce toxins to be considered harmfu

Impacts of HABs

- Health impacts
  - Toxins produced by HABs can have
  - The type of toxins produced depend
affect specific systems within the bo
- Economic impacts
  - Increased costs associated with HAB
    - Beach closures and loss of tou
    - Increased medical expenses a
gastrointestinal illnesses from
    - Declining property values;
    - Loss revenue when commerc
    - Increased cost of water treatm
- Ecological impacts
  - Algae can clog fish gills and prevent
during a HAB event.
  - Toxins produced by HABs can kill fis
  - HABs can also deplete oxygen levels

Examples of HABs

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

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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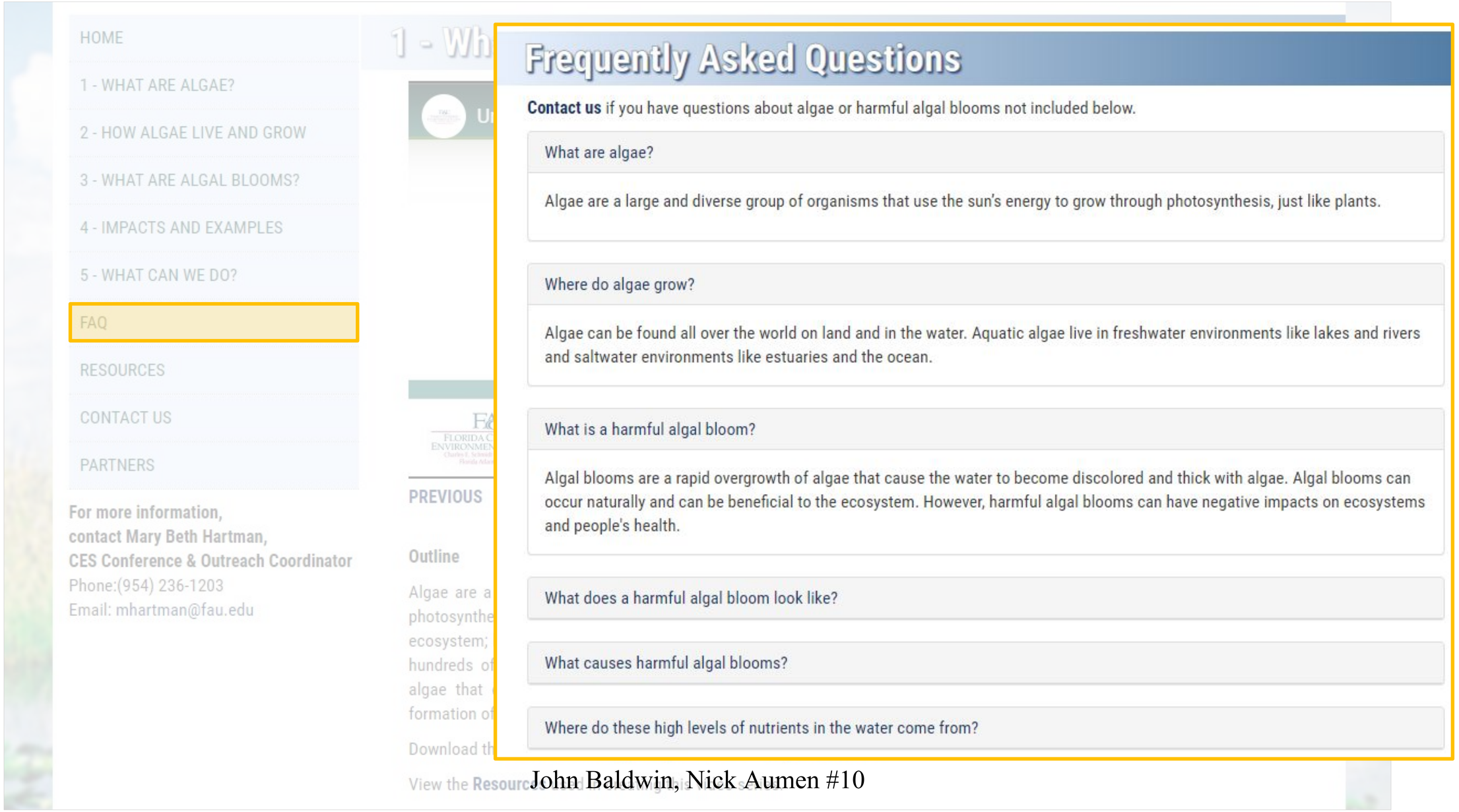

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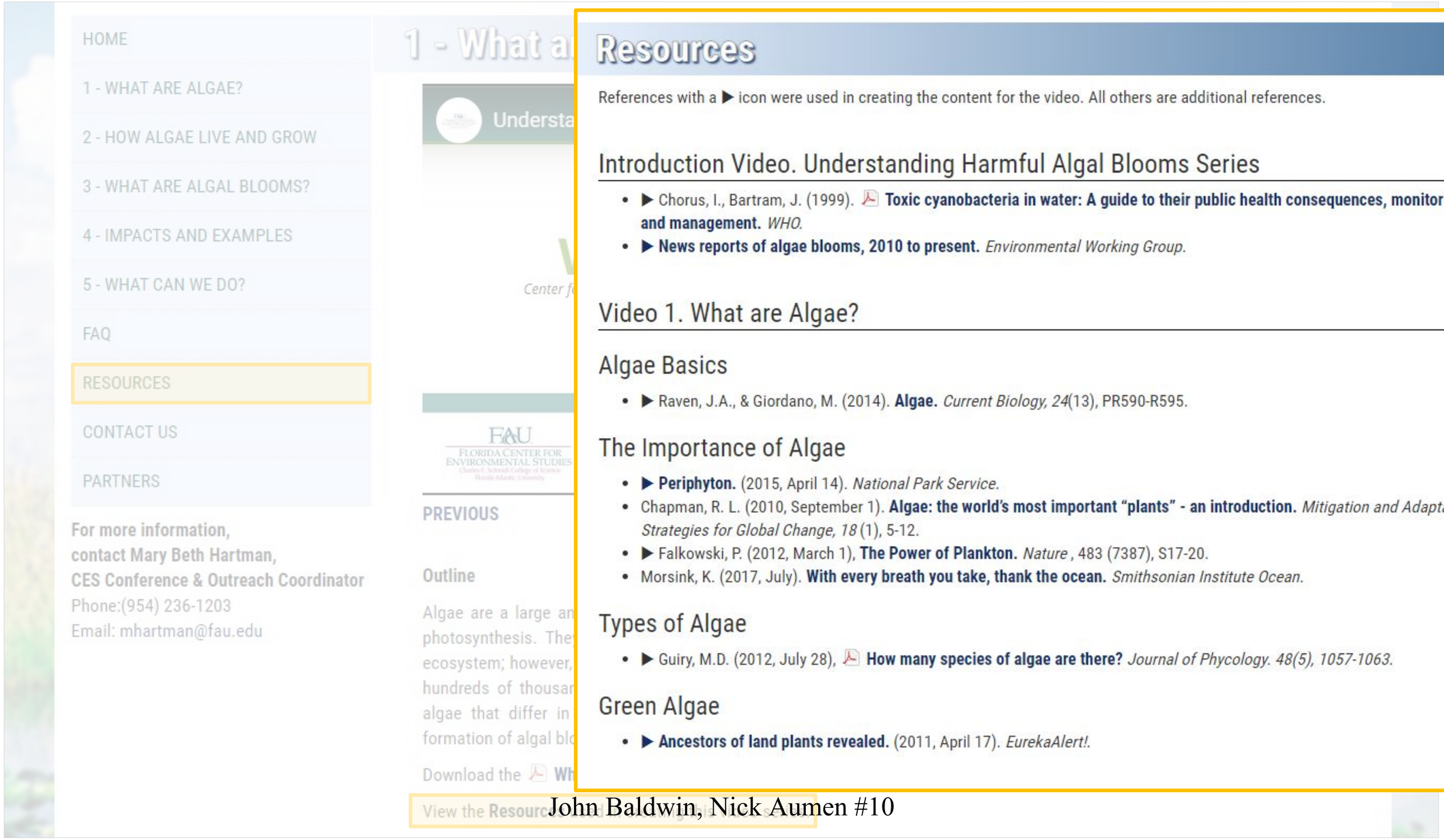

Resources

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

- ▶ Chorus, I., Bartram, J. (1999). **Toxic cyanobacteria in water: A guide to their public health consequences, monitoring, and management.** *WHO.*
- ▶ **News reports of algae blooms, 2010 to present.** *Environmental Working Group.*

Video 1. What are Algae?

Algae Basics

- ▶ Raven, J.A., & Giordano, M. (2014). **Algae.** *Current Biology, 24*(13), PR590-R595.

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- ▶ **Periphyton.** (2015, April 14). *National Park Service.*
- Chapman, R. L. (2010, September 1). **Algae: the world's most important "plants" - an introduction.** *Mitigation and Adaptation Strategies for Global Change, 18* (1), 5-12.
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- Morsink, K. (2017, July). **With every breath you take, thank the ocean.** *Smithsonian Institute Ocean.*

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Green Algae

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

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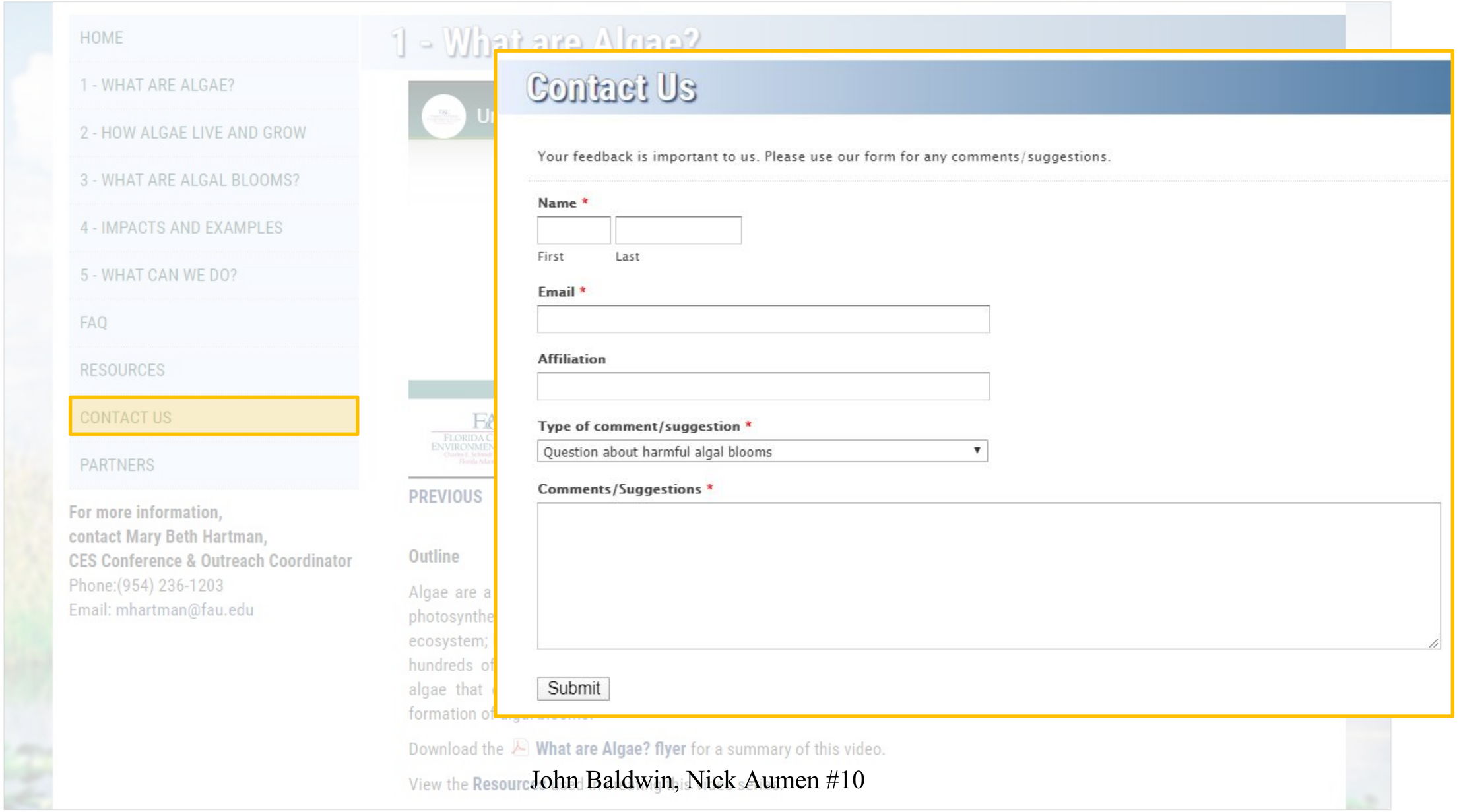

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FUTURE OF THE SERIES

- 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.

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