OBOC 2021-2022
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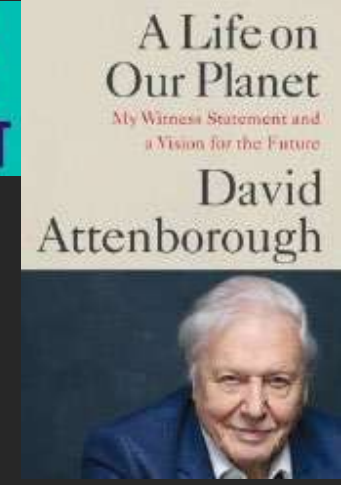

Is red tide a sign of unsustainable growth in Southwest Florida?

Juan Carlos Ginarte, Ph.D
Social Sciences Department
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Outline of Presentation

- What is sustainability?
- Is growth in Southwest Florida sustainable?
- Selected characteristics and Facts: Algae, Cyanobacteria, and Harmful Algal Blooms
- Red tide's impact on our economy
- What causes harmful algal blooms?
- What can be done?
- References

Source of red tide picture on title slide: Gulf Coast Preservation Society, http://www.gulfpreserve.org/redtide.htm

What is Sustainability?

- A key message in “A Life on Our Planet” is that perpetual growth of the economy is unsustainable. It cannot continue indefinitely.
- We cannot take resources from the earth at the current rate indefinitely without severely damaging our environment.
- Growth can put great stress on the environment.
- For example, we cannot continue to clear forests as we have been doing to make room for agriculture, particularly meat production, without seriously warming our planet, destroying the diversity of life, and ultimately threatening our own existence.

Logs and cleared land in the Amazon rainforest, source: www.firstpost.com

What is Sustainability?

- For decades, South Florida has been one of the fastest growing parts of this country.
- People are attracted to Florida by its climate, job and business opportunities, and lack of income taxes.
- The quality of life is a big attraction to our area.
- Businesses, including financial services and technology companies, see a huge potential to expand in our region (Dean, 2021).
- Is red tide a sign of environmental stress from the growth we have experienced in recent decades?
- If so, does this mean that the rapid pace of growth here is unsustainable because our quality of life will be damaged?

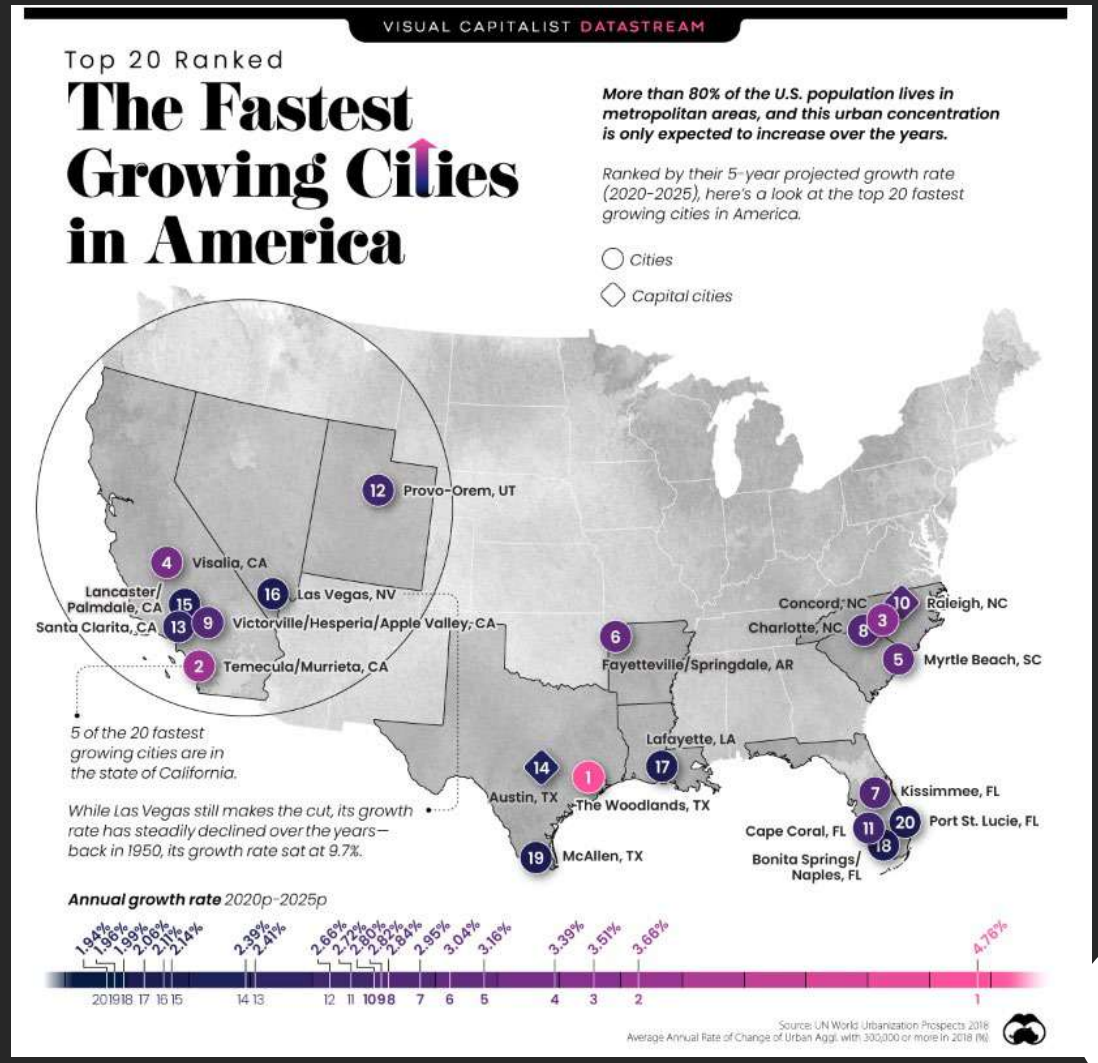


Image: Map of the U.S. showing the fastest growing regions, via Visual Capitalist: https://www.visualcapitalist.com/fastest-growing-cities-in-the-us/

Selected Characteristics and Facts

- There are possibly as many as one million species of algae (Guiry, 2012).
- They exist naturally in most saltwater and freshwater environments.
- Algae range in size from the single-celled diatom to the multicellular seaweed. Kelp (brown algae) is a type of seaweed which can measure up to 200 feet in length.
- Like plants, most algae are photosynthetic organisms (use carbon dioxide, water, and energy from the sun to produce their own food – simple sugars).
- Cyanobacteria are photosynthetic bacteria that are frequently referred to as blue-green algae, but at not algae.

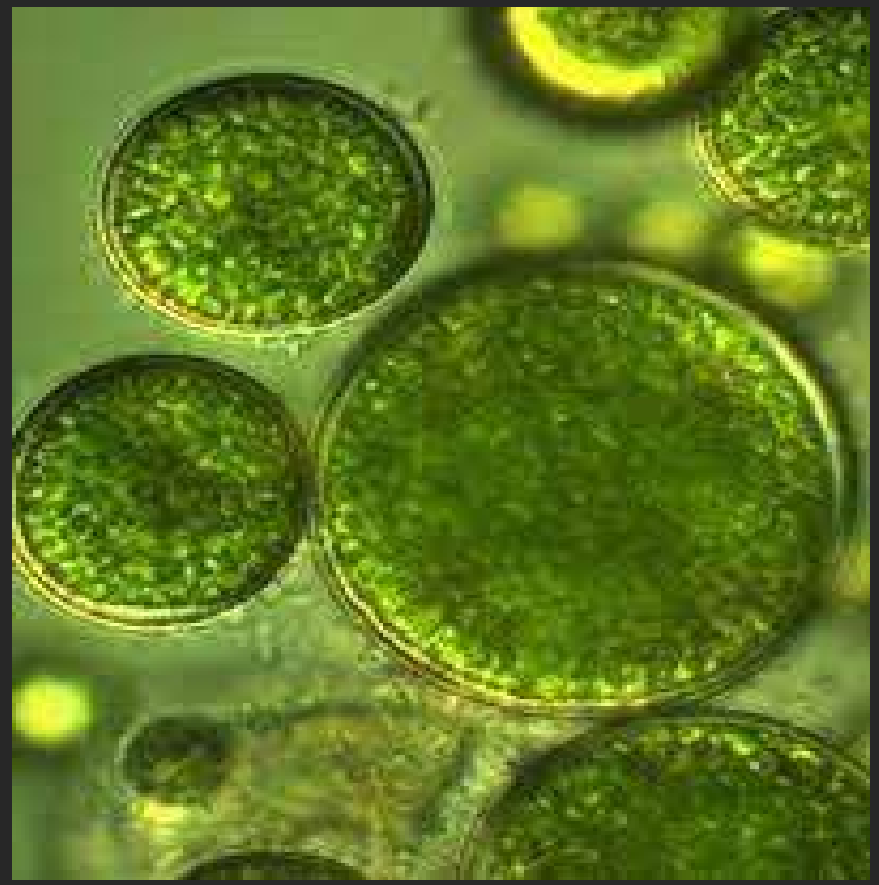


Image source: https://algaeliving.com/2020/03/24/interesting-facts-about-algae/

Selected Characteristics and Facts

- Like plants, algae release oxygen as a waste product when they convert their food to energy. Algae are the ancient ancestors of plants.
- The oxygen released by algae and other photosynthetic microorganisms made it possible for large, multicellular organisms like animals to evolve (oxygenated our planet).
- They produce about 50% of the oxygen in the world. So, without this service we would suffocate (Kassinger, 2019).
- Between 50-80% of the world's oxygen is produced by drifting plants, algae, and bacteria in the oceans (NOAA, n.d.).
- Algae and other phytoplankton constitute the primary source of energy supporting life in the ocean (Mladenov, 2020).

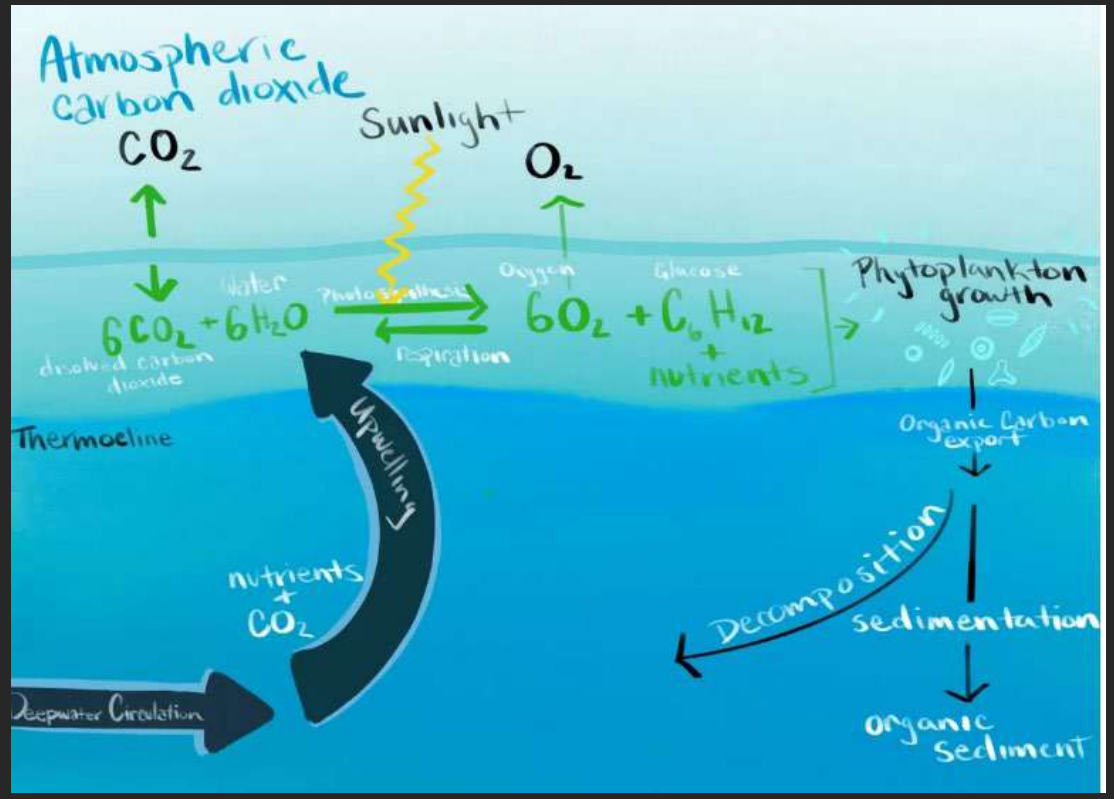


Image source: The Artful Biologist, https://www.artfulbiologist.com/phytoplankton-week-2/

Harmful Algal Blooms

- Harmful algal blooms (HABs) are excessive concentrations of certain algal and bacterial species that can negatively impact residents, tourists, pets, businesses, and governments.
- HABs are more commonly known as red tide, but the blooms can discolor the water green, yellow or brown, as well as red.
- Algae such as *Karenia brevis* can poison marine organisms with neurotoxins that can prevent breathing and produce respiratory problems in humans with brevetoxins.
- Living and dead cyanobacteria both release toxins.
- The blooms and the associated growth of cyanobacteria can also lead to the suffocation of marine animals (loss of oxygen).

Dead fish on North Shore Park in St. Petersburg on July 15, 2021, https://www.wfla.com/weather/red-tide/red-tide-update-bloom-concentrations-found-in-5-tampa-bay-counties/

Harmful Algal Blooms

- Red tide can occur naturally and is not new. There are reports dating back to the 1600s
- Red tide events have been spreading and growing in frequency and severity around the state and the country.
- The blooms were rare on the northern Atlantic side of the state
- Red tide was First documented on the Atlantic side of the state in 1972, and in Jacksonville in 1980.
- The first report of a *K. brevis* bloom in Nassau County was in 2007 (CDC, 2008)

HABs observed for the Florida Department of Environmental Protection, Sept. 17-23, 2021: https://floridadep.gov/sites/default/files/Blue-Green%20AlgalBloomWeekly-092321.pdf

Harmful Algal Blooms

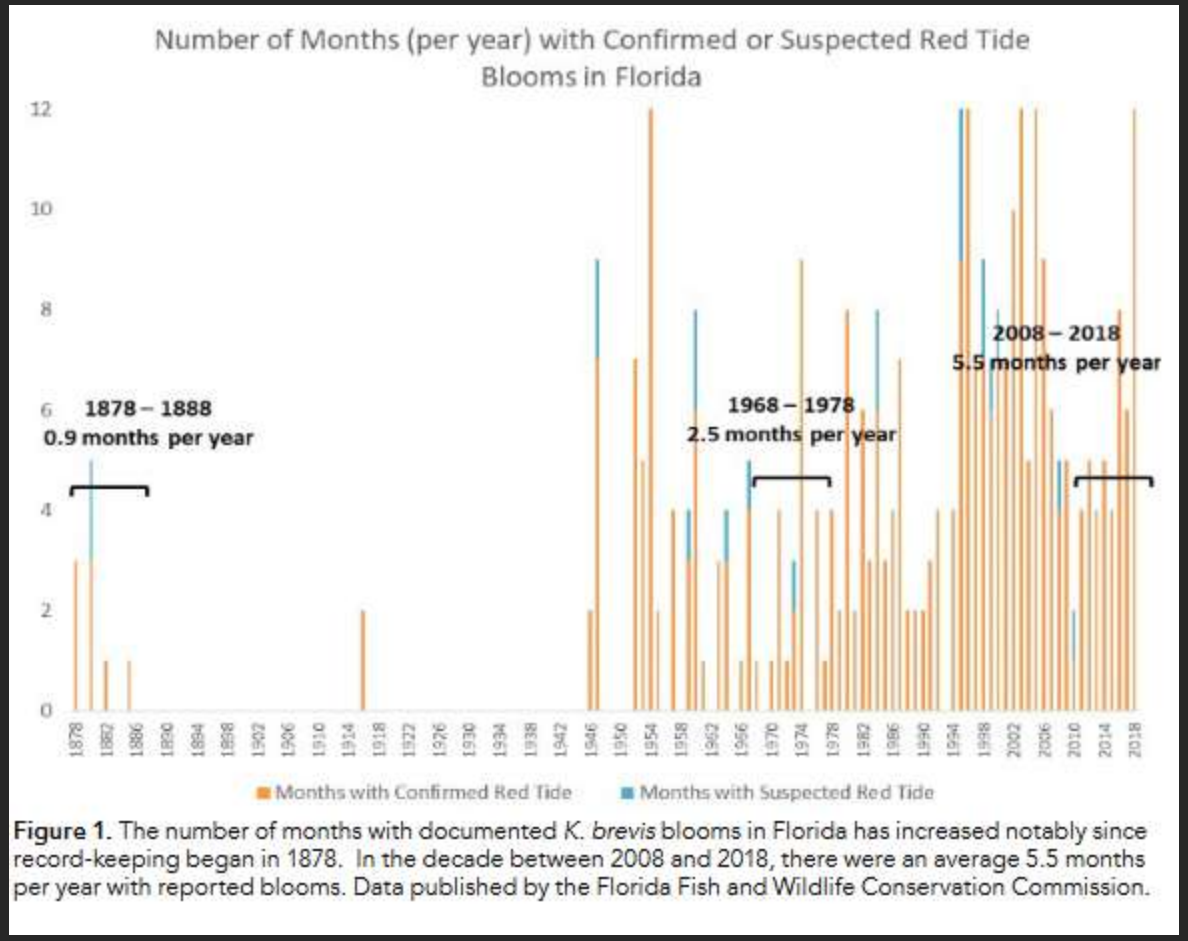
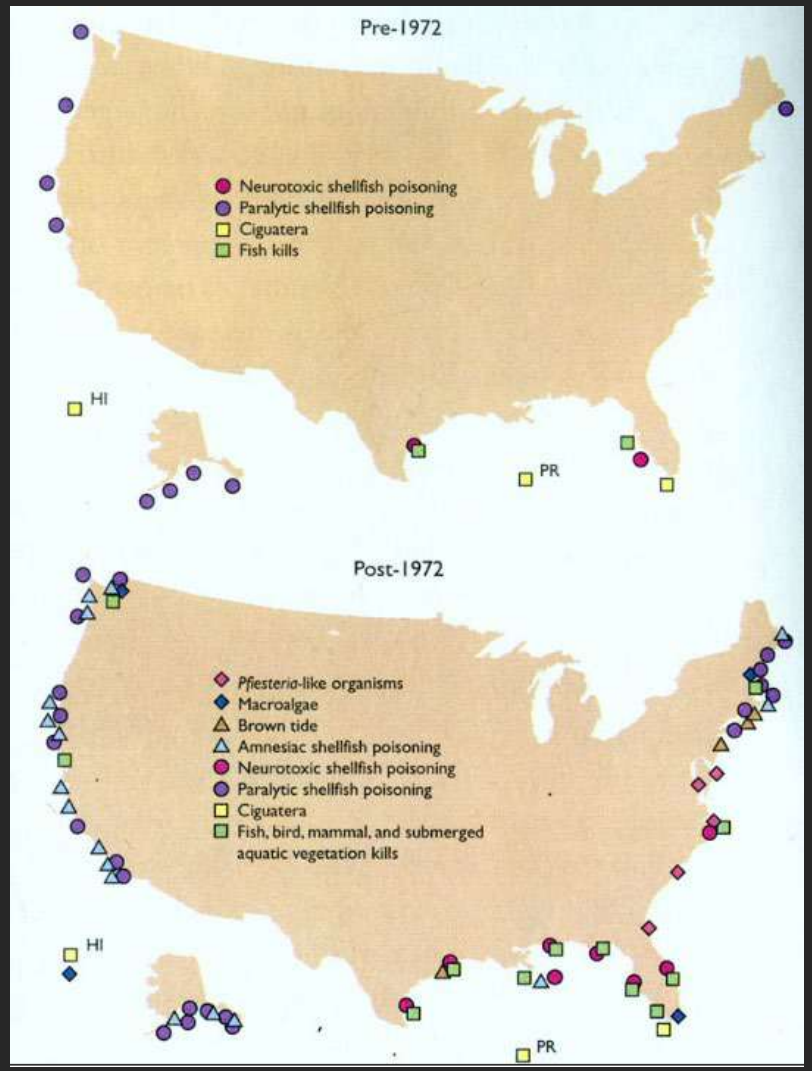


Figure 1. The number of months with documented *K. brevis* blooms in Florida has increased notably since record-keeping began in 1878. In the decade between 2008 and 2018, there were an average 5.5 months per year with reported blooms. Data published by the Florida Fish and Wildlife Conservation Commission.

Frequency of *K. brevis* blooms in Florida, source: University of Central Florida, https://stars.library.ucf.edu/cgi/viewcontent.cgi?article=1049&context=rosen-research-review

Harmful Algal Blooms



Frequency of HABs in the U.S., pre- and post-1972; source: University of South Florida, http://fcit.usf.edu/florida/maps/pages/2100/f2140/f2140.htm

Economic Impact of Algal Blooms

- HABs can make it unpleasant or dangerous to be in the proximity of the coast or inland waterways.
- As people avoid the smell and toxic air, waterfront businesses (hotels, restaurants, vendors, marinas, etc.) suffer and coastal property sales and rentals decrease.
- Harmful algal blooms typically last a few weeks or months, but the 2018 outbreak lingered for over a year (Nemo, ibid).
- That year a state of emergency was declared for Lee County and 6 other Gulf Coast countries.
- We experienced a year-long HAB that cost hotel cancellations in Captiva and Sanibel islands alone $8 million in revenues between August and October (Burton, 2019).

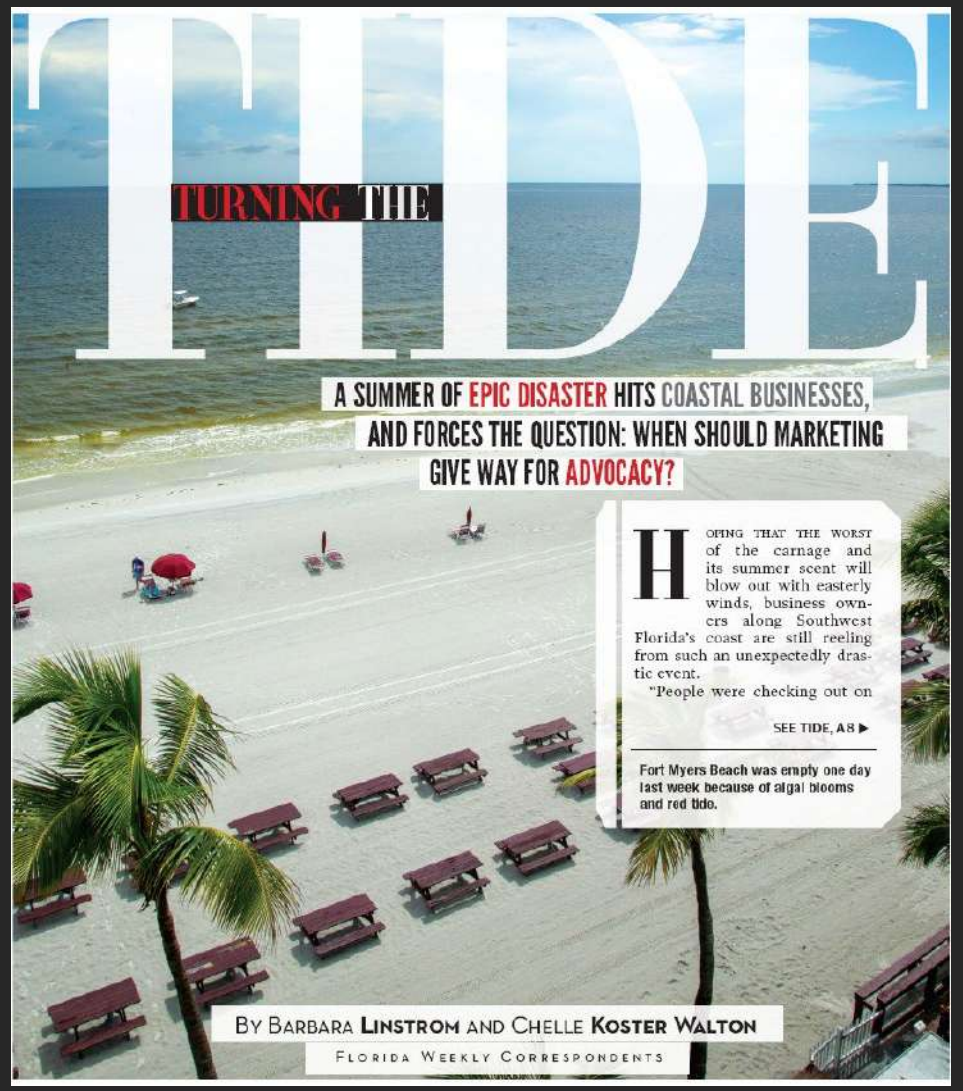


Image: Scene on Fort Myers Beach one day in August 2018, *Florida Weekly*, August 16, 2018, https://naples.floridaweekly.com/articles/turning-the-tide/

Economic Impact of Algal Blooms

- The crisis affected a 100-mile stretch of the coast from Sarasota to Naples, for which local chambers of commerce together estimated a 27% decrease in hotel revenue in July of that year, and led to reports in major national news publications (Ibid).
- River cruises along the Caloosahatchee River were cancelled. Residents were cautioned not to swim in Cape Coral's Yacht Club beach or to eat fished caught in the city's canals (Linstrom and Koster Walton, 2018).
- An FGCU economic survey at the end of 2018 found that 15% of firms experienced a major negative impact on profits, and 29% experienced a moderate impact (FGCU, 2018).

Image: Fort Myers Beach without foot traffic, *Florida Weekly*, August 16, 2018, https://naples.floridaweekly.com/articles/turning-the-tide/

Economic Impact of Algal Blooms

- State of Florida government assistance to the affected counties exceeded $13 million that year.
- The assistance funded cleanups, animal rescue, enhanced monitoring, research, and support for production of redfish, among other programs (Florida Disaster, 2018).
- The debris can include many dead manatees, sea turtles and sharks, as well as small fish.
- The cleanup of 4 million pounds of dead fish and other marine debris in 2018 cost Lee County $2.55 million dollars, including the payment for 39,000 labor hours (Nemo, 2018).
- The county purchased specialized machines ("surf rakes") that sift through the mix of sand and debris at a cost of $61,000 each (paid for by savings from tourism taxes).

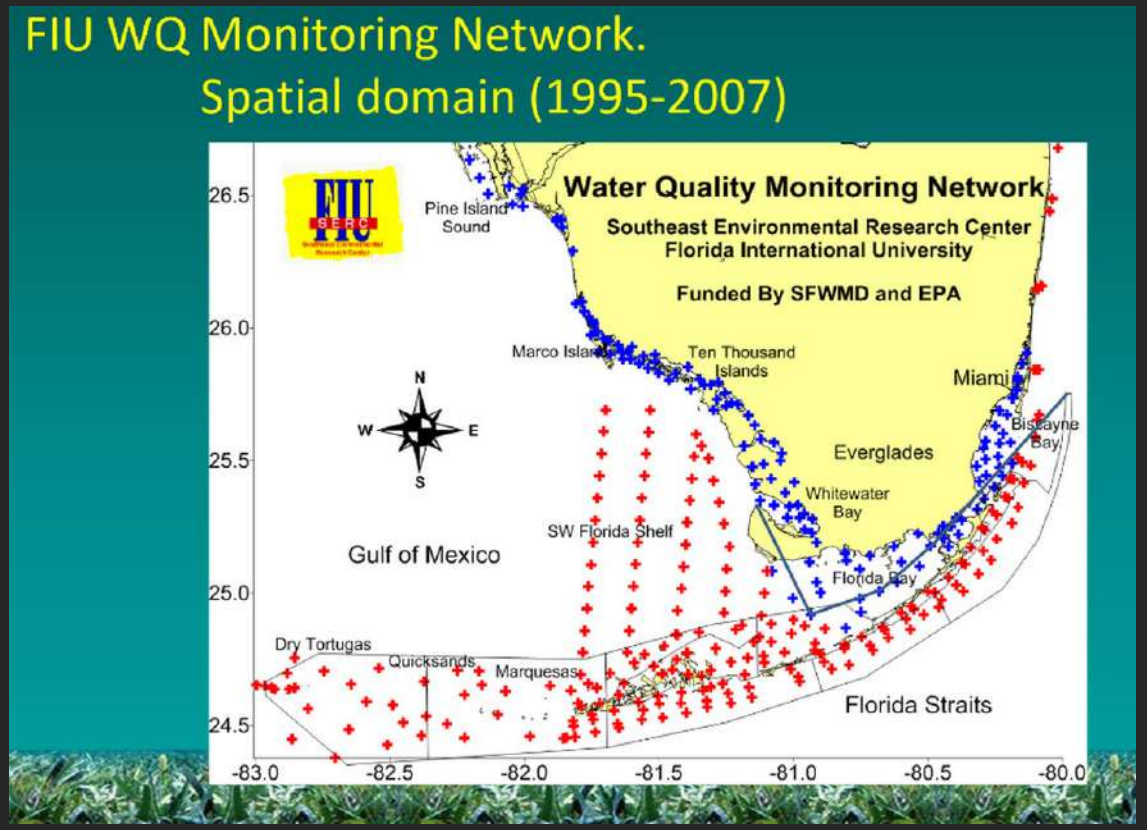
Image: Workers in Lee County scooping up dead fish in 2018, https://www.bloomberg.com/news/articles/2018-11-28/how-florida-counties-got-red-tide-debris-off-beaches

Economic Impact of Algal Blooms

- Before this outbreak the state government had cut the budget for red tide research and preventive measures (e.g., water quality monitoring and enforcement of environmental regulations) for five straight years (Staletovich, 2018).
- Frequent monitoring of algae and bacterial concentrations in the water is important to provide early warning when its dangerous to swim and fish in infected toxic waters.
- Water monitoring can help provide information about conditions on Lake Okeechobee and other locations and help with the fight against the outbreaks.
- The number of stations was cut from 350 to 115 between 2008 and 2014. The U.S. Environmental Protection Agency had also cut 43 stations in the Keys.
- State funding for monitoring on Biscayne Bay, where half of the seagrass had died in recent years, was cut 30 percent in 2014.

Image: Manatee killed by red tide, https://mediaassets.abcactionnews.com/photo/2018/07/31/dead-manatee_1533092768683_93867204_ver1.0_640_480.jpg

Economic Impact of Algal Blooms



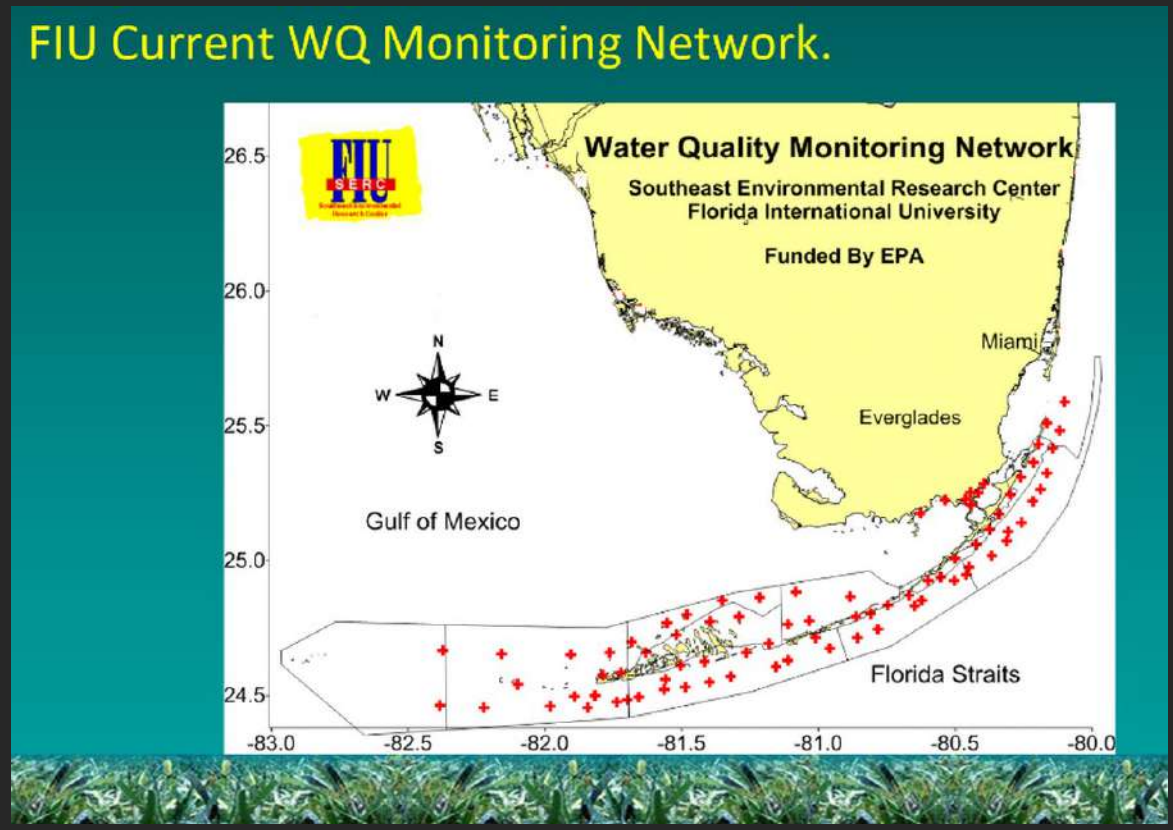
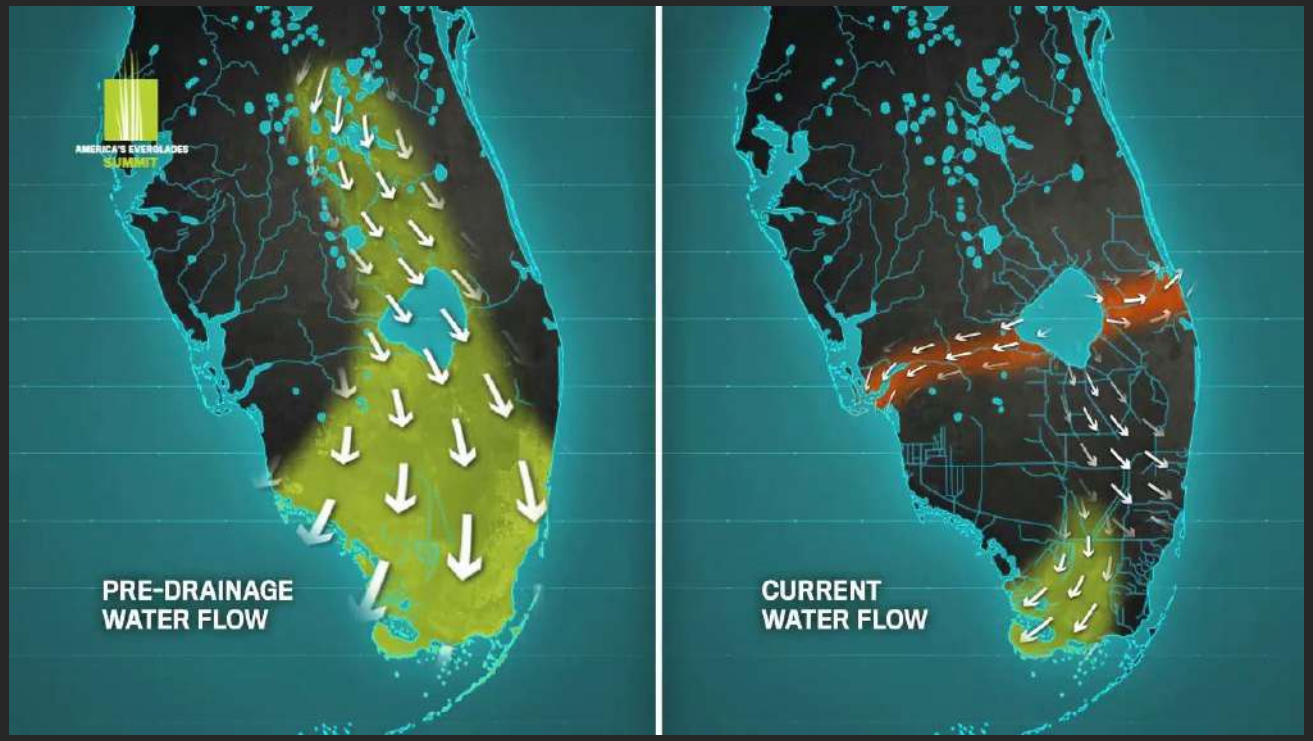


Image: Workers in Lee County scooping up dead fish in 2018, https://www.bloomberg.com/news/articles/2018-11-28/how-florida-counties-got-red-tide-debris-off-beaches

What causes Harmful Algal Blooms?

- Algal blooms are naturally occurring, but their frequency and severity are believed to be increasing due to excessive amounts of nutrients in inland and coastal waters.

- Fertilizer runoff from agricultural lands, golf courses, lawns, septic systems, increases the concentration of nitrogen and phosphorus on the water (hyper-eutrophication).



Flow of water in South Florida before and after drainage; source: https://www.youtube.com/watch?v=5ZycljKgzuA

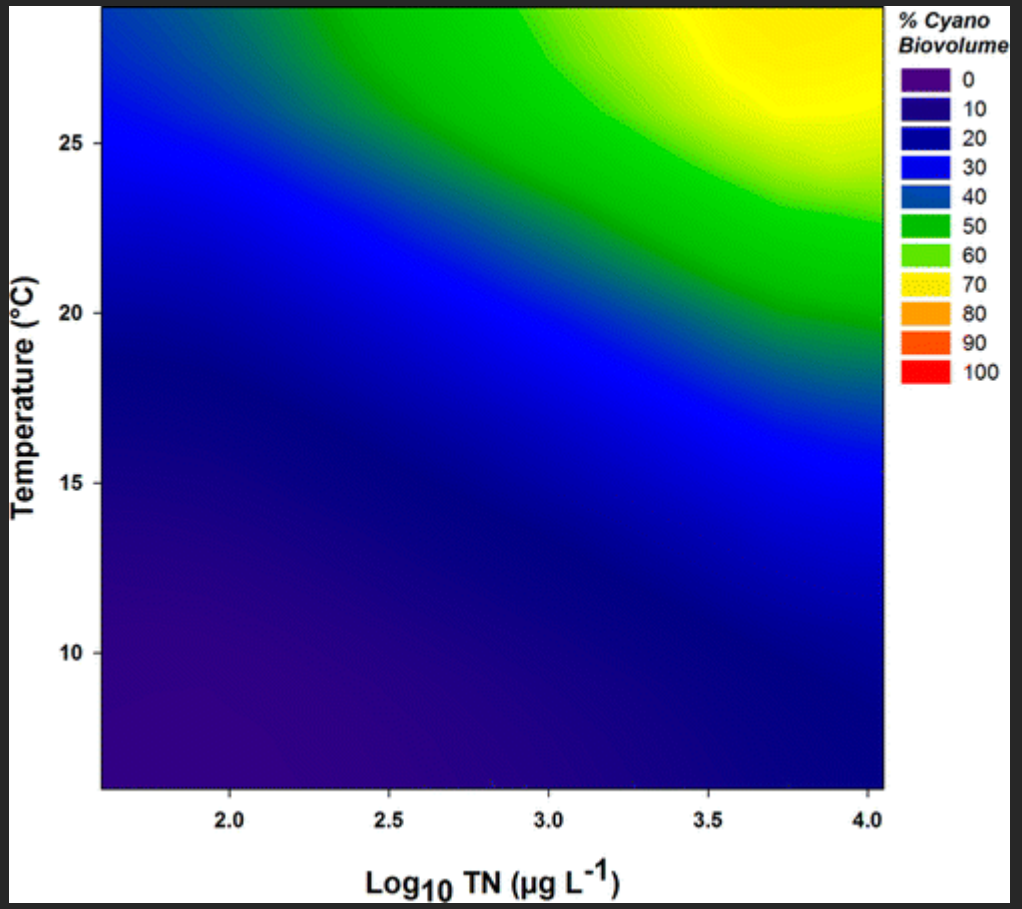
What causes Harmful Algal Blooms?

- In Southwest Florida, much of the nitrogen and phosphorus originates from the polluted runoff from agricultural lands around Lake Okeechobee.
- The historical southerly water flow of the Everglades has been largely diverted westward and eastward along the Caloosahatchee River and St. Lucie River, respectively.
- Also, in order to avoid flooding, several times a year the U.S. Army Corp of Engineers releases nutrient laden water from the lake into rivers leading to the Gulf of Mexico and the Atlantic Ocean

Cyanobacterial bloom on Lake Okeechobee in 2016; photo taken from the NASA Earth Observator, via https://edis.ifas.ufl.edu/publication/SG153

What causes Harmful Algal Blooms?

- Climate change also appears to be a factor as the microorganisms, especially cyanobacteria, thrive in warm waters.
- A study of 143 lakes in latitudes from Europe to the South America found that, the greater the total concentration of nutrients and higher temperatures, the greater the concentration of cyanobacteria in total biomass (Havens and Paerl, 2015).
- Duration of blooms might be result of longer periods of warm temperature - shorter winters/longer summers.



Cyanobacteria concentration and water temperature; source: https://pubs.acs.org/doi/10.1021/acs.est.5b03990

Florida's Economy

- Florida employs 1.3 million people directly in leisure and hospitality, or about 14 percent of nonagricultural employment in the state (Bureau of Labor Statistics, 2019).
- In Southwest Florida, approximately 12 percent of workers are employed in leisure and hospitality.
- In 2019, 130 million people visited Florida (Visit Florida, 2021).
- Tourism accounts for about 9 percent of the state's GDP.
- Tourism generates about 6.5 percent of total state and local government revenues.

Image: Beach in Florida, https://vacationidea.com/florida/best-family-beach-vacations-in-florida.html

Florida's Economy

- Florida has 600 miles of beaches and 1,500 miles of navigable inland and intra-costal waterways.
- These are among the state's most important natural assets and major drivers of the state's economy (Tax Watch, 2021).
- Water-related economic activities (e.g., boating and fishing) employ thousands of people in the state (Tax Watch, ibid.).
- In our three-county region, recreational boating alone accounted for $2.4 billion in economic activity, which supported over 11,000 jobs in 2018 (NMMA, 2018).

Economic Significance of Florida Bay

	Value in Perpetuity	Annual Value	Annual Economic Impact
Recreational Fishing	$7,121,324,467	$213,639,723	$438,690,467
Commercial Fishing	$426,452,420	$12,793,573	$19,977,299
Residential Real Estate	$1,181,622,839	$35,448,685	---
Carbon Sequestration	$4,529,394,426	$135,881,833	---
Gene Pool Protection, Spiritual Experiences, Cognitive Information	$1,935,000,000	$58,050,000	---
Total	**$15,193,794,152**	**$455,813,814**	**$458,667,766**

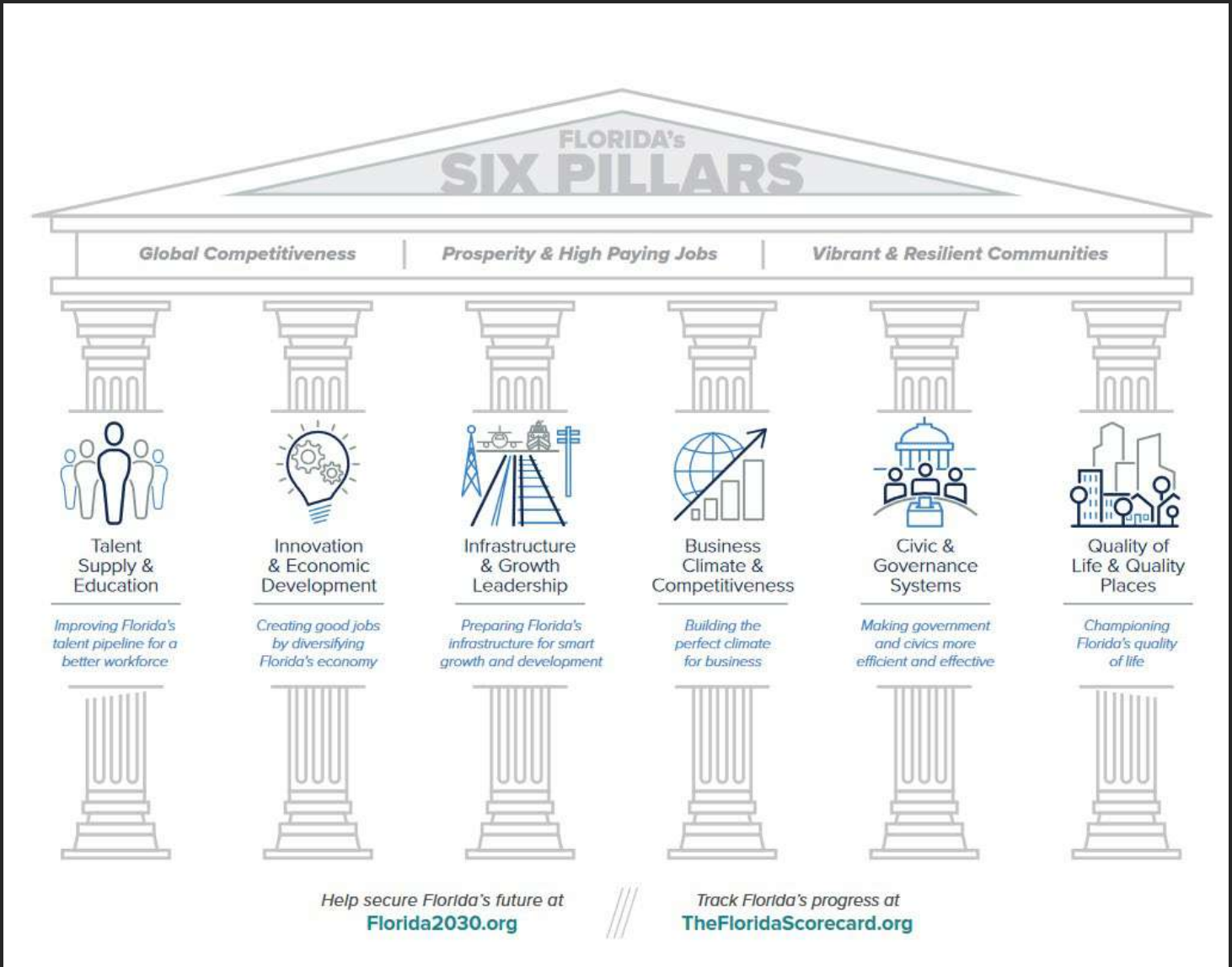
Note: The commercial fishing estimates are based on gray snapper (*Lutjanus griseus*) and pink shrimp (*Farfantepenaeus duorarum*) and do not include other important species (spiny lobster, sponges, etc.). Thus, the true economic value and impact of commercial fishing is likely greater than reported here.

Source: Stainback (2019), https://www.ingentaconnect.com/content/cog/tme/2019/00000014/f0020001/art00006;jsessionid=2j4jasd20b4oc.x-ic-live-01

Florida's Economy

Source: Rockport Analytics (2019), https://www.visitflorida.org/media/71465/2017-contribution-of-travel-tourism-to-the-florida-economy.pdf

Chamber of Commerce's Blueprint for the Future



Source: Florida 2030: The Blueprint to Secure Florida's Future, Florida Chamber Foundation, https://www.flchamber.com/wp-content/uploads/2018/09/ES_FLChamber2030_TargetsandStrategies_Sep12.pdf

Chamber of Commerce's Blueprint for the Future

WHERE DO WE WANT TO GO?

2030 Targets

GOALS

Global Competitiveness	*Prosperity & High Paying Jobs*	*Vibrant & Resilient Communities*
Grow Florida into a top 10 global economy	**Create a path to prosperity for all zip codes in Florida**	**Position Florida among the top states for attracting and retaining talent and visitors of all ages**

Building the perfect climate for business	***Making government and civics more efficient and effective***	***Championing Florida's quality of life***
Actuarially sound **property insurance** rates based on **actual risk and competition**	**100%** of **state agencies** aligned with Florida 2030 goals	**Top 5** state for **overall well being**
#1 business tax climate in the nation	**100%** of **regional economic development plans** aligned with Florida 2030 goals	Florida's brand and reputation as **best place to live, work, raise a family, visit, learn, play, relocate, and compete** remains **top in the nation**
Regulatory, labor, and operating risk environments rated among **top 5** in the nation	**100%** of Florida residents covered by **regional visioning processes**	**<10%** of Florida children **live in poverty** and **100%** have a **pathway out**
Environmental permitting and local land use processes rated among **top quartile in the nation**	**Increased** size and impact of **nonprofit and philanthropic sectors**	**< 10%** of Florida residents live in **housing-cost burdened households**
Occupational licensing laws rated among **top 5 in the nation**	**Doubling** the rate of Floridians who **volunteer and participate in civic and public service,** moving us from the bottom to the **top quartile**	**Crime rates** rank among the **lowest 10 states**
Legal climate improves to **top quartile in the nation**		Florida **protects and enhances** the value of its **arts, culture, heritage, and sense of place**

Source: Florida 2030: The Blueprint to Secure Florida's Future, Florida Chamber Foundation, https://www.flchamber.com/wp-content/uploads/2018/09/ES_FLChamber2030_TargetsandStrategies_Sep12.pdf

Nature-Based Solutions

- Re-wilding of the Southwest Florida and Tampa Bay estuaries with Southern Hard Clams could help to prevent HABs (Florida TaxWatch, 2021).
- Clams could help to clean the waters by consuming the algae and removing the excess nitrogen and phosphorus. Clams can also promote the growth of bacteria capable of making the nitrogen less useful to the algae (Florida Tax Watch, ibid).
- Replace plants that depend on the addition of nutrients with native species (Havens.
- Floating wetlands – rafts of floating native plants placed in the water to absorb excess phosphorus and nitrogen.
- Regenerative farming …

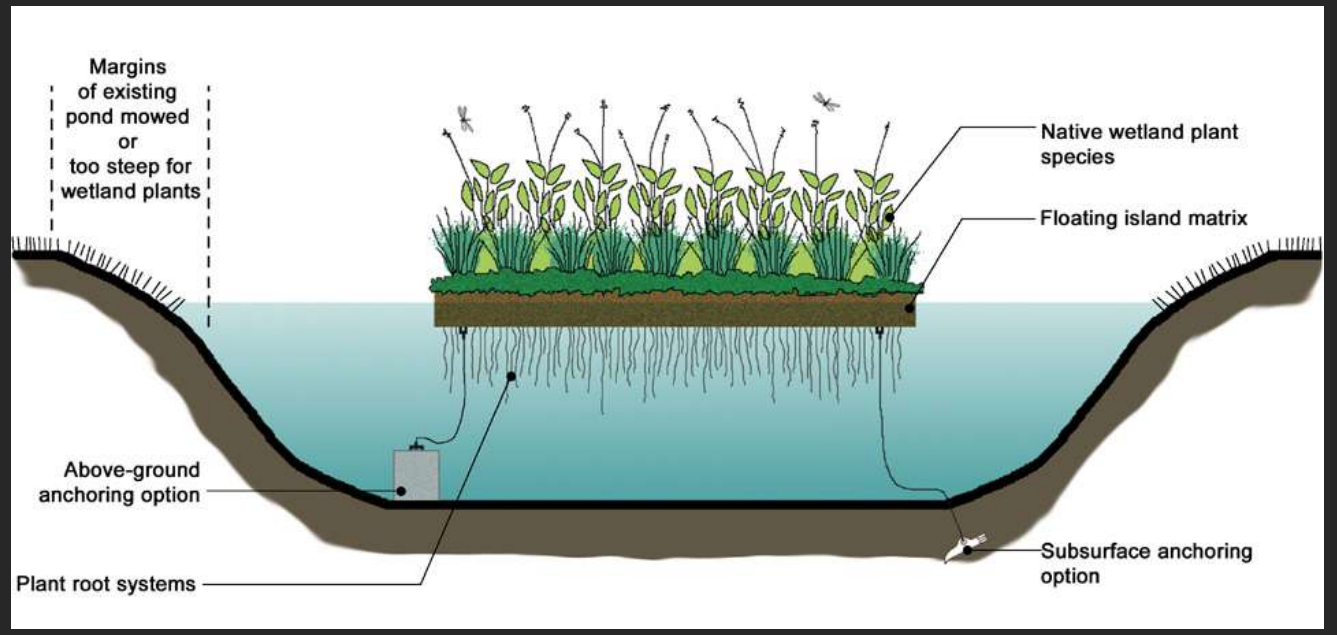


Image: Drawing of floating wetlands concept, https://tcwp.tamu.edu/floating-wetland-islands/

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