

HARBOR HAPPENINGS

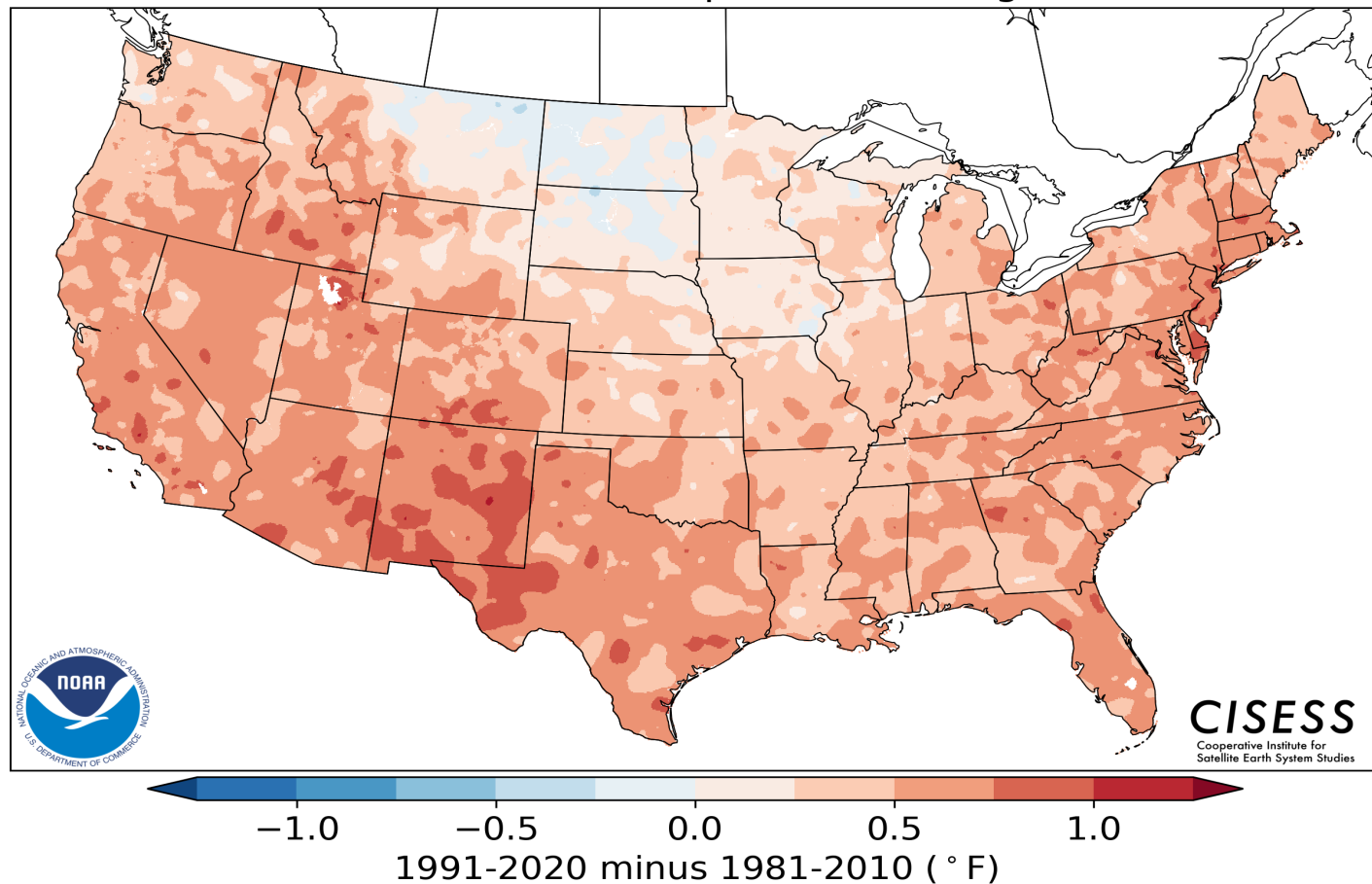
Uniting Central and Southwest Florida to protect water and wildlife

Spring/Summer 2021: Volume 25, Issue 2

A CHANGING CLIMATE

The National & Oceanic Atmospheric Administration recently updated climate “norms”, with the map below showing temperatures in most of the United States rising steadily over the past two decades - Central & Southwest Florida being approximately 1 degree warmer on average. Additionally, sea levels have risen more than 6” in Southwest Florida over the past 50 years and other climatic changes are being currently documented. The Coastal & Heartland National Estuary Partnership recently held the inaugural Southwest Florida Climate Summit to bring together policymakers, scientists, advocates, and the public to talk about what is, and can be done, to adapt and build more resilient communities in our region.

Annual Mean Temperature Change



EXECUTIVE DIRECTOR UPDATE

The once predicted climate changes are now occurring, with a headline from the Washington Post recently reading “America’s new normal: A degree hotter than two decades ago”. These past couple years, there is more evidence of increased intensity of storms, sea level rise, and other climate impacts being felt across the globe. In fact, the 2020 Atlantic hurricane season had 30 named storms - the most storms on record, with 6 of those being major hurricanes like the Category 4 Hurricane Laura.

Warming waters create conditions more conducive to harmful algae growth and sea level rise can cause flooding and saltwater intrusion, effects that not only harm our environment but also our economy and quality of life. While the challenge is immense and the window of opportunity to curtail it is narrowing, we are seeing growing awareness and acceptance that is manifesting into bipartisan actions at all levels of government.

At the federal level in just the past few months, our President pledged at the international 2021 Leaders Summit of Climate, that the United States will reduce greenhouse gas emissions by half from 2005 levels - by the year 2030, as well as issued an executive order to achieve net-zero emissions by no later than 2050, and one that calls for increasing Renewable Energy on Public Land and in Offshore Waters. There is also a new focus on bringing environmental justice to disadvantaged communities who are often disproportionately impacted by climate change.



On the state level, our Governor and legislature have taken bold steps to establish the Resilient Florida Program, with \$611 million dollars of funding appropriated this year to implement projects to enhance community resiliency across our state. The Governor also created Florida’s first Chief Resiliency Officer position. On the regional level, there are multiple climate compacts amongst local governments that have formed, including one right here in Southwest Florida.

The Coastal & Heartland National Estuary Partnership (CHNEP) has, and continues to be, deeply involved in this issue. We co-authored the first Climate Adaptation Plan for the City of Punta Gorda more than a decade ago and now assist in its updating and implementation. The CHNEP hosted the first Southwest Florida Climate Summit, where we learned more about how urgent this issue is for our region, and the actions we can take together to address this challenge and build more resilient vibrant communities. This is a daunting time but also a hopeful time with more resources, political support and actions being applied to this problem than ever before.

We hope this Climate issue of Harbor Happenings informs and inspires you on this important issue, as well as on other issues pertaining to the protection of our water and wildlife. Thanks to concerned citizens like you giving time, talent and other contributions to this effort, we are affecting real positive change to preserve what we care about here in our beautiful corner of the earth.

To a clean healthy planet and Southwest Florida,

A handwritten signature in blue ink that reads "Jennifer Hecker".



CHNEP's 2022 Nature Calendar Photography Contest

Our annual nature calendar photo contest is currently underway! Each year we accept photos from across our program area - focusing on wildlife, birds, landscapes, and marine environments. Please visit our website today to see contest guidelines, and submit your own nature photos!

www.chnep.org/nature-calendar-photo-contest

Conservation Grants Available

Every year we provide Conservation Grants to support projects that implement our Comprehensive Conservation and Management Plan (CCMP). Since 2001, CHNEP has offered community grants to help support local environmental education and natural resource protection efforts. These grants of up to \$3,000 help to reimburse expenses and are set up for easy application and reporting.

The next grant deadline is August 1st, 2021.

More information can be found on our website here: www.chnep.org/conservation-grants



CHNEP recently joined *Growing Climate Solutions* - a regional climate initiative aimed at developing a network of local organizations, leaders and citizens who will work to build climate awareness, protect our natural assets and empower Southwest Florida residents, businesses and civic institutions to support and engage in climate solutions. Learn more at <https://growingclimatesolutions.org>.



Introducing Conservation Associate Intern Sarina Weiss

Sarina graduated from the University of Florida with a BS in Wildlife Ecology and Conservation, and has since worked on several projects involving wildlife research and data science. "I am excited about CHNEP's holistic mission to protect and restore water quality and flows, habitats, and the fish and wildlife they support." Sarina is already using her GIS and scientific research skills to assist in several CHNEP projects.



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2021 Southwest Florida Climate Summit

The Coastal & Heartland National Estuary Partnership hosted the inaugural 2021 Southwest Florida Climate Summit on May 6th, together with our event sponsors: the Florida Gulf Coast University Water School, Environmental Defense Fund, and WGCU Public Media. The day-long event was comprised of five sessions featuring *Southwest Florida Climate Leadership*, *the State of Climate Change in Southwest Florida*, *the Policy and Legal Framework for Climate Action*, *Growing Climate Awareness*, and *Actions to Move Resiliency Forward* - each featuring an interactive audience question and answer period.

The summit began with the *Climate Leadership* session, starting with a video address from Senator Marco Rubio of the bipartisan Senate Climate Solutions Caucus, who shared how he believes “a holistic approach to improving environmental quality and restoring debilitated ecosystems must be central to improve our state’s climate resilience.” In Director of the US EPA’s Region IV Water Division Jeaneanne Gettle’s video address, she explained how the administration has made “addressing climate change a priority” with a “focus on community partnerships.” It concluded with a live presentation followed by a question and answer period with Florida’s Chief Resiliency Officer and Secretary of the Florida Department of Environmental Protection Noah Valenstein, who explained new tools, resources, and processes for expanding resiliency initiatives across the state.

Q&A Chief Resiliency Officer and Secretary of FDEP Noah Valenstein

rise?

Can you speak to what co2 mitigation efforts might be included in the upcoming plans at the state level?

What are efforts for the dissolution of phosphate waste storage lakes

what mechanism is in place for adjustment of projections in a timely fashion as conditions change in order to have meaningful resilience projects and adjustment to the year 3 projects?

How can we make permitting easier for restoration and enhancements projects?

process to help incentivize green infrastructure?

Will there be funding available for local non-profits to participate in your community vulnerability analysis or other data collection projects?



Videos and other Summit materials available at
<https://www.chnep.org/2021-climate-summit>

SW Florida - Evidence of Sea Level Rise

Barrier Island Instability, Erosion, and Migration



Back-barrier Mangroves on Beach
Keewaydin Island

Saltern Formation Islands within
RBNERR



Erosional Dune Scarp After Debby, Keewaydin Island



In the *State of Climate Change* session, participants were treated to briefings from some of Florida’s top climate scientists, as well as lead CHNEP science staff. Dr. Joanne Muller explained how “sea level rise, and storms on top of that, are really affecting our coastline”, showing local photos and data that has been collected on those coastline changes (see picture above). Dr. Wendy Graham went over the implications of climate change on Florida’s water resources, where she explained that though increased temperatures of 1-3 degrees Celsius is fairly certain - future rainfall amounts in response to climate change are not, and that could potentially impact meeting future water supply needs. CHNEP Research & Outreach Manager Nicole Iadevaia wrapped up the session, sharing research on habitat shifts and migration in response to climate change. The science shared helped participants understand what we know about the types of climate changes and impacts we will likely see in our region.

The *Policy and Legal Framework* session featured top national and state climate policy and legal professionals. Elizabeth Gore from the DC Environmental Defense Fund office shared the latest federal-level policy developments and Whitney Gray of the Florida Department of Environmental Protection’s Office of Resiliency shared current state-level Florida Resilient Coastlines Program projects and initiatives. Rounding it off was environmental attorney Erin Dedy going over what local governments are doing to create local policies to mitigate climate change impacts. From these presentations, audience members gained an understanding of the policy and legal avenues that are available for advancing climate action.

250+ participants gather for a day-long virtual summit on Climate Change, the first in the region.

In the *Growing Climate Awareness* session, CHNEP Executive Director Jennifer Hecker presented the CHNEP Climate Change Vulnerability Assessment - covered in the next article in this magazine. Messisa Baldwin from Florida Clinicians for Climate Action then provided riveting information about how climate change will directly affect human health - including exacerbating heat-related illnesses, allergies, mosquito-borne illnesses, and worsening air-quality. She shared that “climate solutions are health solutions,” in that many things that help us live healthier lives actually also reduce drivers of climate change - like walking or biking whenever possible versus driving.

Dr. Ana Puszkin-Chevlin of Growing Climate Solutions talked about various surveys to gauge people’s views on climate change, which show that half the people in Florida know that climate change is occurring, and half of those people believe that human activities are contributing to it. She also covered specific strategies for helping to raise public awareness and engagement, which starts with people talking about it more and incorporating personal climate actions into their lifestyle. Presenters brought this down to a personal level, with ideas on how we can protect our health and the environment, as well as raise climate awareness and action amongst those we interact with on a daily basis.



Life-threatening storm surge was forecast for areas of the Florida panhandle. This mobile home park north of the coastal highway in Mexico Beach, Florida, was washed away from the storm surge and wave impacts of Hurricane Michael, Nov. 2, 2018 (NOAA)



The final session was devoted to *Actions to Move Resiliency Forward* in Southwest Florida. Dawn Shirreffs, Florida Director of Environmental Defense Fund, presented on a state economic study on the costs of inaction in what we are experiencing right now in climate-related economic costs. They found Southwest Florida to be suffering the worst economic losses. The study also determined that, by 2045, both Lee and Manatee counties could each lose \$22 million each in property taxes due to chronic flooding, and that families will have to pay 5-7% annually in increased energy associated from higher temperatures. Dr. Mike Saverese closed the Summit with the hopeful recent development of a Southwest Florida Climate Compact being formed, comprised of Collier, Lee and Charlotte counties as well as ten incorporated cities within them - to work collaboratively on building resiliency on a regional scale. He concluded that “hopefully there are brighter, but not warmer, days ahead.”

We thank those who attended, and plan to host another Climate Summit in Spring 2022. Videos of the presentations and a Citizen Climate Action Guide, are available at chnep.org/2021-climate-summit.

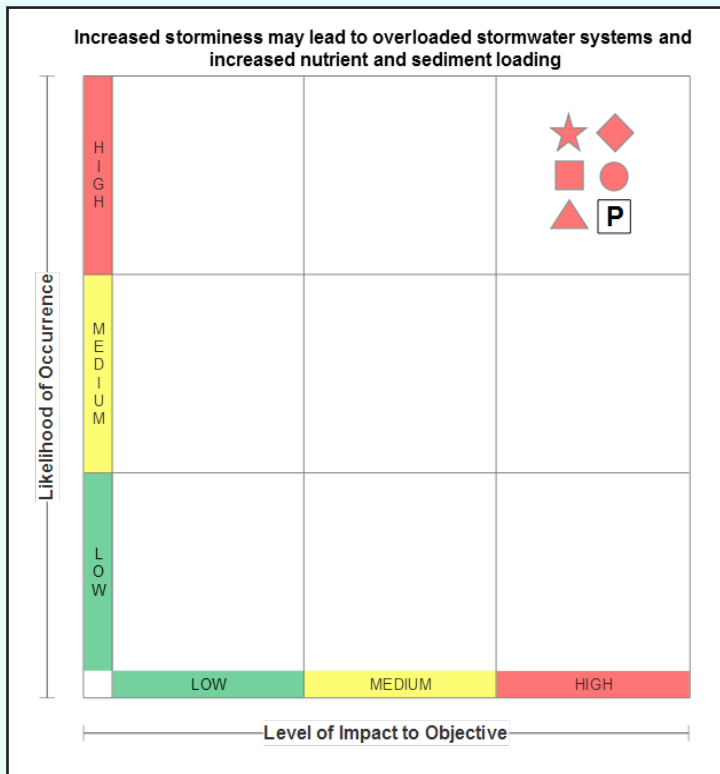
Thank you to our Event Sponsors:



CLIMATE AWARENESS

The Coastal & Heartland National Estuary Partnership surveyed a group of experts and citizens to assess their awareness of potential climate change risks that could impede achievement of the CHNEP's Comprehensive Conservation and Management Plan (CCMP) goals - improving water quality, restoring hydrology, and protecting fish, wildlife, and their habitats.

Forty-eight climate risks were identified and evaluated for their likelihood to occur, and their potential level of impact to an objective if they did occur (with both ranked low, medium, high). This exercise helped to identify areas of scientific consensus as well as where additional research is needed. It also helped identify where there were significant disconnects between the public and the experts - indicating topics where more public outreach and education may be needed.



The above graphic illustrates where the experts (represented by different shapes) agreed with each other, and where the public (represented with the P) agreed with the experts. This occurred in less than half of the risk assessment response results.

The following topics are where the public and experts had differing levels of awareness:

Water Quality Improvement

- Sea level rise may lead to septic system failure and increased nutrient and bacteria loading. The experts ranked this as high likelihood and impact while the public ranked it as low on both.
- Precipitation changes and changes in evapotranspiration rates may alter freshwater flows, affecting salinity and other constituent levels. Experts ranked this as medium to high level of likelihood and impact, and public ranked as low on both.
- Sea level rise and/or precipitation changes may lead to inundation of contaminated areas. The experts ranked this as highly likely and impactful, while the public ranked it as low likelihood and impact.
- Sea level rise may shift salinity regimes farther upstream, constraining oyster habitat and affecting reef productivity. The public ranked this as low likelihood and high level of impact.

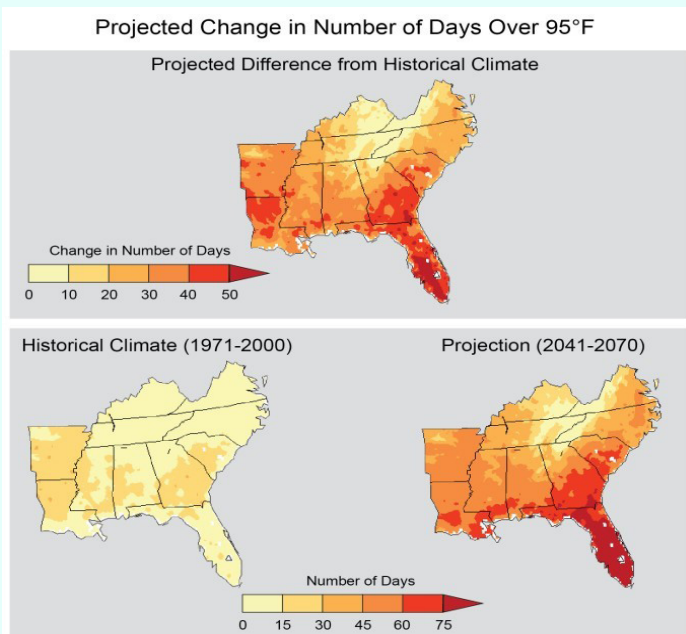
Restoring Hydrology

- Sea level rise may lead to more frequent flooding and an increased demand for artificially created drainage and flood protection structures. Experts ranked high, whereas the public ranked low likelihood of occurrence and medium level of impact.
- Changes in precipitation, temperature, and sea level rise may affect hydrological restoration planning objectives and priorities. Experts ranked medium to high, and the public ranked this as low.

Fish and Wildlife Protection

- Warmer temperatures may affect plant zonation. Experts ranked medium to high, whereas the public ranked low likelihood and medium impact.
- Ocean acidification may impact shellfish and condition of habitat created by shellfish. Experts ranked medium to high, and the public ranked it as low likelihood and high level of impact.
- Sea level rise may cause loss of existing shallow water and coastal habitat. Experts ranked high, whereas the public ranked as low likelihood and high level of impact.

The CHNEP surveys experts and the public to gauge their level of awareness of potential climate threats to our water and wildlife.



These disconnects can arise from scientific information not being effectively communicated to the public, or inadequately explaining how a climate factor might create a cascading series of effects - such as sea level rise raising the water table, which can lead to septic system drainfield failure, that in turn would cause more nutrient pollution to enter ground and surface waters. While water managers are aware of these issues, the public needs to be as well.

The good news is here are a number of issues that the public and experts agreed on, having a similar level of awareness and understanding, including that:

- Warmer temperatures may promote bacteria growth or disease, promote algae growth, and lead to lower dissolved oxygen levels
- Increased storminess may lead to overloaded stormwater systems, increased nutrient loading, and loss of vegetative buffer.
- Changes in precipitation and evapotranspiration rates may alter freshwater flows, affecting salinity and other constituent levels.
- Sea level rise may lead to loss of coastal vegetation, changes to coastal morphology, and alter water exchange between gulf and estuary.
- Ocean acidification may impact shellfish populations.
- Increased temperatures may lead to higher rates of evapotranspiration.

- Precipitation changes may lead to reduction in freshwater flows and less water to meet minimum flow levels.
- Loss or degradation of wetlands may impact freshwater flows and drainage patterns.
- Sea level rise may push development inland, altering drainage patterns.

CHNEP used this information in updating our strategic plan, to ensure it aims to minimize these risks. This consensus allows us to begin taking actions right away on these fronts.

To reduce risks to our communities, we can avoid building in wetlands and floodplains, convert areas on septs to centralized sewer where possible, increase the amount and level of stormwater treatment required in new developments, provide better bicycling and walking path networks to allow people to safely use alternative transportation methods to cars, plant more trees to provide shade to reduce the heat island effect of urbanized areas, as well as a host of other actions. These would work to reduce climate drivers to slow climate change, and allow us to better adapt our communities to the changes that will be occurring - such as higher temperatures, sea level rise, and increased frequency and severity of major storms.

We can also take action to build a more resilient natural environment by restoring it now to its healthiest state. Our waters have the ability to absorb small amounts of pollution, but when they are already overloaded, they cannot take any added pollution from stormwater, agricultural and industrial runoff, and wastewater spills that occur with increased major storms. Habitats can migrate if there are sufficient contiguous areas for them to move inland and upland, but if those areas are not provided for, then wildlife movement corridors as well as some habitat types and wildlife species could be lost. Raising public awareness on the changes likely to occur enables us to better manage these natural resources to protect our water and wildlife.

The Climate Change Vulnerability Assessment Report is available at <https://www.chnep.org/publications>

ADDRESSING A GROWING PROBLEM: MACROALGAE



A 3-day workshop was recently held to discuss a growing problem in Florida, excessive macroalgae. The workshop focused on the estuaries of the four National Estuary Program entities in Florida (including the Coastal & Heartland National Estuary Partnership, Indian River Lagoon National Estuary Program, Sarasota Bay Estuary Program, and Tampa Bay Estuary Program). Over three days, participants learned about what macroalgae is, where it is becoming overabundant, what contributes to it occurring, and what its impact is on aquatic life. There was also discussion on gaps in scientific knowledge and what research is needed to fill those gaps.

Macroalgae are easily seen aquatic plants, unlike smaller organisms which appear to just tint the water like red tide or cyanobacteria blue-green algae. There are three main groups: red (ex. *Gracilaria*), green (ex. *Caulerpa* - pictured above, *Ulva*), and brown (ex. *Sargassum*). When macroalgae becomes overly abundant, it can negatively affect fisheries, recreation, and important aquatic habitats.

Many aspects about the macroalgae blooms occurring in our region have not been well studied. What is known is that excessive nutrients can increase macroalgae growth, which can then reduce the available light needed for seagrass. Recently, the eastern portion of Charlotte Harbor experienced a significant seagrass loss of approximately 50%, in areas where macroalgae have been observed to be proliferating. Unfortunately, there are similar occurrences all across Florida. For example, in the last seven years, Sarasota Bay has seen higher nitrogen levels than the previous 15 years, which has resulted in seagrass declines and macroalgae increases. By sharing such information at this workshop, it was

clear to participants that this is becoming a serious statewide issue.

When water quality declines to the point that it is no longer safe for its intended use, typically a total maximum daily load (TMDL) pollution limit is established to lower pollution levels. Many TMDLs in Florida have been established to control nutrient pollution, a contributing factor to excessive macroalgae growth. In the Indian River Lagoon and Kings Bay, the nutrient TMDLs are being met but macroalgae blooms are still occurring. Workshop participants discussed whether those limits may need to be adjusted to further reduce nutrients to lessen excessive macroalgae growth. The macroalgae can also uptake nutrient pollution from the water column, reducing measurable amounts in samples, leading to better water quality readings. However, those nutrients are re-released when the algae later dies off, leaving that nutrient pollution still in the system to cause future problems.

Macroalgae can also affect the whole aquatic food chain, both through what feeds on it directly and how it affects those that feed on what it is displacing - seagrass. Research has shown that macroalgae, especially those in tropical and reef areas, can produce toxins that can act as an herbivore deterrence. Aquatic herbivore animals such as manatees are left without enough of their traditional food source, seagrass. Meanwhile, there is anecdotal evidence that after a macroalgae bloom, there is an explosion of “sea hares” or sea slugs (pictured below) that feed upon the algae. The change in aquatic plants changes the animals in that system as well.



The CHNEP is working to support macroalgae monitoring efforts occurring within the CHNEP area. *Eyes on Seagrass* is a University of Florida - IFAS citizen science project comprised of volunteers conducting surveys in April and July. The program focuses on gathering seagrass and macroalgae data, to determine the amount and types that are present. CHNEP interns are assisting in sample collection, and the CHNEP offered a training event for those interested in volunteering.

Additionally, the Southwest Florida Water Management District has conducted aerial seagrass mapping since 1988. They have been able to see the successional variation of rooted macroalgae from the aerial imagery and have documented patterns.

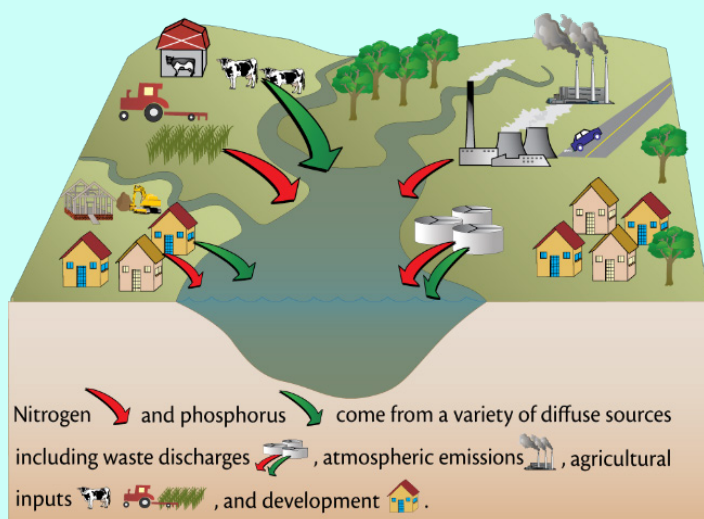
From the limited data collected to date, it appears that the macroalgae is most abundant in many Gulf estuaries in the summertime, whereas in Charlotte Harbor and Pine Island Sound, it is in the winter. The CHNEP is in the process of collecting all publicly accessible harmful algae data to create an interactive mapper that will allow natural resource managers and the public to view all of that data with other information, such as seagrass and water quality data. By putting it all together, we hope to learn more about related interactions.

Although these monitoring efforts and a few others are occurring, added macroalgae monitoring is needed to address filling knowledge gaps in understanding the scope and implications of this growing problem.



UF/IFAS photo by Tyler Jones

Conditions are likely to become even more favorable to macroalgae growth with climate change. Increasing water temperatures and more potential runoff and spills from more intense storms and heavy rainfall events could wash even more nutrient pollution into waterways. While macroalgae has been around for millions of years, its widespread overabundance is relatively recent and there are improvements to water management policies and infrastructure that can reduce some of the contributing factors to its excessive growth.



Nutrient pollution is when an excessive amount of man-made nutrients, nitrogen and phosphorous, enter waterbodies. Nutrient pollution is a common problem in Florida and accounts for about 73% of all waterway impairments, which means those waterbodies are not meeting state water quality standards. There are many sources of nutrient pollution including agricultural and industrial runoff, urban stormwater runoff, and wastewater discharges/failing septic systems. Excessive nutrients can lead to increased algae growth, reduced dissolved oxygen, and decreased water quality.

Diagram courtesy of the Integration and Application Network (ian.umces.edu), University of Maryland Center for Environmental Science. Source: Lane, H., J.L. Woerner, W.C. Dennison, C. Neill, C. Wilson, M. Elliott, M. Shively, J. Grallie, and R. Jeavons. 2007. Defending our National Treasure: Department of Defense Chesapeake Bay Restoration Partnership 1998-2004. Integration and Application Network, University of Maryland Center for Environmental Science, Cambridge MD.

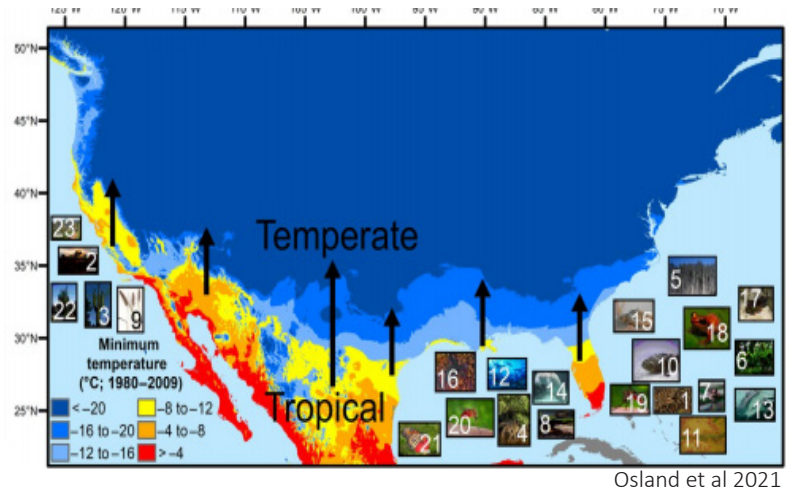
THE TROPICS ARE MARCHING NORTHWARD

In recent years, climate change studies have revealed that, in addition to changes in average temperatures, there will also be changes with regards to temperature extremes. In North America, warmer winter temperatures are expected to lead tropical (cold-sensitive) organisms to expand their ranges northward, pushing out some native temperate (cold-tolerant) species. This is referred to as tropicalization.

Tropical-temperate transition zones are areas where the climate changes from hot temperatures (tropical) to more mild temperatures (temperate). In North America, many of these transition zones occur along Florida's coasts. In these zones, extreme cold events can cause severe impacts similar to natural disasters, triggering loss of certain types of native plants and animals.

In South and Central Florida, extreme cold events control how far north several plants, fishes, sea turtles, reptiles, amphibians, manatees, and insects can live. For example, mangroves are unable to survive extreme cold events and temperatures, so their northern range limits are strongly influenced by these events. During the last glacial maximum, about 19,000 years ago, mangrove range limits were confined to Central America. Since the last extreme cold events in the 1980s, warmer winters have allowed mangroves to expand north into the Southeastern United States. As mangrove forests continue moving north, they are taking over temperate salt marsh ecosystems in Texas, Louisiana, and North Florida.

CHNEP's Habitat Resiliency to Climate Change modeling found similar shifts from salt marsh to mangrove forest predicted in our area in response to sea level rise. Rising sea levels can cause mangrove forests to move inland, pushing out the upland and upriver ecosystems already there. Along with sea level rise, winter warming will also accelerate the tropicalization of salt marsh ecosystems by mangrove forests.



In addition to mangroves, warming winters are leading to northward range shifts in other species such as the tropical tiger mosquito. This carrier for dengue and chikungunya viruses was once confined to Florida and Texas. Due to warming winters, the tiger mosquito has been reported in over 30 U.S. states today, and it's range is expected to increase by 50% by the end of the century. As the climate continues to change, understanding the potential effects of tropicalization is imperative to better prepare and respond to its effects.



- **Contact your elected leaders to express your views on addressing climate change**
- **Invest in energy-efficient appliances**
- **Change standard light bulbs to LED's**
- **Use a programmable thermostat to set the AC temperature higher when you're away**
- **Use smart/advanced power strips and turn off electronics when not in use**
- **Lower the thermostat on your water heater to 120 F and add an insulating blanket**



GET INVOLVED

CHNEP offers both virtual and in-person free events to help you to get informed and engaged in helping to protect our water and wildlife in Central and Southwest Florida.

In the past few months, we've offered several events where participants were given information on how to collect data to support national and international science initiatives including the Great Backyard Bird Count. One participant was doing the count here in Florida, while her granddaughter was doing it virtually with her in Scotland!

CHNEP also hosted an Earth Echo Water Challenge event, in conjunction with World Water Day. We handed out water testing kits that allows volunteers to test waterbodies near their home. Following a presentation on water quality which also instructed participants on how to use their water kits and how to add the data to a central website - each participant was

given a free water quality testing kit to take with them. The kits can be used multiple times, so the health of the same waterbodies can be tracked throughout the year.

CHNEP has also been doing public outreach at regional community events, including the Swamp Cabbage Festival in LaBelle, the Chalo Nitka Rodeo in Moore Haven, and the Frostproof Earth Day. We are always looking for volunteers to assist us in helping to deliver environmental education and resources to communities - including those traditionally underserved in our region.

We hope you will consider signing up as a CHNEP volunteer or attending one of our great upcoming events. To learn more about how you can get involved, please see our website for the Get Involved tab and our events at chnep.org/monthly-volunteer-events.



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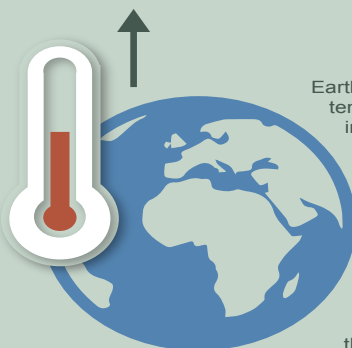
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BUILDING RESILIENCE TO CLIMATE IMPACTS

WHY AND HOW IS CLIMATE CHANGING?

CARBON DIOXIDE

Increasing surface, atmospheric, and oceanic temperatures since the mid-20th century are primarily caused by human activities, especially greenhouse gases emissions such as carbon dioxide, much of which is produced by the burning of fossil fuels.



Earth's average temperature has increased by over

1°C

in the past century, and scientists predict temperatures will continue to rise more quickly over the coming century.

HOW IS CLIMATE CHANGE IMPACTING THE OCEAN?

The ocean has **absorbed over 93%** of the excess heat from greenhouse gases, but its ability to buffer climate change impacts has become overloaded.

WARMING OCEAN ▶

Sea surface temperature has warmed by nearly **0.8° C** since 1900. Warmer waters can damage or kill coral reefs, hold less oxygen to sustain marine life, change ocean currents, and generate more intense storms.



OCEAN ACIDIFICATION

The ocean has become **30%** more acidic over the past 200 years due to increased carbon dioxide, reducing the ability of marine life to form shells and skeletons and affecting the ocean food web.



RIISING SEA LEVELS ▼

Rising sea levels caused by warming ocean and melting glaciers affect coastal habitats and threaten coastal communities, including many major cities.



EXTREME WEATHER EVENTS

Stronger storms damage both human and ecological communities. Marine heat waves (extremely warm temperatures over extended periods) can cause mass mortality of marine species.



IUCN WCPA