HURRICANE IAN

4
Maximum Category

9.4
Max Inches of Rain
(measured by NERRS)

59
MPH of Max Wind Speed
(measured by NERRS)

9+
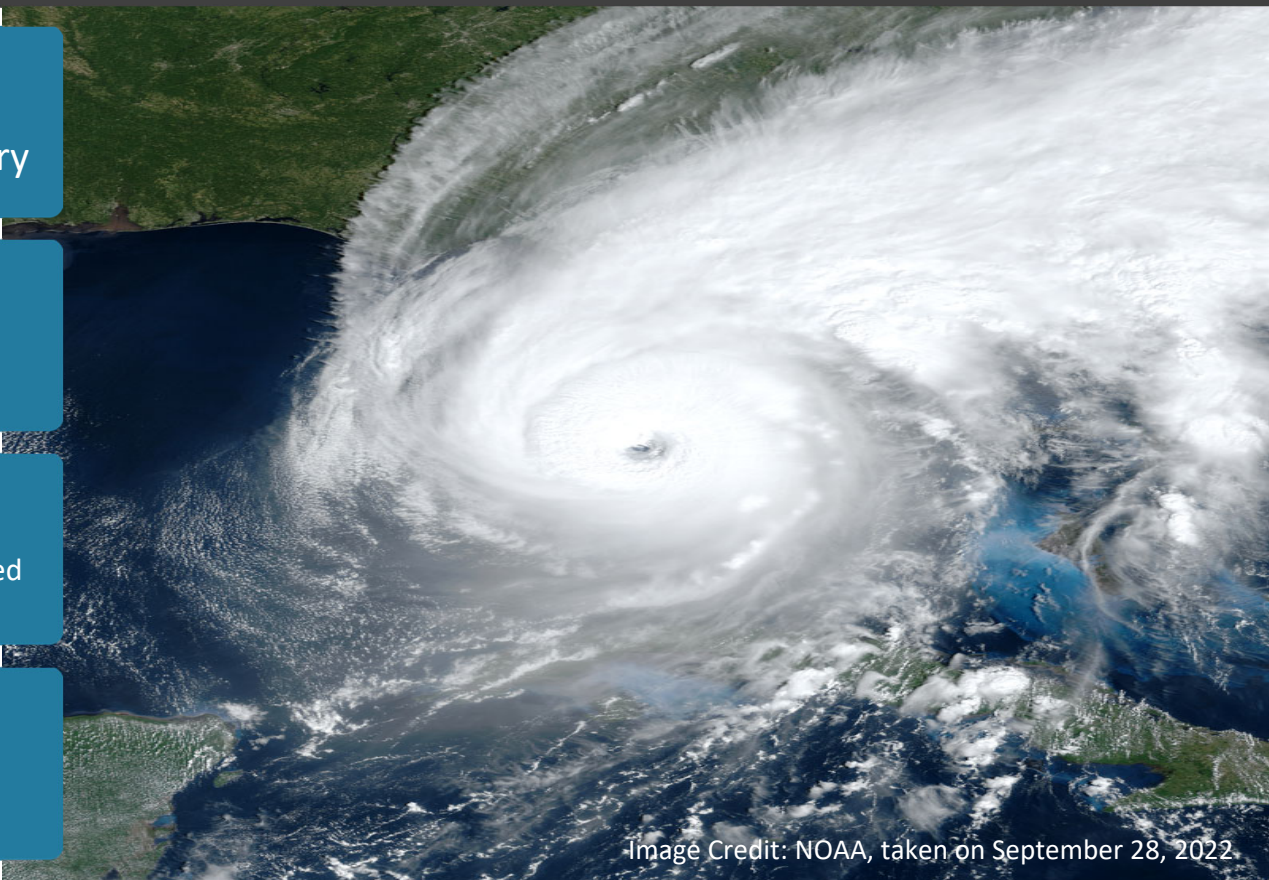Max Feet of Storm
Surge

Image Credit: NOAA, taken on September 28, 2022

Monitoring the Impact of Hurricane Ian across the NERR System
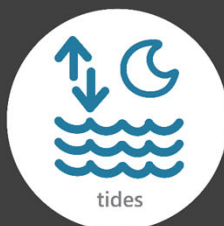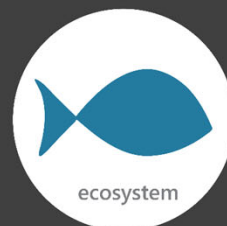
wind + flooding rain + storm surge + tides + ecosystem

Hurricane Ian was the most destructive hurricane of the 2022 Atlantic hurricane season. It first made landfall in Cuba, then hit the gulf coast of Florida as a Category 4 hurricane. The storm slammed into Florida coast north of Naples and crossed over the state to the Atlantic near Melbourne, Fl. Over the Atlantic, the storm strengthened again into a Category 1 and turned west toward the Carolinas. It made landfall a second time near Georgetown, South Carolina before passing over North Carolina and weakening. The storm caused damage across the southeast, affecting six different National Estuarine Research Reserves. Impacts were varied across the region. High winds resulted in the most damage for some communities while others experienced coastal flooding due to storm surge.

STORM STORIES

ACE Basin NERR

NATIONAL ESTUARINE RESEARCH RESERVE SYSTEM

NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

National Estuarine Research Reserve System
Science Collaborative

Data shown are based on NERRS monitoring sites
Created on December 16, 2022

NERR System

The **National Estuarine Research Reserve System (NERRS)** is made up of 30 Reserves across the country. Each site is a state-federal partnership that combines research, monitoring, and education to advance the understanding and management of estuarine environments.

NERRS
Centralized Data
Management Office
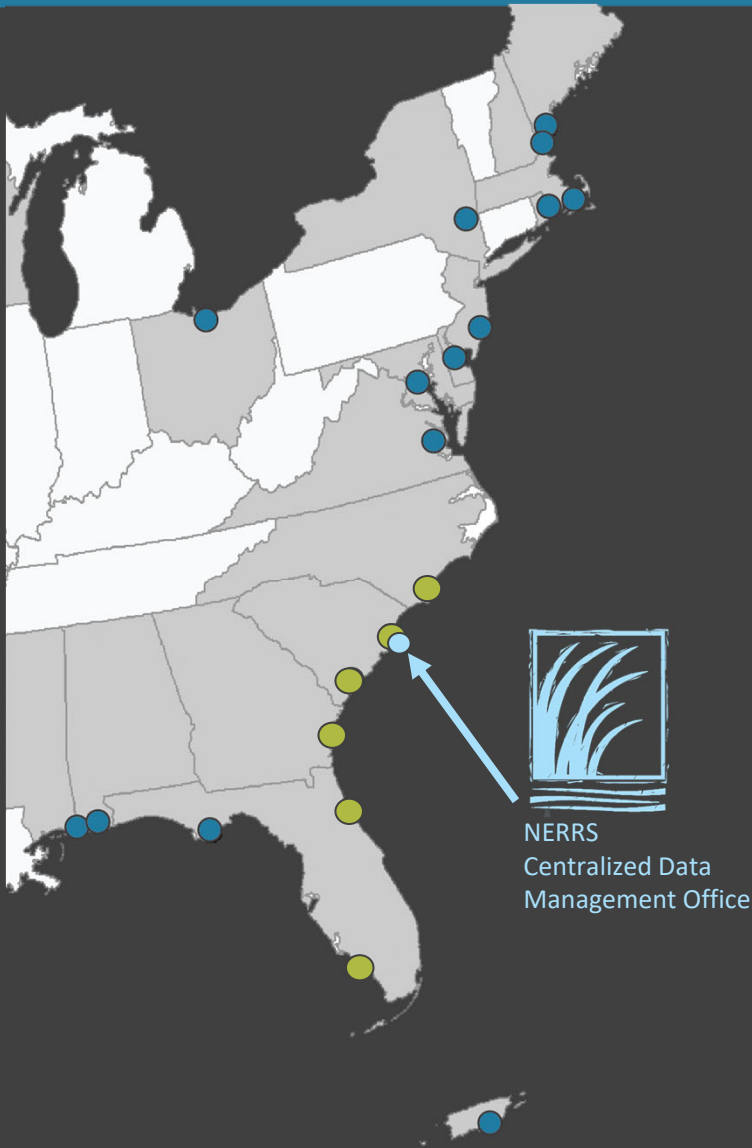
Locally Relevant, Nationally Significant

The **System Wide Monitoring Program (SWMP)** tracks weather and water quality as a storm happens and the impacts that follow. Scientific instruments (i.e., data sondes and sensors) are deployed at Reserves along the Atlantic and Gulf of Mexico coastal areas collecting data on the condition of our estuaries 24/7 to help protect people and places.

Data from the extensive monitoring network are delivered to the **Centralized Data Management Office (CDMO)**. Near real-time SWMP data are now available to via smartphone or tablet at: **www.nerrsdata.org/mobile**

This **Storm Story** covers the six Reserves that were impacted by Hurricane Ian, shown in green.

NERRS Storm Monitoring

Each NERR operates a weather station and maintains continuous, long-term water quality stations. The Reserves in this report each maintain several SWMP stations within their estuaries. ACE Basin NERR south of Charleston, SC operates a weather station located at Bennett's Point (BP under MC) and maintains six continuous, long-term water quality stations.

As Hurricane Ian approached each Reserve, SWMP stations monitored the weather and water quality, collecting data every 15 minutes for the following parameters: air temperature, relative humidity, atmospheric pressure, rainfall, wind speed and direction, water temperature, depth, salinity, dissolved oxygen, turbidity, and pH.

GP
FC
JI
MC
SP
EI

- ● Weather Station
- ● Water Quality Sample Location
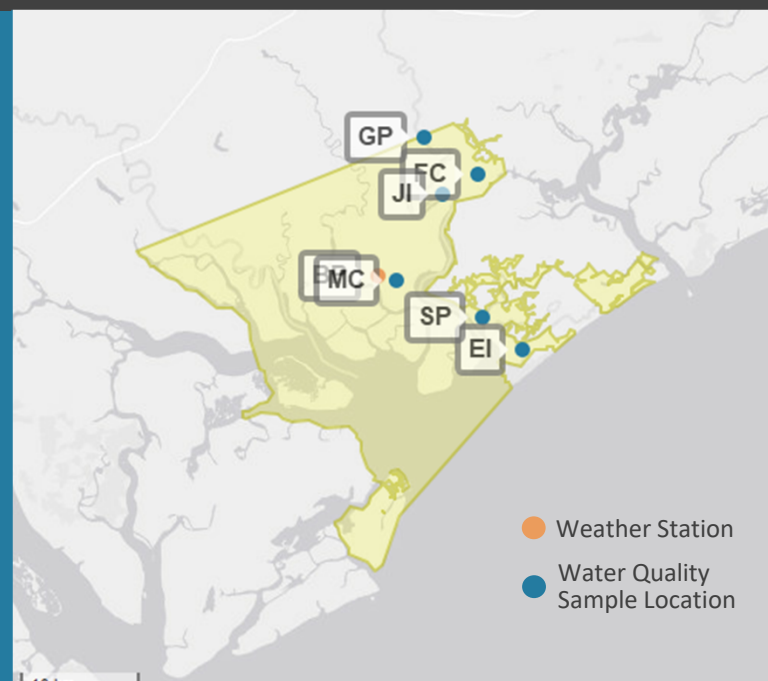
Storm Track

Hurricane Ian first made landfall in Cuba, then slammed into the Florida coast north of Naples as a Category 4 storm. It crossed over Florida to the Atlantic, passing near Melbourne, Fl. Passing over land weakened the storm, but it strengthened again into a Category 1 and turned north toward the Carolinas. The storm track predictions changed rapidly at this stage. Initial models predicted the storm would make landfall near the GA-SC border, but as it approached the coast the track continued shifting north. It eventually made landfall a second time near Georgetown, South Carolina, then moved into North Carolina where it finally weakened.

Ian was a Category 4 on the Saffir–Simpson scale when it made landfall near Cayo Costa, Florida. It weakened to a Tropical Storm as it passed over the state, but by the time it reached the NI-WB Reserve, it was a Category 1 storm.

ACE

Ian

Event Impacts

Human Health & Safety

– At least 160 direct fatalities resulted from the storm, mostly in Florida

– Over 2.7 million people were without power in Florida and the Carolinas

– Numerous roadways were flooded or damaged, including the causeway connecting Sanibel Island, Fl to the mainland

Economic Losses

– Damages and losses due to Ian exceeded $50 billion dollars

– More than 30,000 homes were damaged

– Unemployment is likely to rise in impacted areas, especially in tourism

Ecosystem Impacts

– Coastal flooding resulted in pollutants, such as sewage and debris, entering aquatic ecosystems

– Storm surge caused significant erosion of beach and dune ecosystems.

– Southeast ecosystems are adapted to hurricanes, but stressors from human activities make them more vulnerable to disturbances
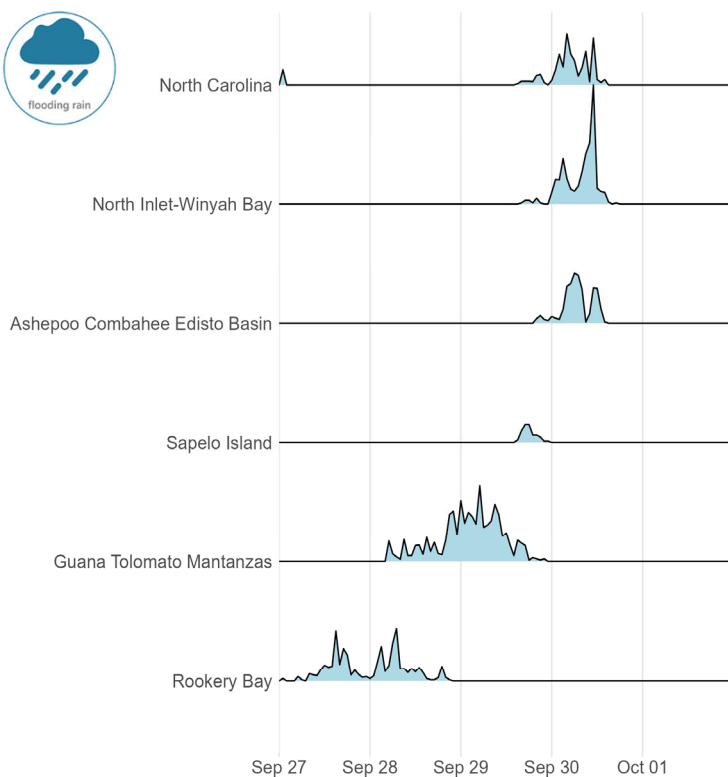
Weather Data

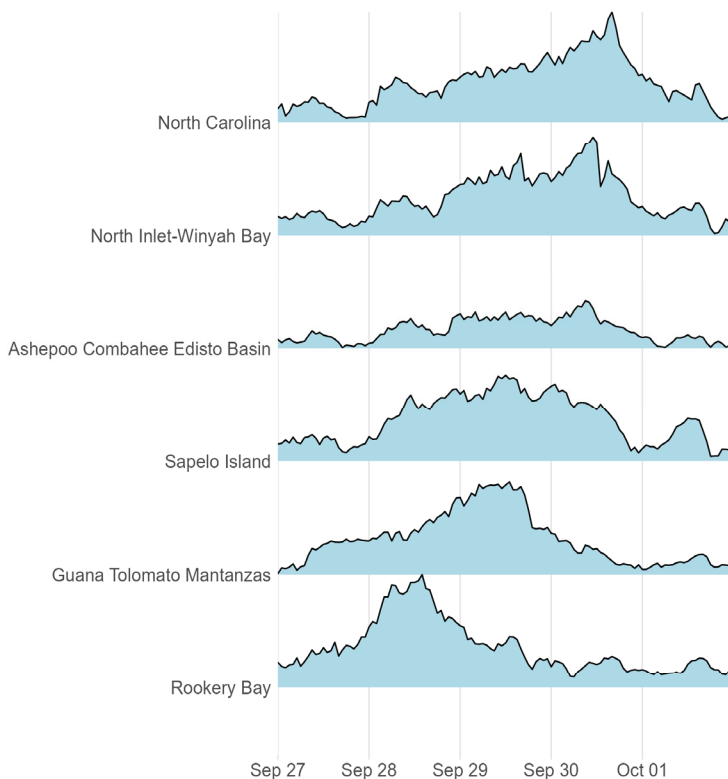| Reserve	Date	Total Precipitation (inches)	Average Relative Humidity (%)	Max Wind Speed (mph)	Min Barometric Pressure (millibars)
Rookery Bay	9/28/2022	2.7	97	59	995
GTM	9/29/2022	6.3	92	48	1001
Sapelo	9/29/2022	0.7	75	47	1008
ACE Basin	9/30/2022	3.1	93	27	1001
NI - WB	9/30/2022	4.6	94	51	981
North Carolina	9/30/2022	2.8	90	59	997

The highest wind measurements were recorded by Rookery Bay NERR in Florida, followed by the North Carolina NERR. GTM NERR received the highest cumulative rainfall.

Data reporting time periods for Hurricane Ian: 9/27/22 - 10/1/22

RAINFALL

Rainfall measurements at southeast NERRS stations:
- North Carolina
- North Inlet-Winyah Bay
- Ashepoo Combahee Edisto Basin
- Sapelo Island
- Guana Tolomato Mantanzas
- Rookery Bay

Sep 27 · Sep 28 · Sep 29 · Sep 30 · Oct 01

Rainfall measurements at southeast NERRS weather stations from Sept. 27 - Oct. 1

WIND SPEED

Maximum Wind Speed at southeast NERRS stations:
- North Carolina
- North Inlet-Winyah Bay
- Ashepoo Combahee Edisto Basin
- Sapelo Island
- Guana Tolomato Mantanzas
- Rookery Bay

Sep 27 · Sep 28 · Sep 29 · Sep 30 · Oct 01

Maximum Wind Speed at southeast NERRS weather stations from Sept. 27 - Oct. 1

Hurricane Ian caused major damage to coastal development and infrastructure such as causeways and piers

Image Credit: Ricardo Arduengo/AFP via Getty Images

Image Credit: NAPLES POLICE DEPT. TWITTER

Hurricane Ian made two hurricane-strength landfalls in the continental US. Across the region, impacts varied depending on the strength of the storm and location relative to its track. Southwest Florida was battered by winds nearly 150 mph. Coastal towns were inundated with storm surge, while inland areas received intense rainfall. Other areas experienced coastal erosion from scouring waves.

In Florida, Rookery Bay NERR is south of where Ian made its first landfall. It recorded the highest windspeed, with a max of 59 mph. Despite making its second landfall at NI-WB NERR, the NC Reserve recorded higher wind speeds. Hurricanes are more intense on their northeast quadrant, and the NC NERR was positioned to receive the stronger winds. GTM NERR in St. Augustine received the highest cumulative rainfall during the event, most likely because the storm slowed as it passed over Florida. The NI-WB NERR experienced significant coastal flooding as a result of storm surge with no significant change in the ACE Basin NERR.

The diverse effects of the storm were reflected in the data recorded by NERRS SWMP stations. Ian highlighted that each hurricane is unique and a single storm can result in different experiences across coastal communities and their watersheds.
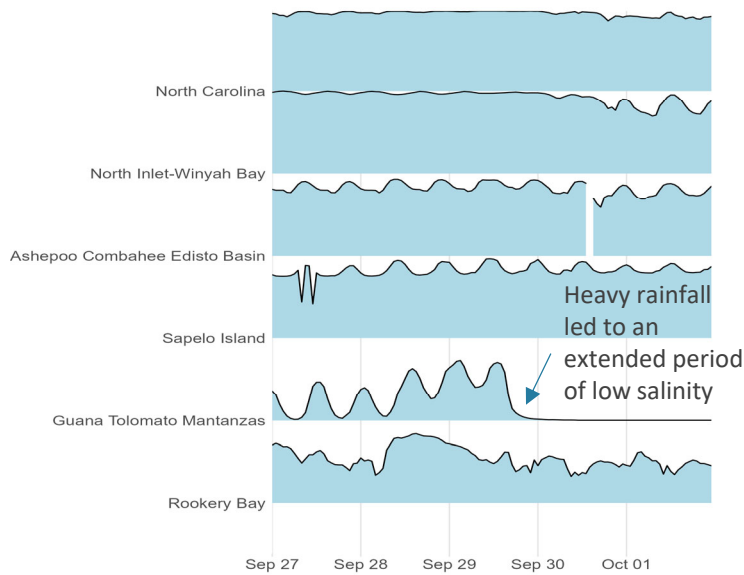
Water Quality Data

Reserves closest to the storm track saw the most pronounced spike in turbidity. GTM experienced a sustained drop in salinity following the storm.

Reserve	Date	Turbidity Maximum (NTU)	Salinity Minimum (psu)	Dissolved Oxygen Average (mg/L)	Maximum Depth (feet)
Rookery Bay	9/28/2022	379	11.8	5.7	9.9
GTM	9/29/2022	134	0.6	6.1	NA
Sapelo	9/29/2022	572	28.9	6.6	19.9
ACE Basin	9/30/2022	147	21.5	6.4	8.9
NI - WB	9/30/2022	423	27.7	6.4	13.0
North Carolina	9/30/2022	335	30.9	6.6	NA

Data reporting time periods for Hurricane Ian: 9/27/22 - 10/1/22

SALINITY

Heavy rainfall led to an extended period of low salinity

Salinity measurements at southeast NERRS water quality stations from Sept. 27 through Oct. 1

TURBIDITY
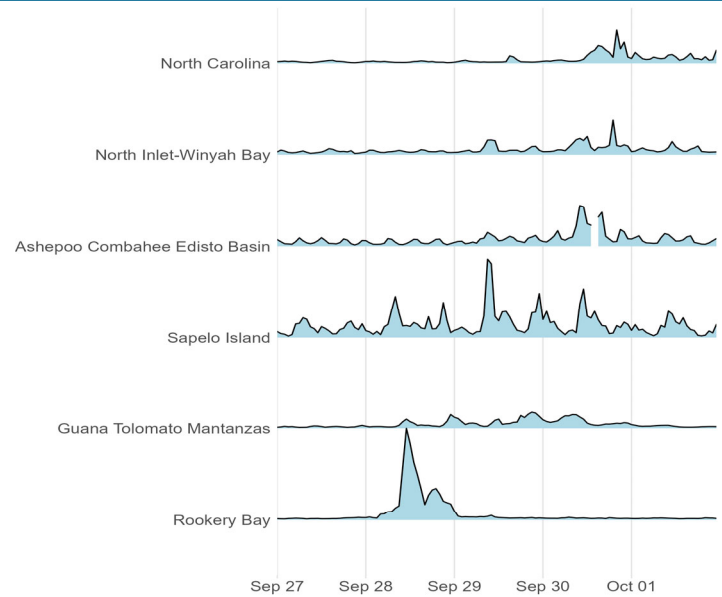
Turbidity measurements at southeast NERRS water quality stations from Sept. 27 through Oct. 1

Salinity and turbidity levels show different impacts of Hurricane Ian, as well as differences in the baseline conditions of estuaries throughout the NERR system. The most dramatic drop in salinity occurred at GTM NERR, where a pulse of freshwater moved down rivers and dropped estuary salinity to near zero. Other Reserves saw a more subtle drop in salinity from Ian's rainfall.

Each Reserve is different when it comes to "normal" levels of turbidity. However, most Reserves experienced a spike in turbidity when Ian passed by. Wave energy from the storm churned up sediments. Turbidity can be a stressor for aquatic organisms, but the spike in turbidity was a short lived disturbance in these estuaries.

Image Credit: Rookery Bay NERR
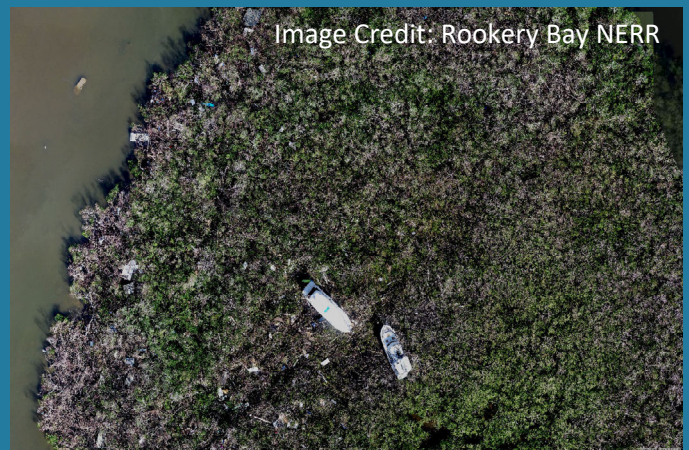
Boats and debris litter mangroves in southwest Florida. Coastal inundation introduces pollution that threatens the health of ecosystems and wildlife.

About NERRS

Established in 1972, the NERRS is a network of 30 ecologically significant, locally treasured estuarine places in 23 states and Puerto Rico. Each Reserve is a partnership between NOAA and a state agency or university. Most of the 1.3+ million acres of estuary lands and waters that Reserves help to protect and steward are open to the public. Reserves work with local decision makers, states, universities, nonprofits, and others to set natural resource management priorities and address them through research, environmental monitoring, education, training, and stewardship.

The health of every reserve is continuously monitored by the System Wide Monitoring Program (SWMP). SWMP is a robust, long-term, and versatile monitoring program that uses the NERRS network to intensively study estuarine reference sites for evaluating ecosystem function and change. Reserve-generated data and information are available to local citizens and decision makers. For more information, go to: **https://coast.noaa.gov/nerrs/**

Image Credit: City of St. Augustine Police

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DATA

Visit www.nerrsdata.org to view and download weather and water quality data from the NERR System.

EXPLORE

Interested in learning more? Visit https://northinlet.sc.edu/
https://dnrec.alpha.delaware.gov/coastal-programs/research-reserve/.
For video, news updates, online storm data and prediction visualization tools, check out our Storm Story Map at BLANK
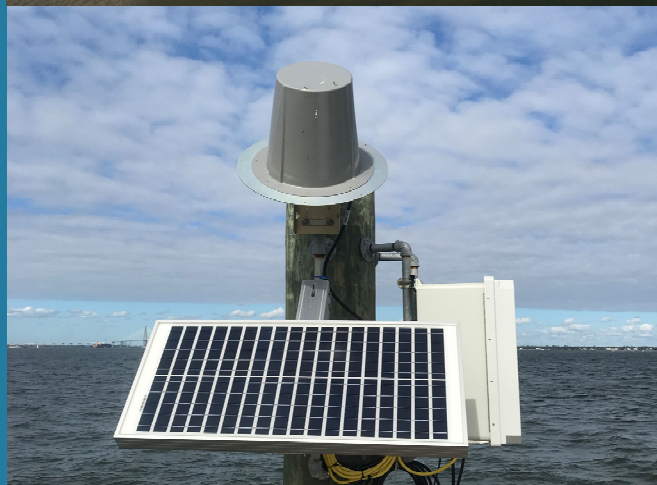
Image Credit: Town of Pawleys Island PD

National Estuarine Research Reserves Protect People & Places

Connect with us!

@NIWBReserve