

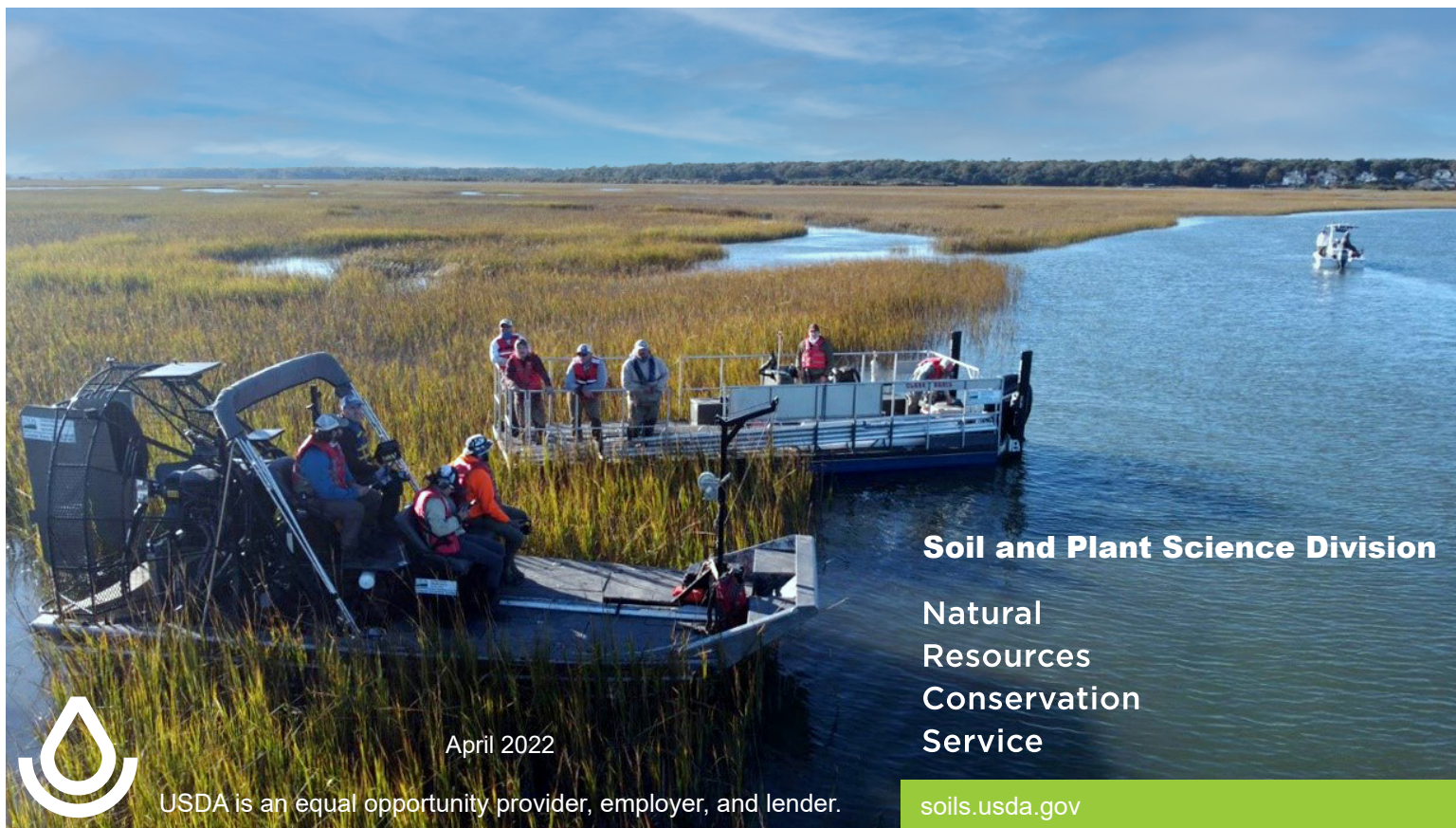


United States Department of Agriculture



Coastal Zone Soil Survey

Fiscal Year 2022



Soil and Plant Science Division

Natural
Resources
Conservation
Service

April 2022



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National Cooperative Soil Survey

The National Cooperative Soil Survey (NCSS) is a nationwide partnership of Federal, regional, State, and local agencies, private entities and institutions to cooperatively investigate, inventory, document, classify, interpret, disseminate, and publish information about soils. The USDA NRCS Soil and Plant Science Division (SPSD) provides leadership for NCSS activities and is committed to delivering science-based CZSS information.



Helping People Help the Land

in Nearshore and Coastal Zone Environments

The United States Department of Agriculture (USDA) is a world leader in delivering coastal zone soil survey data and technical soil services to urban, underserved, and socially disadvantaged communities vulnerable to extreme weather-related events along the coast.

For over two decades, the Natural Resources Conservation Service (NRCS) and partners of the National Cooperative Soil Survey have supported rigorous scientific content by gathering field and research data; building diverse and uniquely effective partnerships; and developing innovative approaches to produce and distribute coastal zone soil surveys.

A coastal zone soil survey (CZSS) is a seamless data set of soils information that encompasses coastal inland soils, tidal marshes, and shallow subaqueous and submerged soils. It provides spatial soil maps, a database of soil properties and characteristics, and interpretations. Soil surveys are a valuable resource for systematically evaluating land-use and climate changes from one soil area to another.

NRCS Mission:

We deliver conservation solutions so agriculture producers can protect natural resources and feed a growing world.

NRCS Vision:

A world of clean and abundant water, healthy soils, resilient landscapes, and thriving agricultural communities through voluntary conservation.

Knowledge of soil properties and characteristics along with their occurrence enables soil scientists to predict soil behavior under conservation management practices and climate change.





Soil and Plant Science Division

Providing data-driven science

By completing coastal zone soil surveys, the SPSP is:

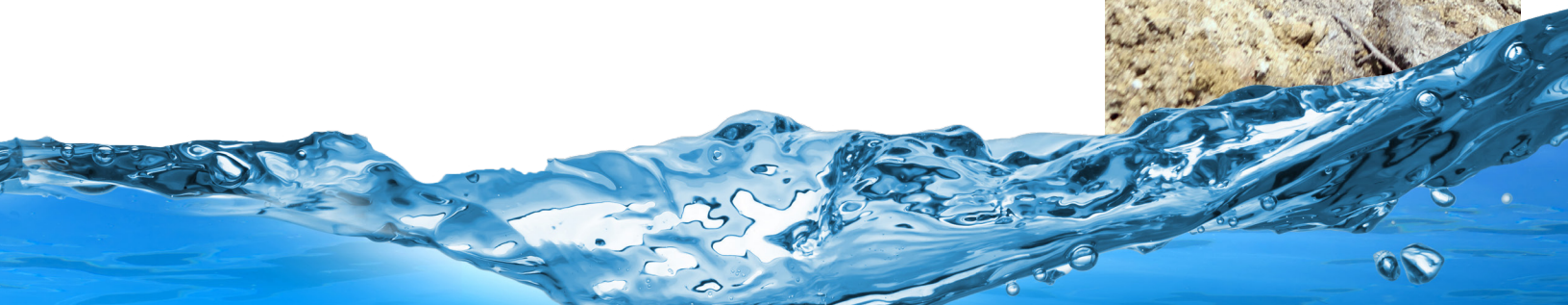
- Bridging the knowledge and information gap between climate science and farmers to increase their participation in conservation adaptation practices concerning coastal agricultural sustainability.
- Researching how natural resources may transform under the influence of climate change in the dynamic and resource-rich coastal regions.
- Investigating the sustainability of coastal agriculture and infrastructure in the face of a changing climate.
- Addressing critical skillsets to recruit, retain, and train soil scientists and ecologists to work in coastal zone areas.
- Integrating coastal resource management and proper land-use planning using best management practices to address viability and food security.
- Delivering soil survey data and technical soil services to urban, underserved, and socially disadvantaged communities along the coast.
- Assisting in the restoration of healthy, productive tidal marshes identified as having endangered, threatened and special concern species, as well as provide enormous ecosystem services through storm surge protection and sequestering carbon.

Coastal Zone Soil Survey Projects

This fiscal year, the Soil and Plant Science Division (SPSP) is working on the collection, analyses, and/or release of CZSS data for 16 projects, which will impact:

- 10 Major Land Resource Areas (MLRA) — 144A, 149A, 149B, 150B, 151, 153B, 153C, 153D, 155 and 273.
- 11 states and 1 territory — Connecticut, Delaware, Florida, Maryland, New Hampshire, New Jersey, North Carolina, Massachusetts, Puerto Rico, Rhode Island, Texas, and Virginia.
- Approximately 1.4 million acres.

CZSS supports Farm Bill programs that help address NRCS resource concerns such as soil erosion of shorelines or riverbanks, soil quality degradation, coastal flooding, water quality, carbon sequestration, and habitat degradation and loss.





Project Highlights



Senator Murphy Congressionally Directed Spending to complete a Coastal Zone Soil Survey of Long Island Sound

The Connecticut Council on Soil and Water Conservation, as prepared by board member Denise Savageau, submitted a request for congressionally directed spending for a coastal zone soil survey of Long Island Sound. Created by state statute, the Council coordinates activities and partnering opportunities of Connecticut's conservation districts and other federal, state and local agencies on environmental and natural resource land use projects.

The Council was notified that President Biden signed the bill into law on Friday, March 11, 2022.

The congressionally directed spending will provide USDA Natural Resources Conservation Service (NRCS) funding to work with partners to conduct and publish a coastal zone soil survey for the shallow water and nearshore mainland areas of the Long Island Sound Estuary System in Connecticut and New York. This will become part of the National Cooperative Soil Survey managed by NRCS and provide crucial information to help manage, restore, and protect the Long Island Sound and its coastal areas.





Project Highlights

CZSS supports Farm Bill conservation programs in New Jersey and Maryland

The Soil and Plant Science Division will publish CZSSs of two estuaries, Shrewsbury River in Monmouth County, New Jersey and South River in Anne Arundel County, Maryland, that are approximately 200 miles apart. Soil scientists determined that seven new soil series would need to be established, consisting of Sulfiwassents with glauconitic minerology. When the CZSSs are published, partners at the University of Maryland,

Stockton University, and New Jersey Department of Environmental Protection will use the soils data to assist with determining suitable areas for shellfish and subaquatic vegetation restoration efforts. With the development of aquaculture conservation practices in New Jersey, subaqueous soil mapping of these estuaries is critical in implementing Farm Bill programs.



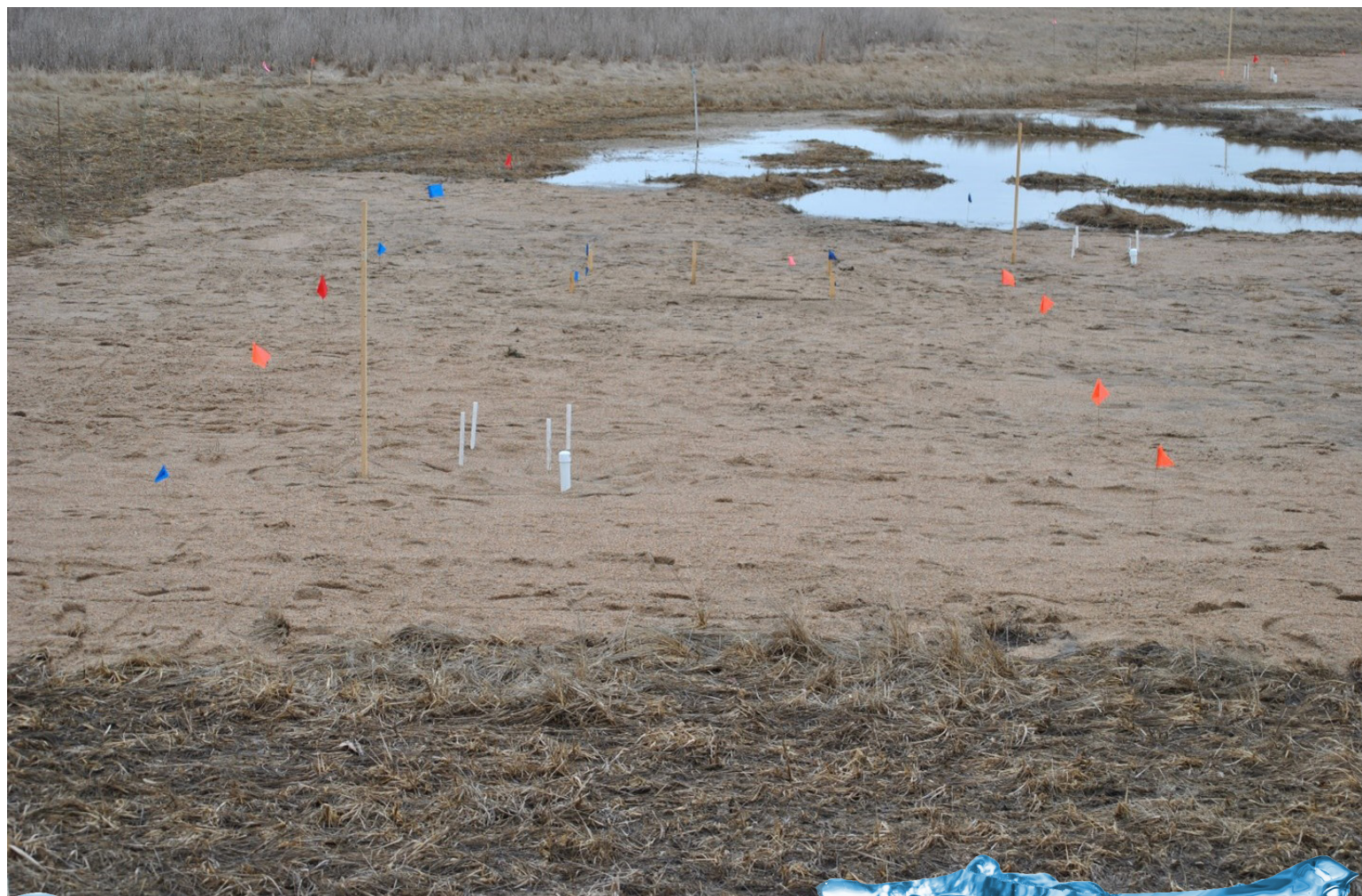


Project Highlights

Web Soil Survey identifies thin-layer placement in southern New England

Soil map units having a thin-layer of sediment placed on top of tidal marsh soils were updated along the Rhode Island and Connecticut shorelines. These updates are published in Web Soil Survey, the largest natural resource information system in the world and the single authoritative source of soil survey information produced by the NCSS.

Thin-layer placement is the addition of soil materials (from about 1 cm to 50 cm or more thick) to restore or enhance tidal marsh resilience. Updating CZSS soil map units where this approach has been used will help track and monitor the effectiveness of such projects.





Project Highlights



CZSS reveals effects of sea level rise in North Carolina

Preliminary CZSS analysis conducted by North Carolina State University and SPSPD portrays an alarming situation in the Albemarle-Pamlico Estuary. Since 1985, the unstable coastline is eroding at a startling rate of one meter per year, with some areas losing well over 300 meters of shoreline. Historic freshwater ecosystems with stressed vegetation from increased saltwater input, termed “ghost forests,” are eroding at the greatest rate of all. This

loss of valuable wetland ecosystems means losing the area’s ability to store or sequester carbon and having several hundred to a thousand tons of carbon emitted to the atmosphere. To combat land loss, soil interpretations are being developed to convert marginal farmland into marshes; in theory, acting as natural berms against the erosive force of the tides.





Project Highlights

The Cape Fear Estuary CZSS evaluates PFAS persistence

The University of North Carolina at Wilmington (UNCW) and SPSSD are conducting an initial soil inventory and chemical analysis of the Cape Fear Estuary. The university requested a CZSS to better understand the relationship of subaqueous soils and PFAS (per-and polyfluoroalkyl substances). Because of certain industries in the watershed, it is documented that the Cape Fear Estuary contains elevated levels of PFAS. PFAS are a group of manufactured chemicals that have been used in consumer, commercial, and industrial products since

the 1940s. Many PFAS break down very slowly and over time can build up in people, animals, water, air and soil. Scientific studies have shown that exposure to some PFAS in the environment may be linked to harmful health effects in humans and animals. The results of this project will provide soil interpretations and CZSS mapping of the estuary. Chemical data from UNCW will provide insight to the persistence and effects of PFAS in subaquatic, high-energy environments.





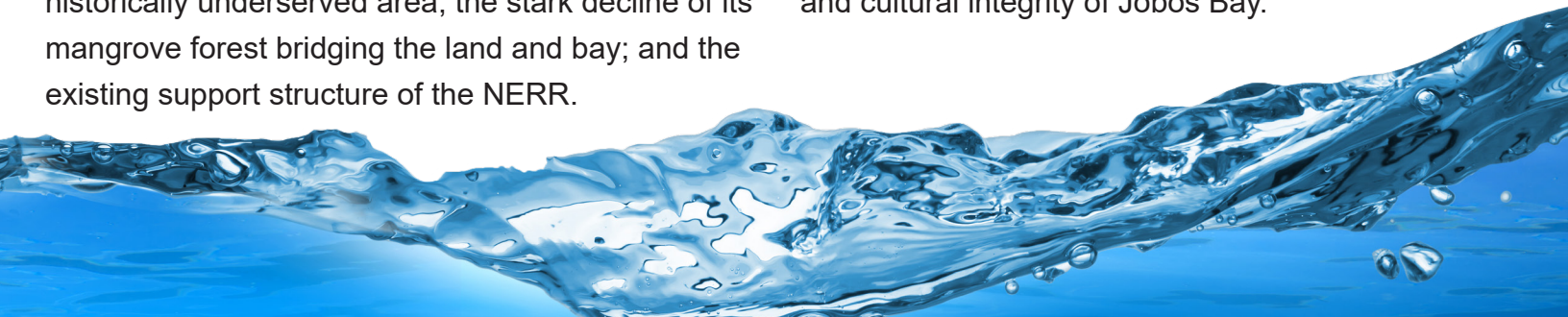
Project Highlights



Jobos Bay, Puerto Rico CZSS investigating lost mangrove forests

The SPSPD recently deployed subaqueous soil survey equipment to Puerto Rico, where they plan to move forward with a CZSS of Jobos Bay, a National Estuarine Research Reserve (NERR) in Puerto Rico. Jobos Bay was selected for several reasons: its location within an economically depressed and historically underserved area; the stark decline of its mangrove forest bridging the land and bay; and the existing support structure of the NERR.

The CZSS will provide insight into the soil's influence on the extent, survivability, and general growth conditions of ecologically valuable wetland and aquatic ecosystems. When completed, best management practices will be developed and implemented to assist in preserving the ecological and cultural integrity of Jobos Bay.





Project Highlights

Great Bay, New Hampshire CZSS finds a 4,000-year-old continuous oyster reef

In 2018, the University of New Hampshire Jackson Estuarine Laboratory, NH NRCS, and SPSD started a CZSS to assess the location and longevity of existing oyster reefs in the Great Bay estuary. Great Bay is New Hampshire's largest estuary encompassing over 6,000 acres of tidal waters, saltmarshes, mud flats, eelgrass meadows, rocky shoreline, and oyster reefs. With a tidal amplitude of over two meters, more than 50 percent of the estuary is exposed at low tide.

Great Bay is also home to several thriving aquaculture businesses, growing some of the finest high-quality oysters in the region. On one of the oyster reefs in the Lamprey River, an oyster shell was dated at over 4,000 years old. The most interesting fact is that it was buried 1.4 meters below the subaqueous soil surface, in a soil core containing oysters throughout the entire profile, indicating the site has been a continuous oyster reef for over 4,000 years.

New Hampshire NRCS is utilizing Farm Bill EQIP funds to restore critical oyster reefs in the estuary and CZSS data to locate favorable soil conditions important for successful oyster restoration efforts. The Great Bay CZSS is set to be published on Web Soil Survey in 2022.





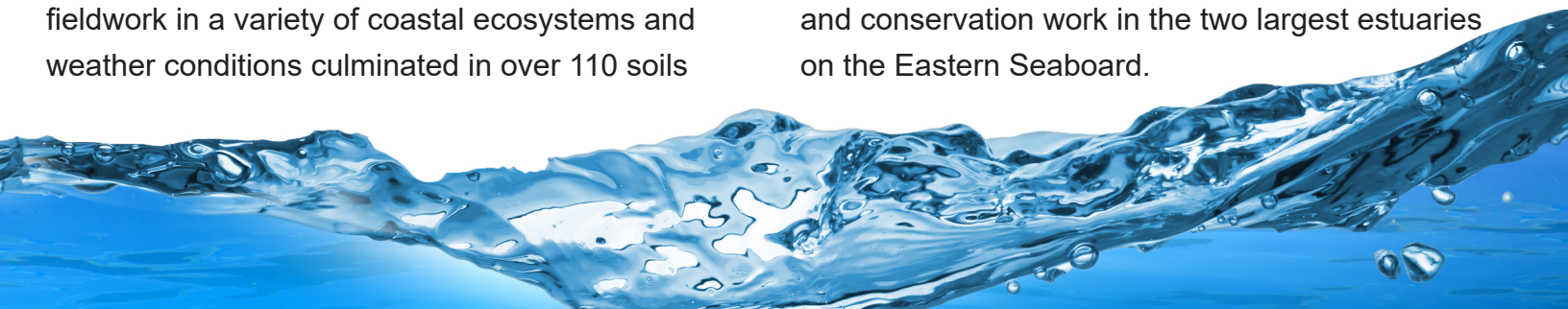
Project Highlights



Carbon stock inventory of Chesapeake Bay and Albemarle-Pamlico Estuary

The Virginia Institute of Marine Sciences, North Carolina State University, and SPSD conducted an initial survey of carbon stocks in the Virginia section of the Chesapeake Bay and Albemarle-Pamlico Estuary in North Carolina. Several weeks of intense fieldwork in a variety of coastal ecosystems and weather conditions culminated in over 110 soils

being sampled for analysis. The data will provide better CZSS maps and products, provide the most modern soil series concepts, help quantify carbon sequestered in the different soil types throughout the ecosystem and inform and prioritize future research and conservation work in the two largest estuaries on the Eastern Seaboard.





Project Highlights

West Galveston Bay, Texas CZSS to help restore, protect vital natural resources

Texas A&M University and SPSP soil scientists began a CZSS of West Galveston Bay in Galveston, Texas to help plan the maintenance and restoration of shoreline ecological functions. Galveston Bay is the largest and most productive estuary in Texas, producing more seafood than any estuary in the United States, except the Chesapeake. Between 1950 and 1990, the greater Galveston Bay watershed lost nearly 35,000 acres (20 percent) of its wetlands and 1,800 acres (70 percent) of its seagrasses. Much of the wetland loss and most of the seagrass loss occurred in and around West Galveston Bay.

CZSS work began with the help of a GIS specialist who created 100 conditioned Latin hypercube Sampling (cLHS) points for random sampling. These points were accessed by wading into the water and later, by boat. Upon completion of sampling the cLHS points and running the data at the local soil survey laboratory, some samples were sent to Texas A&M University. A total of 10 new tidal marsh and subaqueous soil series were developed. The group is creating a CZSS Digital Soil Model or predictive soil map for West Galveston Bay and will begin verifying its accuracy in 2022. In addition, the group will develop ecological site descriptions for the new series.





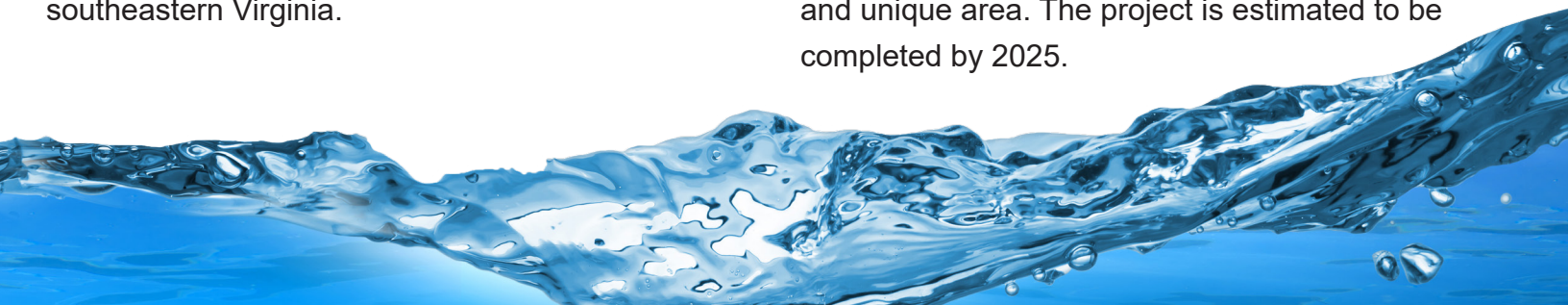
Project Highlights



CZSS and vegetation mapping in Currituck Sound, North Carolina

The Albemarle-Pamlico National Estuary Partnership, National Audubon Society, North Carolina Coastal Reserve and National Estuarine Research Reserve, East Carolina University, Virginia Department of Wildlife Resources, US Fish and Wildlife Service, and SPSPD will be conducting a CZSS, and vegetation inventory of the Currituck Sound located in northeast North Carolina and southeastern Virginia.

This project will study marsh migration, saltwater intrusion, and subaqueous vegetation decline to better prepare land managers with mitigating and adapting to the effects of climate change. Analyzing and mapping subaqueous vegetation, along with its associated decline, is aimed at protecting and revitalizing aquatic plant communities and the associated fisheries in the economically valuable and unique area. The project is estimated to be completed by 2025.





Project Highlights

CZSS uses side scan sonar in Rhode Island

The SPSD and RI NRCS completed a CZSS for Hundred Acre Cove and Potowomut River in Rhode Island. Mapping was conducted by collecting cores and surveying the bottom of the cove using side scan sonar. The side scan sonar unit, recently

purchased by the SPSD to assist with CZSS mapping, is an active sonar system for detecting and imaging underwater objects and seafloor features. This tool is cost effective, portable, and can be easily deployed on the SPSD small boats.





Project Highlights

A 150-mile long CZSS of Indian River Lagoon in Florida

The Florida Department of Environmental Protection, St. Johns River Water Management District, University of Florida – Whitney Lab, National Aeronautics and Space Administration (NASA), U.S. Department of Defense Air Force, U.S. Fish and Wildlife, FL NRCS, and SPSP are collaborating on a CZSS that runs approximately 150 miles encompassing over 218,750 acres along the eastern coast of Florida called the Indian River Lagoon (IRL). Spanning from near New Smyrna Beach in the north to Jupiter Inlet to the south, the IRL is a grouping of three lagoons: the Mosquito Lagoon, the Banana River, and the Indian River. It covers four counties in Florida: Volusia, Brevard, Indian River, and St. Lucie.

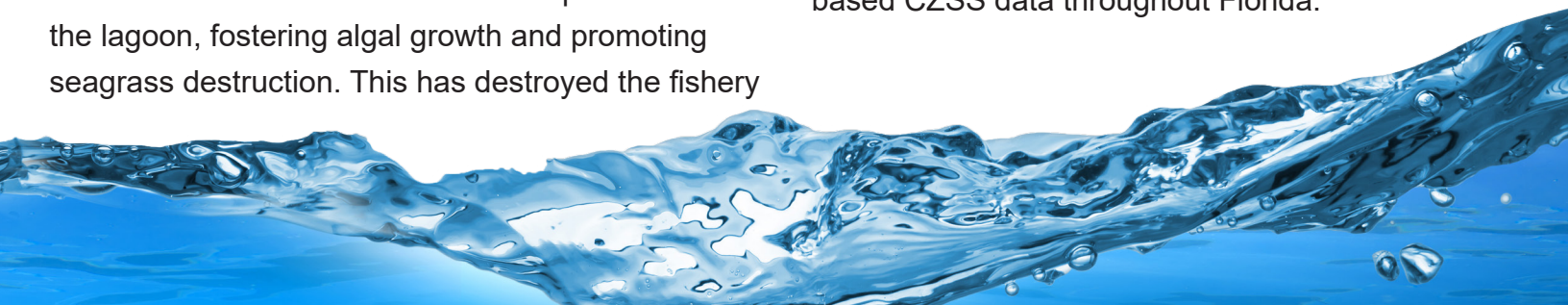
Supporting more than 4,300 species of plants and animals, the IRL is known as one of the top fishing destinations in the world for Speckled Seatrout and Red Drum. This, along with beaches, local seafood, and being home to NASA's Cape Canaveral, it is one of the country's most popular tourist destinations.

Under constant stress since the 1970's, many natural areas of the IRL have been lost due to anthropogenic activities. Constant increase of freshwater discharges into the IRL has depleted the shellfish habitat and carried soils and pollutants into the lagoon, fostering algal growth and promoting seagrass destruction. This has destroyed the fishery



balance and diversity, reducing and/or eliminating the lagoons natural capacity of restoration.

Completion of the CZSS and corresponding ecological site descriptions will help Florida coastal communities identify and maintain healthy ecosystems, determine where to focus eelgrass and aquaculture restoration efforts, detect early warning signs of degradation, make wise decisions concerning coastal-related natural resources and infrastructure, and build a foundation of science-based CZSS data throughout Florida.





Technical Soil Services

Partnering with Stockton University on eelgrass restoration in New Jersey

The SPSPD worked with Dr. Elizabeth Lacey, a Stockton University marine ecologist, in defining subaqueous soil properties and characteristics suitable for eelgrass (*Zostera marina*) restoration. During the process of developing an eelgrass restoration key, SPSPD soil scientists helped Dr. Lacey understand soil textures, sampling standards and techniques, how to identify sulfides, and soil

fluidity. A decision key was then developed for marine ecologists to use when evaluating the suitability of a site for potential eelgrass habitat restoration. In the end, Dr. Lacey emphasized that subaqueous soils are one of many key factors in determining a suitable habitat for eelgrass to grow and flourish.

Enhancing blue carbon datasets on the Northeast Ocean Data Portal

The Northeast Blue Carbon Workgroup, US EPA Region 1, and SPSPD are working together to update the existing data layers depicting current and historical extents of eelgrass (*Zostera marina*) and current extents of tidal wetlands as well as develop new data products that represent stocks of blue carbon in the Northeast associated with these habitats. The CZSS data collected and provided by the SPSPD will result in more accurate accounting of blue carbon stored in these wetland systems.

Blue carbon is the term used to define carbon sequestered in marine habitats, i.e., seagrasses, marshes, and mangroves. These coastal and marine ecosystems sequester carbon dioxide from the atmosphere and oceans at significantly higher rates, per unit area, than terrestrial and tropical forests. Although coastal systems are much smaller in size than the planet's forests, they sequester carbon at a much faster rate and could continue to do so for millions of years with the correct conservation practices.



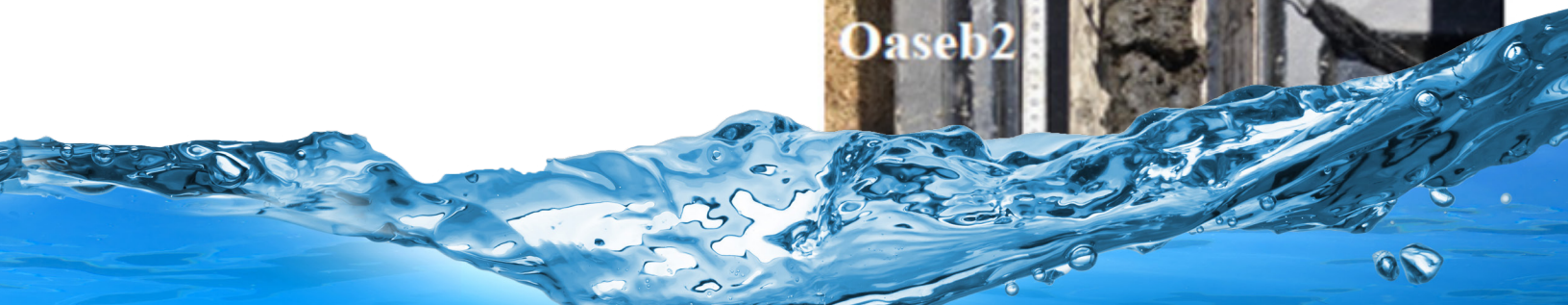
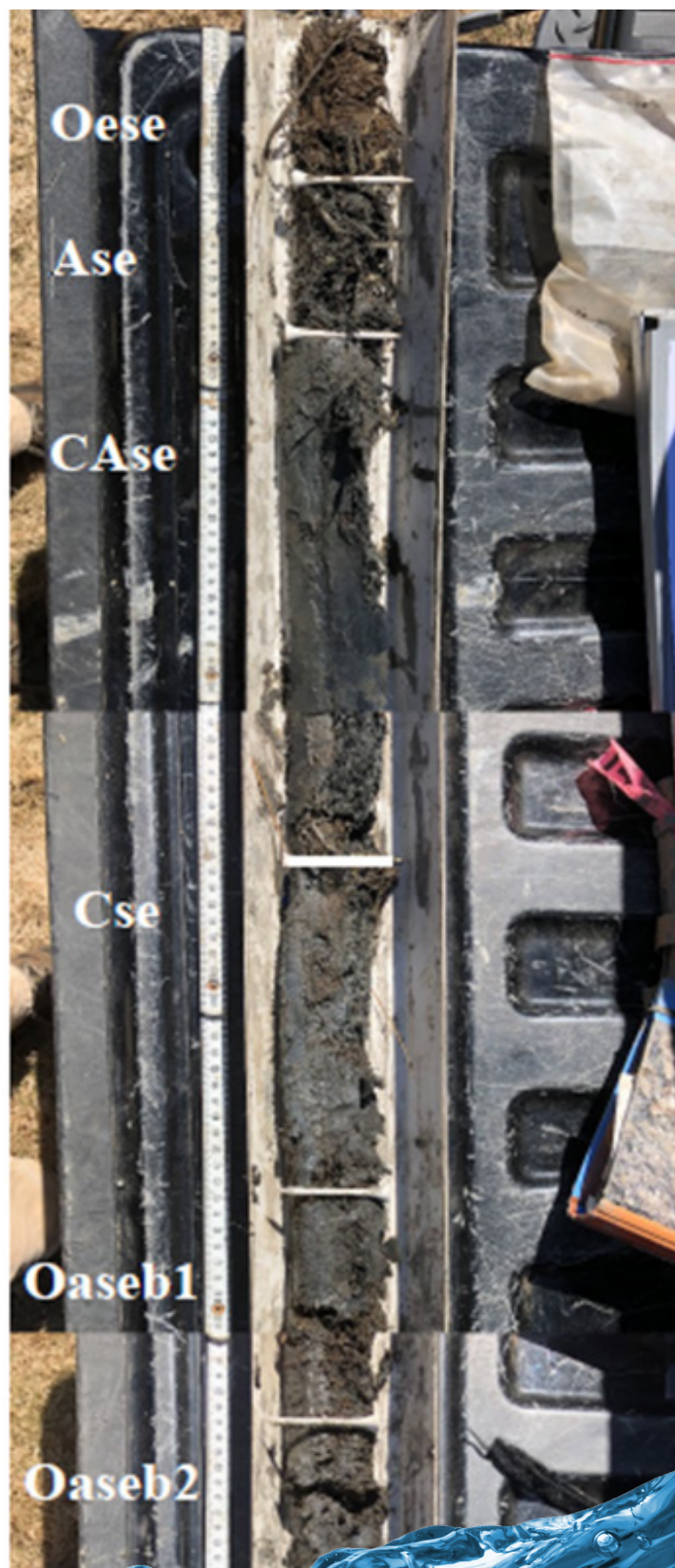


Technical Soil Services

Sluice Creek Tidal Marsh Restoration Project in Connecticut

The University of Connecticut, Connecticut Department of Energy and Environmental Protection, and NRCS completed an extensive soils investigation to evaluate soil properties at a planned tidal marsh restoration site at Sluice Creek. The report served to interpret the potential of using dredge materials for thin-layer placement or as material to fill drainage ditches.

Based on the results of the oxidation pH analysis, one soil sample met the definition of sulfidic materials and the remainder meet the definition of hyposulfidic materials. This investigation also supported USDA NRCS' commitment to assist in the restoration of healthy, productive tidal marshes as this site is identified as having endangered, threatened and special concern species as well as significant natural communities.





Technical Soil Services



Restoration of Great Meadows Marsh, a Globally Important Bird Area in Connecticut

Audubon Connecticut, the University of Connecticut, Connecticut Department of Energy and Environmental Protection, U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Administration, and NRCS collaborated on a tidal marsh restoration project at Great Meadows Marsh. A component of the Stewart B. McKinney National Wildlife Refuge in Stratford, Connecticut, the 600-acre marsh is the state's largest remaining unditched salt marsh.

Direct and indirect anthropogenic impacts had adversely affected this salt marsh complex situated

in an urbanized landscape along Long Island Sound. The \$4 million dollar project design focuses on restoration of irregularly-flooded salt marsh and long-term resilience to benefit the salt marsh sparrow (*Ammodramus caudacuta*) and other high-marsh dependent species. It also aims to restore the last remaining population of marsh pink (*Sabatia stellaris*) in southern New England by expanding habitat, as well as to increase and improve nesting habitat of the state-endangered diamondback terrapin (*Malaclemys terrapin*).

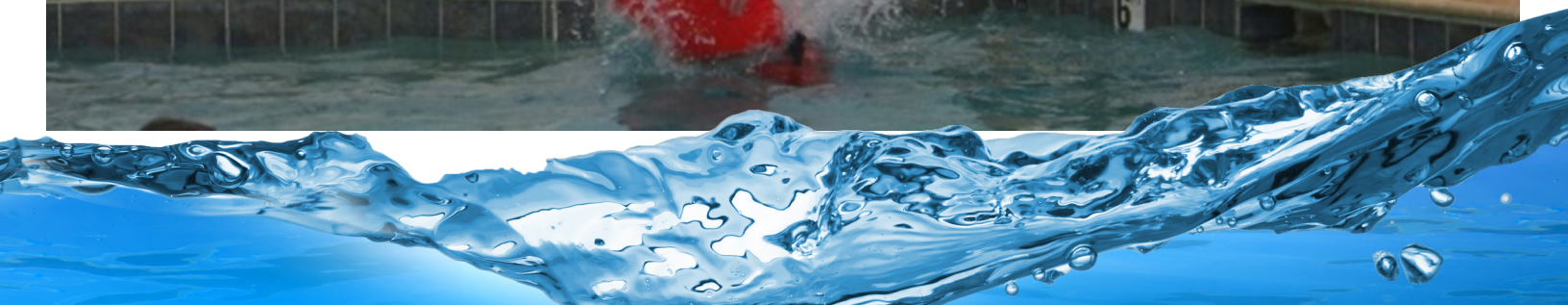




CZSS Highlights

Motorboat operator certification course added to CZSS safety standards

The Motorboat Operator Certification Course (MOCC) is required of all SPSP boat captains to increase safety and knowledge of motorboats. Currently, six SPSP staff are enrolled in the training, and one is certified as a MOCC instructor. Offered through the U.S. Fish & Wildlife Service, this training provides proper instruction and use of different types of vessels in variable environments including open waters and rivers. Completion of the training will allow for better understanding of basic boat mechanics, maneuvering, and logistical use of current SPSP assets.





CZSS Highlights

CZSS updates to the National Soil Survey Handbook

The CZSS focus team developed a new section on field and laboratory sampling techniques and standards to be included in the National Soil Survey Handbook (NSSH) Part 656 Coastal Zone Soil Survey. The NSSH provides the main operational and procedural guidance for conducting the NRCS portion of the National Cooperative Soil Survey program.

The new sections are 656.2 Coastal Zone Soil Survey Laboratory Sample Collection Methods

and 656.3 Coastal Zone Soil Survey Laboratory Sample Analysis Methods. The incorporation of these methods into the NSSH allows for a reference to laboratory sampling and performing laboratory analysis in the Coastal Zone environment where traditional sampling techniques may not apply. This documentation helps train new soil scientists working in the coastal zone as well as standardizing the techniques across the agency.

Saturated Bulk Density methods added to Kellogg Soil Survey Laboratory Methods Manual

The CZSS focus team are assisting with preparing the Kellogg Soil Survey Laboratory Methods Manual Soil Survey Investigations Report No. 51 (SSIR 51). The manual serves as a reference for standard laboratory analyses and to document methodologies. It is expected that this manual will continue to change and expand over time as new knowledge and technologies result in the development of new methods and the modification or retirement of old

methods. In the new SSIR 51, two new sections for saturated bulk density were added under Section 3.3.2.1 Saturated Bulk Density - Subaqueous Samples – Macaulay Peat Sampler, Vibracore Half Core, Block/Brownie, Hole Saw, Field Core, and Syringe Methods and 3.3.2.2 Saturated Bulk Density - Subaqueous Samples – Vibracore Whole Core.





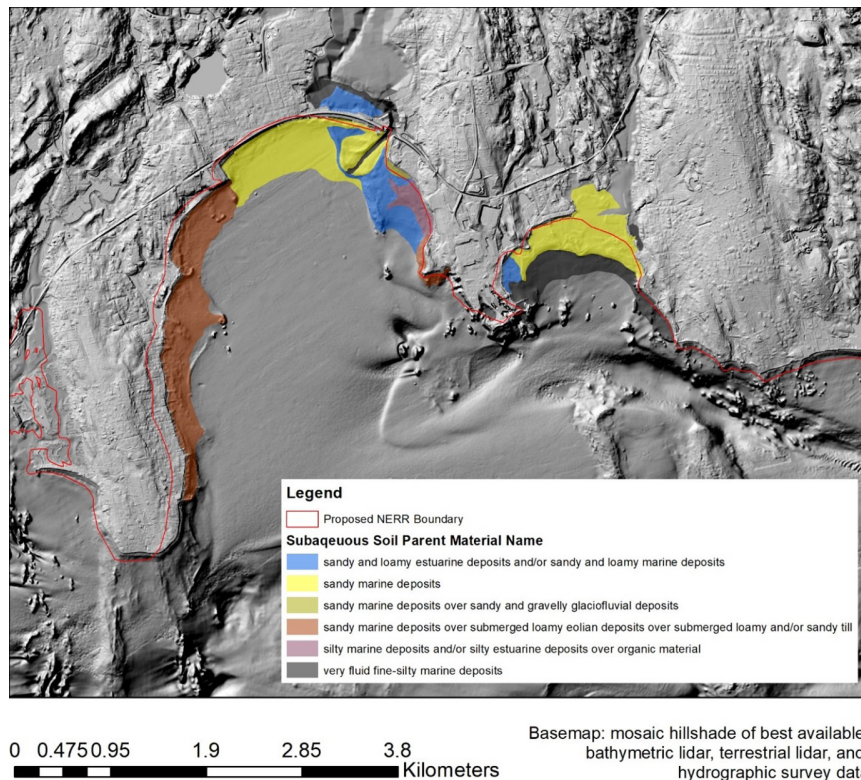
CZSS Highlights

Connecticut National Estuarine Research Reserve designated in 2022

On Friday January 14, 2022, the Connecticut National Estuarine Research Reserve (NERR) was officially designated by NOAA, becoming the nation's 30th NERR. NRCS soil scientists helped secure this designation by preparing a soils section for the CT NERR Environmental Impact Statement and Management Plan to include areas of coastal zone soil survey mapping in Niantic and Jordan Cove, which includes coastal inland soils, tidal marshes, and shallow subaqueous and submerged soils.

NERRs are established through The Coastal Zone Management Act of 1972 as an Act of Congress to encourage coastal states to develop and implement coastal zone management plans. As of 2015, Connecticut and Louisiana were the only salt-water coastal states in the country lacking a NERR.

Now, the CT Reserve is one of 30 reserves in the NERR that are protected for long-term research, water quality monitoring, education, and coastal stewardship. The CT NERR protects a portion of one of Connecticut's most important natural resources, the Long Island Sound.





CZSS Highlights

Conservation Innovation Grant supports shellfish restoration efforts in Connecticut

Connecticut Sea Grant, UConn Extension and their state partners from the Connecticut Department of Agriculture-Bureau of Aquaculture and Connecticut Department of Energy and Environmental Protection received a Natural Resources Conservation Service Conservation Innovation Grant (CIG) to lay the foundation for shellfish restoration planning in the state. Through CIG, NRCS partners with public and private entities to accelerate technology transfer and adopt promising technologies.

The tools developed from this CIG will aid practitioners in prioritizing, planning, permitting and implementation of shellfish restoration projects and will provide funding agencies with confidence in their ability to support and invest in high priority shellfish restoration projects. Ultimately, this work will contribute to the conservation and management of shellfish and shellfish habitats and accelerating the CZSS work in Connecticut.





Supporting USDA Goals

The Soil and Plant Science Division supports USDA goals by:

- ◆ Providing USDA with a strong foundation to support America's farmers with addressing the complexities of climate change, climate variability, and extreme events.
- ◆ Delivering quality CZSS data and technical soil services to assist partners in designing innovative marsh, eelgrass, and aquaculture restoration projects that improve and protect critical or sensitive ecosystems.
- ◆ Partnering with scientific research institutions, Conservation Districts, and other Federal and state agencies to promote and support voluntary conservation and disaster programs in a changing nearshore and coastal zone environment.
- ◆ Developing highly qualified and trained soil scientists and ecologists who deliver science-based, coastal conservation solutions and communicate effectively about coastal climate changes and sustainable agriculture.
- ◆ Assisting coastal managers with incorporating soils data into real-world natural resource management, resilience, and adaptation projects to address the ecological, social, and economic demands on the landscape.

Adapting to Coastal Climate Change

The SPSD is leading CZSS strategies to combat climate changes by:

- ➔ Producing and disseminating CZSS data that is widely recognized as critical for mitigating hazards, creating resources inventories, guiding restoration efforts, and tracking environmental changes.
- ➔ Supporting climate and environmental literacy by providing CZSS information that facilitates action at the individual, community, and national levels to resolve environmental challenges.
- ➔ Building soil reports and interpretations for conservation management systems that facilitate adaptation and sustainability from impacts of climate variability and extremes along the coast.
- ➔ Developing science-based soil survey information and tools to enhance the adaptive capacity of plant and animal production systems to coastal climate variability and extremes.
- ➔ Conducting outreach and education to coastal managers, policymakers, and agricultural producers on how climate variability and change will impact soil resources and ecosystems.
- ➔ Providing CZSS data and technical soil services to increase the adaptive capacity of American farmers, ranchers, forest owners, and other stakeholders to maintain competitiveness and sustainability.

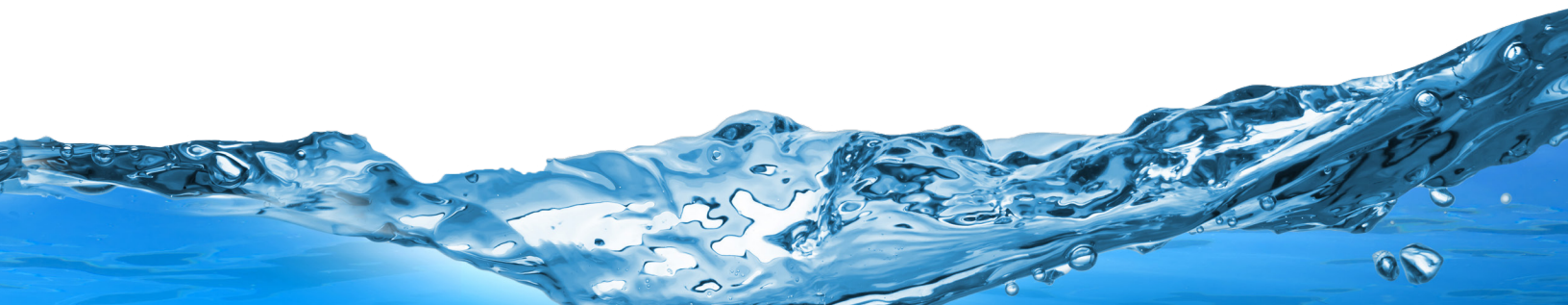
The rate at which restoration services are needed across coastal landscapes are currently outpacing the capacity of land management agencies and their partners.

USDA, Action Plan for Climate Adaptation and Resilience

Building climate literacy across all levels will enable USDA staff to best serve its stakeholders in the decades ahead.

Secretary Tom Vilsack in the USDA Action Plan for Climate Adaptation and Resilience

Carbon can remain in the soil for thousands of years, making it one of the longest-term climate mitigation solutions.





CZSS Presentations

Nov. 7-10, 2021	ASA-CSSA-SSSA International Annual Meeting
Dec. 13, 2021	Restoration Retrospective Meeting
Jan. 25 and Mar. 24, 2022	Interagency Working Group for Ocean and Coastal Mapping (IWG-OCM) meetings
Feb. 9-10, 2022	Soil Survey & Land Resource Workshop, Texas: CZSS and Blue Carbon Mapping
Feb. 15, 2022	IOCM Seminar on Multi-Sensor Nearshore Bathymetric Mapping
Mar. 1, 2021	NOAA Science Seminar Series – USDA NRCS CZSS: Mapping Soils and Blue Carbon Stocks in the Coastal United States
Mar. 2022	Environmental Protection Agency Zosterapalooza Annual Workshop: Soil Property Trends in Eelgrass Beds and Use of Coastal Zone Soil Survey Information to predict Eelgrass Site Suitability
Jun. 2022	Regional Cooperative Soil Survey Conferences – Delaware, Michigan, Montana, and South Carolina
Aug. 1-5, 2022	World Soil Congress of Soil Science, Glasgow, UK
Dec. 5-8, 2022	Restore American Estuaries Summit, New Orleans, LA

