Region 7 Trip Report: **Training and Soil Sampling in the MS Coastal Marsh**

A multi-faceted soil sampling and training exercise was conducted the week of October 23-27, 2018. The objective was to gather data in MLRA 152A and assist researchers at the Grand Bay National Estuarine Research Reserve (GB NERR). Participants included Local & Regional NRCS Soil Scientists, GB NERR research scientists, and members of the Professional Soil Classifiers Association of Mississippi (PSCAM) and the Professional Soil Classifiers Association of Alabama (PSCAA).

The members of PSCAM and PSCAA attending the Grand Bay training and service exercise (left to right): Delaney Johnson, Chris Hatcher, Steve Goode, James Curtis, Larry Kichler, Cooper Nichols, Jerome Langlinais, Rachel StoutEvans, Allen Curry, Joxelle Velazquez (kneeling), Dr. Henry Langston, Mike Lilly, Joey Koptis, Ed Janak, Sandy Page, and Greg Brannon.

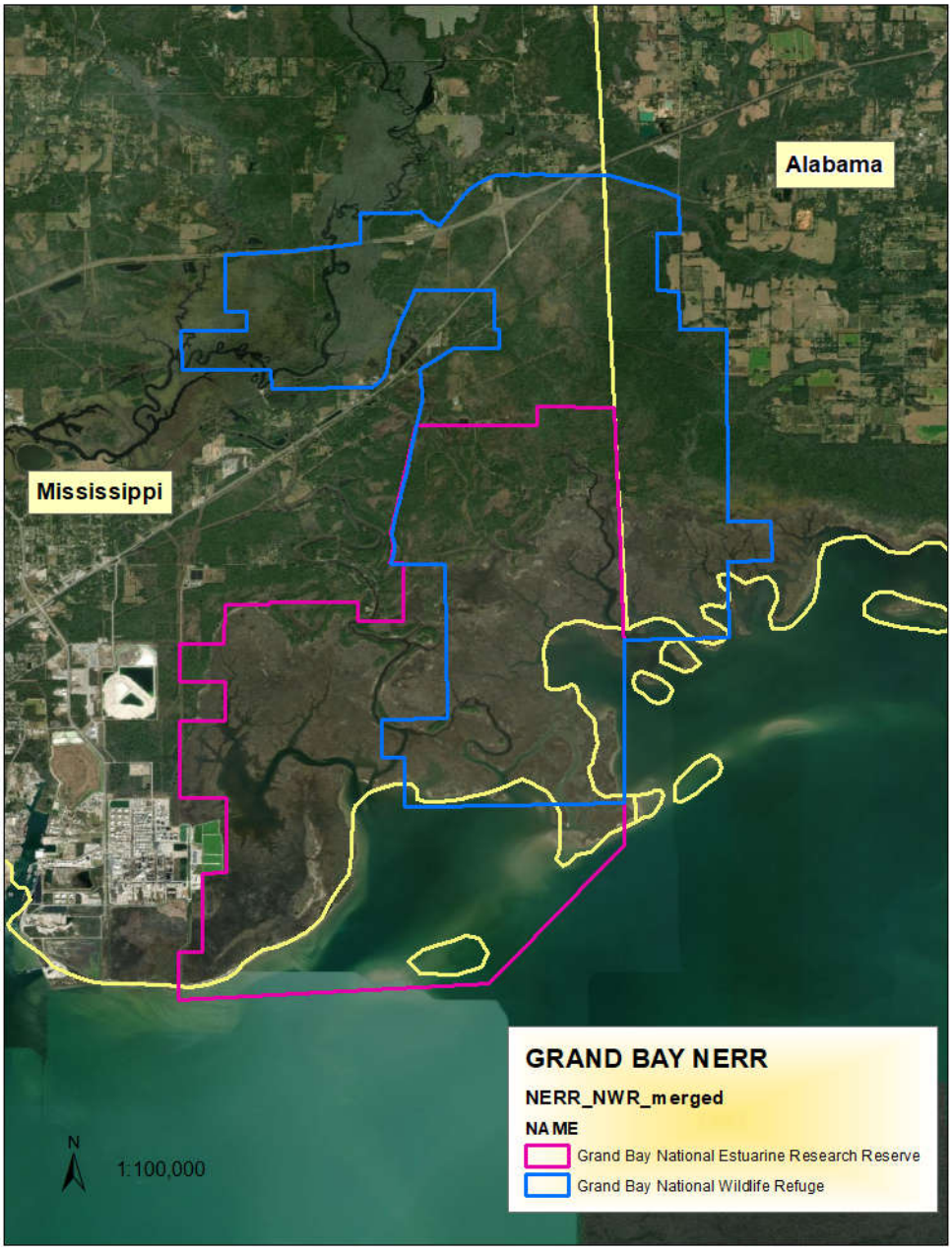
The NERR environs include significant areas of coastal marsh, fresh-water marsh, maritime forest, bayous, swamps, pine savannas, and coastal low flatwoods that straddle the Mississippi and Alabama state line. These habitats provide an ideal setting for a variety of important research projects. For example, NERR staff and collaborators are monitoring fluctuations in marsh elevations with respect to sea level rise, along with the potential impacts and the natural response of the marsh and its denizens to these changes. Other projects include Ecology of Special Habitats (including salt pannes, shell middens, and submerged aquatic vegetation), Ecology of Tidal Marsh Vertebrates, Monitoring Ecosystem Effects of Atmospheric Mercury, and Coastal Plant Ecology and Mapping. The NERR at Grand Bay encompasses extensive areas of estuarine marsh and pine savannas. However, coastal marsh areas of Alabama and Mississippi lack needed soil characterization data of these environmentally sensitive and important habitats.

These pine savannas are often characterized by hydric soils.

Maritime forest along Cumbest Bayou.

Spartina alterniflora and *Juncus roemerianus* in the brackish marsh (left). Near the mouth of Cumbest Bayou with pine island in background (right).

The Venue. The Grand Bay National Estuarine Research Reserve (GB NERR) is co-located with the Grand Bay National Wildlife Refuge (GB NWR). Grand Bay NERR is located in the southeast corner of Jackson County, MS and the adjoining GB NWR partially overlaps and extends into Mobile County, AL. Grand Bay NERR is managed by the Mississippi Department of Marine Resources (MDMR) as part of the National Oceanic and Atmospheric Administration's Office for Coastal Management. Other partners and stakeholders include Mississippi State University, University of Southern Mississippi, Mississippi Department of Environmental Quality, the Mississippi Secretary of State's Office, and The Nature Conservancy. The Grand Bay NWR is dedicated to protecting one of the largest remaining expanses of wet pine savanna habitat.



The Grand Bay National Estuarine Research Reserve (pink) is co-located and overlaps with the Grand Bay National Wildlife Refuge (blue) just east of Pascagoula, MS.

A brief history. In 2017 the PSCAM membership decided that during the fall annual meeting they would assist on-going research at the GB NERR by providing soil information. There were several active research projects that would benefit from having soil information. NRCS personnel from 7-LOX joined in this effort. However, recent activities involving NRCS coastal marsh evaluation projects, plus the exercise in the fall of 2017 in which several soil scientists received a reality check regarding available data and soil describing protocols in these unique environments, resulted in a decision for a return trip to the coastal lowlands at GB NERR in October 2018. In addition, increasing the effort towards subaqueous soil mapping seems to be receiving support from Soil Survey Division leadership. Added to the mix was a request to the PSCAM membership from Dr. Mark Woodrey, Ph.D., Research Coordinator at Grand Bay NERR, to provide soil data on a recently acquired part of the reserve that had been developed homesites at one time but had been abandoned and reverted to nature following severe hurricane damage from several years ago. A grant to restore wetlands and natural habitats to these impacted areas generated a need for more detailed soil information.

The 7-LOX personnel, in conjunction with officers of Professional Soil Classifiers of MS, saw this return trip as an opportunity to maximize data acquisition and submitted a suggestion to the PSCAA membership to help their neighboring colleagues. NRCS Region 7 and Region 3 leadership also recognized the possibilities of heightening the awareness of Coastal Zone Soil Survey (CZSS) methods and equipment to the many NRCS personnel that would be gathering for this exercise. This dovetailing of events resulted in a full week of searching out suitable soil sampling sites, demonstrating vibracore sampling, describing profiles from sampling tubes, and describing soil profiles in the human modified flatwoods and pine savannas. Prior to the week of the trip to GB NERR, much energy was expended in logistical preparations and gathering aluminum core tubes, boats, safety equipment, and soil sampling gear.

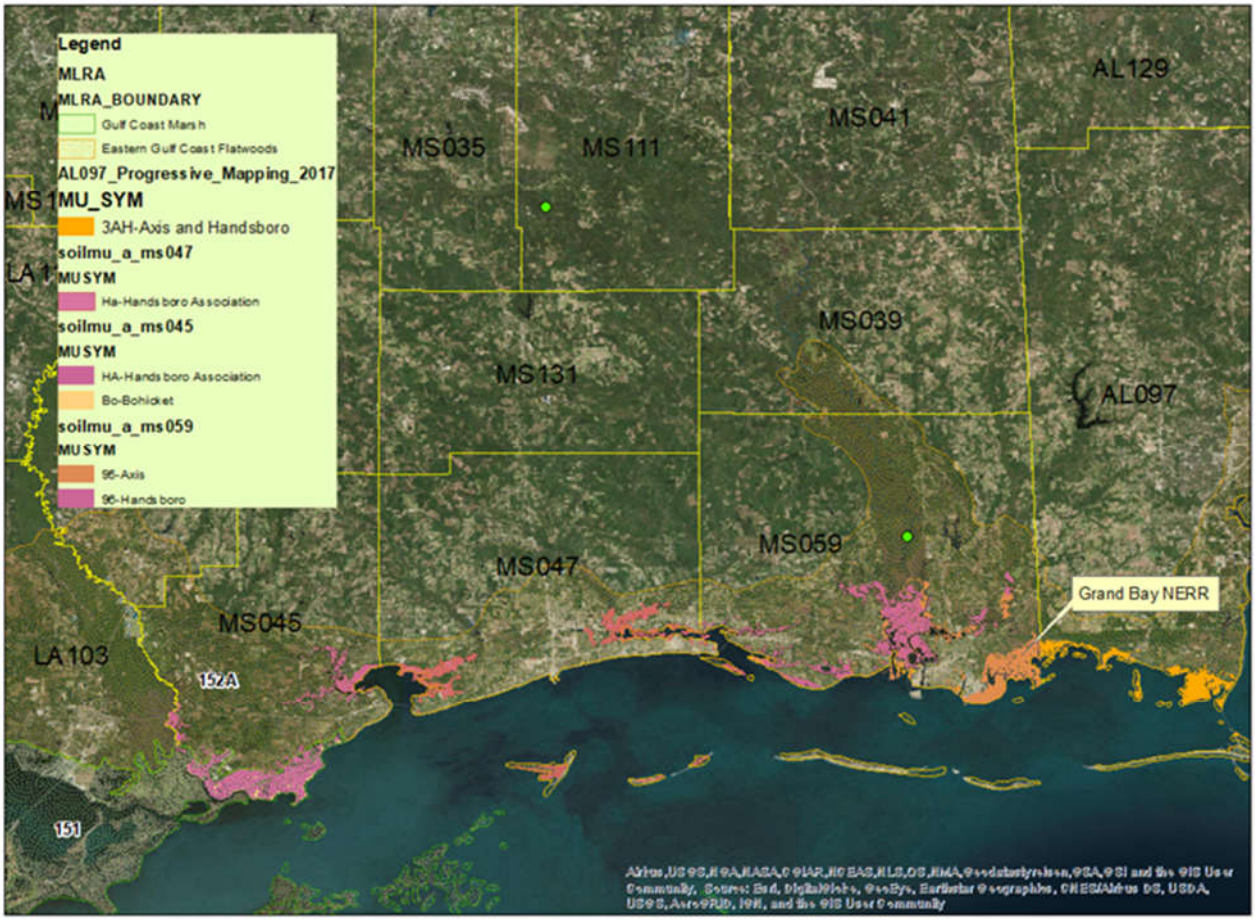
Objectives. The effort at Grand Bay took on a four-pronged approach:

1. The objective of PSCAM was to provide soil information to researchers and managers at the NERR facility.
2. The NRCS 7-LOX personnel wanted to obtain characterization data of coastal marsh habitats that stretch across the Alabama and Mississippi as part of an MLRA (Major Land Resource Area) project.
3. Southeast Region leadership wanted to enhance awareness and provide training for CZSS and subaqueous soil mapping.
4. On the job training regarding the previous three objectives would assist with broadening a knowledge base of soil scientists who do not have much experience in these unique environments.

For example, consider the soil environmental factors along the coastline. there are many critical properties and features of brackish soil regimes that need data along the Gulf Coast. They include:

- pH change of anaerobic to aerobic situations
- sulfidic material presence; susceptibility to creation of acid sulfate soils
- n value – fluidity; a measure of bearing strength
- salt chemistry: Na, Mg, S; effects on habitat
- organic matter percent
- organic matter properties: highly, moderately, or slightly decomposed
- fiber content: rubbed and unrubbed
- particle-size components – mineral or organic
- how ecological habitats are influenced by the above factors
- improved accounting of carbon sequestration in inundated habitats (blue carbon stocks)

Coastal Marsh



Desirable information/data outcomes: In the Loxley Soil Survey Area, there are more than 75,000 acres of brackish or salt marsh mapped along the gulf coast of MS and AL. Characterization data collected at Grand Bay NERR will influence decision making for these map units.

To meet these objectives, equipment needed to be collected to do the job. Two experienced subaqueous soil mappers and leaders of the NRCS CZSS team, Greg Taylor, NRCS Senior Regional Soil Scientist, and Rob Tunstead, Soil Survey Leader in Hammonton, NJ discussed needs with MLRA Leader, Jerome Langlinais and helped procure needed sampling equipment: a vibracore and aluminum sampling tubes plus a tripod and block and tackle for extraction. Two NRCS aluminum flat bottom boats were located to perform these tasks; one with a well in the bottom over which included a 10 ft mounted tripod which a core tube could be inserted into the sediments under the boat.

Greg Taylor at the helm in Cumbest Bayou.

Greg Taylor and Rob Tunstead demonstrate the vibracore.

Project Evolution. The Friday before the training week, 7-LOX MLRA Soil Survey Leader, Jerome Langlinais, and soil scientist, Sandy Page conferred onsite with Dr. Mark Woodrey, Research Coordinator at GB NERR, and Dr. Jonathon Pilcher, about their needs and suitable locations to collect soil data. It was determined that Cumbest Bayou would provide convenient access to estuarine habitats that contained brackish marsh, maritime forest, salt pannes, and shell middens. Dr. Woodrey also provided a guided tour of areas he wanted investigated for remediation in the pine savanna/flatwood habitats north of the NERR facility building. Monday, the aluminum coring tubes arrived at the NERR. They had been collected in LA and transported and delivered by soil scientists and PSCAM association leaders Dr. Henry Langston and Rachel StoutEvans. We all made an exploratory reconnaissance trip by boat out into the marsh, and located sites to use vibracore equipment directly in marsh for successful core extraction without support of a boat for a base. On Tuesday, Greg Taylor, Rob Tunstead, and Regional Director, Debbie Anderson, arrived with the vibracore equipment including block and tackle to insert, extract, and document the aluminum core sampling tubes. Also arriving from NRCS AL State Office were Data Quality specialists Aaron Friend and Alison Steglich, joined also by NRCS Soil Scientist and current PSCAA President, Cooper Nichols. Our first day in the field we extracted three core samples.

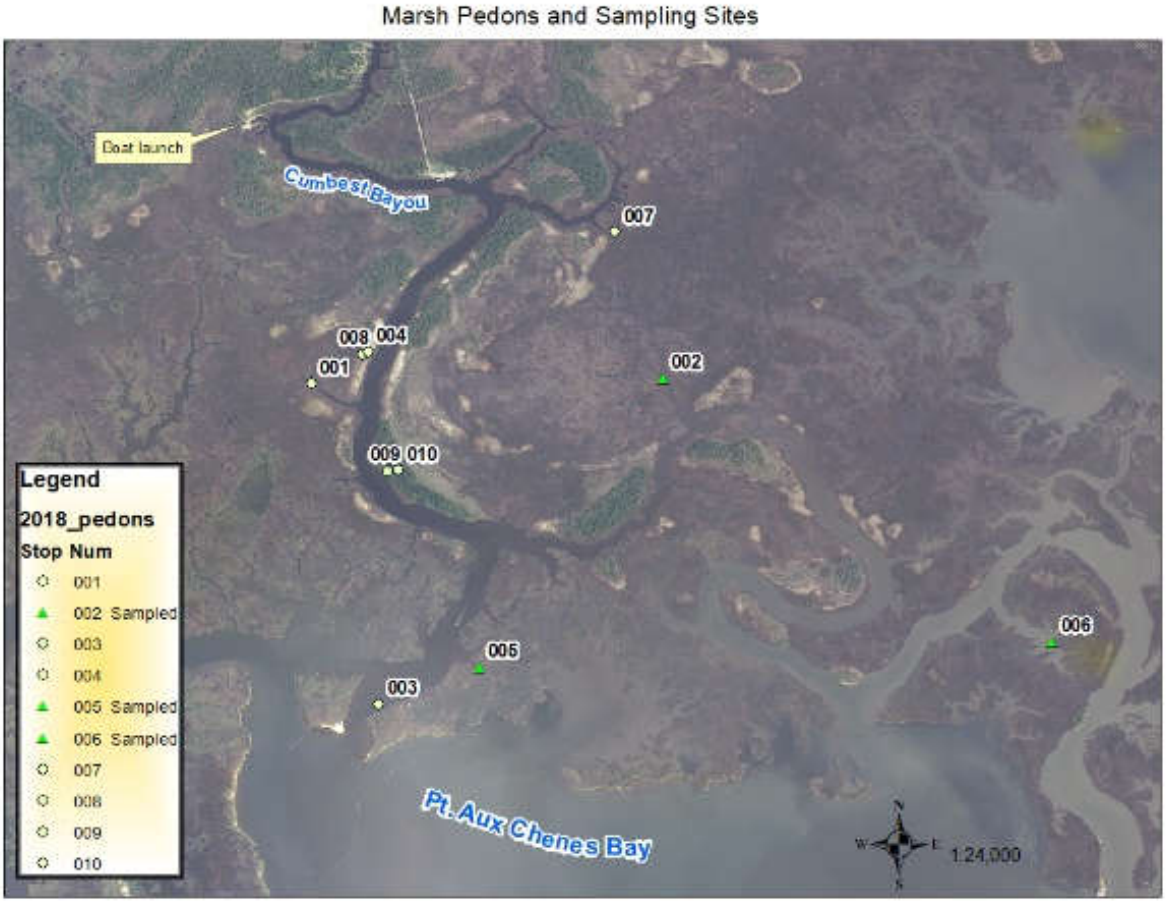
This was a learning expedition. We learned that dragging the tripod rigging into the marsh was more time-consuming and labor intensive than running the boat equipped with the tripod up to the edge of the shoreline and inserting the core tube through the well in the boat. We learned that extracting a full 200 cm core was problematic when underlying sediments are clayey and the fluidity is slight or non-fluid. We learned that for the sake of safety and efficiency at least a four-person crew is needed to handle the equipment and record observations and that at least one person is required to be strong and tall to attach the extraction rigging to the top of the tripod.

Rob Tunstead (left) supervises vibracore tube insertion.

Rachel observes Greg, Rob, and Jerome apply extra weight to vibracore and tube to extract the maximum core length.

Cooper Nichols, Jerome Langlinais, and Aaron Friend (left to right) extract a core sample along the shoreline of the marsh.

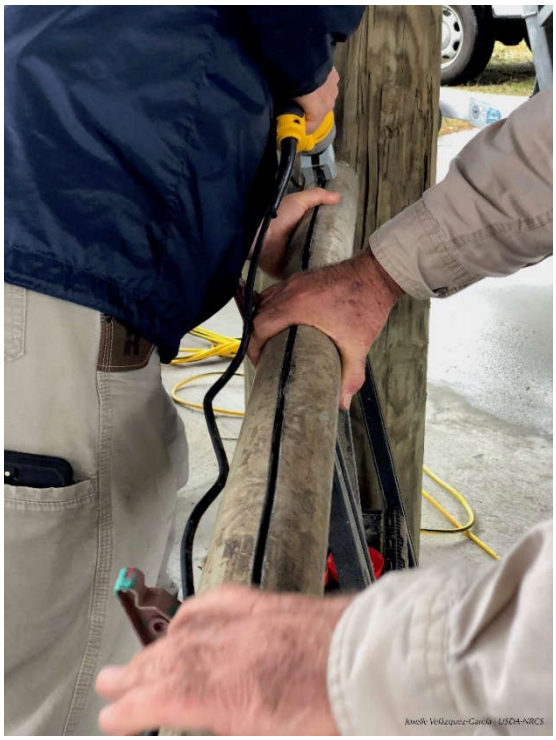
Greg supervises Jerome, Rob, Aaron, and Cooper (left) insert aluminum tube attached to vibracore. Alison hoists the tube using block and tackle mounted to tripod (right).



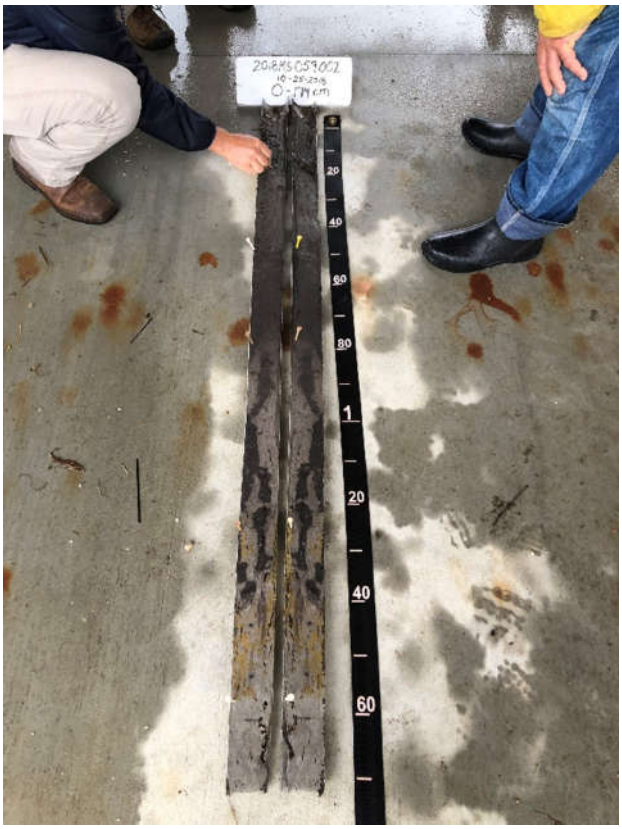
The green triangles (stops 002, 005, and 006) show the locations of pedons sampled for characterization.

Wednesday was also spent in the field, in the marsh. A flotilla of three boats – one designed to house the tripod core extraction gear – and two support boats to transport other gear and personnel. One of the boats belonged to MDMR and was piloted by two NERR botanists in the morning. Dr. Woodrey joined us that afternoon to observe the operation first-hand. Four more vibracore samples were extracted and three additional pedons described on levee positions along Cumbest Bayou. Over these two field days, 10 pedons were described, and three of them were considered worthy of sending samples to the Auburn University Soil Lab for characterization. All the vibracore sample tubes were returned to the NERR facility and stored upright until they could be described. While onsite, however, basic site information was collected on a modified subaqueous soil profile description sheet, including information related to inside and outside tube length to monitor potential settling of the soil sample. Once extracted the tubes are capped at both ends to retain all the sample during transport, and to preserve moisture and soil chemistry to prevent oxidation.

Thursday brought the arrival of several more PSCAM and PSCAA members along with some heavy rain. The rain curtailed field observations of the vibracore assembly but allowed time to focus on the soil profile describing process. Electric shears were used to cut open the aluminum tubes on opposing sides for describing the pedons. Once the two cuts are made, a sawing motion from one end to the other with a thin wire inserted between the cuts enables the describer to separate the tubes in half, exposing two equally good profiles. One profile was used for describing. The horizons of the other profile, when desirable, were bagged and tagged to be sent to the soil lab.



The aluminum tube is cut in half with electric shears.



A thin wire is used to cut the soil material (left), so the two halves of the profile can be observed (right).

The official PSCAM meeting began on Thursday afternoon with a classroom presentation with a focus on soil sampling in the marsh. A 7-LOX sampling expedition in March of 2018, led by Professor Joey Shaw, Auburn University, provided an opportunity to learn many things about desired data products and logistical considerations for sampling in the brackish marsh. Some of the lessons learned were presented to the joint PSCAM and PSCAA participants.

Sandy Page offers information about desired data outcomes in the marsh.

The following discussion points were given to participants for consideration when data gathering in inundated soil environments:

- Decomposition processes in the tidal marsh
- Brief overview of sulfidization process
- Overview of the "cheat sheet": important soil properties in tidal marsh environments
    - ❖ What to look for and describe
    - ❖ Organic or mineral?
    - ❖ Fluidity
    - ❖ Odor
    - ❖ pH
    - ❖ EC – electrical conductivity
- Mobile County, AL marsh sampling examples with NRCS and Auburn University
- Inundated and Subaqueous description sheets

Also, briefly covered in the classroom (for those folks helping with the wetland restoration project) were considerations of what to be aware of when describing soils in the savanna and flatwoods environments of the lower Gulf coast:

- What is the internal soil drainage class?
- Does the soil have a perched or apparent water table?
- Hydric soil? If so, what indicator?
    - Umbric or histic epipedon?
    - Depleted or reduced matrix?
    - Redox concentrations or depletions at or near surface? What percent?
    - Aquic, Aeric, or Aquults?
    - >/= 50% 2.5Y or 5Y hue in upper 5" of argillic between 10" to 16" with distinct or prominent redox concentrations?
- Is there a discontinuity that may be suggested by a jump in particle-size or structural change?
- What are the particle-size constituents?
    - Clay %
    - Silt %; does a cutoff of + or – 30% silt work for the series
    - Sand fraction
- What is the structure of horizons below a meter?
- Does the subsoil have fragic properties?
- Does the subsoil have significant plinthite?
- What is the elevation above mean sea level or the nearest stream?
- What is the chance of flooding or ponding? Storm surge?
- What is the nature of the vegetation?
    - Pine productivity including basal area
    - Fac-wet or obligate vegetation

Following the classroom presentation, all the participants gathered under the NERR facility equipment shed to open and describe the core samples.

Rob Tunstead demonstrates the electric shears as Jerome Langlinais, Aaron Friend, and Dr. Henry Langston observe.

Describing the soil profiles involved teamwork: Cooper Nichols, Joxelle Velazquez, Rachel StoutEvans, and Dr. Henry Langston in discussion with Rob Tunstead (left). Rachel and Jerome input descriptions into the Pedon PC for subaqueous soils spreadsheet that will be uploaded into NASIS.

NRCS'ers and PSCAM members Delaney Johnson, MS State Soil Scientist, Larry Kichler (retired), and former MS State Soil Scientist, Mike Lilly (retired), engage in some "war stories", while NRCS Regional Director Debbie Anderson oversees the operation and becomes acquainted with Region 7 staff.

After the deluge on Thursday, the weather broke, and several tasks and personnel were divided up for Friday's mission. One crew returned to the marsh with all the folks who arrived on Thursday and missed the opportunity the previous days. They were guided by NERR Research Coordinator, Dr. Mark Woodrey. Another land-based crew headed for the flatwoods and savannas to describe profiles within the restoration sites. Mike Lilly, Larry Kichler, and Sandy Page remained behind in the equipment shed to cut open and describe the last three remaining core samples.

Dr. Woodrey launches the MDMR boat assisted by Joey Koptis

Cooper Nichols inserts a Macaulay peat augur into the marsh as (left to right) Jerome Langlinais, Joey Koptis, Chris Hatcher, James Curtis, Greg Brannon, Steve Goode, and Dr. Mark Woodrey observe.

The land crew, tasked with providing soil information on possibly disturbed old homesites, consisted of Dr. Henry Langston, Rachel StoutEvans, Delaney Johnson, Allen Curry, and Ed Janak. Soil/site information collected for five pedon descriptions included presence of human transported material, hydric soil indicators, hydrology indicators, water table depths, and vegetation components.

Accomplishments. The consensus was that objectives were met on all four fronts. Regarding training, a heightened awareness of several aspects of CZSS was certainly achieved with all participants. Including data collected in 2017, Grand Bay NERR now has about three dozen pedon descriptions within its boundaries. Once the lab data is completed, a much better understanding of estuarine soil chemistry, inundated soil taxonomy, and prevalence of organic matter vs. mineral constituents should begin to emerge.

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Results. Progress was made towards obtaining soil survey information to correct the following deficiencies once the needed lab data analysis is completed and stored in NASIS:

- Outdated soil survey information with very little lab data for salt or brackish environments.
- Absence of characterization addressing the potential for creation of acid sulfate soils.
- Ecological site data has no substrate or soil component attributes.
- Marshland map units are associations or consociations with transect/pedon locations absent or sketchy.
- Potential erroneous data in NASIS including outdated classification (Handsboro series) and mis-characterization (horizonation, inability to calculate soil properties dependent on salt chemistry data).
- Minimal experience and lack of training of local NRCS personnel in these coastal environments.
- Insufficient equipment to accomplish gathering pertinent coastal zone soil information.
- More data to predict blue carbon stocks in inundated habitats.
- Enhanced information to be used to ameliorate potential impacts of sea level rise.