Development of Standard Terminology and Taxa for Subaqueous Soils

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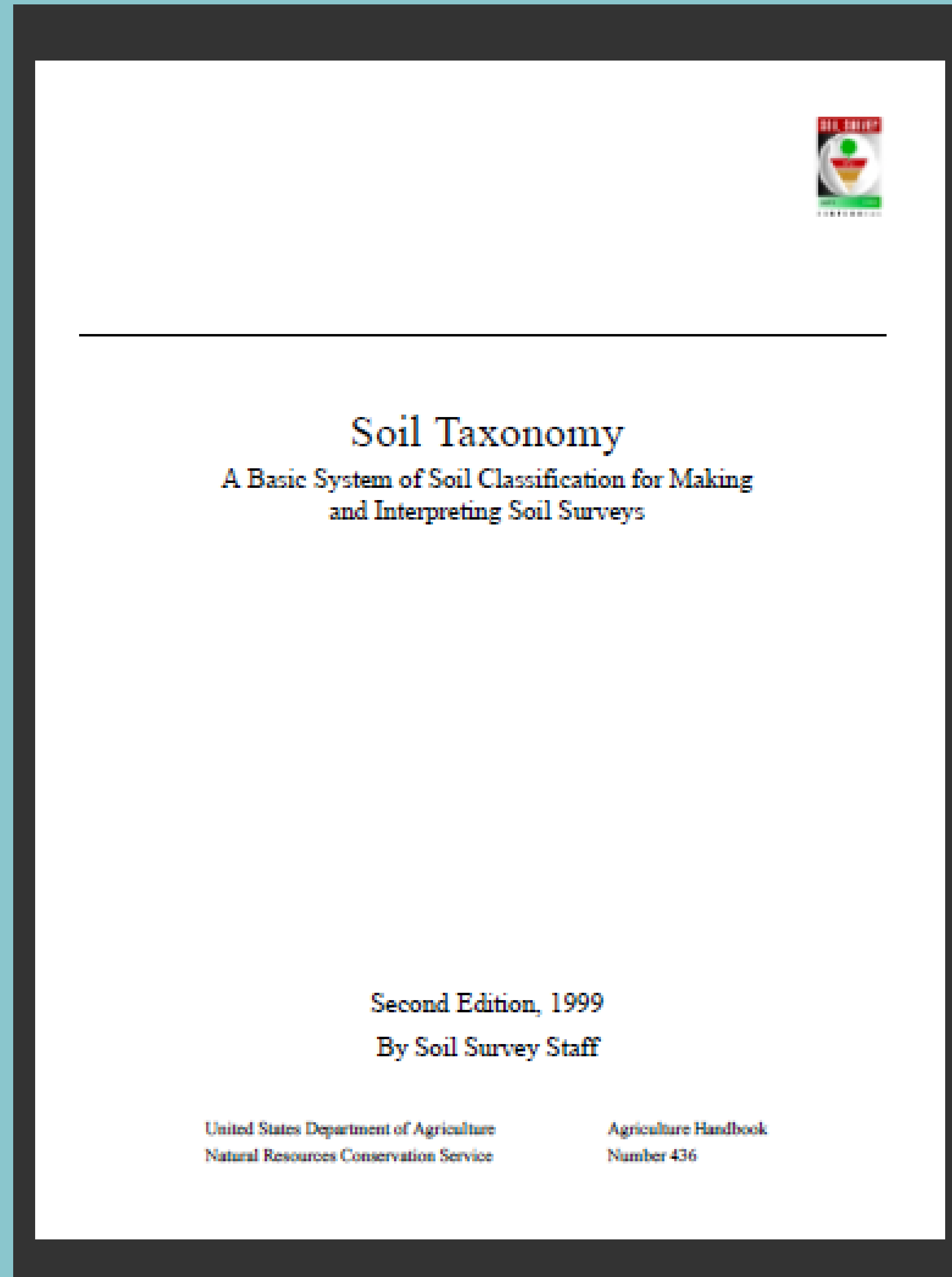
Why was there a need?

Subaqueous soils have a combination of properties and characteristics not typically found in most subariel soils.

Why was there a need?

Soil Taxonomy classes did not fully apply to the range and characteristics of subaqueous soils important for interpretations



Soil Taxonomy

A Basic System of Soil Classification for Making and Interpreting Soil Surveys

Second Edition, 1999

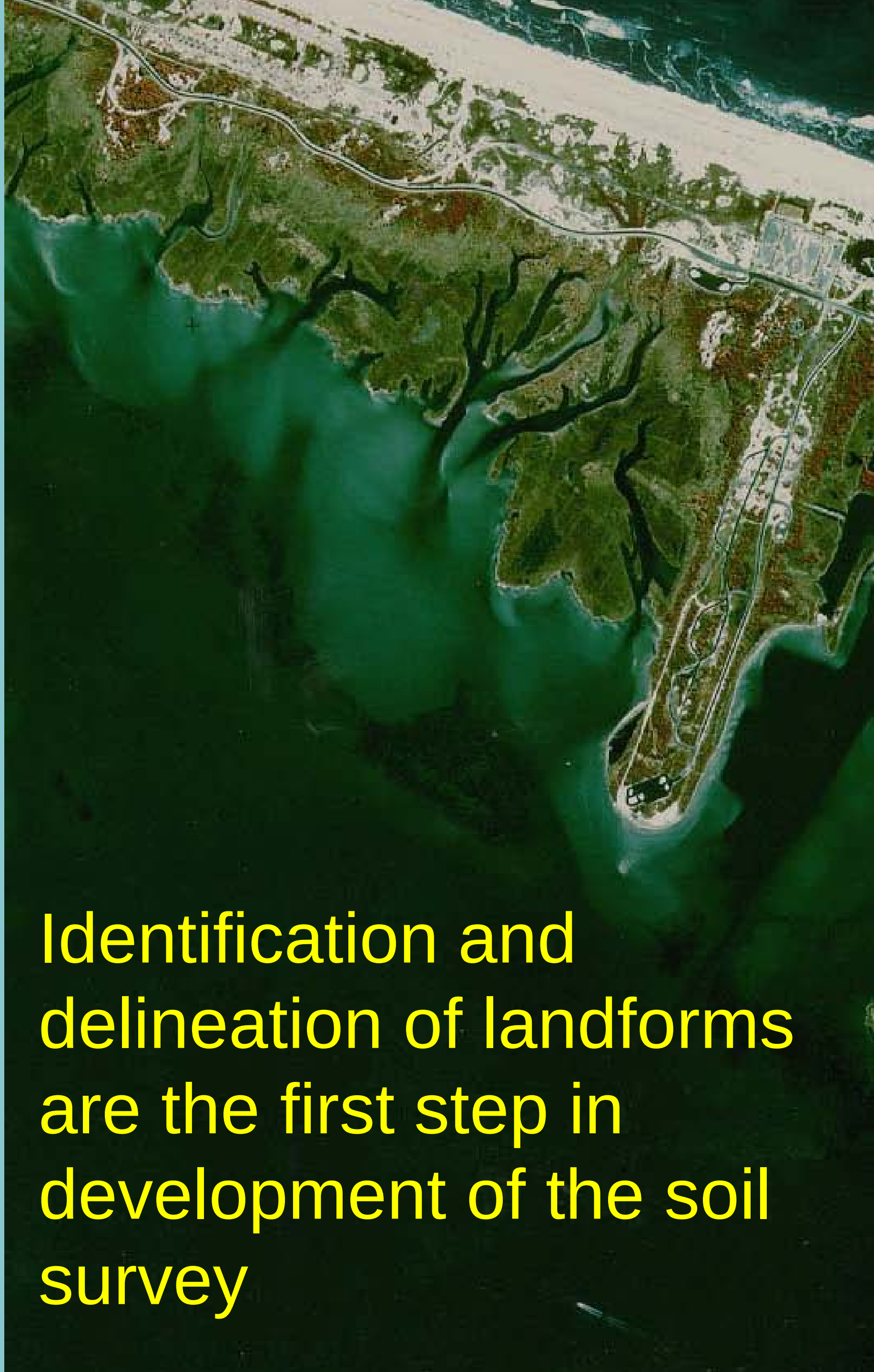
By Soil Survey Staff

United States Department of Agriculture
Natural Resources Conservation Service

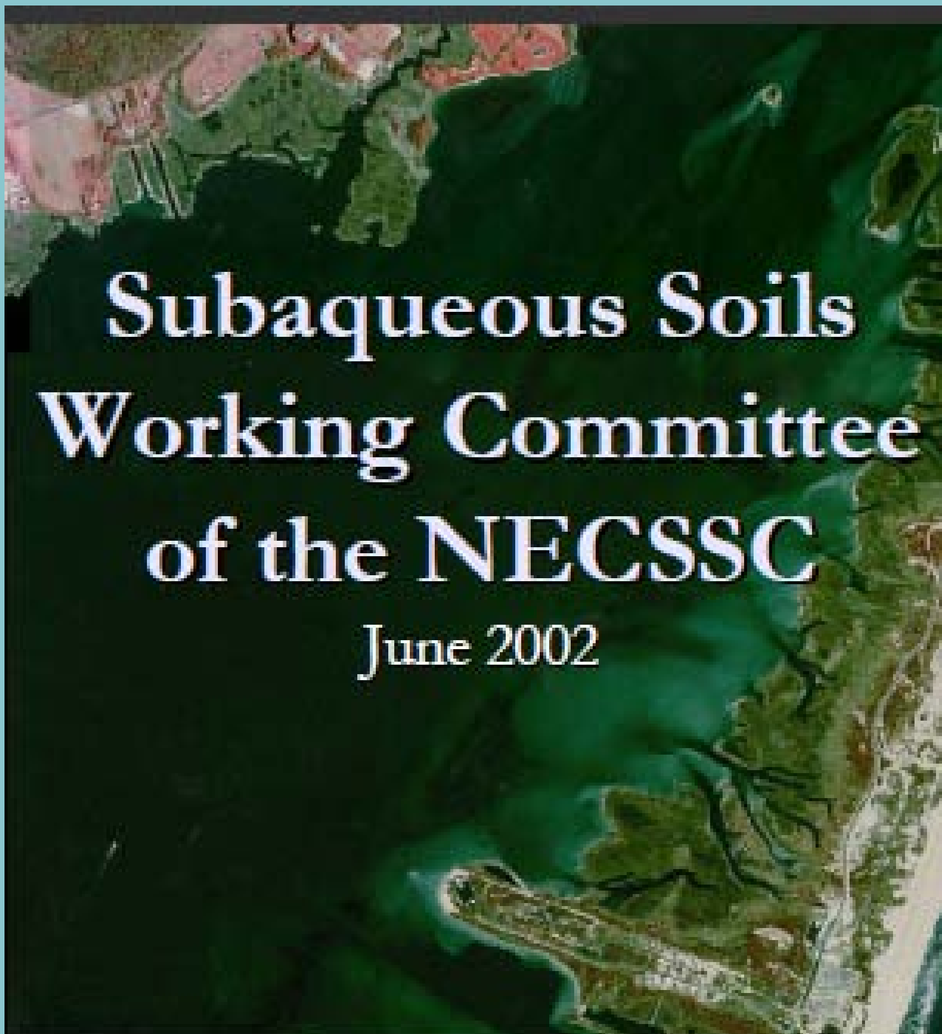
Agriculture Handbook
Number 436

Why was there a need?

No standard set of terms for landforms and parent materials.



Identification and delineation of landforms are the first step in development of the soil survey



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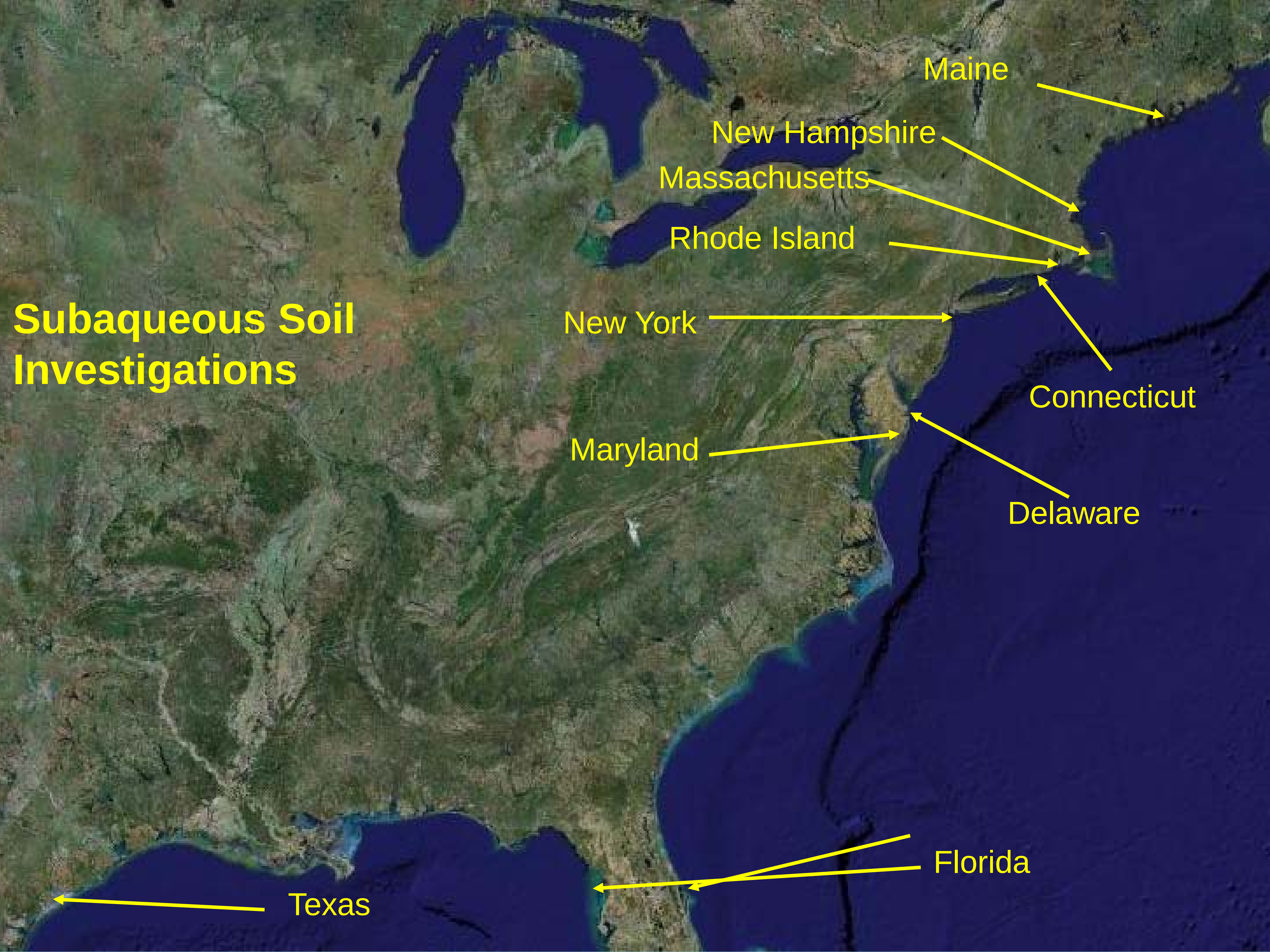
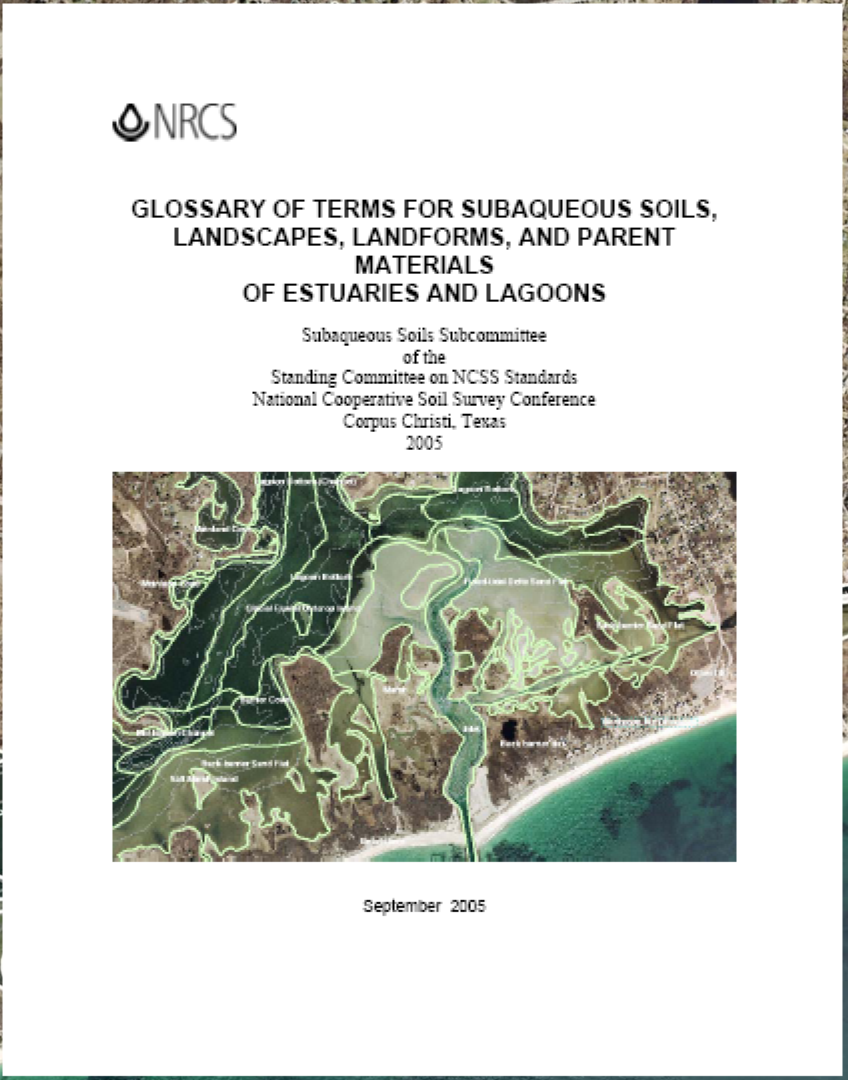

Subaqueous Soil Investigations
Maine
New Hampshire
Massachusetts
Rhode Island
New York
Connecticut
Maryland
Delaware
Florida
Texas

NRCS

GLOSSARY OF TERMS FOR SUBAQUEOUS SOILS, LANDSCAPES, LANDFORMS, AND PARENT MATERIALS OF ESTUARIES AND LAGOONS

Subaqueous Soils Subcommittee
of the
Standing Committee on NCSS Standards
National Cooperative Soil Survey Conference
Corpus Christi, Texas
2005

September 2005


NRCS

GLOSSARY OF TERMS FOR SUBAQUEOUS SOILS, LANDSCAPES, LANDFORMS, AND PARENT MATERIALS OF ESTUARIES AND LAGOONS

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Incorporated into the National Soil Survey Handbook (2007?)

Amendments to Soil Taxonomy

George Demas originally proposed “subaquic” subgroups. For example, “Subaquic Fluvaquents”

At the 2002 NENCSS meeting in NY folks agreed that this was acceptable but there may be a better approach;

Most argued that the difference between subaerial Aquents and subaqueous Aquents was too big to separate at the subgroup level; some wanted a new order.

Final consensus was to make the distinction at the suborder level where most moisture regime breaks are applied.

Subaqueous Soil Suborders

- **Wassents:** subaqueous Entisols. Defined as Entisols that have a positive water potential at the soil surface for more than 21 hours of each day. These soils are the first suborder to classify out under Entisols. The formative element Wass is derived from the German (Swiss) word “wasser” for water.
- **Wassists:** subaqueous Histosols. Defined as Histosols that have a positive water potential at the soil surface for more than 21 hours of each day. These soils are the second suborder to classify out under Histosols after Folists.

Wassent Great Groups

- **Frasiwassents:** Wassents that have, in all horizons within 100 cm of the mineral soil surface, an electrical conductivity of <0.2 dS/m in a 5/1 by volume mixture of water and soil.
- **Psammowassents:** Wassents that have less than 35 percent (by volume) rock fragments and a texture of loamy fine sand or coarser in all layers within the particle-size control section.
- **Sulfiwassents:** Wassents that have a horizon or horizons with a combined thickness of at least 15 cm within 50 cm of the mineral soil surface that contain sulfidic materials.
- **Hydrowassents:** Wassents that have, in all horizons at a depth between 20 and 50 cm below the mineral soil surface, both an *n* value of more than 0.7 and 8 percent or more clay in the fine earth fraction.
- **Fluviwassents:** Wassents that have *either* 0.2 percent or more organic carbon of Holocene age at a depth of 125 cm below the mineral soil surface; *or* an irregular decrease in content of organic carbon from a depth of 25 cm to a depth of 125 cm or to a densic, lithic, or paralithic contact if shallower.
- **Haplowassents:** Other Wassents.

Wassent Subgroups

- There are between four and six subgroups for each great group.
- Examples include:
  - **Lithic Sulfiwassents**: have a lithic contact within 100 cm of the mineral soil surface.
  - **Haplic Sulfiwassents:** have, in some horizons at a depth between 20 and 50 cm below the mineral soil surface, *either or both*: 1. An *n* value of 0.7 or less; *or* 2. Less than 8 percent clay in the fine-earth fraction.
  - **Thapto-Histic Sulfiwassents:** have a buried layer of organic soil materials, 20 cm or more thick, that has its upper boundary within 100 cm of the mineral soil surface.
  - **Fluvic Sulfiwassents:** have *either* 0.2 percent or more organic carbon of Holocene age at a depth of 125 cm below the mineral soil surface *or* an irregular decrease in content of organic carbon from a depth of 25 cm to a depth of 125 cm or to a densic, lithic, or paralithic contact if shallower.
  - **Aeric Sulfiwassents:** have a chroma of 3 or more in 40% or more of the matrix of one or more horizons between a depth of 15 and 100 cm from the soil surface.
  - **Typic Sulfiwassents:** Other Sulfiwassents.

Wassist Great Groups

- **Frasiwassists:** Wassists that have, in all horizons within 100 cm of the mineral soil surface, an electrical conductivity of <0.2 dS/m in a 5/1 by volume mixture of water and soil.
- **Sulfiwassists:** Wassists that have sulfidic materials within 50 cm of the mineral soil surface.
- **Haplowassists:** Other Wassists.

Wassist Subgroups

There are three subgroups for each Wassist Great Group.

- **Fibric subgroups**: have more thickness of fibric soil materials than any other kind of organic soil material either: 1. In the organic parts of the subsurface tier if there is no continuous mineral layer 40 cm or more thick that has its upper boundary within the subsurface tier; or 2. In the combined thickness of the organic parts of the surface and subsurface tiers if there is a continuous mineral layer 40 cm or more thick that has its upper boundary within the subsurface tier;

- **Sapric subgroups:** have more thickness of sapric soil materials than any other kind of organic soil materials either: 1. In the organic parts of the subsurface tier if there is no continuous mineral layer 40 cm or more thick that has its upper boundary within the subsurface tier; or 2. In the combined thickness of the organic parts of the surface and subsurface tiers if there is a continuous mineral layer 40 cm or more thick that has its upper boundary within the subsurface tier.

- **Typic subgroups:** others Wassist subgroups.

Wassepts
(not proposed but observed)

Great Groups

- AA. Wassepts that have, in all horizons within 100 cm of the mineral soil surface, an electrical conductivity of <0.2 dS/m in a 5/1 by volume mixture (not extract) of water and soil. **Frasiwassepts**
- AB. Other Wassents that have a horizon or horizons with a combined thickness of at least 15 cm within 50 cm of the mineral soil surface that contain sulfidic materials. **Sulfiwassepts**
- AC. Other Wassents that have *either* 0.2 percent or more organic carbon of Holocene age at a depth of 125 cm below the mineral soil surface *or* an irregular decrease in content of organic carbon from a depth of 25 cm to a depth of 125 cm or to a densic, lithic, or paralithic contact if shallower. **Fluviwassepts**
- AD. Other Wassents. **Haplowassepts**

Msc
Mbe
FtdS
Ftd
Mc
Sh
Mbe
Mc
LB
Bbe
Mbe
-0.6
-0.3
Marshneck
Point
Mc
-2.1
Bc
-1.8
-1.5
Grassy Point
BbS
Sl
-1.2
Mch
-0.9
-0.6
Bb


Msc
Mbe
FtdS
Ftd
Mc
Sh
Mbe
Mc
LB
Bbe
Mbe
-0.6
-0.3
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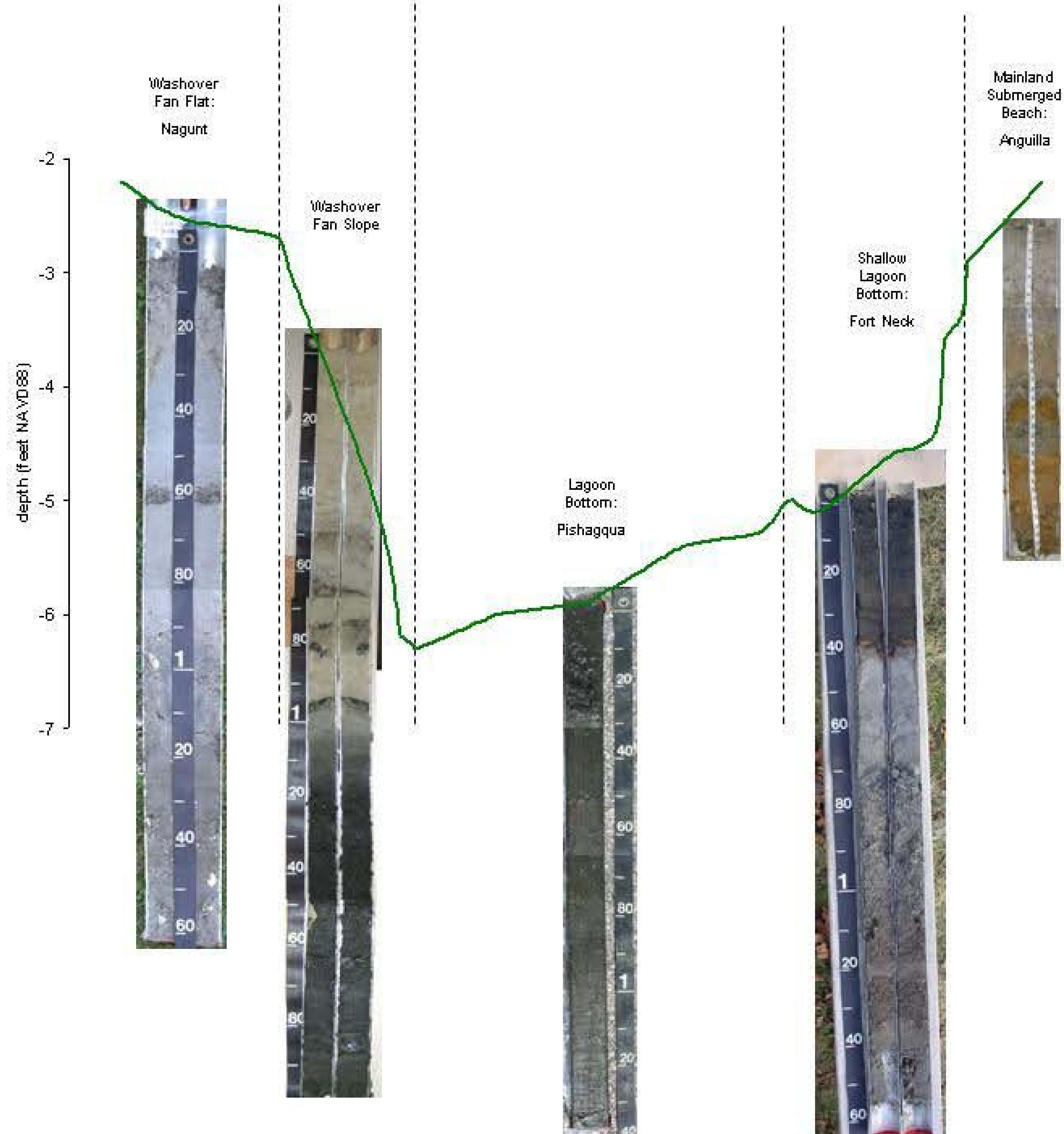
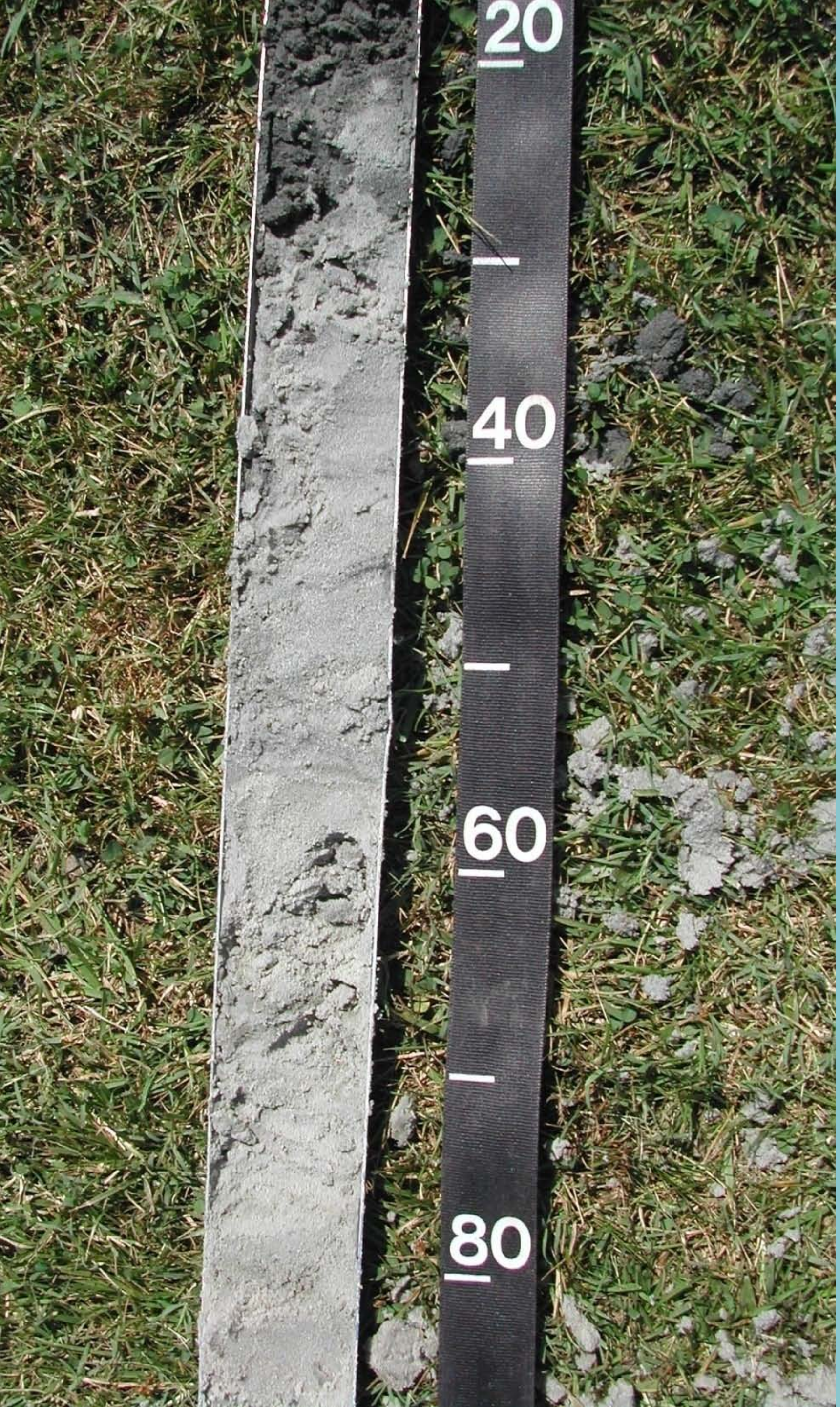

Washover Fan Flat: Nagunt
Washover Fan Slope
Lagoon Bottom: Pishagqua
Shallow Lagoon Bottom: Fort Neck
Mainland Submerged Beach: Anguilla
depth (feet NAVD88)
-2
-3
-4
-5
-6
-7



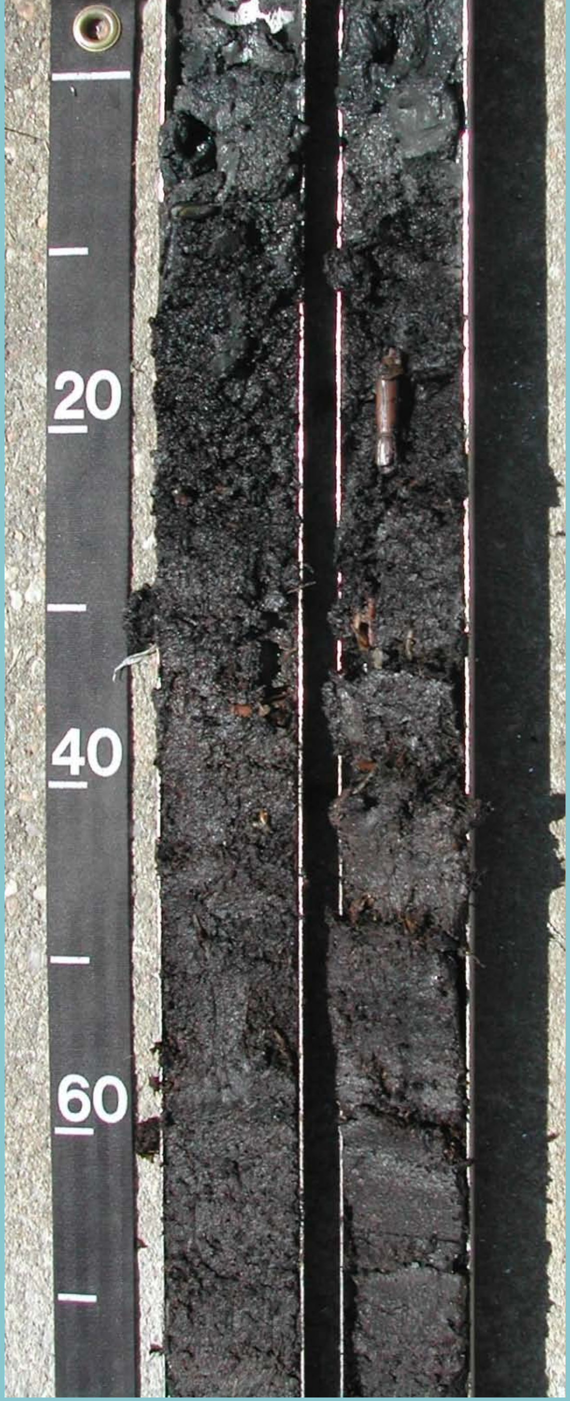
Washover Fan Flat

Flood-Tidal Delta

Typic Psammowassent

Flood-Tidal Delta Slope

Sulfic Fluviwassent



Mainland Cove

Sapric Sulfiwassist

Mainland Submerged Beach

Aeric Haplowassent

Sapric Frasiwassist


Histic Fluvawassept

LOCATION PISHAGQUA RI
Tentative Series
JDT, MPB, MS
03/2007

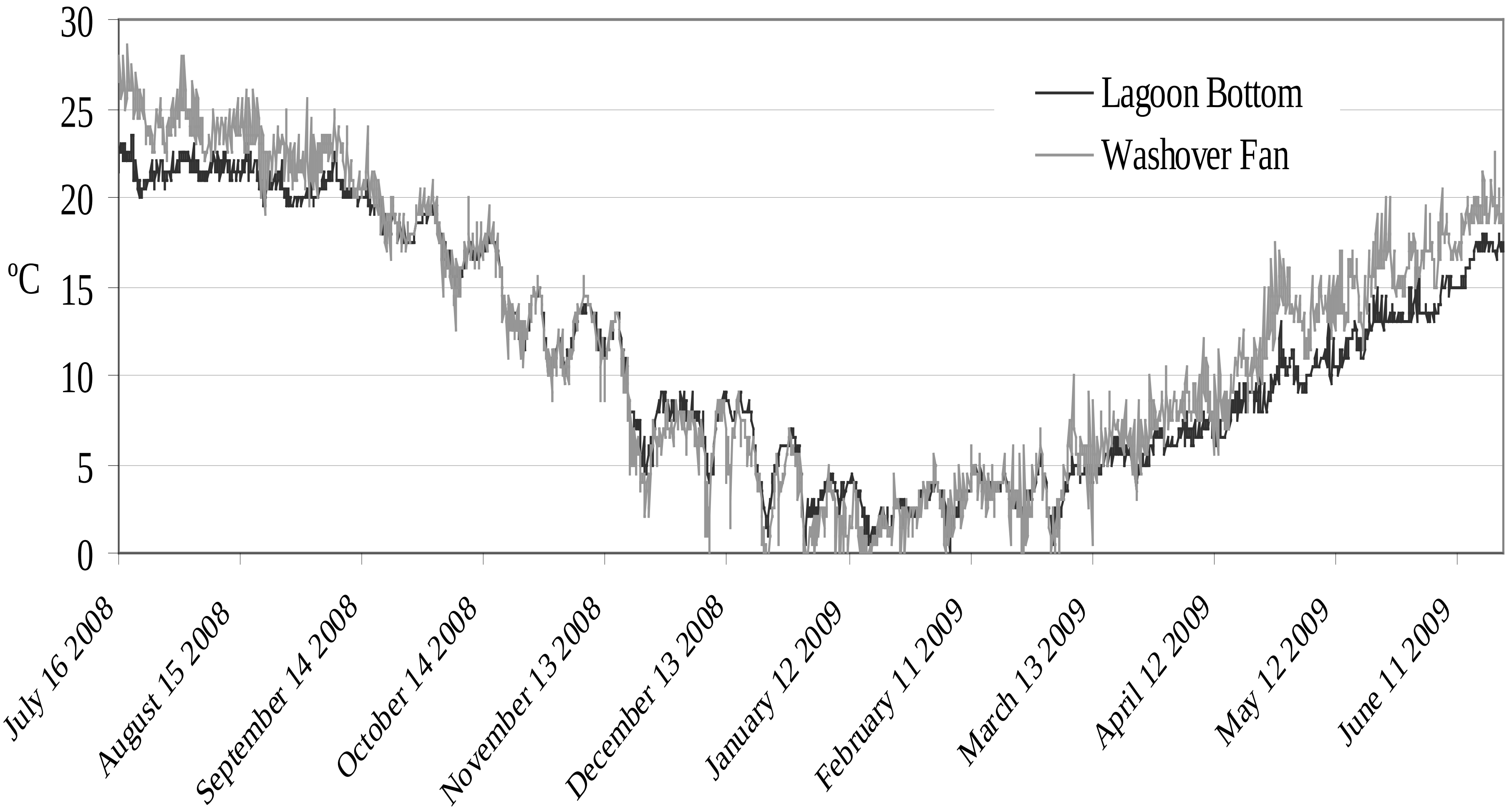
PISHAGQUA SERIES

The Pishagqua series consists of very deep, subaquic soils that are permanently submerged in low energy depositional basins, estuaries and coastal lagoons. The Pishagqua soils formed in silty estuarine deposits. Estimated saturated hydraulic conductivity is moderately high to high. Slopes range from 0 to 3 percent, mean annual air temperature is 10 degrees C, and mean annual precipitation is 1320 mm.
TAXONOMIC CLASS: Fine-silty, mixed, superactive, nonacid, mesic Typic Sulfiwassents

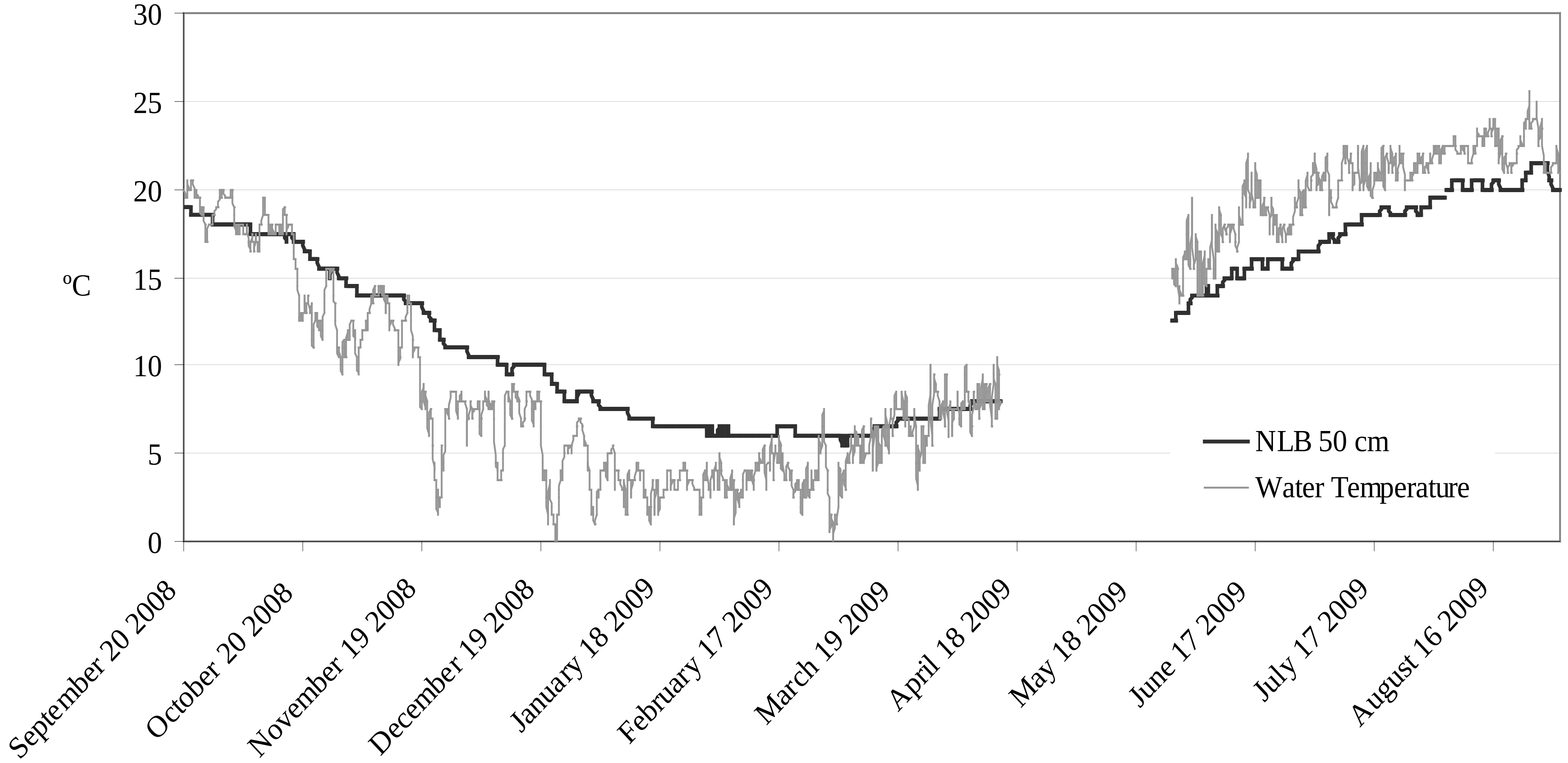
TYPICAL PEDON: Pishagqua silt loam on a south facing 1 percent, concave slope in an Eelgrass (Zostera marina) bed of a lagoon bottom channel under 2 meters (National Vertical Datum 1988) of estuarine water. Tidal range is 24 cm. (Colors are for moist soil unless otherwise noted).
Ag--0 to 15 cm; black (5Y 2.5/2), silt loam, gray (5Y 6/1) dry; massive; loose, nonsticky, nonplastic, very fluid; 1 percent flat angular shell fragments; hydrogen sulfide odor; strongly saline; slightly alkaline (pH 7.5); extremely acid (pH 3.9) after 8 weeks of aerobic incubation; clear boundary. (0 to 38 cm thick).
Cg1--15 to 110 cm; black (5Y 2.5/1) silt loam; gray (5Y 5/1) dry; massive; loose, nonsticky, nonplastic, very fluid; 1 percent flat angular fine and medium shell fragments; hydrogen sulfide odor; strongly saline ;neutral (pH 7.0); extremely acid (pH 3.7) after 8 weeks of aerobic incubation; gradual boundary.
Cg2--110 to 160 cm; black (5Y 2.5/1) silt loam, gray (5Y 6/1) dry; massive; loose, nonsticky, nonplastic, moderately fluid; hydrogen sulfide odor; neutral (pH 6.8); strongly saline; ultra acid (pH 3.3) after 8 weeks of aerobic incubation; gradual boundary.
Cg3--160 to 200 cm; black (5Y 2.5/1) silt loam, gray (5Y 6/1) dry; massive; loose, nonsticky, nonplastic, moderately fluid; 1 percent flat subangular shell fragments; hydrogen sulfide odor; moderately saline; neutral (pH 6.7); ultra acid (pH 3.4) after 8 weeks of aerobic incubation; .
TYPE LOCATION: Washington County, Rhode Island; Town of Charlestown, Fort Neck Cove of Ninigret Pond, about 1,360 feet north of the western tip of Potato Point and 1,260 feet south-west of the eastern-most shoreline position of Tautog Cove, Carolina USGS Quadrangle; lat. 41 degrees 22 minutes 33.77 seconds N. and long. 71 degrees 38 minutes 48.47 seconds W. NAD 83.

Soil Series	Depositional Environment(s)	Subgroup
Billington	Mainland Cove	Thapto-histic Sulfiwassent
	Lagoon Channel	Typic Haplowassent
Fort Neck	Lagoon Bottom	Haplic Sulfiwassent
Massapog	Flood-Tidal Delta Flat, Abandoned Inlet Channel	Fluventic Psammowassent
Pishagqua	Lagoon Bottom	Typic Sulfiwassent
Nagunt	Washover Fan Flat	Typic Psammowassent
Napatree	Submerged Beach	Haplic Sulfiwassent

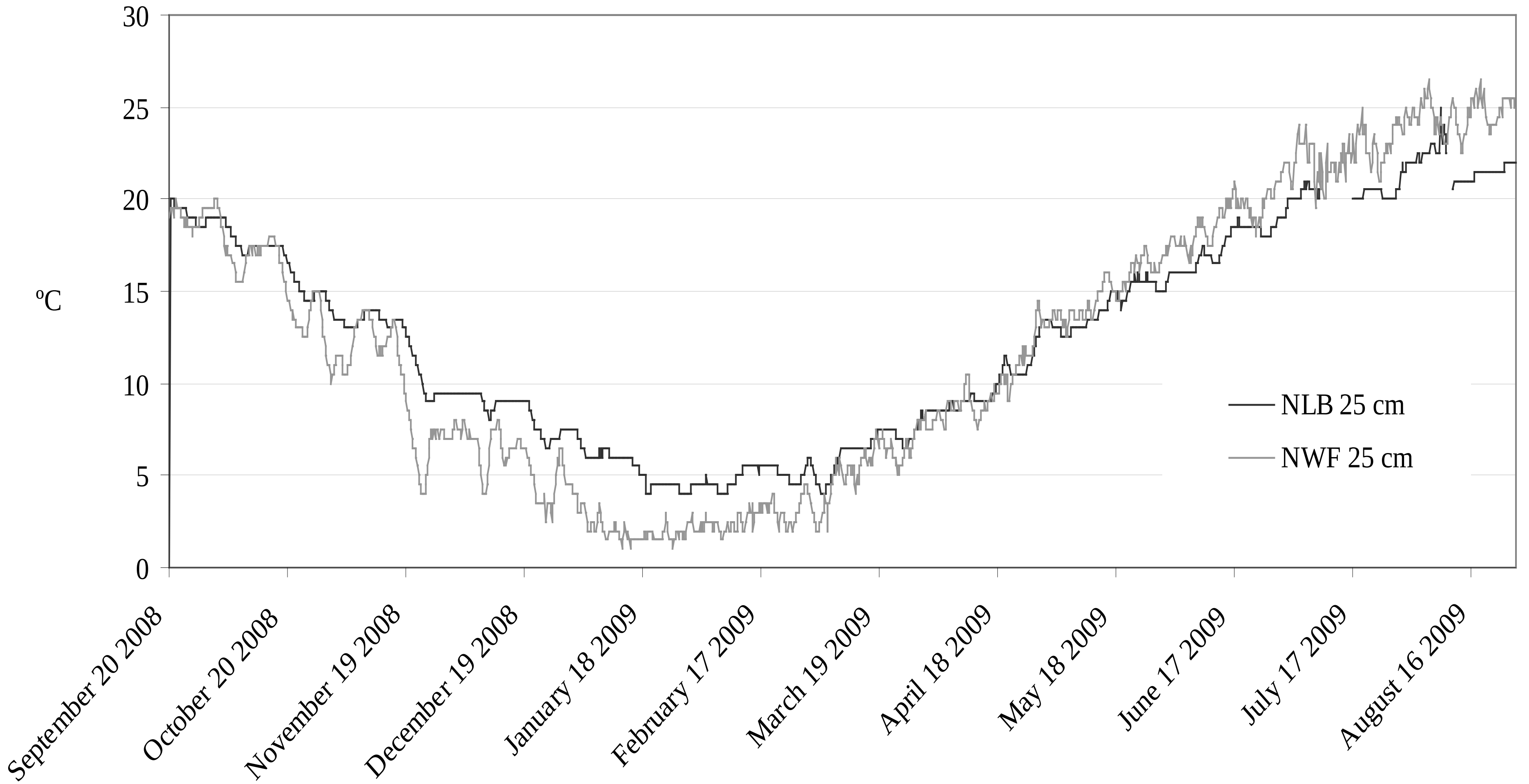
Salisbury, 2010



Water temperature fluctuations in Quonochontaug Pond. Water temperature fluxes decreased with increasing water depth as can be seen between Washover Fan (0.8 meters deep) and Lagoon Bottom (3.2 meters deep).



Soil temperature at 50 cm in Ninigret Pond Lagoon Bottom and at the soil-water interface.



Soil temperatures at 25 cm in Ninigret Pond Lagoon Bottom and Washover Fan . Both sites have the same water depths (1.00; 1.04 m). The coarser textured soil (NWF) has higher summer temperatures and lower winter temperatures suggesting a texture effect on soil temperature.

Subaqueous soil and water temperatures means for September 20, 2008 – August 27, 2009. Data were collected every 4 hours.

Soil Temperatures (ºC)

Site (iButton depth)	Annual	Summer	Winter	Summer - Winter	Water Depth (m)
NWF (25 cm)	12.3	22.3	3.5	18.8	1.04
NWF (50 cm)	12.3	20.5	4.9	15.6	"
NLB (25 cm)	12.5	19.8	6.3	13.5	1.00
NLB (50 cm)	12.6	17.9	7.6	10.3	1.50
QWF (25 cm)	12.1	21.6	3.5	18.3	0.79
QSMB (25 cm)	12.1	20.7	4.7	16.0	0.99
QLB (25 cm)	10.8	16.9	5.6	11.4	3.19
Pawcatuck (40 cm)	8.7	16.8	4.5	12.3	-

Water Temperatures (ºC)

NWF	11.5	23.0	2.2	19.7	1.04
NLB	12.0	22.3	2.8	19.5	1.00
QWF	12.1	22.0	3.5	18.5	0.79
QSMB	12.4	21.8	4.3	17.5	0.99
QLB	11.2	19.5	4.2	15.3	3.19

Soil Temperature Summary

- Differences in subaqueous soil temperature among soil-landscape units controlled by:
  - Overlying water column temperature
  - Water column depth
  - Soil texture (especially at 25 cm)
  - Other factors? Tidal range, vegetation, distance to inlet

- Subaqueous soil temperature in Rhode Island
  - Mesic temperature regime
  - Subaqueous soil temperature warmer in winter, cooler in summer with respect to water column temperature