

CAPE COASTAL CONFERENCE December 4-5, 2018



Soil Survey and the Coastal Zone: Bridging the land-water divide

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Helping People Help the Land





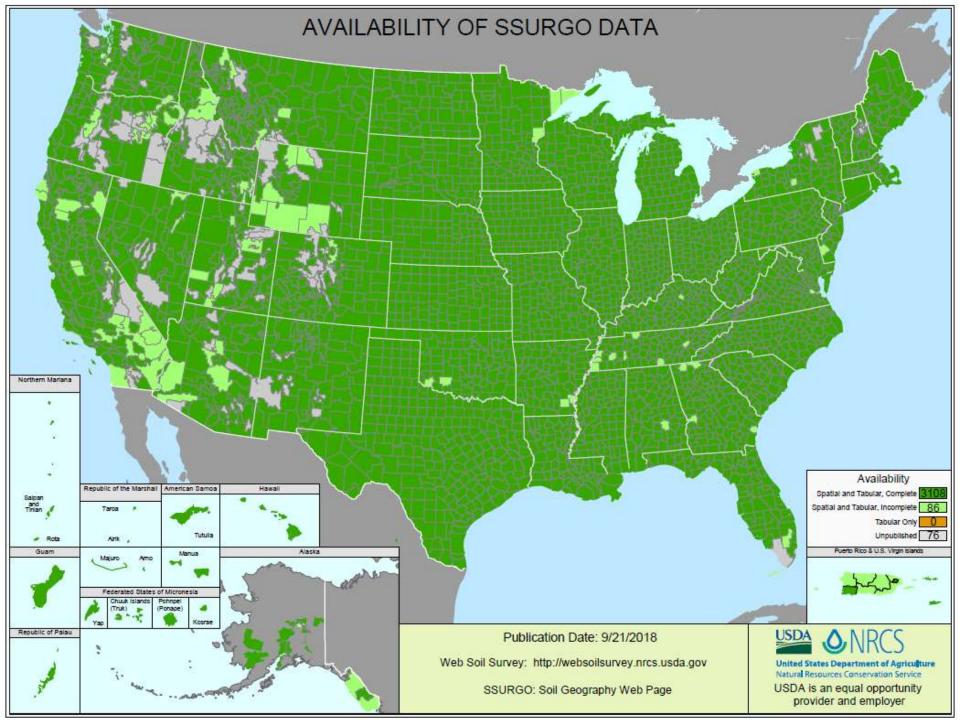
- What is soil survey?
- Crossing into the coastal zone
- Soil Interpretations
 - Carbon
 - Marsh restoration
 - Shoreline erosion
 - Ecological sites
- Accessing data

Flowe 1 .-- Typical pattern of soils and underlyi

As a member of the National Cooperative Soil Survey, NRCS is the lead federal agency for the mapping and interpretation of the Nation's soil resources.

Soil color at 5 cm

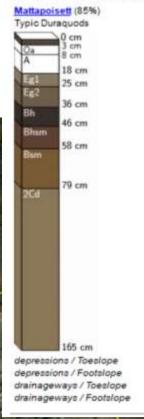
As a member of the National Cooperative Soil Survey, NRCS is the lead federal agency for the mapping and interpretation of the Nation's soil resources. Flows 1.-Typical pattern of soils and underlying material in the Paxton-Woodbridge-Whitman association Soil color at 50 cm

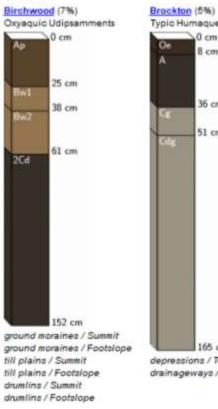


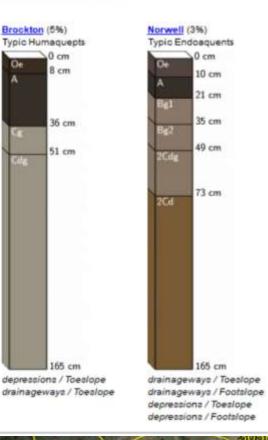
Mattapoisett loamy sand, 0 to 3 percent slopes, extremely stony (SSURGO Export 2018-09-07)

Components within map unit 309363

USDA



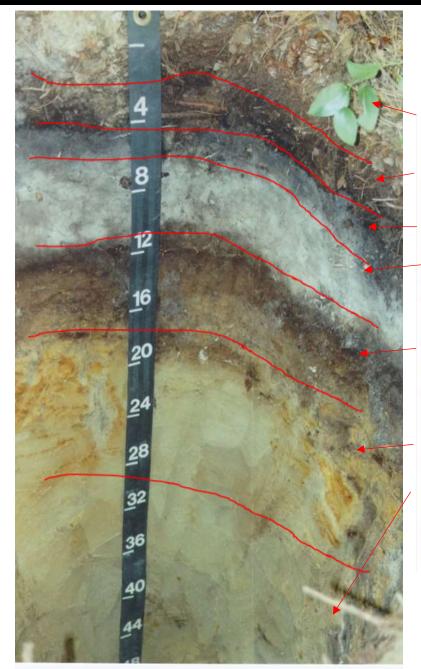






310B

70B



Oi-0 to 5 centimeters ; loose; abrupt wavy boundary. Lab sample # 93P04863

Oe--5 to 10 centimeters; very dark gray (5YR 3/1) broken face and dark reddish brown (5YR 3/2) rubbed partially decomposed organic matter; very friable; common fine to coarse roots throughout and many very fine roots throughout; abrupt wavy boundary. Lab sample # 93P04864

Oa--10 to 18 centimeters; dusky red (2.5YR 3/2) broken face and very dark gray (N 3/0) rubbed; very friable; common fine to coarse roots throughout and many very fine roots throughout; extremely acid, pH 4.3, Bromcresol green; abrupt wavy boundary. Lab sample # 93P04865

A--18 to 24 centimeters; very dark gray (N 3/0) broken face fine sandy loam; weak medium and coarse granular structure; friable, nonsticky, nonplastic; common very fine and fine roots throughout and few medium and coarse roots throughout; strongly acid, pH 5.1, Bromcresol green; abrupt wavy boundary. Lab sample # 93P04866

E--24 to 36 centimeters; dark gray (10YR 4/1) broken face fine sandy loam; 10 percent medium faint spherical very dark gray (10YR 3/1) and 25 percent medium and coarse faint spherical gray (10YR 5/1) mottles; massive; friable, nonsticky, nonplastic; few very fine to medium roots throughout; organic stains; strongly acid, pH 5.3, Chlorophenol red; abrupt wavy boundary. Lab sample # 93P04867

Bhs--36 to 57 centimeters; dark brown (7.5YR 3/2) broken face loamy sand; 10 percent fine distinct spherical strong brown (7.5YR 4/6) and 10 percent fine and medium distinct spherical very dark gray (5YR 3/1) mottles; massive; friable, nonsticky, nonplastic; common very fine and fine roots throughout and few medium roots throughout; strongly acid, pH 5.5, Chlorophenol red; abrupt wavy boundary. Lab sample # 93P04868

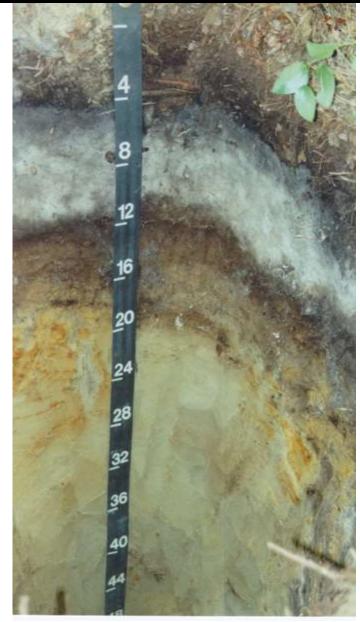
Bsm-57 to 65 centimeters; strong brown (7.5YR 5/6) broken face loamy sand; 10 percent fine and medium prominent irregular dark reddish brown (2.5YR 3/4) and 10 percent fine and medium prominent irregular dusky red (2.5YR 3/2) mottles; massive; very firm, hard, nonsticky, nonplastic; common very fine roots in cracks; strongly acid, pH 5.5, Chlorophenol red; clear wavy boundary. Lab sample # 93P04869, sample # 93P4875 is a subsample of this horizon.

Bs-65 to 98 centimeters; 85 percent (10YR/), broken face and 15 percent (2.5Y/), broken face; 25 percent medium and coarse prominent irregular red (2.5YR 4/6) and 25 percent medium and coarse distinct irregular strong brown (7.5YR 4/6) mottles; firm, slightly hard, nonsticky, nonplastic; few fine roots in cracks and common very fine roots in cracks; strongly acid, pH 5.5, Chlorophenol red; clear wavy boundary. Lab sample # 93P04871. 93P4870.

C-98 to 126 centimeters; yellowish brown (10YR 5/4) broken face loamy sand; 10 percent fine and medium distinct irregular yellowish brown (10YR 5/6) and 10 percent fine faint irregular brown (10YR 5/3) mottles; massive; friable, loose, nonsticky, nonplastic; moderately acid, pH 5.7, Chlorophenol red; clear wavy boundary. Lab sample # 93P04872

2Cd1--126 to 150 centimeters; light olive brown (2.5Y 5/3) broken face sandy loam; 1 percent medium prominent irregular yellowish brown (10YR 5/6) and 1 percent medium distinct irregular light brownish gray (10YR 6/2) mottles; massive; firm, slightly hard, nonsticky, nonplastic; brittle; common very fine and fine moderate-continuity vesicular pores; moderately acid, pH 5.6, Chlorophenol red; clear wavy boundary. Lab sample # 93P04873

2Cd2–150 to 183 centimeters; grayish brown (2.5Y 5/2) broken face sandy loam; 1 percent fine and medium prominent irregular yellowish brown (10YR 5/6) mottles; massive; firm, hard, nonsticky, nonplastic; brittle; common very fine and fine moderate-continuity vesicular pores; 1 percent fine spherical extremely weakly cemented dark redish brown (5YR 3/2) ironmanganese masses throughout; moderately acid, pH 5.7, Chlorophenol red. Lab sample # 93P04874 USDA





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PSDA & Rock Fragments

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Matapoinett USDA-MRCS-HISSC-National Boil Survey Laboratory

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Solls Analyzed by: NRCS Hellogy Soll Servey Laboratory & Cooperating University Laboratories

Sengtied As Series Name: Mattapoisett Correlated Series Name: Mattapoisett Country: United States State: Measurchanette County: Physically MLRA: 144A Latitude: 41,6291656 Longitude: 70.8102758

Lab Data Report Peden Description Report Complete Perion Index: 6

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*** Primary Characterization Data ***

(Plymouth, Massachusetts.)

Peter No. 33P0704

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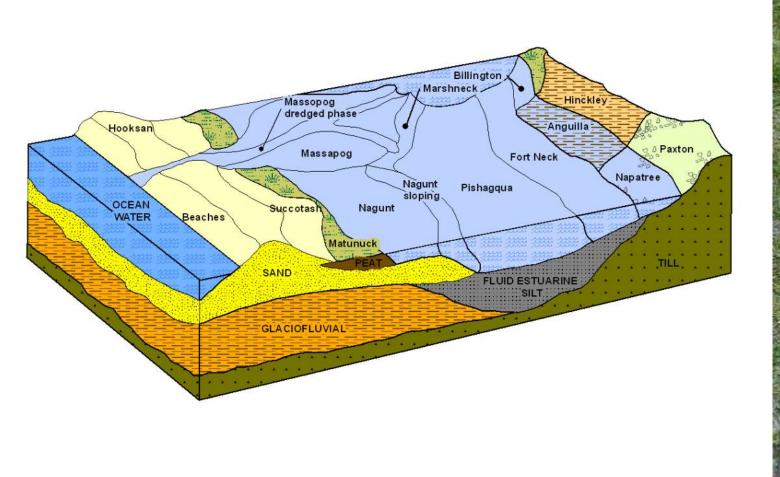
Coastal zone soil survey:

- Update existing soil survey data to include
 - Detailed salt marsh survey data
 - Dune land, beach land
 - Subaqueous soils
- These areas were mapped very broadly in many original soil surveys

The well established standards, techniques, and protocols used in mapping and interpreting these resources have been applied to coastal and subaqueous soil survey projects.

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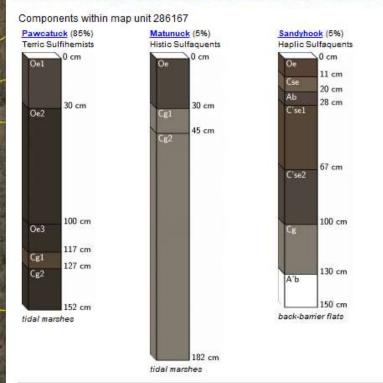


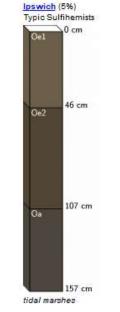


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Pawcatuck mucky peat, 0 to 2 percent slopes, very frequently flooded (SSURGO Export: 2018-09-05)

In the second second





Block Diagrams: <u>o'o NCSS Job Aids</u> note that these diagrams may be from multiple survey areas

- 1. MA-2012-02-01-01
- 2. MA-2012-02-01-02
- 3. MA-2012-02-01
- 4. MA-2012-02-02-10 5. NY-2012-02-15-34
- 6. NY-2012-02-15-40
- 0. 11120120210





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Uses of soil survey

- Soil Interpretations
 - Carbon accounting
 - Marsh restoration
 - Shoreline erosion
 - Oyster habitat
 - Ecological sites

Map — Organic Matter





☑ Area of Interest (AOI)

🗹 🖂 Soils

Map Legend

USDA

- Soil Survey Areas
- Soil Map Unit Polygons

🗖 🛛 🛩 Soil Map Unit Lines

🗖 🛛 🗖 Soil Map Unit Points

🗹 🖻 Soil Rating Polygons

= <= 1.29

> 1.29 and <= 2.57</p>

> 2.57 and <= 40.68</p>

> 40.68 and <= 64.00</p>

> 64.00 and <= 86.75</p>

Not rated or not available

🗹 🗉 Soil Rating Lines

🗹 🗄 Soil Rating Points

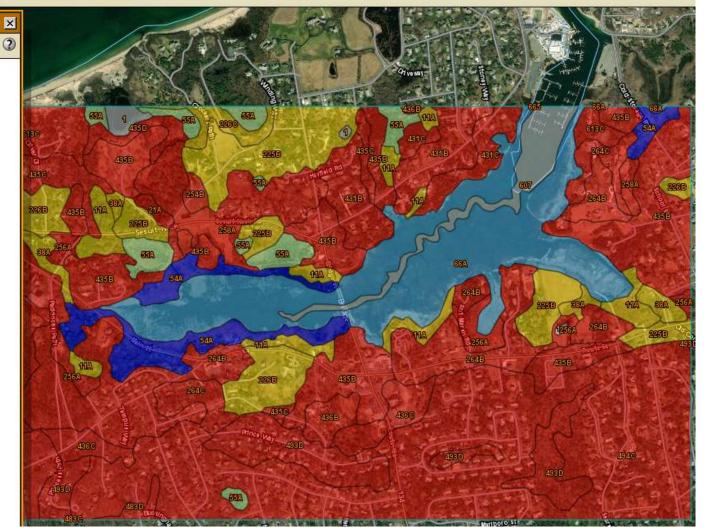
🗖 🗉 Special Point Features

🗂 📪 Special Line Features

□
Political Features

□
Federal Land

🗹 🗉 Background



% Organic Matter; 0 to 100 cm

Blue carbon inventories

Hydropedology Symposium: 10 Years Later and 10 Years into the Future

Estuarine Subaqueous Soil Organic Carbon Accounting: Sequestration and Storage

Christina M. Millar Adiza Ama Owusu Aduomih Brett Still Mark H. Stolt* Dep. of Natural Resources Science Coastal Institute-Kingston Univ. of Rhode Island Kingston, RI (2001) Subaqueous soils have largely been overlooked in soil C accounting studies. Recent work suggests that shallow, subtidal soils along the Atlantic Coast contain soil organic C (SOC) pools that are equal to or greater than comparable upland pools. In this study, we investigated the spatial relationships between SOC pool size and subaqueous soil landscape units in three coastal lagoons in Rhode Island and estimated SOC sequestration rates for these soils. Fifty-lwo pedons were sampled to 1 m and analyzed for SOC content and bulk density to calculate SOC pools. Pools varied significantly among soil landscape units and subamuous soil Great Groups. Average SOF much for the unner URI research suggests that subaqueous soil organic carbon pools and sequestration rates are essentially equivalent to regional forest subaerial mineral soils.



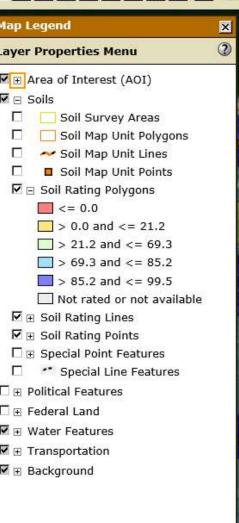
Soil Classification		Mean SOC		
(subgroup)	n	(Mg ha ⁻¹)	CV (%)	Reference
Typic Udipsamments	20	110	15	Davis et al., 2004
Typic Dystrudepts	29	136	29	Davis et al., 2004
Aeric Endoaquepts	20	187	31	Davis et al., 2004
Aeric Endoaquepts	29	246	39	Ricker et al., 2013
Typic Haplosaprists	30	586	20	Davis et al., 2004
Fluventic Psammowassents	9	47	43	This Study
Sulfic Psammowassents	5	57	82	This Study
Typic Fluviwassents	5	109	50	This Study
Haplic Sulfiwassents	10	123	43	This Study
Typic Sulfiwassents	5	141	42	This Study
Fluventic Sulfiwassents	5	196	28	This Study
Thapto-Histic Sulfiwassents	3	494	35	This Study

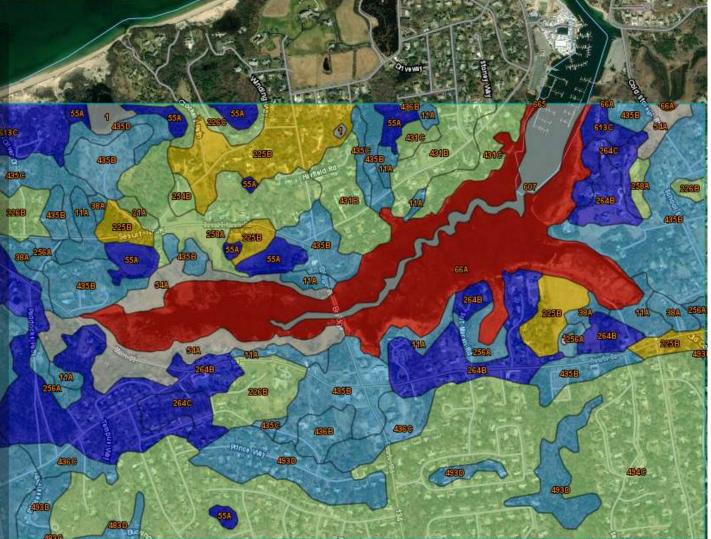


photo credit: Jim Turenne

ap — Percent Sand

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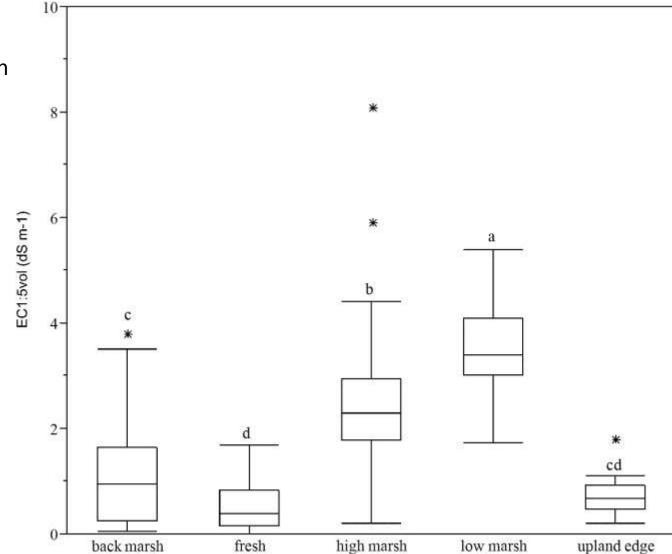


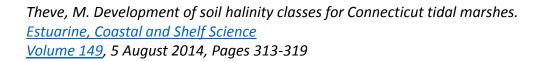


Percent Sand, 0-30 cm depth

Soil Halinity Classes

 Identifying brackish salt marshes





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Halinity Class

Back Marsh High Salt Marsh Low Salt Marsh

Connecticut River

Fenwick Barough

Great Island

Tidal Fresh Marsh

Halinity Classes*

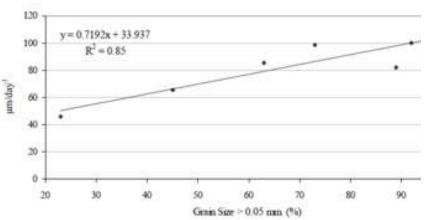
Classes determined by grouping like vegetative communities after preliminary sampling:

Low Marsh	High Marsh	Back Marsh	Upland Edge	*names subject to chang Fresh
Spartina alterniflora	Spartina patens, Distichlis spicata, & Juncus gerardii	Bolboschoenus maritimus & Schoenoplectus robustus	Iva frutescens & Panicum virgatum	Typha x glauca & Phragmites australis
smooth cordgrass	saltmeadow cordgrass, saltgrass, blackgrass	salt marsh bullrush	marsh elder, switchgrass	hybrid cattail, common reed

Theve, M. Development of soil halinity classes for Connecticut tidal marshes. Estuarine, Coastal and Shelf Science Volume 149, 5 August 2014, Pages 313-319

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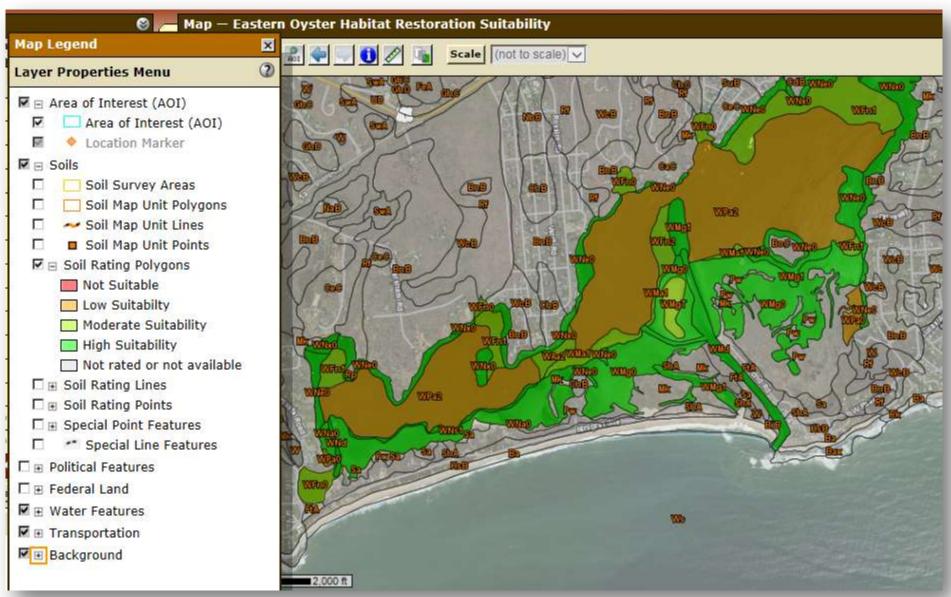
Eastern Oyster Habitat Restoration Suitability



Relationship of sand content to oyster growth (Salisbury, 2010). Soils with increasing siltclay contents showed a relative reduction in growth



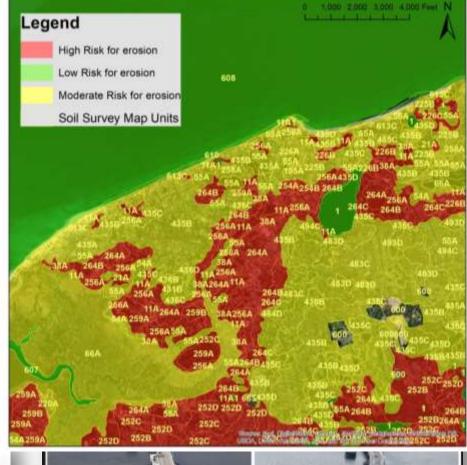
		High Suitability	Moderate Suitability	Low Suitability	Not Suitable	References
	Water Depth	0.5 to 3 meters	3 to 5 meters	0 to 0.5 meters or > 5 meters		Hines and Brown (2012); <u>Nau</u> (2007)
7	Soil Particle Size: percent clay and/or silt (surface horizon)	< 10 %	10 to 90 %	> 90%		Starke et al. (2011); Rhoads and Young (1970); Shumway (1996); Marshall, (1954); Salisbury (2010); Still (2016)
	Soil Particle Size: percent sand (surface horizon)	> 80 %	10 to 80%	< 10%		Starke et al. (2011); Rhoads and Young (1970); Shumway (1996); Marshall, (1954); Salisbury (2010); Still (2016)
	Rock Fragments (includes shell fragments) (surface horizon)	>=15 %	0.1 to <15 %	None		Starke et al. (2011)
	Rock Fragment Phases	rocky, very rocky, or bouldery phase				Starke et al. (2011)
	Presence of Reduced Monosulfides (surface horizon)	No		Yes		Salisbury (2010); Still, (2016); de Zwaan A, and JMF <u>Babarro</u> (2001)
	Oxidized pH (surface horizon)	pH >4		pH 4 or less		Salisbury (2010); Still, (2016); de Zwaan A, and JMF <u>Babarro</u> (2001)
	Soil Reaction Class: pH (surface horizon)	pH 6.8 to 8.8	pH 6.0 to 7.5 and pH 8.8 to 9.0	pH < 6.0 and pH > 9.0		Galtsoff (1964); Sellers and Stanley (1984); Kennedy et al. (1996)
	Electrical Conductivity 1:5 by Volume				<0.2 dS/m	Thayer et al. (2005); Starke et al. (2011); Begget et al. (2014); Soil Survey Staff (2014)





Shoreline Erosion

- Soils prone to mass movement along coastal, lake and river shorelines
 - Soil texture
 - Discontinuity
 - Hydraulic conductivity
 - Slope
 - Bedrock







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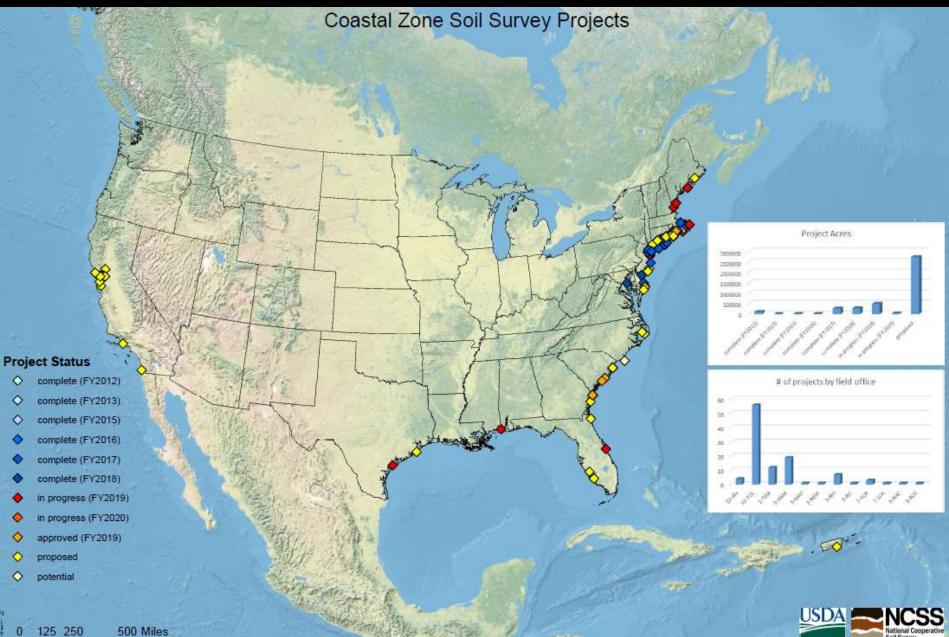
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Soil Survey

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Accessing Soils Maps and Data:

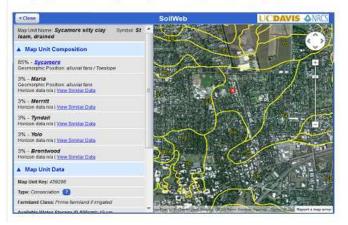
- Web Soil Survey
- Soil Web
- Soil Web Earth

SoilWeb Apps

SoilWeb products can be used to access USDA-NCSS detailed soil survey data (SSURGO) for most of the United States. Please choose an interface to SoilWeb:

SoilWeb

Explore soil survey areas using an interactive Google map. View detailed information about map units and their components. This app runs in your web browser and is compatible with desktop computers, tablets, and smartphones.

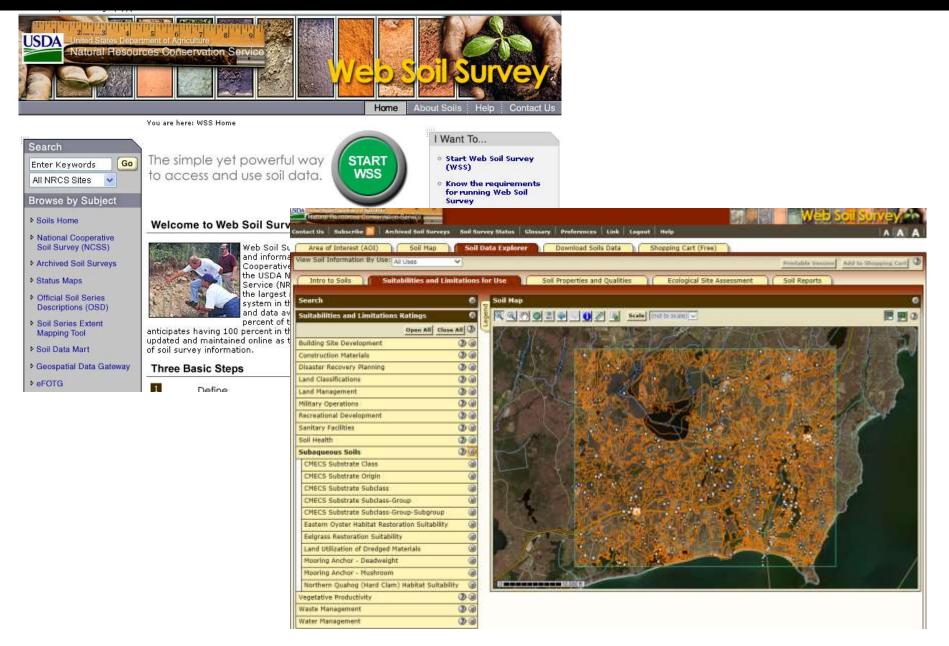


SoilWeb Earth

Soil survey data are delivered dynamically in a <u>KML</u> file, allowing you to view mapped areas in a 3-D display. You must have <u>Google Earth</u> or some other means of viewing KML files installed on your desktop computer, tablet, or smartphone.









Thank You

