WINDSOR

Connecticut State Soil

SOIL SCIENCE SOCIETY OF AMERICA

Introduction

Many states have a designated state bird, flower, fish, tree, rock, etc. And, many states also have a state soil – one that has significance or is important to the state. The Windsor is the unofficial state soil of Connecticut. Let's explore how the Windsor is important to Connecticut.

History

The Windsor soil series was established in the Connecticut Valley Area in 1899. On May 3, 1899 with an appropriation of $16,000, Milton Whitney, the Chief of the Division of Agricultural Soils, began four soil survey field operations. One of surveys was located in Connecticut and concentrated on tobacco lands in the Connecticut Valley. The soils of the Connecticut Valley were classified and mapped according to any condition which might influence the character of the vegetation, especially the character of the tobacco, the kind of crops adapted to the land, as well as the quality and quantity of the crops. Windsor was one of the soils classified and mapped this way.

The Windsor sand as it was called, represented the original bottom of the old glacial Lake Hitchcock in its shallowest parts. Initial lab data found the soil to be composed of yellowish-red or brown sand, containing less than 5 percent clay. In favorable seasons, very fine quality thin-leaved silky tobacco was produced on these soils.

The Windsor soil was named after the town of Windsor. Windsor is a town in Hartford County, Connecticut and was the first English settlement in the state.

What is Windsor Soil?

The Windsor series consists of very deep, excessively drained, rapidly permeable soils formed in sandy outwash or *eolian* deposits (material accumulated through wind deposits). They are found on nearly level through very steep slopes (0 to 60 percent slopes) on *glaciofluvial landforms*. Surface runoff is negligible to medium.

Every soil can be separated into three size fractions called *sand*, *silt*, and *clay*, which make up the *soil texture*. They are present in all soils in different proportions and tell us a lot about the character of the soil.

Photo Soil Monolith: Chip Clark/Smithsonian Institution

Fig. 1. Soil profile of a Windsor soil from Hartford County, CT. Credit: USDA-NRCS.

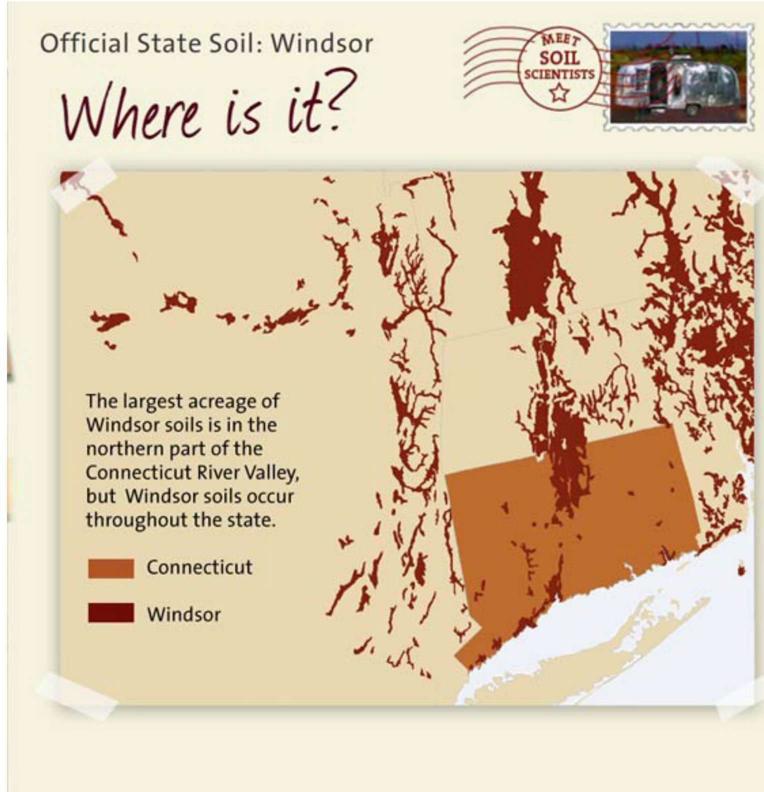

Fig. 2. Distribution of Windsor soil series. Credit: Smithsonian Institution's Forces of Change.

Where to dig Windsor?

Yes, you can dig a soil. It is called a soil pit and it shows you the *soil profile*. The different horizontal layers are called *soil horizons*. The Windsor soil profile consists of an upper layer (A horizon) that can be up to 12 inches thick with textures ranging from loamy fine sand to sand. The next layer (B horizon) is loamy sand to sand. The next layer (C horizon) is loamy fine sand to coarse sand (**Figure 1**). With these types of sandy soils, the soil is friable (easily crumbles) and its *soil structure* is said to be granular (like grains of sand).

So, where would you dig a Windsor soil pit? The largest areas of Windsor soils are in the northern Connecticut River Valley, but the soils are mapped throughout the state. Windsor soils cover about 34,000 acres in Connecticut (**Figure 2**). Some soils formed in sand dunes swept by winds from the Connecticut River Valley as ancient glacial Lake Hitchcock receded.

In all, there are a total of 112 named soil series in Connecticut. Each soil series has specific relationships to landscapes, regional geology, and parent materials. Look for road cuts and other instances of exposed soils as you travel around Connecticut and get a feel for how many different soils there are!

Uses and Importance

Generally, Windsor soils throughout its range can be used for agriculture (growing food for humans and animals); engineering (roads, buildings, tunnels); ecology (wetlands); recreation (ball fields, playgrounds, camp areas), and more. Common trees are white, black, and northern red oak, eastern white pine, pitch pine, gray birch, poplar, red maple, and sugar maple.

Windsor soils are well suited to the highly diversified agriculture of Connecticut and are the preferred soils for the production of shade tobacco (**Figure 3**). They are also important for fruit and vegetable crops, silage corn, and ornamental shrubs and trees. It is no wonder that the Windsor soils are classified as being a farmland of statewide importance. Farmland of statewide importance are soils that fail to meet one or more of the requirements of prime farmland, but are important for the production of food, feed, fiber, or forage crops. They include soils that are nearly prime farmland and that economically produce high yields of crops when treated and managed according to acceptable farming methods. It's the Windsor soil's sandy textures, thus a need for supplemental irrigation that limits its classification to important rather than prime. And, present day users must take into consideration its high leaching potential and proximity to ground water sources.

Windsor soils are also well suited for commercial and residential development, as well as a source for construction material. In addition, the combination of soil characteristics of Windsor soils provide a high potential for preservation of bone, a great advantage for those studying archaeology and related sciences.

Fig. 3 . Tobacco grown on Windsor loamy sand. The tobacco shed in the background is a long, low windowless building with a pitched roof which uses ventilation to aid the curing of the tobacco. Credit: USDA-NRCS

Limitations

When a soil cannot be used for one or more of the described functions, it is referred to as a limitation. Soil experts, called *Soil Scientists*, studied Windsor soil and determined that the main limitation is droughtiness for crops, lawns, and landscaping. During dry months, irrigation is necessary for optimal production.

Windsor soils overlay sand and gravel groundwater aquifers so there is also a hazard of ground water pollution due to the rapid *permeability* and low water holding capacity of these soils.

Soil Management

Windsor soils typically are low in organic matter and clay, and have medium natural fertility but are productive with added fertilizer. Since these soils are sandy, adding fertilizer and lime can easily be leached from these soils and must be managed carefully. Drought is the main limitation of this soil, so irrigation is necessary to increase productivity in some locations.

Windsor Formation

Before there was soil there were rocks and in between, CLORPT. Without CLORPT, there will be no soil. So, what is CLORPT? There are five major factors that are responsible for forming a soil like the Windsor series. There are **Cl**imate, **O**rganism, **R**elief (topography), **P**arent material, and **T**ime – CLORPT, for short.

CLORPT is responsible for the development of soil profiles and chemical properties that differentiate the soils. So, the characteristics of Windsor soil (and all other soils) are determined by the influence of CLORPT. Weathering takes place when environmental processes such as rainfall, freezing, and thawing act on rocks causing them to fracture and break into pieces. CLORPT then acts on rock pieces, marine sediments and vegetative materials to form soils.

Climate – Temperature and precipitation influence the rate at which parent materials weather and dead plants and animals decompose. They affect the chemical, physical and biological relationships in the soil. The Windsor soils are found in areas where the mean annual temperature is about 10 degrees C (50 degrees farenheit) and mean annual precipitation is about 1092 mm (43 inches). The growing season ranges from 120 to 190 days.

Organisms – This refers to plants and animal life. In the soil, plant roots spread, animals burrow in, and bacteria break down plant and animal tissue. These and other soil organisms speed up the breakdown of large soil particles into smaller ones. Plants and animals also influence the formation and differentiation of soil horizons. Plants determine the kinds and amounts of organic matter that are added to a soil under normal conditions. Animals breakdown complex compounds into small ones and in so doing add organic matter to soil. Windsor soil develops mostly under forested areas or in low growing brushy vegetation which deposit leaves, twigs, and other plant remains on the surface that readily degrade and leach through the sandy soil. Windsor soils typically have little accumulation of organic matter unless they are used as farmland where thick, dark surface colors have formed indicating greater organic matter content.

Relief – Landform position or relief describes the shape of the land (hill and valleys), and the direction it faces which makes a difference in how much sunlight the soil gets and how much water it keeps. Deeper soils form at the bottom of the hill rather than the top because gravity and water move soil particles downhill. Windsor soils formed on nearly level through very steep soils typically on glaciofluvial landforms. The steeper slopes are typically on terrace escarpments. (**Figure 4**)

Parent Material (C horizon) – Just like people inherit characteristics from their parents, every soil inherits some traits from the material from which it forms. Some parent materials are transported and deposited by glaciers, wind, water, or gravity. Windsor soils develop on glaciofluvial landforms shaped by glaciers from the late Pleistocene but include late-Wisconsin-aged dunes.

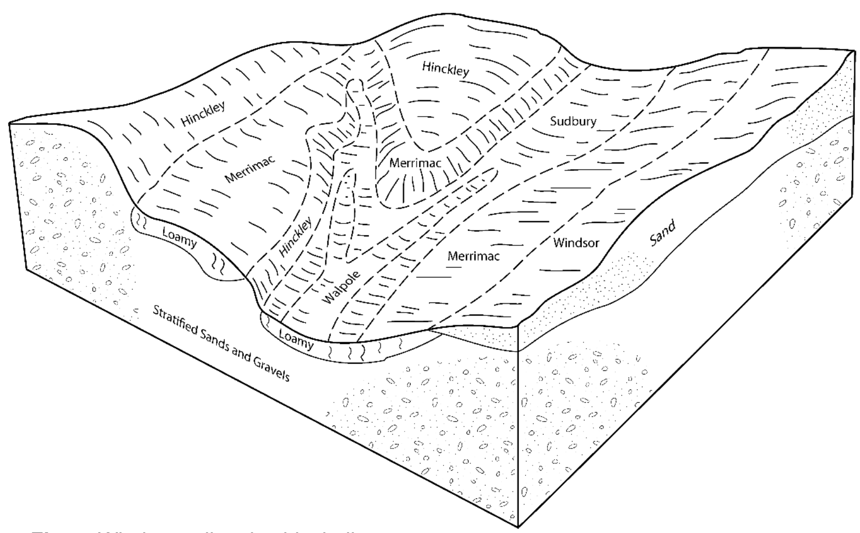

Fig. 4. Windsor soil series block diagram.
Credit: USDA-NRCS.

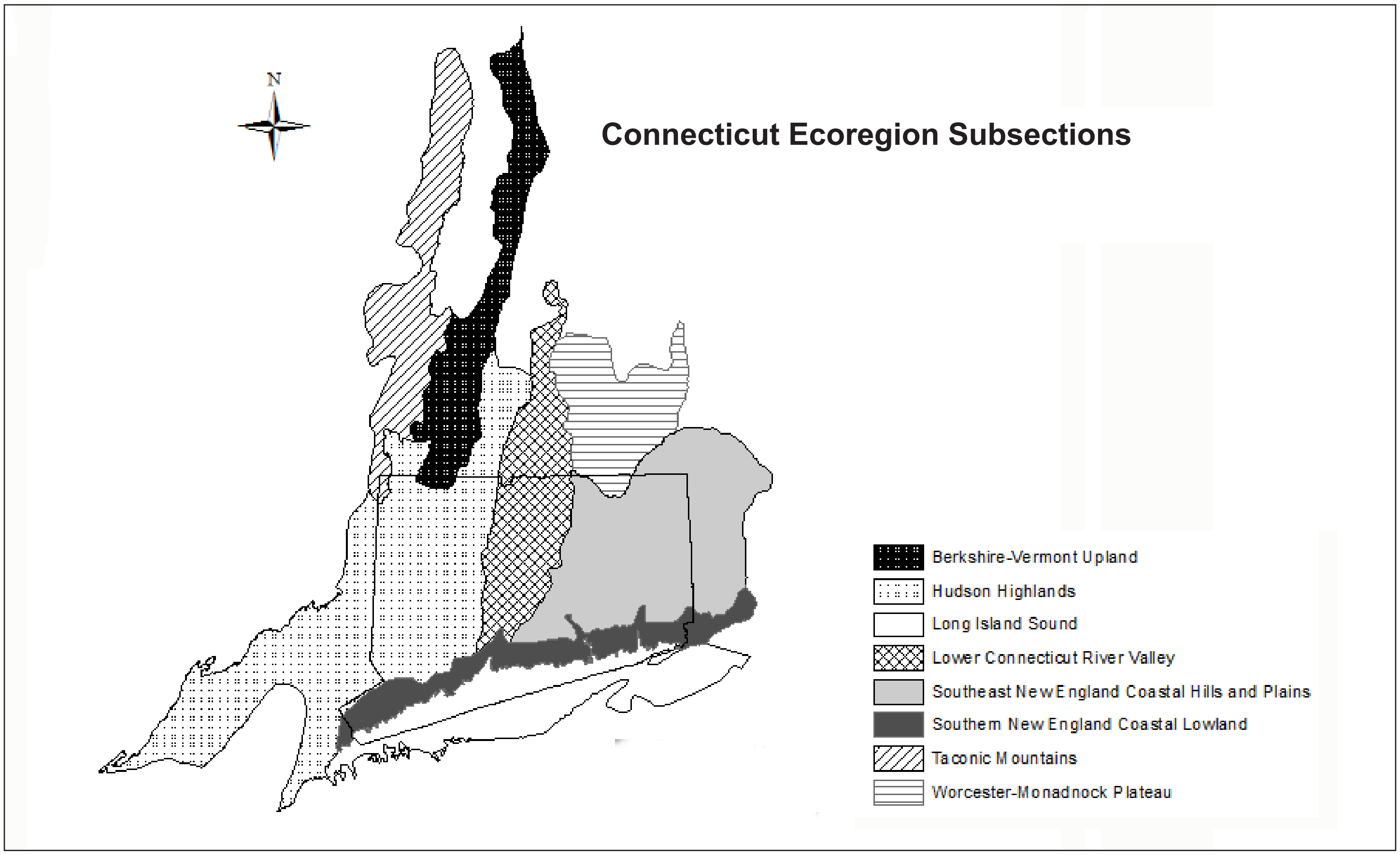

Fig. 5. Connecticut Ecoregions map. Credit: US Forest Service Subsections (Keys et al., 1995).

Time – All the factors act together over a very long period of time to produce soils. As a result, soils vary in age. The length of time that soil material has been exposed to the soil-forming processes makes older soils different from younger soils. Generally, older soils have better defined horizons than younger soils. Less time is needed for a soil profile to develop in a humid and warm area with dense vegetative cover than in a cold dry area with sparse plant cover. More time is required for the formation of a well-defined soil profile in soils with fine textured material than in soils with coarse-textured soil material. Glaciation profoundly affected Connecticut as continental glaciers moved through the region during the Pleistocene Epoch most recently about 24,000 years ago (the Wisonsinan glacier) and spread rapidly as far as the southern edge of Long Island. Deglaciation began about 18,000 years ago, and by about 13,000 years ago the last ice sheet receded from Connecticut leaving glaciofluvial material which forms the Windsor soil.

Ecoregions, Soils, and Land Use

Despite its small geographic extent, Connecticut is an ecologically diverse state. Based on its physical and ecological variation, Connecticut is divided into eight *ecoregion* subsections (**Figure 5**). Here, the effects of surficial material, local relief, and major drainage features play a large role in the determination of vegetative differences.

Land clearing for agriculture, cuts for charcoal production, and now urban development has changed the pre-settlement appearance of the land.

Remember CLORPT? All these factors contribute to the many different types of soil that can be found in Connecticut. These individual soils are classified into groups based on similarities in their profiles and other characteristics. Soil, like plants and animals, has a classification system. It's called Soil Taxonomy. It has six levels: Order, Suborder, Great Group, Subgroup, Family, and Series. Four out of twelve Orders of Soil Taxonomy can be found in Connecticut. They are Histosols, Entisols, Inceptisols, and Mollisols. The Windsor series is in the Entisols order.

Glossary

Clay: A soil particle that is less than 0.002 mm in diameter. Clay particles are so fine they have more surface area for reaction. They hold a lot of nutrients and water in the soil. A clay soil is a soil that has more than 40% clay, less than 45% sand and less than 40% silt.

Ecoregion: Represents areas with similar biotic and abiotic characteristics which determine the resource potential and likely responses to natural and man-made disturbances. Characteristics such as climate, topography, geology, soils, and natural vegetation define an ecoregion. They determine the type of land cover that can exist and influence the range of land use practices that are possible.

Eolian Deposits: Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Glaciofluvial deposits: Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Horizon: see Soil horizons

Organic matter: Material derived from the decay of plants and animals. Always contains compounds of carbon and hydrogen.

Permeability, Soil: The ease with which gases, liquids, or plant roots penetrate or pass through a bulk mass of soil or a layer of soil. Different soil horizons vary in permeability.

Sand: A soil particle between 0.05 and 2.0 mm in diameter. Sand is also used to describe soil texture according to the soil textural triangle, for example, loamy sand.

Silt: A soil particle between 0.002 and 0.05 mm diameter. It is also used to describe a soil textural class.

Soil Horizon: A layer of soil with properties that differ from the layers above or below it.

Soil Profile: The sequence of natural layers, or horizons, in a soil. It extends from the surface downward to unconsolidated material. Most soils have three major horizons, called the surface horizon, the subsoil, and the substratum.

Soil Scientist: A soil scientist studies the upper few meters of the Earth's crust in terms of its physical and chemical properties; distribution, genesis and morphology; and biological components. A soil scientist needs a strong background in the physical and biological sciences and mathematics.

Soil Structure: The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grained (each grain by itself, as in dune sand) or massive (the particles adhering without any regular cleavage, as in many hardpans).

Soil Texture: The relative proportion of sand, slit, and clay particles that make up a soil. Sand particles are the largest and clay particles the smallest. Learn more about soil texture at www.soils4teachers.org/physical-properties

Additional Resources

Soil! Get the Inside Scoop. David Lindbo and others. Soil Science Society of America, Madison, WI.

Know Soil, Know Life. David L. Lindbo, Deb A. Kozlowski, and Clay Robinson, editors. Soil Science Society of America, Madison, WI.

Soil Survey in the Connecticut Valley. Clarence W. Dorsey and J.A. Bonsteel. Report No. 64 U. S. Department of Agriculture.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey; Soil Survey of the State of Connecticut. Available online at http://websoilsurvey.sc.egov.usda.gov/. Accessed [March, 2016].

Keys Jr., J., Carpenter, C.A., Hooks, S.L., Koenig, F.G., McNab,W.H., Russell, W.E., Smith, M.L., 1995. Ecological units of the eastern United States—first approximation. Technical Publication R8-TP21. U.S. Department of Agriculture, Forest Service, Atlanta, GA.

Web Resources

Soils for Teachers—www.soils4teachers.org

Soils for Kids—http://www.soils4kids.org/

Have Questions? Ask a Soil Scientist—https://www.soils.org/ask

Soil Science Society of America—https://www.soils.org/

Authors: Deborah Surabian, State Soil Scientisit CT/RI

SSSA
Soil Science Society of America
5585 Guilford Road
Madison WI 53711-5801
Tel. 608-273-8080 • Fax 608-273-2021
www.soils.org
www.soils4teachers.org/state-soils

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