Chesuncook

Maine 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 "Chesuncook" is the official state soil of Maine. Let's explore how the Chesuncook is important to Maine.

History

The Chesuncook Series was established in 1992 in Franklin and Somerset Counties in the western part of Maine. Chesuncook soils are found from Maine's western border with New Hampshire to the Canadian border to the north and east. On April 16, 1999 Governor Angus S. King Jr. signed LD 592 officially designating Chesuncook as Maine's State Soil. The Chesuncook soil was chosen because it is a highly productive forest soil and supports hundreds of thousands of acres of timberland in Maine. The word Chesuncook is derived from Native American descriptions of converging water bodies. The character of the Maine landscape is a reflection of this soil. This state soil symbolizes the commitment of the people of Maine to maintain their natural resource richness for the future.

What is Chesuncook Soil?

The Chesuncook series consists of very deep, moderately well drained soils on upland till plains, hills and mountainside slopes. These soils formed in dense glacial till, derived from dark metamorphic rocks. They are found mostly on forested landscapes with slopes ranging from 3% to 45%. Forested Chesuncook soils typically have a 2 inch organic layer on top of a thin (often 2-3 inches) light pinkish gray *silt loam* mineral soil layer. The *subsoil*, is typically a silt loam with dark reddish brown to yellowish-brown colors about 14 inches thick. The lower subsoil and substratum, where a seasonal high water table occurs, is usually gravelly loam with light olive brown color to a depth of 65 inches or more. Every soil can be separated into three separate mineral soil size fractions called *sand, silt,* and *clay*, which makes up the *soil texture.* They are present in all soils in different proportions and say a lot about the character of the soil. The Chesuncook soil is made up of silt loams, which have a simlar contribution from the three size fractions to how they feel and behave.

Where to dig Chesuncook

Yes, you can dig a soil. The different horizontal layers of the soil are called *soil horizons*. When you dig a soil pit, it shows you the collection of soil horizons called a *soil profile.* Typically soil profiles have three main soil zones: surface, subsoil and substratum. Forested Chesuncook soils have an organic horizon at the surface **(Figure 1)**. This collection of horizons have unique features and characteristics that make the Chesuncook soil different from all other soils. Chesuncook covers approximately 150,000 acres of land in six counties of Maine **(Figure 2**). This does not mean that other types of soil cannot be found there but that the Chesuncook is the most common. In all, there are a total of about 120 named soils (series) in Maine.

Photo: Soil Monolith. Chip Clark/Smithsonian Institution

Fig. 1. Chesunook soil profile. Credit: Dover-Foxcroft Soil Survey Staff

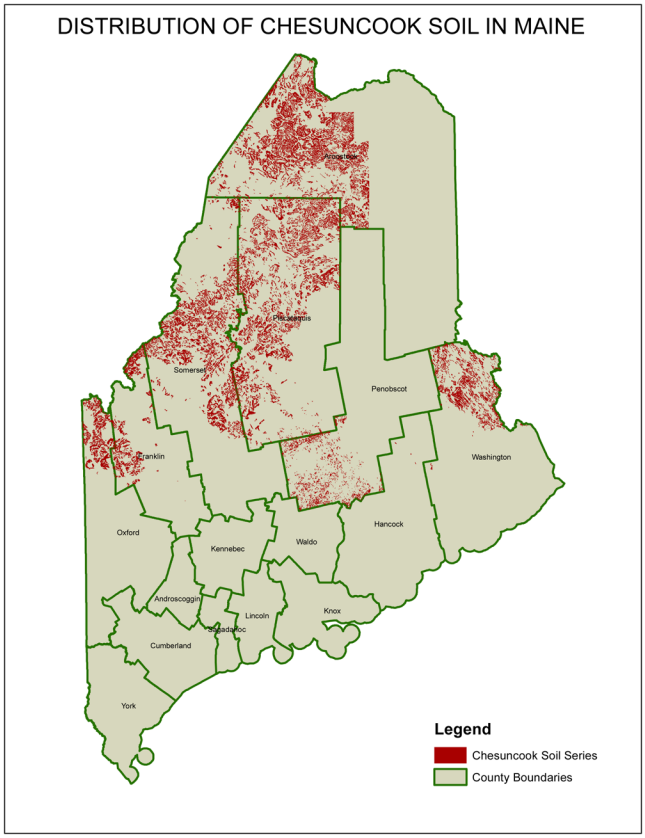

Fig. 2 Chesunook soil distribution map in Maine. Credit: Lindsay Hodgman.

Importance

What makes the Chesuncook soil so important? It is a highly productive forest soil, particularly for northern hardwoods. Maine is about 90% forested **(Figure 3)**, the highest percentage for any state, so forest products are important to Maine's economy (about 6 million cords harvested per year). This soil provides Maine with other ecosystem services that support clean air, clean water, carbon storage, wildlife, and recreation to name a few.

Uses

In general, soils can be used for agriculture (growing foods, raising animals, stables); engineering (roads, buildings, tunnels); ecology (wildlife habitat, wetlands), recreation (ball fields, playground, camp areas) and more. Chesuncook soils are typically used for timber production. A variety of wood products are harvested from timberlands. They include veneer logs, sawtimber, pulpwood, biomass, and firewood. In some areas Chesuncook soils have been cleared and used for hayland, pasture land or cropland.

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 Chesuncook soil and identified that it has a few limitations. Slow permeability in the substratum of this soil, which means water moves so slow that it begins to build up at times and can result in a seasonal high *water table*, and restricted rooting depth are the main limitations for Chesuncook. Occasionally, Chesuncook soils are found on very steep slopes which limit the access of machinery for timber harvest.

Management

Chesuncook is not typically a cultivated soil. They have moderate natural fertility and can be productive with management that improves fertility and reduces acidity. Chesuncook soils are naturally suited to northern hardwood forest cover types featuring: sugar maple, American beech, yellow birch, and white ash trees.

Chesuncook Formation

Before there was soil there were rocks and in between, ClORPT. Without ClORPT, there will be no soil. So, what is ClORPT? It is the five major factors that are responsible for forming a soil like the Chesuncook series. It stands for **Cl**imate, **Or**ganisms, **R**elief, **P**arent material and **T**ime. ClORPT is responsible for the development of soil profiles and chemical properties that differentiate soils. So, the characteristics of Chesuncook (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 dissolve or fracture and break into pieces. ClORPT then acts on rock pieces, marine sediments and vegetative materials to form soils. One of the major soil-forming processes active in Maine is called *podzolization*. Soils formed by podzolization are acid and relatively course textured. In Maine, this type of soil formation is common in moderately well drained soils such as Chesuncook. Soils formed by this process are in the *Spodosols* order of Soil Taxonomy.

Fig. 3. Typical landscape for Chesunook soil. Credit: Dover-Foxcroft Soil Survey Staff

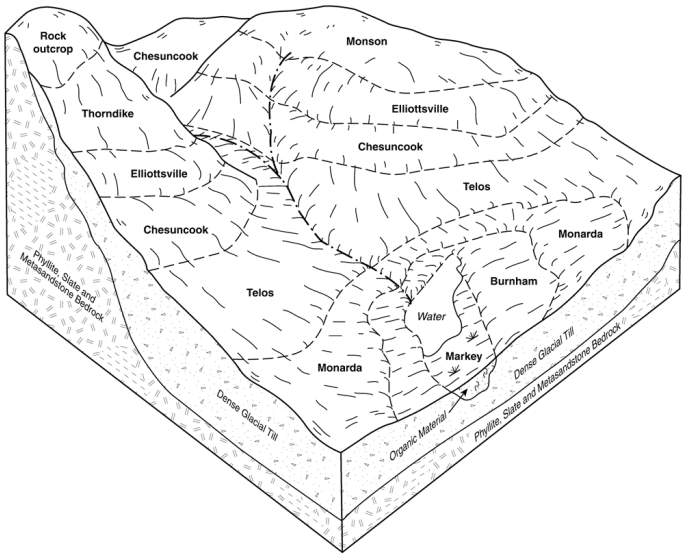

Fig. 4. Relationship of soils, landform position (relief) and parent material. Credit: USDA-NRCS

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 Chesuncook soil typically developed under forest cover in cool, moist environments, averaging 34 to 46 inches of rainfall per year. These influences result in the decomposition of organic matter, *leaching* of soluble bases and weathering of rocks.

Organisms – This refers to plants and animal life. In the soil, plant roots spread, animals burrow, and bacteria and fungi 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. Animals breakdown complex compounds into small ones that adds organic matter to soil. Chesuncook soils developed predominantly under hardwood forests that deposited leaves, twigs, roots and other plant remains on and in the soil. Forested Chesuncook soils have an accumulation of organic matter at the surface, known as the forest floor.

Relief – Landform position or relief describes the shape of the land (hills and valleys), and the direction it faces which makes a difference in how much sunlight the soil gets and how much water it keeps. Concave areas collect surface water while convex and steep linear areas shed water. Deeper soils form at the bottom of the hill rather than at the top because gravity and water move soil particles downhill. Chesuncook soils are formed on linear to convex moderately steep slopes resulting in them being moderately well drained and are commonly found on the middle to lower half of the hill. **(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. Chesuncook soils developed from dense glacial till deposits derived from dark metamorphic rocks.

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. Chesuncook soil is 10,000–12,000 years old, which is when the Wisconsin ice sheet receded from Maine at the end of the last ice age. This makes Chesuncook soil relatively young on a global basis, although they represent the most mature soils found in the state of Maine.

Ecoregions of Maine

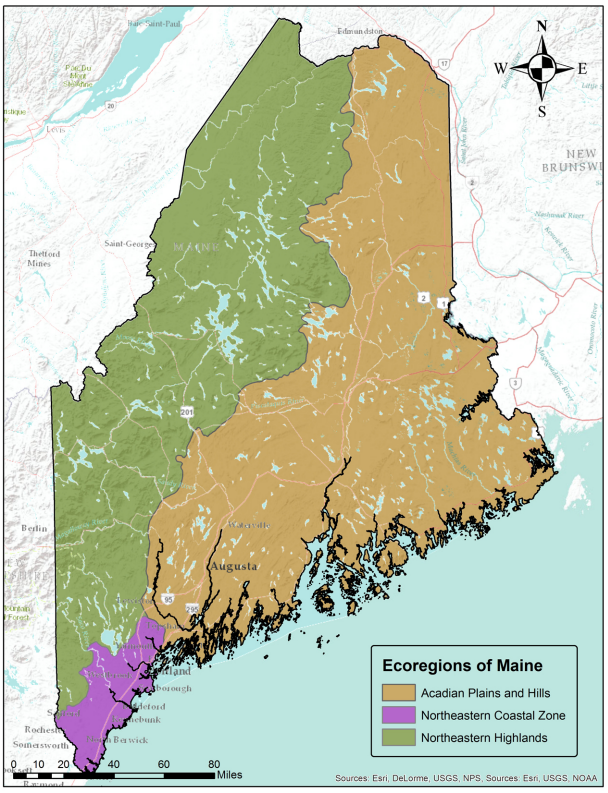

Fig. 5. Ecoregions of Maine. Credit: Jamin Johanson.

Ecoregions, Soils and Land Use in Maine

The state of Maine can be subdivided into three major Ecoregions **(Figure 5)** in order to highlight important differences in the environmental factors (ClORPT) affecting soil development and plant species ranges. Southern Maine, and much of the southern New England coast, is warmer than the rest of the state and belongs to the Northeastern Coastal Zone Ecoregion. As a result, York, Cumberland, and Androscoggin counties in southern Maine are home to soils and many plant species associated with temperate forests to the south, but which are not common in the northern Ecoregions of the state.

Chesuncook soils are abundant in the Northeastern Highlands Ecoregion in western Maine, and are commonly found in the Acadian Plains and Hills Ecoregion in eastern Maine as well. Though the Northeastern Highlands includes higher elevations and more rugged terrain than the Acadian Plains and Hills, the two ecoregions are similar enough in the other ClORPT factors that the Maine state soil is present in both. Chesuncook soils are typically productive northern hardwood sites occurring on sloping glacial till deposits.

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.

Horizon: see Soil horizons

Leaching: The removal of soluble material from soil or other material by percolating water.

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

Podsolization: a soil formation process usually occurring in cool, humid regions, in which iron, aluminum, and organic matter are leached from upper levels and accumulate in lower layers

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.

Silt Loam: Soil material that contains more than 50 % silt, and between 12- 27% clay or 50-80% silt and less than 12 % clay.

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 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.

Spodosol: (from Greek spodos, "wood ash") are acid soils characterized by a subsurface accumulation of primarily Fe, Al, organic matter. These photogenic soils typically form in coarse-textured parent material and have a light-colored E horizon overlying a reddish-brown spodic horizon. The process that forms these horizons is known as podzolization.

Subsoil: (B horizon) The soil horizon rich in minerals that eluviated, or leached down, from the horizons above it. Not present in all soils.

Topography: The shape of the land surface. (Relief: refers to differences in elevation of different points in a region.)

Water table: The top layer of ground water where the soil is filled with standing water. It can move up or down during different seasons.

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.

Web Resources

SOIL SCIENCE LINKS:
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/

MAINE LINKS:

Additional Maine Soils Information:

http://www.nrcs.usda.gov/wps/portal/nrcs/detail/me/technical/?cid=nrcs141p2_002909

Natural Resources Conservation Service, Maine Homepage:
http://www.nrcs.usda.gov/wps/portal/nrcs/site/me/home/

Maine Association of Professional Soil Scientists:
http://www.mapss.org

Maine Agricultural & Forest Experiment Station, Univ. of ME, Orono:
http://www.umaine.edu/mafes/

Maine Assoc. of Conservation Districts *(Envirothon & other programs)*:
http://maineconservationdistricts.com/

Maine Department of Agriculture:
http://www.maine.gov/dacf/

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Rourke, Robert V., 1994. Chemical and physical properties of the Chesuncook, Colonel, Dixfield, and Telos soil map units. University of Maine, Maine, Agricultural and Forest Experiment Station, Technical Bulletin 155.

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United States Department of Agriculture, Natural Resources Conservation Service, in Cooperation with Maine Agricultural and Forest Experiment Station and the Maine Soil and Water Conservation Commission. 2006. Soil Survey of Washington County Area, Maine.

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