

# PORT SILT LOAM

## Oklahoma 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 Port Silt Loam is the official state soil of Oklahoma. Let’s explore how the Port Silt Loam is important to Oklahoma.

### History

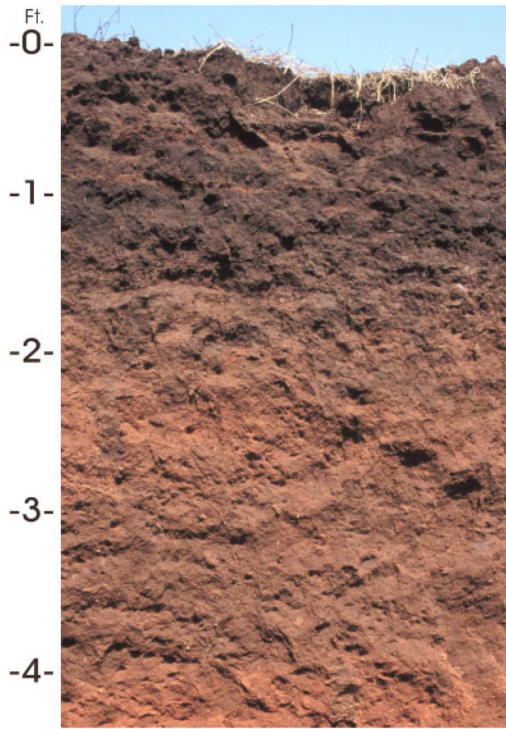
Soils are often named after an early pioneer, town, county, community or stream in the vicinity where they are first found. The name “Port” comes from the small community of Port located in Washita County, Oklahoma. The name “silt loam” is the texture of the topsoil. This texture consists mostly of silt size particles (.05 to .002 mm), and when the moist soil is rubbed between the thumb and forefinger, it is loamy to the feel, thus the term silt loam. In 1987, recognizing the importance of soil as a resource, the Governor and Oklahoma Legislature selected Port Silt Loam as the official State Soil of Oklahoma.

### What is Port Silt Loam Soil?

Every soil can be separated into three separate 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. Port Silt Loam has a silt loam texture and is usually reddish in color, varying from dark brown to dark reddish brown. The color is derived from upland soil materials weathered from reddish sandstones, siltstones, and shales of the Permian Geologic Era. Port Silt Loam is deep, well-drained, and highly productive, suited for a wide range of crops, including alfalfa, small grains, sorghums, cotton and other sown crops, as well as range, pasture and woodland. In a no-till rotation plan, milo is planted in wheat stubble. When Port soils are undisturbed, they produce native vegetation including tall grasses with an over story of pecan, walnut, bur oak, and cottonwood trees. This native condition offers very desirable wildlife habitat for most of Oklahoma’s wildlife species.

The Port series consists of very deep, well-drained, moderately permeable, nearly level and very gently sloping soils on flood plains that are subject to frequent, occasional, or rare flooding. These soils are in western and central Oklahoma. These soils formed in limestone with clay and sand mixtures deposited by water and under native grasses. A high volume of organic matter recycled in a grass ecosystem has resulted in good soil structure and easy to cultivate. Most areas of the soils are used as cropland. The main cultivated crops are alfalfa, wheat, grain sorghum, and cotton. Some areas are used as pasture or rangeland.

Port soils are dark reddish brown loam in the surface, followed by reddish brown silt loam in the subsurface layer, reddish brown loam in the upper subsoil, and very fine sandy loam in the lower subsoil (**Figure 1**).



### Port Soil Profile

Surface layer: dark reddish brown loam  
 Subsurface layer: reddish brown silt loam  
 Subsoil - upper: reddish brown loam  
 Subsoil - lower: red very fine sandy loam

Fig. 1. Port Soil Profile. Credit: USDA-NRCS

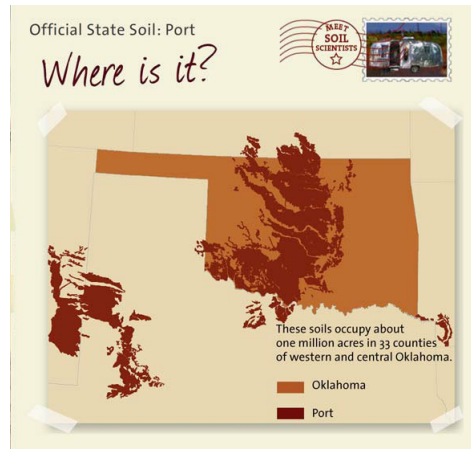


Fig. 2. Location of the Port soil in Oklahoma. Credit: Smithsonian Institution's Forces of change. <http://forces.si.edu/soils/interactive/statesoils/index.html>



Fig. 3. Port soil landscape. Credit: USDA-NRCS

## Where to dig Port

Yes, you can dig a soil. It is called a soil pit and it shows you the *soil profile*. The different horizontal layers of the soil are called *soil horizons*. This does not mean that other types of soil cannot be found there but that the Port is the most common. Port Silt Loam occurs in more counties than any other soil. Port covers around one million acres (4,000 km<sup>2</sup> of land) in 33 of the 77 counties of Oklahoma (Figure 2). In all, there are a total of 2500 named soils (series) in Oklahoma.

## Importance

What makes the Port soil so important is its use and prevalence in the State. Port soils are fertile and support production of many crops, including alfalfa, small grains, sorghum and cotton (Figure 3). Soil is one of our most valuable natural resources. Without soil, we could not survive and enjoy life as we know it. We get our food and much of our clothing and shelter from plants growing in the soil. Unfortunately, over 100 million tons of top-soil wash and blow away each year in Oklahoma.

## 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. Port Silt Loam occurs in flood plains and is subject to occasional flooding. Mainly cultivated to

alfalfa, small grains, grain sorghum, and cotton. Some areas are used for tame pasture or rangeland for grazing beef cattle. Native vegetation is tall grasses with an overstory of pecan, black walnut, bur oak, and eastern cottonwood trees.

## 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 Port soil and identified that it has capability subclass IIw-2 limitation. This means that Port soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices. However, water in or on the soil interferes with plant growth or cultivation. In fact, occasional flooding is the main limitation. Low strength and shrinking and swelling are limitations for local roads and streets.

## Management

In areas of the Port soils that are well drained bottom land, this soil is highly valued for farming. It is easily tilled and is only slightly damaged by flooding. Erosion is not likely. Nearly all of this soil is cultivated. Wheat and alfalfa are the main cash crops and have favorable yields. Response to management is good. Most areas of the Port soils that are not frequently flooded are cultivated. In frequently flooded areas, the choice of crops is limited. Tall grasses and trees make up the native vegetation on Port soils.

## The Ecoregions of Oklahoma

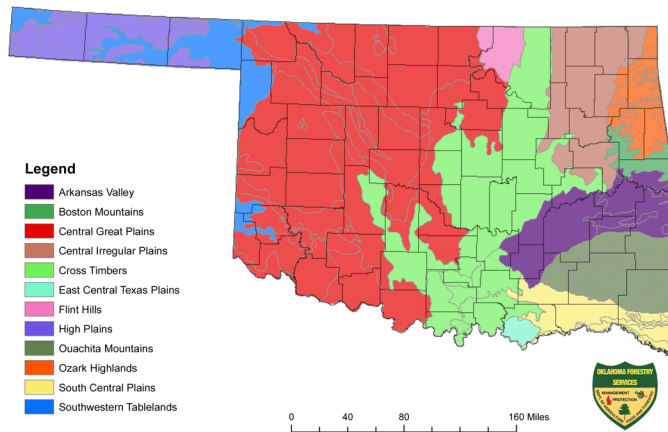


Fig. 4. Source: [www.forestry.ok.gov/websites/forestry/images/ecoregions.pdf](http://www.forestry.ok.gov/websites/forestry/images/ecoregions.pdf)

## Port Formation

Before there was soil there were rocks and in between, CIORPT. Without CIORPT, there will be no soil. So, what is CIORPT? It is the five major factors that are responsible for forming a soil like the Downer series. It stands for **C**limate, **O**rganisms, **R**elief, **P**arent material and **T**ime. CIORPT is responsible for the development of soil profiles and chemical properties that differentiate soils. So, the characteristics of Port (and all other soils) are determined by the influence of CIORPT. 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. CIORPT 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 Port series formed in the region where mean annual precipitation is between 26 to 40 inches and mean annual temperature varies from 57 to 64 degrees Fahrenheit. Thornthwaite annual P-E indices, which indicate potential evaporation, range from 44 to 64 and frost free days are between 185 to 220.

**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. Port soils are mainly cultivated with alfalfa, wheat, grain sorghum, and cotton, in addition being used as pasture or rangeland.

**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. Deeper soils form at the bottom of the hill rather than at the top because gravity and water move soil particles downhill. Port soils are on nearly level or very gently sloping flood plains in the eastern part of the central rolling red plains and in the central rolling red prairies. Slopes range from 0 to 3 percent.

**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. The Port series formed in alkaline to *calcareous*, silty, reddish sediments deposited by floodwater. A high volume of organic matter recycled in a grass ecosystem has resulted in good soil structure and tilth.

**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. Port soils form in calcareous loamy alluvium under native grasses of recent age.

These soils formed in calcareous, loamy alluvium and under native grasses. A high volume of organic matter recycled in a grass ecosystem has resulted in good soil structure and tilth.

## Ecoregions, Soils & Land Use in Oklahoma

Ecoregions signify ecosystems sharing general similarity in the type, quality, and quantity of environmental resources, stratify the environment by its probable response to disturbance, and serve as a spatial framework for assessment, management, and monitoring of ecosystem components and services. Identification of ecoregion requires analysis of spatial patterns and understanding biotic and abiotic characteristics, such as physiography, geology, climate, soils, land use, wildlife, fish, hydrology, and vegetation, which reflect differences in ecosystem quality.

Recognizing ecoregions are critical for structuring and implementing ecosystem management strategies across federal and state agencies as well as nongovernment organizations that are responsible for managing the use of resources within a geographical region. Ecological regions are assigned to five levels in a Roman numeral hierarchical scheme with Level I being the coarsest level, dividing North America into 15 ecological regions. Level II divides the continental United States into 52 regions; level III divides the United States to 104 regions; and Level IV are further subdivisions of level III ecoregions. In Oklahoma, there are 12 level III ecoregions (**Figure 4**). Most of these ecoregions continue into parts of adjacent states.

The ecological diversity in Oklahoma is strongly related to its varied climate, terrain, geology, soil, and land use. Ecoregions in Oklahoma include valley, mountains and hills, great and high plains, cross timbers, highlands, and tablelands (see figure on the right). Aside from vast plains in Oklahoma, there are elevated karst plateaus, hills, and mountains. Rainfall variability increases westward, while precipitation increases eastward. Mean annual temperature and the length of growing season increase southward.

Forests cover most of the Ozark Plateau and the Ouachita Mountains, while pine forests cover the southeast region. Central and western Oklahoma is the home for tall grass prairie, mixed grass prairie, and short grass prairie. The relatively dry southwest region is occupied by mesquite and other xeric plants. Oklahoma shows strong east-west zonation of vegetation and climate, which significantly influences biota distribution in the region.



Soil off Route 66 in Oklahoma; photo by dotpolka on Flickr

Much of Oklahoma's natural vegetation has been lost to overgrazing, burning, logging, erosion, and cultivation. Today, the state is a mosaic of grazing land, cropland, woodland, forests, and abandoned farmland. The main cultivated crops are alfalfa, wheat, grain sorghum, and cotton. Wheat and alfalfa are the main crops. Soybeans are becoming increasingly common on eastern plains and moist parts of the prairie. Cotton is concentrated on irrigated land in the southwest. Corn was once a major Oklahoma crop, has declined due to soil depletion and periodic droughts. In the frequently flooded areas, tall grasses and trees make up the native vegetation.

## 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](http://www.soils4teachers.org)

**Soils for Kids**—<http://www.soils4kids.org/>

**Have Questions? Ask a Soil Scientist**—<https://www.soils4teachers.org/ask>

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

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This state soil booklet was developed under the auspices of the Soil Science Society of America's K-12 Committee—their dedication to developing outreach materials for the K-12 audience makes this material possible.

## Glossary

**Alluvium:** Soil or sediment deposited by flowing water, especially soil formed in river valleys and deltas from material washed down by the river.

**Calcareous soil:** A soil mostly or partly composed of calcium carbonate (containing lime or being chalky).

**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.

**Geology:** The study of the physical earth, its composition (materials), history and processes (physical and chemical) that act on it.

**Geologic formation:** A body of rock of considerable extent with distinctive characteristics that allow geologists to map, describe, and name it.

**Geomorphology:** A branch of geology and geography that studies the development of landforms.

**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.

**Loamy sand:** Soil material that is a mixture of between 70-90% sand, up to 30% silt, and less than 15% clay. It has more sand than sandy loam.

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

**Physiographic province:** Broad-scale subdivisions based on terrain texture, rock type, and geologic structure and history.

**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.

**Sandy Loam:** Soil material that contains between 43-85% sand, 0-50% silt and 0-20% clay. It has less sand than 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 Management:** The sum total of how we prepare and nurture soil, select type of crops that suitable for a type of soil, tend the crop and the soil together, and determine fertilizer types and other materials to be added to soil to maintain productivity and preserve soil.

**Soil Texture:** The relative proportion of sand, silt, 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](http://www.soils4teachers.org/physical-properties)

**Soil Tilth:** Physical condition of the soil in relation to planting or growing crops.

**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.)

**Topsoil:** (A horizon) The horizon that formed at the land surface. Mostly weathered minerals from parent material with a little organic matter.

**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.