PAMUNKEY
Virginia 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 Pamunkey is the state soil of Virginia. Let's explore how the Pamunkey is important to Virginia.

History

The Virginia Association of Professional Soil Scientists (VAPSS) selected the Pamunkey soil series as Virginia's state soil in 1999. Pamunkey soils are composed of *sediments* deposited by the James River, which crosses the entire state of Virginia **(Figure 1)**, and therefore the soil contains sediments from various regions of the state. The Pamunkey soils are very *fertile* and supported the Pamunkey Native American tribe as well as the settlers at the Jamestown settlement.

Fig. 1. The James River in Virginia. (Source: Wikipedia)

What is Pamunkey Soil?

Soils of the Pamunkey series are very deep and well drained, formed primarily in Coastal Plain sediments. They are on nearly level to sloping stream terraces, with slopes ranging from 0 to 15 percent. Due to its high fertility, most of this soil is farmed, and the remainder is used for pasture and forest. 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. Pamunkey soils typically have a dark brown fine *sandy loam* surface layer, called the *topsoil* or A horizon, to a depth of about 23 cm (9 in.). The *subsoil*, or B horizon, can be sandy clay loam or *clay loam*, yellowish red in color, to a depth of about 109 cm (43 in.). In the lower layers of the soil, fine flakes of *mica* are common **(Figure 2)**.

Where to dig Pamunkey

Yes, you can dig a soil. It is called a soil pit and it shows you the *soil profile* **(Figure 2)**. The different horizontal layers of the soil are called *soil horizons*. You can find Pamunkey soil on the terraces of the James and other rivers in the eastern part of the state **(Figure 3)**. This does not mean that other types of soil cannot be found there but that the Pamunkey series is common. Pamunkey soil covers 23,262 acres of land in 12 counties of Virginia. In all, there are a total of approximately 5900 named soils (series) in Virginia.

Importance

What makes the Pamunkey soil so important is its use and prevalence in the State. It is formed from sediments which originated in every *physiographic province* in Virginia and therefore represents the whole state better than most other soils. It is also a historically and economically significant soil. The representative profile of Pamunkey soil was excavated near Jamestown on a farm which has been designated the oldest continuously

Photo Soil Monolith: Chip Clark/Smithsonian Institution

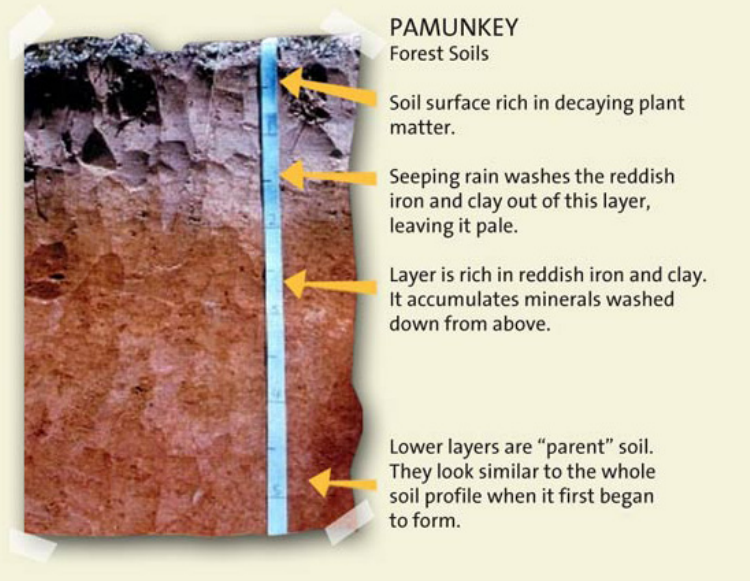

Fig. 2 Pamunkey soil profile. Credit: Smithsonian Institution

Fig. 3. Location of the Pamunkey soil series in Virginia and surrounding states. Credit: Smithsonian Institution

worked farm in the United States. Pamunkey soils are some of the most productive soils in the state **(Figure 4)**. In 2014 Pamunkey soils produced an overall world corn yield record when David Hula produced 454.9837 bushels to the acre on a farm in Charles City, Virginia.

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. Most of this soil is cultivated, and the remainder is used for pasture and forest. Crops include corn, small grain, cotton, soybeans, alfalfa, peanuts, and truck crops. Forested areas are in mixed hardwoods and pines.

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 Pamunkey soil and identified that it has only slight limitations for most uses. It has moderate limitations for ponds, landfills and septic tank absorption fields due to excessive *permeability*.

Management

The Pamunkey soil has few management issues. Since it occurs in landscapes which do not accumulate water or have a high water table, it is considered to be well-drained.

Pamunkey 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 Pamunkey series. It stands for **Cl**imate, **O**rganisms, **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 Pamunkey (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.

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. Pamunkey soils formed in the humid subtropical climate characterized by hot, usually humid summers and mild to cool winters. Mean annual precipitation is about 48 inches and mean annual temperature is about 59 degrees F.

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. Some organisms which likely contributed to the formation of Pamunkey soils include ground hogs, earth worms, Fungi, tree roots, lichens and bacteria.

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. Pamunkey soils formed on stream terraces above flood plains and are therefore well drained **(Figure 5)**.

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. These soils have formed in stratified fluvial sediments derived principally from weathered igneous and metamorphic rocks.

Fig. 4 Corn, a common crop grown in Pamunkey soils in Virginia. Credit: Mary Hammock, USDA NRCS.

Fig. 5. Typical Pamunkey landscape depicting cropland on the banks of the James River in Prince George County, Virginia. Credit: Allison Leapard, USDA NRCS.

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. Pamunkey soils are made up of Holocene and late Pleistocene stream terrace sediments.

Ecoregions, Soils and Land Use in Virginia

Virginia contains six ecoregions **(Figure 6)**. Pamunkey soils are primarily found in the Mid-Atlantic Coastal Plain region of Virginia where the state's major rivers flow into the Chesapeake Bay. Most of the Coastal Plain is gently sloping. As far as vegetation, temperate rainforest is representative in this region. Evergreen oaks and members of the laurel and magnolia families are common. Low ground cover such as tree ferns, shrubs, and herbaceous plants are also common. Gum and cypress are predominant species in the wide-ranging coastal marshes and interior swamps along the Atlantic coast. Upland areas are commonly dominated by subclimax pine forest with an understory of grasses and sedges. Ultisols, and Entisols are predominant soils in the Coastal Plain of Virginia. Temperate rainforest typically grows on soils which are wet, acidic, and low in major plant nutrients. The parent material for these soils consists of coastal plain sediments ranging from heavy clay to gravel, with sandy materials predominant. Silty soils are found primarily on level expanses while sands are customary in hilly areas.

With regards to wildlife, the Coastal Plain provides habitat for an extensive assortment of animals. With the exception of a few isolated areas inhabited by small populations of black bear, the whitetail deer is the only large indigenous mammal. Raccoons, opossums, flying squirrels, rabbits, and numerous species of ground-dwelling rodents are common small mammals residing in the Coastal Plain. Migratory nongame bird species and migratory waterfowl are abundant. Bobwhite quail and wild turkey are the primary game birds and the red-cockaded woodpecker is an endangered species in the region. Numerous reptile species are found on the Coastal Plain.

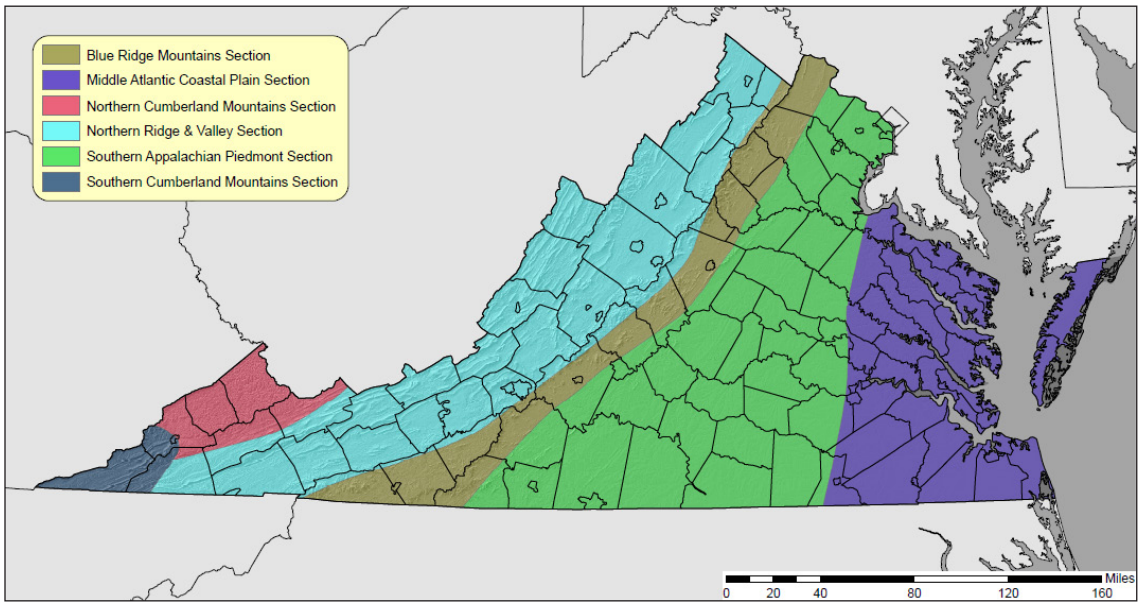

Fig. 6. Ecoregions of Virginia. Credit: US-EPA

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.

Clay Loam: A loam containing from 20 to 30 percent clay.

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.

Fertile: (of soil or land) producing or capable of producing abundant vegetation or crops.

Horizon: see Soil horizons

Loam: A soil composed of about 40% sand, 40% silt and 20% clay particles.

Mica: Silicate minerals, known as sheet silicates, because they form in distinct layers.

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

Permeability: The ease with which gases, liquids or plant roots penetrate or pass through a layer of soil.

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.

Sediments: naturally occurring materials that are broken down by processes of weathering and erosion, and are subsequently transported by the action of wind, water, or ice, and/or by the force of gravity acting on the particles.

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 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

Stream Terrace: Deposit of old floodplain material oriented parallel to the river valley which forms an elevated area above a valley floor.

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

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

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

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/

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