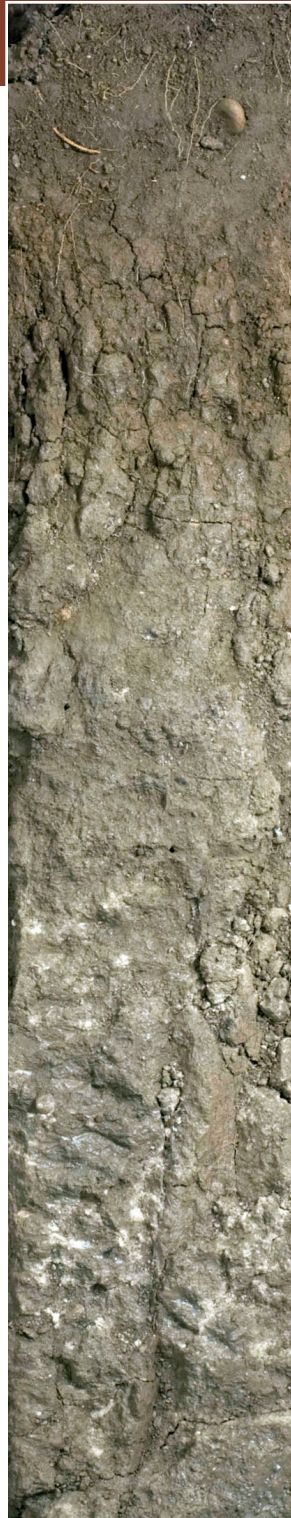


# SCOBEY

## Montana State Soil



SOIL SCIENCE SOCIETY OF AMERICA



### Introduction

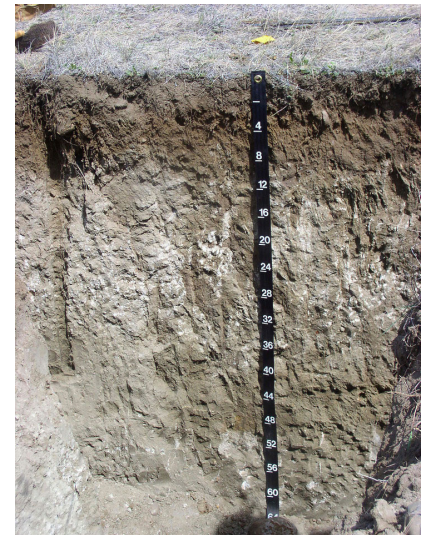
Many states have a designated state bird, flower, fish, tree, rock, etc. And, many states also have a state soil – one that has significance or is important to the state. The Scobey is the official state soil of Montana. Fourth-graders at Bozeman’s Longfellow School, who had the idea for Senate Bill 176, went to the Capitol to testify. And, former Gov. Brian Schweitzer wrote his master’s thesis on Scobey soil in 1980! Let’s explore how the Scobey is important to Montana.

### History

In 1928, the Scobey series was established in the Milk River Area, located in the northern plains of Montana. The series was named for the northeastern Montana town of Scobey and used to represent dark grayish-brown farming soils. The Scobey soil was designated the official Montana state soil in 2015.

### What is Scobey Soil?

Scobey soil is a very deep, well-drained soil developed from glacial till. The Laurentide Ice Sheet flowed from Canada into northern Montana depositing till rich in clay. As the glaciers melted, the till deposits became soil as they weathered (see CLORPT below) and plants, animals and microorganisms began to add organic matter to the top layer over thousands of years. Scobey soil is found on gently rolling till plains, hills and moraines with 0 - 15% slopes. 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. In Scobey soil, the topsoil or A horizon has a clay loam texture, is a very dark grayish brown color and can be up to 15 cm (6 inches) thick. The subsoil or B horizon (the layer below the topsoil) is divided into a couple of different layers and is a dark grayish brown color. The first layer of the subsoil, up to 30 cm (12 inches), has more clay than the topsoil as clay particles move through the soil profile through illuviation and accumulate. The subsoil progressively increases in the amount of lime present and the soil becomes more basic from 30 cm down to 152 cm (60 inches), and the texture returns to a clay loam. (Figure 1).



**Fig. 1** Scobey soil profile near Glasgow, MT. Credit: USDA NRCS



Fig. 2. Distribution of Scobey soil series. Credit: Smithsonian Institution.

## Where to dig Scobey

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*. Scobey soil covers a large area in the northern part of Montana (**Figure 2**). Scobey soil is the most productive soil found in Montana’s Golden Triangle – the area encompassed between Havre, Conrad and Great Falls. This does not mean that other types of soil cannot be found there but that the Scobey is the most common. Scobey covers 700,000 acres of land in multiple counties of Montana. In all, there are a total of 700 named soils (series) in Montana.

## Importance

What makes the Scobey soil so important is its use and prevalence in the State. Scobey soils are the most extensive soils in northern Montana. Scobey soil supports native grasslands that are part of the largest remaining prairie in the northern Great Plains. These mixed prairies are home to a variety of wildlife including the black-tailed prairie dog, swift fox, burrowing owl, pronghorn antelope, and endangered black-footed ferret (**Figure 3**). Scobey soil is also important for agriculture, Montana’s largest industry. Wheat is Montana’s number one export and Scobey soil located in Montana’s Golden Triangle produces a larger annual non-irrigated harvest of wheat than any other soil in the state.

## 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. Scobey soil is found in the northern plains of Montana and is used for agriculture along the hi-line. Productive rangelands provide for livestock grazing and dry land farming produces high-quality wheat (**Figure 4**). The native mixed prairie also provides unique habitat for many wild-life species.



Fig. 3. Black-footed ferret, photo credit : USFWS



Fig. 4. Productive rangelands provide for livestock grazing and dry land farming produces high-quality wheat. Credit: Janice Hendrickson (photo from <http://www.msueextension.org/liberty/agriculture.html>)

## 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 Scobey soil and identified that it has moderate limitation. Scobey soil can be high in clay content causing low strength and the shrinking and swelling of the soil. This can lead to problems when building roads or any type of shallow excavating in Scobey soil.

## Management

Scobey soils are high in organic matter and clay compared to many other soils found in Montana. The soil is therefore able to hold onto water from precipitation that comes during the wet spring season. This allows for productive dry-land farming on these upland soils.

## Scobey 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 Scobey series. It stands for **C**Limate, **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 **Scobey** (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.

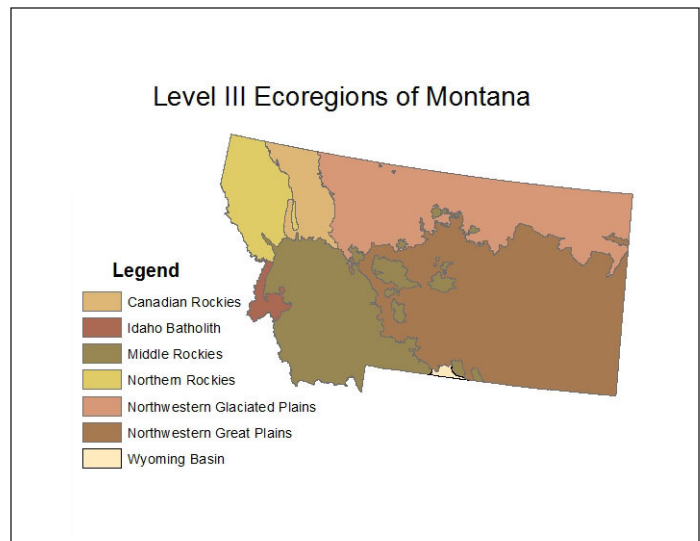
**Climate** – Temperature and precipitation influence the rate at which parent materials weather and dead plants and animals decompose. They affect the chemical, physical and biological relationships in the soil. The Scobey soil developed under a dry cool climate.

**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. The Scobey soil developed under mixed prairie vegetation providing a relatively high amount of organic material to the soil. Both the roots and the above ground growth of the prairie vegetation contribute to the accumulation of organic matter and a darker surface color.

**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. Scobey soil formed on gently rolling till plains, hills and moraines and is a very deep, well-drained soil.

**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. Scobey soil developed from glacial till deposited from the Laurentide Ice Sheet during the Wisconsin glaciation.

**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. Due to past glacial activity and the dry cool climate of the northern Montana plains, Scobey soil is considered a younger soil.



**Fig. 5** Created by S.Rouse using shapefile data from USEPA: <https://www.epa.gov/eco-research/ecoregion-download-files-state-region-8>.

## Ecoregions, Soils and Land Use in Montana

Montana is the fourth largest state behind Alaska, Texas and California. Given such a large area, soils vary widely due to differences in rainfall, topography and parent material. Ecoregions are areas with similar biotic and abiotic characteristics such as climate, topography, geology, soils and natural vegetation. The State of Montana is divided into seven Level III ecoregions (**Figure 5**).

The Scobey soil formed in the Northwestern Glaciated Plains ecoregion. This ecoregion covers approximately 25% of the state of Montana and is located in the northeastern portion of the state. The climate is considered semiarid due to its location in the rain-shadow of the Rocky Mountains to the west. Glacial till deposited by glacial meltwater and runoff dominates the region and brown clay loam soils and gravelly areas are common.

The Northwestern Glaciated Plains ecoregion is mostly comprised of undeveloped private lands. The native mixed grass prairie vegetation provides opportunities for livestock grazing while loam soils on benches and gently rolling uplands allow for productive dryland farming.

## 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.

**Glacial Till:** Unsorted material deposited directly by glacial ice.

**Horizon:** see Soil horizons

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

**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 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)

## 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](http://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/>

## References

**US Environmental Protection Agency.** Ecoregion Download Files by State – Region 8. <https://www.epa.gov/eco-research/ecoregion-download-files-state-region-8>

**Montana Department of Agriculture.** Ag Facts. <http://agr.mt.gov/agr/Consumer/AgFacts/>

**Giesecker, L.F., E.R. Morris, A.T. Strahorn, and C.B. Manifold.** 1929. US Department of Agriculture, Soil Survey (Reconnaissance) of The Northern Plains of Montana.

**NRCS web soil survey.** <http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx>

**Smithsonian National Museum of Natural History**

<http://forces.si.edu/soils/interactive/statesoils/html/State-Soils/Default.aspx?selection=Montana&tab=note>

**USGS Northwestern Glaciated Plains Ecoregion Summary Report.** <http://landcover.trends.usgs.gov/gp/eco42Report.html>

**Brown, Irvin C. and Horace G. Byers.** 1935. The Chemical and Physical Properties of Dry-Land Soils and of Their Colloids. United States Department of Agriculture

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