Threebear
Idaho State Soil

Soil Science Society of America

Introduction

There are many officially designated state symbols. In Idaho, the mountain bluebird is the state bird, western white pine is the state tree, syringa is the state flower, and star garnet is the state gem. Similarly, Idaho also has a state soil known as the Threebear soil.

History

The Threebear soil series was established in 2003 in Clearwater County, making it one of the newer soils recognized in Idaho and in the US. Because of its remote location in the mountains of northern Idaho, it took a long time to identify Threebear soil. It is named after Threebear Creek, which flows in the area. Because of the abundant wildlife (including bears) in this area, you can probably imagine how the name Threebear came about. Threebear was chosen as the state soil because of its unique character and its importance to Idaho's $1.5 billion forest products industry.

What is Threebear Soil?

Threebear soils consist of three distinct layers know as horizons– a forest litter layer, volcanic ash, and loess (carried by the wind) **(Figure 1)**. These soils support coniferous forests **(Figure 2)**. The uppermost layer or soil horizon (O) is made up of needles and twigs that have accumulated at the surface. The next two horizons, a dark-colored A and reddish-brown B have formed in volcanic ash. The volcanic ash was deposited following a huge eruption of Mount Mazama (now Crater Lake, OR) approximately 7,600 years ago. This volcanic ash ranges in thickness from 14 to 23 inches in Threebear soils. The soil horizons (underneath the volcanic ash) have formed in loess, which is dominantly silt-sized material that has been deposited by wind. A light-colored horizon is present just below the volcanic ash and formed as water has removed organic materials, clays, and other pigmenting agents. Over thousands of years, the subsurface silty clay loam horizons have become very dense and are referred to as a fragipan. The fragipan occurs at a depth of 23 to 40 inches, and because of its high density, is not permeable to water and plant roots.

Fig. 2.Typical forested landscape where Threebear soil occurs in northern Idaho.

Fig. 1. (Left) Idaho State Soil Monolith. Credit: Chip Clark/Smithsonian Institution.

Fig. 3. Location of Threebear soil in northern Idaho. Credit: Smithsonian Institution's Forces of change. http://forces.si.edu/soils/interactive/statesoils/index.html

Fig. 4. Some of the best timer in northern Idaho is produced on Threebear Soil. This USDA-Forest Service photo from 1935 shows a loaded logging truck in the Clearwater National Forest where Threebear soil occurs. Credit: USDA Forest Service: http://foresthistory.org/ASPNEt/Publications/first_century/sec6.htm.

Where to dig a Threebear

Threebear soil is found in the forested mountains of northern Idaho **(Figure 3)**. It has been mapped on over 52,900 acres but is probably more extensive because many of the areas where Threebear likely occurs have not been surveyed in detail.

Importance and uses

Threebear soil supports some of the most productive forests in the inland Pacific Northwest region and is used for timber production. The volcanic ash is a very important part of Threebear because it increases the amount of water that the soil is able to provide to trees over the dry summer months. Threebear soil provides habitat for a variety of wildlife including bear, moose, elk, cougar, and wolves. It also helps supply water for the region's streams and rivers and is used extensively for outdoor recreation.

Limitations

As good as Threebear soil is for producing trees, it does have properties that can limit its usefulness for other purposes. Threebear soil has a dense fragipan that restricts the downward movement of water. During the wet winter and spring months, water from rain and snowmelt collects above the fragipan and creates a water table. The presence of this seasonal water table limits Threebear for many uses, such as building houses with basements, roads and streets, and waste disposal. These uses require special engineering practices to ensure that the soil will function properly and environmental quality is maintained.

Management

Like all soils, Threebear soil is a valuable resource and must be cared for to maintain its productivity. The volcanic ash found in surface horizons is very susceptible to erosion. The forest litter layer protects the volcanic ash. But if the litter layer is removed either by fire, by timber harvesting activities, or other disturbance, rain and snowmelt can erode away the volcanic ash. Because the volcanic ash is an important contributor to the water holding capacity of Threebear soil, its loss will result in decreased forest productivity.

Fig. 5. Volcanic eruptions like this 1980 eruption of Mt. St. Helens in Washington state have periodically deposited ash across the Pacific Northwest Region. Volcanic ash found in Threebear soil came from a much larger eruption in Oregon 7,600 years ago. Credit: Richard Bowen: http://www.oregonlive.come/mount-st-helens/

Ecosystems and Soil Formation

The formation of Threebear and all other soils results from the combined effects of five major factors – Climate, Organisms, Relief, Parent material, and Time. These factors, also known as ClORPT, act on rocks and other geologic materials causing them to weather. Weathering occurs when environmental processes such as rainfall, freezing and thawing, cause geologic materials to dissolve or fracture and break into smaller pieces. ClORPT is also responsible for the development of soil profiles and the distinc-

tive layers and properties that distinguish soils from one another. And because ClORPT varies from one location to another, soils are like snowflakes – no two are exactly alike.

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. And as rainfall moves downward through the soil, it redistributes various soil components. Threebear soil developed under a cool, seasonally dry climate. Most precipitation falls during the winter, much of it as snow. These conditions have resulted in slightly acid conditions and moderate levels of organic matter in Threebear soils.

Organisms–This refers to plants and animal life. In the soil, plant roots spread through, animals burrow in and bacteria eat 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 break down complex compounds into small ones and in so doing add organic matter to soil.

Threebear developed under conifer forests, which deposit leaves, twigs, and other plant remains on the surface. These form a 1-to-3-inch thick litter layer in Threebear soils. Threebear soil has millions of microbes living in its surface horizons. These tiny organisms – bacteria, fungi, actinomycetes – help break down plant and animal remains, releasing important plant nutrients in the process.

Relief–Landform position or relief describes the shape of the land (hills and valleys), and the direction it faces 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. Threebear soils occur on gentle to steep mountain slopes, benches, and hills.

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. Threebear soils have formed in materials that were deposited by the wind – volcanic ash and loess.

Time–All the factors act together over a very long 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. In Threebear soil is very interesting because it actually contains two generations of soil! The better-defined horizons (2E and 2B) have formed in loess that is tens of thousands of years old. In contrast, the younger horizons formed in the 7,600-year-old volcanic ash (A and B) are only slightly developed.

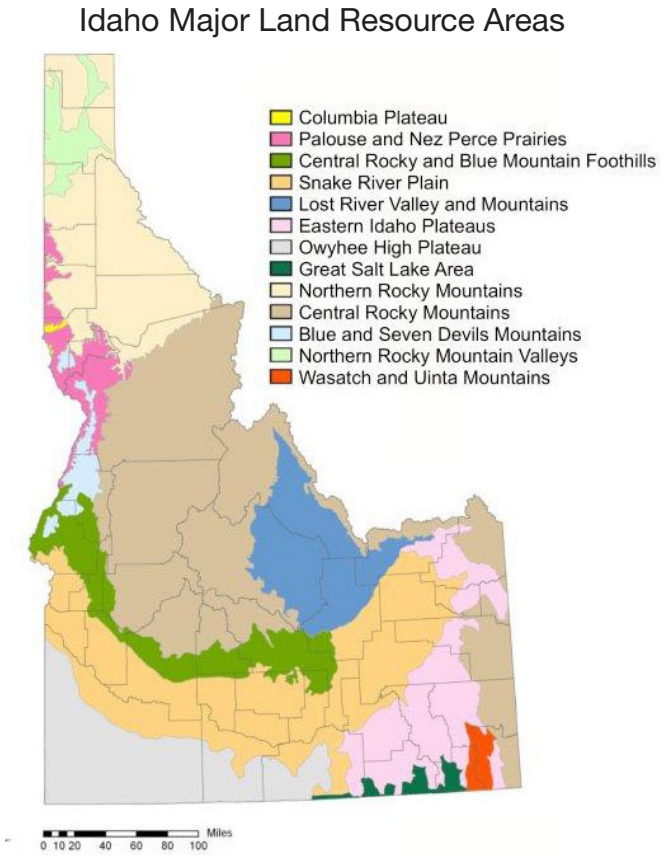

Fig. 6. Major land resource agreas in Indaho.. Source:http..www.nrcs.usda.gove/internet/FSE_MEDIA/nrcs144p2_037988.jpg

Ecoregions, Soils and Land Use in Idaho

Idaho is a large state in which the five soil-forming factors described above vary tremendously. Annual precipitation ranges from 6 inches in the southern part of the state to over 60 inches in the high mountains in northern Idaho. Elevations range from 938 feet to 12,667 feet, creating very diverse landscapes of relatively flat plains and steep mountains. Native vegetation varies from sparse desert steppe in southern Idaho to lush conifer forests of northern Idaho. These differences are illustrated in the variety of major land resource areas in Idaho– all or parts of 13 different land resource areas are found in the state.

In general, northern and central Idaho are home to forests, foothills, and mountains. Timber production and grazing are the major land uses. In the southern part of the state, especially along the Snake River, agriculture is a major land use. A variety of crops including hay, sugar beets, onions, corn, wheat, barley, and Idaho's "Famous Potatoes" are produced under irrigation.

Threebear soil occurs in the Northern Rocky Mountains land resource area of northern Idaho. The majority of this area is forested and lies between elevations of 1,800 to 7,000 feet. Dominant tree species are grand fir, Douglas-fir, western redcedar, western hemlock, ponderosa pine, and western white pine. These trees are harvested from both private and public lands for the forest products industry. Only a very small percentage of the area is used for cropland.

Glossary

CIORPT: Five factors responsible for soil development: Climate, Organisms, Relief, Parent material, and Time

Clay: Soil particles smaller than 0.002 mm in size (about 5 times smaller than the width of your hair!). Clay particles give soils a sticky texture. One of three size classes of soil particles.

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.

Erosion: the gradual destruction of something by natural forces (such as water, wind, or ice)

Fragipan: is a hard dense layer of soil beneath the surface that hinders root growth and the downward movement of water.

Horizon: see Soil horizons

Litter Layer: This layer is composed of decomposing plant material.

Loess: a unique type of soil that started as dust, was carried by the wind from one area to another area and deposited to form a new layer of soil.

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

Sand: Soil particles between 0.05: 2 mm in size. Sand particles gives soils a gritty texture. One of three size classes of soil particles.

Silt: Soil particles between 0.002: 0.05 mm in size. Silt particles give soil a silky smooth texture. One of three size classes of soil particles.

Pedologist: 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 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

Steppe: a large, flat area of land with grass and very few or no trees.

Subsoil: A layer of soil beneath the litter layer and surface soil.

Volcanic ash: A very small porous powder released from volcanos that is typically glassy appearance under a microscope.

Water table: The top layer of ground water that fills the soil with standing water.

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.soils4teachers.org/ask

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

Soilweb (iPhone, Android, Google Maps, Google Earth)

websoilsurvey

Smithsonian—www.forces.si.edu/

NACD—www.nacdnet.org/education

Natural Resources Conservation Service, Idaho homepage—http://www.nrcs.usda.gov/wps/portal/nrcs/site/id/home/

Natural Resources Conservation Service—http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/soils/

Natural Resources Conservation Service, Educational Resources—http://soils.usda.gov/education/resources/k_6/

University of Idaho. The 12 Soil Orders—http://www.cals.uidaho.edu/soilorders/

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U.S. Dept. of Agriculture. 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296, USDA-Natural Resources Conservation Service, Washington, DC.

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