United States Department of Agriculture

2017 Soils Planner

Soils Have Memory

Words From the Chief

We start with our soil and search for clues as to how it interacts with water and the energy of the sun to make productive life on earth. By understanding our planet and how it functions, we build an understanding of our own place in the world. Delivering science-based technical assistance to clients is the foundation for successfully carrying out the Natural Resources Conservation Service's (NRCS) mission of helping people help the land.

Through our onsite assistance, we help our clients identify conservation objectives, assess their resource concerns, analyze alternatives, and formulate treatments through conservation planning. How we provided this technical assistance is documented in 1.6 million conservation plans and 30 million planned practices in our National Conservation Plan Database. In addition to conservation planning, we use our technical expertise to educate the public about the importance of our soil resource and the need to protect it for future generations.

This 2017 Soils Planner focuses on the soil resources' inherent beauty and its ability to record memory of past climates on Planet Earth. We encourage you to study these indicators for use in the field to better protect our natural resources and improve soil health and the future health of our planet.

Jason Weller
Chief, USDA–Natural Resources Conservation Service

Helping People Help the Land

Soils Sustain Life

The Soil Science Society of America (SSSA) celebrates the beauty of soil and the understanding of all its complexities. Soil is critical to life on this planet. That is why we want all people to appreciate how important soil has been and will be to our future. Reading the memory of our planet imprinted on our soils gives us a key to understanding our future climate and provides a guide to sustaining life and our prosperity.

SSSA is an educational organization with more than 6,000 scientists and professionals in over 80 countries. The Society is committed to the advancement of soil science. Our mission is to promote soils as fundamental to life. SSSA supports the education and research needed to protect and understand this natural resource for the health and welfare of our planet. SSSA is pleased to continue our active partnership with the USDA–Natural Resources Conservation Service in producing educational materials, such as the 2017 Soils Planner, for our members, the public, and the science community.

Andrew N. Sharpley
President, Soil Science Society of America
www.soils.org

Soil Science Society of America

The Astronomy Picture of Soils

Like the soils on Mars and the Moon, soils on Earth can be viewed within the context of astronomy. Unlike Mars and the Moon, however, soils on Earth are mineralogically very diverse; the Earth itself has some 4,000 types of minerals compared with 400 types on other planetary bodies. Earth's unique mineralogy is attributed to its other unique factor—life.

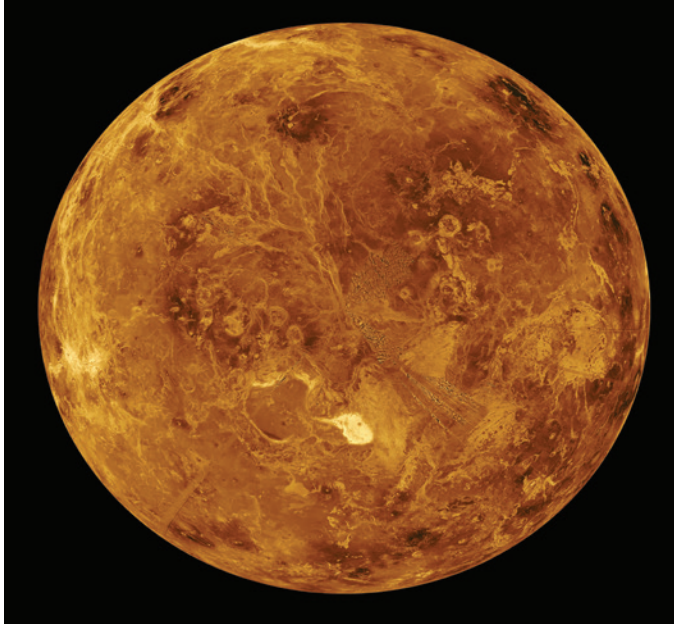
Life, or biota, is one of the five soil-forming factors and has a profound effect on how a soil profile looks, especially regarding organic matter. When biota changes, such as when a forest is replaced with agriculture, the appearance of the soil profile remains the same, at least for a while. The soil, therefore, "remembers" the forest under which it formed.

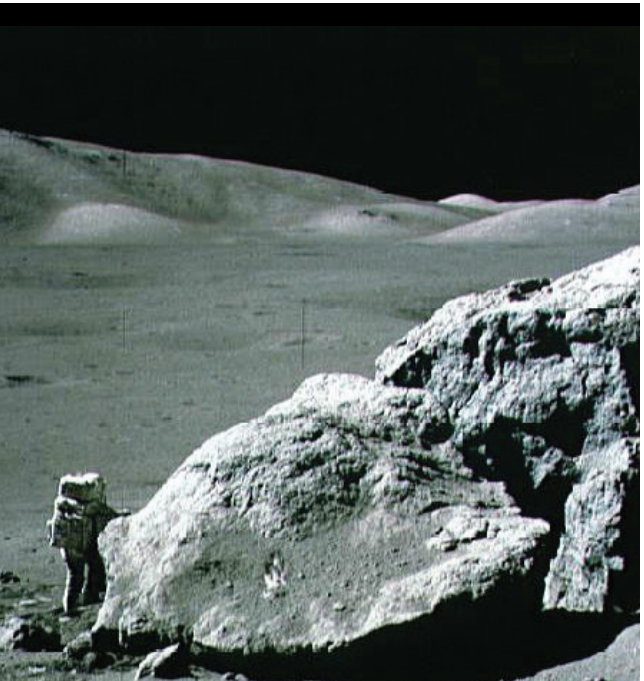
Soil memory is a metaphor developed by Russian pedologists. It is useful for thinking about how past climates, vegetation, and land use are recorded by soil properties and stratigraphy.

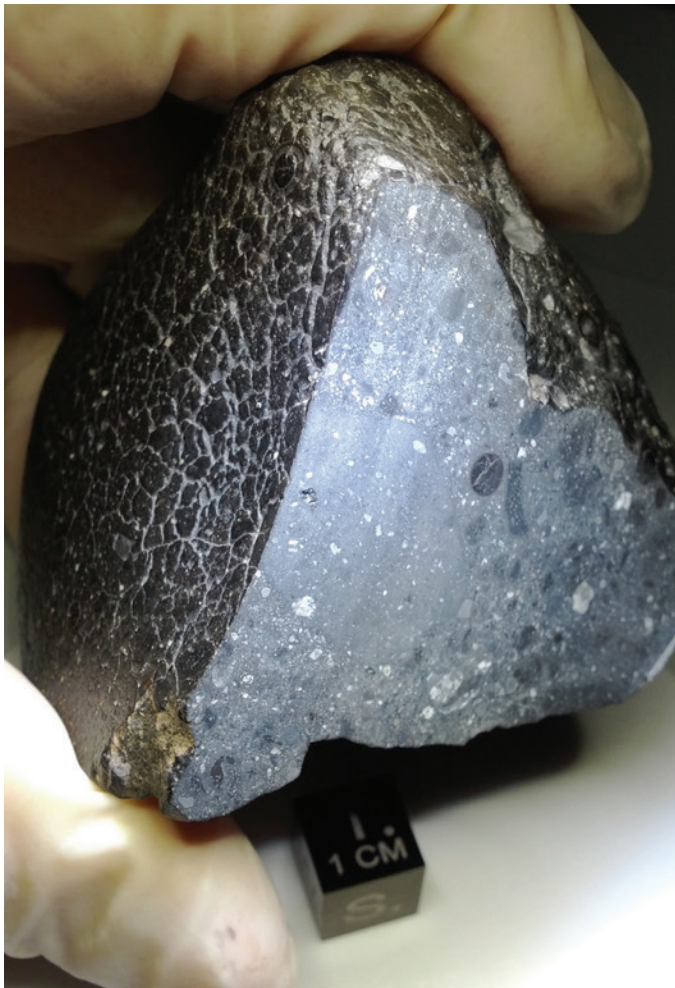
Some properties, like organic matter, can change over decades, in ways similar to rapid memory loss. Other properties, like clay mineralogy, may take millennia to change, which is comparable to long-term memory.

Extraterrestrial Minerals

We know about minerals on other planets from data gathered on Mars and Venus by National Aeronautics and Space Administration, mineral samples collected on the moon, spectral analysis obtained by telescopes, and the remains of meteorites.







Too Young to Remember

Soils—in the pedological sense—are born, mature, and die. They are born when sediments are deposited. They mature after sedimentation stops and soil horizons develop. And they die when erosion strips away the soil horizons and exposes underlying parent material.

Soils lacking pedogenic horizons because of their young age do not have a memory of their environment. Such horizon-less profiles are not confined to any unique bio-climatic zone, but occur in many regions—hence their label “azonal.” The purpose of the Entisol order, for example, was to preserve the azonal concept.

JANUARY 2017

December

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February

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Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1 New Year's Day	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16 Martin Luther King Day	17	18	19	20 Inauguration Day	21
22	23	24	25	26	27	28 Chinese New Year
29	30	31				

Remembering Deserts

Deserts receive so little rain (less than 10 inches per year) that downward percolating water stops beforen reaching the ground water. Consequently, water-soluble minerals accumulate in the soil profile. Calcium carbonate is the most widespread of these minerals. Gypsum and sodium chloride also can accumulate depending on local conditions.

These “non-flushing” profiles remember arid and semiarid climates. They are common in the Aridisol order, but can also occur to a lesser degree in the dry regions of Mollisols, Alfisols, Andisols, and Inceptisols.

FEBRUARY 2017

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March

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Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			1	2 Groundhog Day	3	4
5	6	7	8	9	10	11
12 Lincoln's Birthday	13	14 Valentine's Day	15	16	17	18
19	20 President's Day	21	22	23	24	25
26	27	28 Mardi Gras				

Remembering the Prairies

These soils remember the steppes and prairies of the semiarid and subhumid climates in which vast herds of grazing animals evolved and migrated. Grassland soils have an especially dark, organic-rich topsoil because of an abundance of fibrous grass roots that die and decompose.

Because of their dark, thick, fertile topsoil, most of these soils in the Mollisol order are used in agriculture.

MARCH 2017

February

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April

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5	6	7	8	9	10	11
12 Daylight Savings Time starts	13	14	15	16	17 St. Patrick's Day	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

Remembering Temperate Forests

Although tree roots add some carbon to soils, most carbon drops from the tree canopy to the forest floor. This leaf litter supplies the underlying mineral horizon with carbon carried by earthworms and other biological mixing. The darkened topsoil horizon is underlain by a light-colored eluvial horizon from which clay particles are translocated downward by percolating water and deposited in the illuvial subsoil below.

Even after trees are cleared and the topsoil and eluvial horizon are plowed, the clay-rich illuvial subsoil remembers forest. Forested environments produce Alfisols and Ultisols. Alfisols have more fertile illuvial subsoil horizons than Ultisols.

APRIL 2017

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May

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14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
						1 April Fool's Day
2	3	4	5	6	7	8
9	10	11 Passover	12	13	14 Good Friday	15
16 Easter	17 Taxes due	18	19	20	21	22 Earth Day
23	24	25	26	27	28	29
30						

Remembering Water Saturation

Bacteria living in soil saturated with water are similar to the first life forms that evolved on Earth about 3.7 billion years ago. These bacteria do not require oxygen from the atmosphere, but instead live off the chemical energy of minerals. They are particularly efficient at changing the color of soil from red to bluish gray by reducing iron and for producing mottles, such as in the soil to the left. Long after a water table has been lowered, a soil can remember hydric conditions.

All 12 soil orders have soils intermittently saturated with water caused by local hydrological conditions related to topography and climate.

MAY 2017

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23	24	25	26	27	28	29
30						

June

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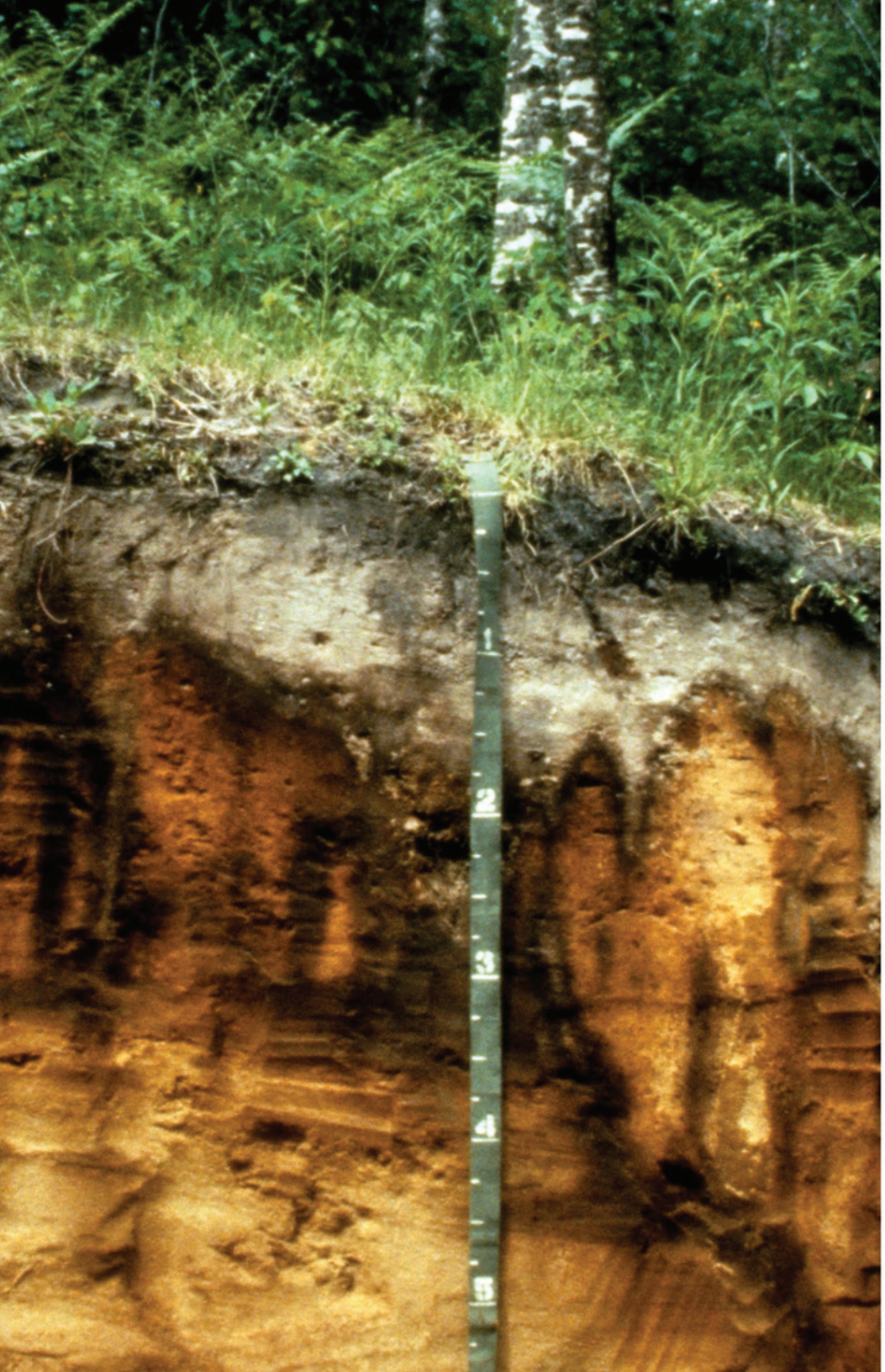
18	19	20	21	22	23	24
25	26	27	28	29	30	

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	1	2 Teacher Appreciation Day	3	4	5 Cinco de Mayo	6
7	8	9	10	11	12	13
14 Mother's Day	15	16	17	18	19	20
21	22	23	24	25	26	27 Ramadan
28	29 Memorial Day	30	31			



Remembering Cool Moist Climates With Acidic Litter

Although soils with subsoil accumulations of iron, aluminum, and/or iron can occur in temperate coastal plain regions, like those in the Southeastern USA, most of these soils develop in boreal forests that cover much of Canada, Scandinavia, Siberia, and high elevations on all continents.

Soils with this type of profile are Spodosols derived from the Russian word “Podzol” (pod meaning “under” and zola meaning “ash”), which refers to the organic horizon beneath the wood ash-like color of the eluvial horizon.

JUNE 2017

May

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21	22	23	24	25	26	27
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July

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30	31					

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
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4	5	6	7	8	9	10
11	12	13	14	15	16	17
18 Father's Day	19	20	21	22	23	24
25	26	27	28	29	30	

Remembering Freezing and Thawing

Freezing and thawing causes a soil to churn or "turbate." Cryoturbation generates unique profiles, such as the one to the upper left that shows a modern soil with frost churning compared to the one on the lower left that no longer churns, but remembers churning during the last Ice Age.

Cryoturbated soils occur in northern and southern Polar Regions, as well as in high elevation areas like the Tibetan Plateau. In addition to churning, cold soils store a lot of carbon and are important to the global carbon cycle, especially when they warm and release carbon dioxide into the atmosphere.

JULY 2017

June

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25	26	27	28	29	30	

August

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20	21	22	23	24	25	26
27	28	29	30	31		

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
						1
2	3	4 Independence Day	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

Remembering Cyclic Wet-Dry Seasons

Other types of churning soil contain high amounts of clay, especially the mineral smectite. During wet seasons, these soils swell, causing blocks of soil to rub against each other. During dry seasons, they dry causing blocks to shrink and form cracks. These soils remember wet-dry seasons because if either continuously wet or dry, they would not develop their churning properties.

Soils with these clay-rich turbated profiles belong to the Vertisol order, whose name comes from the Latin verto, as in vertebra, meaning to turn.

AUGUST 2017

July

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September

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Remembering Tropical Rain Forests

Opposite of the non-flushing desert soils are the soils of the rainy tropics. So much water has flushed through these warm soils that only the most insoluble iron and aluminum minerals remain. In many cases, even quartz has dissolved. This mineralogical memory will not be quickly forgotten in geologic time should the climate become drier or colder.

These highly weathered tropical soils belong to the Oxisol order. As the name suggests, they have high amounts of oxide minerals. So high, in fact, that many are mined as a source of aluminum ore.

SEPTEMBER 2017

August

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27	28	29	30	31		

October

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29	30	31				

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3	4 Labor Day	5	6	7	8	9
10 Grandparents Day	11	12	13	14	15	16
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Remembering More Than One Climate

Some soils are old enough to remember more than one climate. The soil to the left remembers an arid climate as shown by its white horizon of calcium carbonate. But it also remembers a more recent wetter climate when enough moisture percolated through the profile to dissolve parts of the carbonate horizon and form a cross-cutting pipe. Now the climate is arid again and carbonate is forming in the pipe.

Landforms, too, remember climate change. The terraces shown above with white arrows are marks of interglacial climates when sedimentation was greater.

OCTOBER 2017

September

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24	25	26	27	28	29	30

November

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19	20	21	22	23	24	25
26	27	28	29	30		

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
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8	9 Columbus Day	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31 Halloween				

Remembering Prehistoric People

When a land surface gets buried by volcanic ash, advancing sand dunes, or sediment deposited by floods, the buried land surface and underlying soil become fossils that developed in an earlier time.

These fossil soils, or paleosols, contain important clues about the climates in which they formed. Paleosols range in age from a few hundred years to many millions of years old.

The paleosol shown to the left, for example, was used to grow corn some 2,000 years ago. Artifacts like beads and pottery at this site may be found in the sediments above the buried land surface, but not below it.

NOVEMBER 2017

October

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December

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Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
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12	13	14	15	16	17	18
19	20	21	22	23 Thanksgiving	24	25
26	27	28	29	30		

Remembering Land Before Plants

Paleosols can be found throughout the geologic record. The paleosol shown to the left occurs at the Precambrian-Paleozoic contact in the photograph above. Plants had not yet evolved, so, at best, the only life on this barren landscape was microorganisms in the paleosol. Like today, physical and chemical weathering was operating to convert the rock of this ancient landscape into a primitive soil.

Paleosols in the geologic record provide evidence for when oxygen from photosynthesis first accumulated in the Earth's early atmosphere. The oldest paleosols predate atmospheric oxygen and therefore lack the red colors typical of well-drained soils with iron.

DECEMBER 2017

November

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January

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10	11	12	13 Hanukkah	14	15	16
17	18	19	20	21	22	23
24 Christmas Eve	25 Christmas Day	26 Kwanzaa	27	28	29	30
31 New Year's Eve						

2016 Events

January 2017
January 28-February 2: National Association of Conservation Districts (NACD) Annual National Meeting, Denver, Colorado

January 29-February 2: Society of Range Management Annual Meeting, Technical Training & Trade Show 2017, St. George, Utah

February 2017
February 16-20: American Association for the Advancement of Science (AAAS) 2017 Annual Meeting-Serving Society through Science Policy, Boston, Massachusetts.

March 2017
March 26-28: 2nd Agriculture and Climate Change Conference: Climate ready resource use-efficient crops to sustain food and nutritional security, Meliá Sitges, Sitges (near Barcelona), Spain

March 13-17: Joint International Meeting—The Geological Society of America (GSA) and the Geological Society of Africa (GSAf), Addis Ababa, Ethiopia

April 2017
April, Date To Be Determined: National Collegiate Soil Judging Contest, Northern Illinois University, DeKalb, Illinois

April 23-28: European Geosciences Union (EGU) General Assembly 2017, Vienna, Austria

May 2017
May 6-9: American Planning Association, New York City, New York

May 14-18: 15th International Symposium on Soil and Plant Analysis, Nanjing, China

May 29-June 1: International Interdisciplinary Conference on Land Use and Water Quality Effect of Agriculture on the Environment, The Hague, The Netherlands

June 2017
June 4-9: National Cooperative Soil Survey Work Planning Conference and Partnership Training, Moscow, Idaho

June 12-16: First World Conference on Soil and Water Conservation Under Global Change, Lleida, Spain

June 20-23: Second Global Workshop on Digital Soil Morphometrics, The James Hutton Institute in Aberdeen, Scotland, UK

June 25-29: National Cooperative Soil Survey Work Planning Conference and Partnership Training, Boise, Idaho

June 26-July 1: 25th Anniversary of Pedometrics, Wageningen, The Netherlands

July 2017
July 30-August 2: Soil and Water Conservation Society (SWCS) International Annual Conference, Madison, Wisconsin

August 2017
August 6-11: 102st Ecological Society of America (ESA) Annual Meeting, Portland, Oregon

August 12-17: 11th International Symposium on Selenium in Biology and Medicine & The 5th International Conference on Selenium in the Environment and Human Health, Karolinska Institute, Stockholm, Sweden

August 21-25: 12th International Congress of Ecology INTECOL 2017, Beijing, China

September 2017
September 19-22: 125 Years of IUFRO - Anniversary Congress: Interconnecting Forests, Science and People

October 2017
October 22-25: American Society of Agronomy (ASA), Crop Science Society of America (CSSA), and Soil Science Society of America (SSSA) International Annual Meetings, Tampa, Florida

October 22-25: The Geological Society of America (GSA) 2017 Annual Meeting, Seattle, Washington

November 2017
November 12-15: Geo-Institute (GEO) PanAm Unsaturated Soils, Addison, Texas

December 2017
December 11-15: American Geophysical Union Annual Meetings, New Orleans, Louisiana

2018 Calendar

January

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March

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August

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September

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October

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November

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December

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30	31					

Our Mission: Helping People Help the Land
Our Vision: Productive Lands, Healthy Environment

Helping people help the land and helping people understand soil science and its importance in land management and conservation are important goals for the Natural Resources Conservation Service. Farmers, agricultural producers, communities, and local governments work with NRCS State Offices and local USDA Service Centers to help them protect natural resources and maintain productivity on working lands. To find out more about the soils in your State, county, or local community, visit the National Cooperative Soil Survey website at http://soils.usda.gov/. Click on the Web Soil Survey. For more information about natural resources and conservation in your own backyard, visit NRCS at http://www.nrcs.usda.gov. To help with conservation, you can volunteer locally by calling 1-888-LANDCARE.

For information on Soil Health and Conservation Planning in your own State, visit http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/fotg/.

References and Photo Credits

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