USDA Natural Resources Conservation Service
U.S. DEPARTMENT OF AGRICULTURE

Careers in Soil and Plant Science are Everywhere!

Come work with us—you'll go places!

Find a Pathways Program internship at **USAjobs.gov**!

This program provides students currently enrolled in a wide variety of educational institutions, from high school to graduate level, with opportunities to work in agencies and explore Federal careers while still in school and while getting paid for their work!

Students who successfully complete the program may be eligible for conversion to a permanent job.

Scan the QR code and hear from these specialists about their jobs! Learn more about the NRCS Soil and Plant Science Division: **www.soils.usda.gov**

USDA is an equal opportunity provider, employer, and lender.

Career Legend

ICON	MEANING
	Works outside on the ground
	Works outside on the water
	Works indoors
	Works on computer applications/ solutions primarily
	Works with data primarily
	Works with soil climate technology primarily
	Works in a lab primarily
	Likes science and the environment
	Cares about conservation and natural resources

1 Soil Scientist

Ryder Anderson

Soil scientists inventory and investigate the wide variety of soils in our nation. They journey to the far reaches of the country by truck, motorcycle, four-wheeler, helicopter, and boat. Soil scientists investigate soils and soil properties on cropland, grasslands, permafrost, mountains, desert, forested lands, under water, and in the urban areas of major cities. They produce information that resource managers in the United States use every year, and they also work with hundreds of other countries. Soil scientists use the latest equipment for field analysis of chemical, physical, and biological soil properties and submit samples for further analysis at the NRCS Kellogg Soil Survey Laboratory.

2 Coastal Zone Soil Scientist

Greg Taylor

Coastal zone soil survey (CZSS) is a unique type of soil survey. CZSS soil scientists take requests from all over the country, working with local partners to build teams that help move, store, and manage equipment and supplies needed for the projects. What makes CZSS special is also what makes it so fun. Whereas soil surveys typically are conducted on dry ground to provide information to farmers, foresters, landowners, and land planners, CZSS soil scientists go out into marshes and bays to collect soils information for such things as oyster production, dredge planning, or underwater vegetation restoration. They work from customized boats designed to pull soil samples from underneath the water. Not only do CZSS soil scientists get to work all around the country, but they also get to do it from a boat!

3 Soil Climate Specialist

Kent Sutcliffe

A soil climate specialist studies and characterizes the "weather" below the ground. Data, such as soil moisture and soil temperature, are crucial in drought assessment and weather modeling and help inform effective conservation decisions. One day a soil climate specialist may be working with NASA assisting with a weather model, and the next the soil climate specialist is traveling to a weather station to troubleshoot an issue with the solar panel. Day-to-day tasks include a lot of logistics, such as getting parts and supplies to those who are maintaining the sites and staying on top of data quality control and assurance. A soil climate specialist works with a wide variety of professionals, advising on the use of soil climate data, often in support of conservation activities. Interested in what soil climate information is available near you? Look at and download near real-time soil data, reports, products, and resources: **nrcs.usda.gov/resources/data-and-reports/soil-climate-analysis-network**.

4 Data Scientist

Laura Morton and Jason Nemecek

Working with soil and plant information collected in the field, data scientists develop and share data to support employees and customers who make decisions that help get conservation implemented on landowners' properties. Data scientists work with such a large quantity of data, sometimes called "big data," that they can process and compile it in ways to make models or show trends and potential outcomes. They can also harness the data to address a particular need or concern, such as nutrient runoff potential. Data scientists use information, including scientific data, administrative data, or programmatic data, to help NRCS deliver services to our customers to use in conservation planning, soil health activities, climate-smart efforts, and equitable program delivery. For a great example of the work data scientists do, check out the soil data available on Web Soil Survey: **websoilsurvey.nrcs.usda.gov**.

5 Ecologist

Jack Ferrara

Ecologists investigate and describe species living together in diverse ecosystems that include not only the plants and animals but also environmental factors. Environmental factors, like climate, soils, and landforms, influence where species live and how they change over time. Other environmental factors, such as wildfire, drought, and human activities, can also cause ecosystems to change over time. To be an ecologist for soil survey requires getting outside and learning how to piece together clues observed on the landscape to understand how the many parts of an ecosystem fit together. Ecologists tell the story of how plants and animals interact with each other and with their environment, so anyone can go online and learn about the diverse and interesting ecosystems across the country. To learn more, visit the Ecosystem Dynamics Interpretive Tool, or EDIT, at: **edit.jornada.nmsu.edu**.

6 Geographic Information System (GIS) Specialist

Adolfo Diaz

A GIS specialist is a highly trained professional who uses a computer system to manage and analyze geographical data. The computer system can store, transform, analyze, and display different kinds of data into 2-dimensional or 3-dimensional maps. This allows a GIS specialist to see spatial relationships between the data to help organizations make improved decisions on a wide range of areas, such as disaster planning, construction sites, public facilities, and environmental planning. At NRCS, whether staff map soils on the ground or underneath the water, they collect and analyze information in a spatial context. NRCS scientists and conservationists use this data to visualize spatial relationships and analyze how applying conservation practices can affect land when they are assisting farmers, ranchers, and landowners.

7 Research Soil Scientist

Tiffany Carter

Research soil scientists lead experiments to better understand the soil underneath their feet and improve soil survey. Research helps to provide the answers to questions about why the environment works the way it does. The work of research soil scientists helps improve nationwide soil m aps as well as how the maps are made, so farmers, engineers, and landowners can use them to make management and conservation decisions. Every day is different! Research soil scientists might spend their day outside collecting soil samples or conducting field measurements, in the lab testing new techniques to measure soil properties, or on the computer working with data to answer research questions. One of the best parts about a research soil scientist's job is getting to work collaboratively with university professors, soil scientists, and data users, which allows research soil scientists to travel and see soils around the country and world.

7 Physical Science Technician

Armida Rivera and Crystal Schaecher

At the world-renowned USDA NRCS Kellogg Soil Survey Laboratory (KSSL) in Lincoln, Nebraska, physical science technicians lead the way! Each year, the KSSL performs thousands of analyses and experiments on diverse soil samples from across the United States and around the world to measure their chemical, physical, mineralogical, biological, and spectral properties. These physical science technicians prepare and analyze samples using sophisticated and cutting-edge instrumentation, ensure data quality by examining data trends and relationships, and develop new methods of soil analysis. They play a vital role in soil survey, soil research, and soil health assessment. Physical science technicians collaborate with fellow team members, field soil scientists, and research soil scientists in a joint effort to characterize our nation's least understood natural resource—the soil.

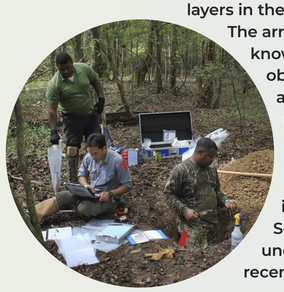
USDA NRCS Soil and Plant Science Division

From the field to the farmer, the rancher, the forester, the engineer, the urban planner, the realtor, the gardener, the researcher, the Federal agency, or the homeowner . . . data generated by USDA's Natural Resources Conservation Service (NRCS) Soil and Plant Science Division staff travels far and wide and should have passports of their own!

The data available to the public on our databases results from thoughtful and thorough documentation by staff traveling long distances to work in remote locations in all types of terrain and weather. Important decisions about how land is used and managed—even underneath the water—are made based on the information the staff obtain, analyze, and document.

Exploring Soil Colors

The first impression most people have when looking at bare earth, or soil, is of the color. Soils come in an assortment of colors, most commonly in shades of black, yellow, brown, red, gray, and white. When looking below the ground, we see various layers in the soil, which are called soil horizons.



The arrangement of these horizons is known as a profile. Soil scientists observe and describe the horizons and profiles to classify the soil and make predictions for land use. Soil color can help us predict mineral content, chemical composition, physical properties, and other important soil characteristics. Soil color supports a practical understanding of a landscape's recent and long-term history.

Soil Data and Education Resources

Web Soil Survey: The largest natural resource information system in the world, Web Soil Survey provides soil data and information produced by the National Cooperative Soil Survey. Visit: **websoilsurvey.nrcs.usda.gov**.

Soil Climate Analysis Network: Also known as SCAN, the network supports natural resource assessments and conservation activities by providing near real-time data about soil moisture content at several depths, air temperature, relative humidity, solar radiation, wind speed and direction, liquid precipitation, and barometric pressure. Visit: **bit.ly/3TXcpps**.

Soil Properties Data: To look at different soil properties in your area like the soil pH, texture, and land capability class, visit: **https://casoilresource.lawr.ucdavis.edu/soil-properties/**.

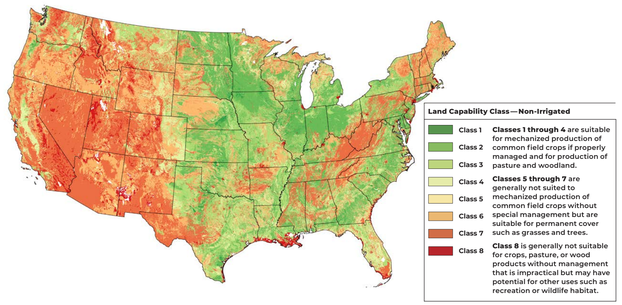
Soil Education for Teachers and Students: For soil-related educational resources visit: **bit.ly/443QmSE** and **www.americangeosciences.org/nrcs**.

Soil Color

The color of soil is one of the few things in nature that is arguably of equal interest to both natural resource scientists and children at play. Successful soil scientists appreciate the tremendous quantity of information typically related to soil color variation in depth and space. While not always entirely quantitative, soil color supports a practical, qualitative scaffolding for our understanding of a landscape's recent and long-term history, clues about dominant mineralogy, a striking picture of where organic matter has accumulated, and many other factors that affect our use and understanding of the soil. Given the right context, soil color and its interpretation can be effectively used as a narrative for educating people about "what types of soils are where, and why?" Visit **bit.ly/4aF5ubI** to explore soil color maps online. Enjoy this unique opportunity to see how soils and geologic features are inextricably linked and vary across the landscape.

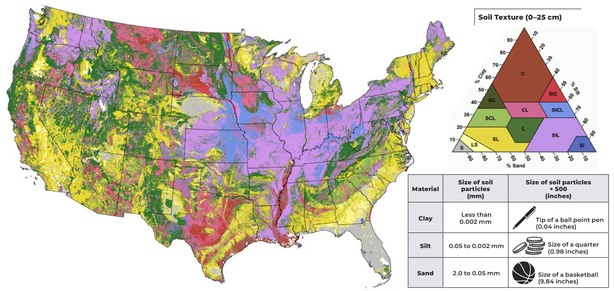
Land Capability Class—Non-Irrigated

Soil scientists use the soil classification land use property to identify land capability class. The system of grouping soils by class is primarily based on their capability to produce common cultivated crops and pasture plants without deteriorating over an extended period. Through careful planning, landowners can avoid repetitive agricultural land management practices that would otherwise cause the soil's quality to diminish over time on the same plot of land. To identify which class an area falls into, soil scientists will look at many different soil characteristics. They will consider the soil location as well as soil texture, pH, depth, and slope, which will help them to determine multiple factors including soil erosion, the soil's available moisture capacity, and the soil's ability to maintain nutrients.



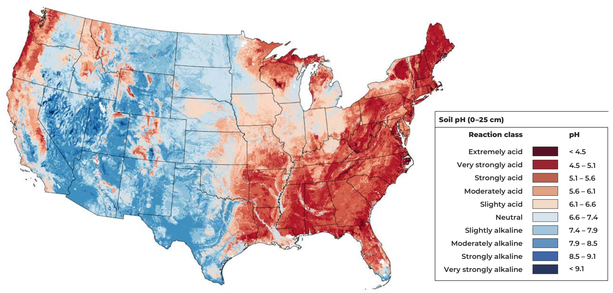
Passport to Earth Science Data

Whether collected from the field, generated by remote sensors, or examined in our laboratories, our data are made available to **everyone everywhere**.



Soil Physical Properties: Soil Texture

When it comes to the physical property of soil texture, or the feel of the soil, adults and children tend to think the same. Some children think of the time they played in a sand box or made mud pies. Simply by feeling the texture of the sand and the soil, children know if it will be good for making mud pies. Without knowing it, what they were playing with was the texture of soil. Soil texture is an important estimate because it determines different soil characteristics like the soil's available moisture capacity and permeability as well as how workable and fertile the soil is, which can all affect plant growth. For a soil scientist, soil texture is estimated out in the field when looking at soil profiles or cores. To do this, a soil texture triangle is used to estimate the clay, sand, and silt percentages in the sample that is being textured, and where the three intersect is the soil type. Clay soils have a lot of fine particles that hold a lot of water and nutrients tightly, so these soils retain water more than silty soils. Sandy soils have the largest particle size, which allows water to drain quickly. Silty soil has medium-sized particles, and during drought, these soils can retain moisture for longer periods compared to sandy soils.



Soil Chemical Properties: Soil pH

Soil pH is possibly the most important chemical property soil scientists can collect out in the field or analyze in a lab. The pH of the soil affects the quantity of chemicals and minerals that dissolve in soil water that, in turn, influence the amount of nutrients that are available to plants. Some essential nutrients for plants affected by soil pH include potassium (K) to help with seed formation, phosphorus (P) for root formation, and nitrogen (N) to help with plant growth and development through the process of photosynthesis. The map above shows the western half of the country tends to be more alkaline, except for the northwest areas, and the eastern half of the country tends to be more acidic. The differences in pH are typically due to climate, vegetation, topography, and time. The western states tend to be more alkaline because there is much less rainfall to leach out the basic elements, like P and K, from the soil. The eastern states tend to be more acidic due to the higher abundance of vegetation, like trees, which can contribute to the acidic soil levels when their leaves and needles fall on the ground and begin to decompose.

The United Nations Sustainable Development Goals (SDGs) are a universal call to action to end discrimination, protect the planet, and ensure prosperity for all. Addressing the SDGs can help students make connections between what they are studying and the major issues in society today, especially focusing on the role that geoscience professionals can play in addressing these issues and meeting the goals that the SDGs set to improve the quality of life for all people, as well as for the environment. Understanding soil science is pivotal for advancing many SDGs. It is essential to educate students about the profound impact that work in soil science can have on achieving these goals.

SDG 2 Zero Hunger—Soil science contributes to achieving this goal by improving agricultural productivity, soil fertility management, and sustainable land use practices, which are essential for ensuring food security and ending hunger.

SDG 3 Good Health and Well-being—Healthy soils support the growth of nutritious crops, contributing to improved nutrition and human health. Soil science helps prevent soil degradation and contamination, which can have adverse effects on human health.

SDG 6 Clean Water and Sanitation—Soil plays a crucial role in regulating water quality and availability. Soil science helps in understanding and managing soil-water interactions, reducing pollution, and enhancing water filtration and purification processes.

SDG 13 Climate Action—Soil science contributes to climate change mitigation and adaptation efforts through practices such as carbon sequestration, soil carbon management, and sustainable land management practices, which help mitigate greenhouse gas emissions and enhance soil resilience to climate change.

SDG 15 Life on Land—Soil is a vital component of terrestrial ecosystems, supporting biodiversity, ecosystem services, and ecological balance. Soil science plays a crucial role in soil conservation, habitat restoration, and sustainable land use planning to protect and conserve terrestrial ecosystems and biodiversity.

Learn about all 17 SDGs at **sdgs.un.org**. Learn how to incorporate soil data and the SDGs into your teaching using the new Educator Guides to Web Soil Survey found at **nrcs.usda.gov/resources/education-and-teaching-materials/soil-education** or at **www.americangeosciences.org/nrcs**.

"Essentially, all life depends upon the soil . . .
There can be no life without soil and no soil without life;
they have evolved together."
— Charles E. Kellogg, USDA Yearbook of Agriculture, 1938

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AGI american geosciences institute
connecting earth, science, and people

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