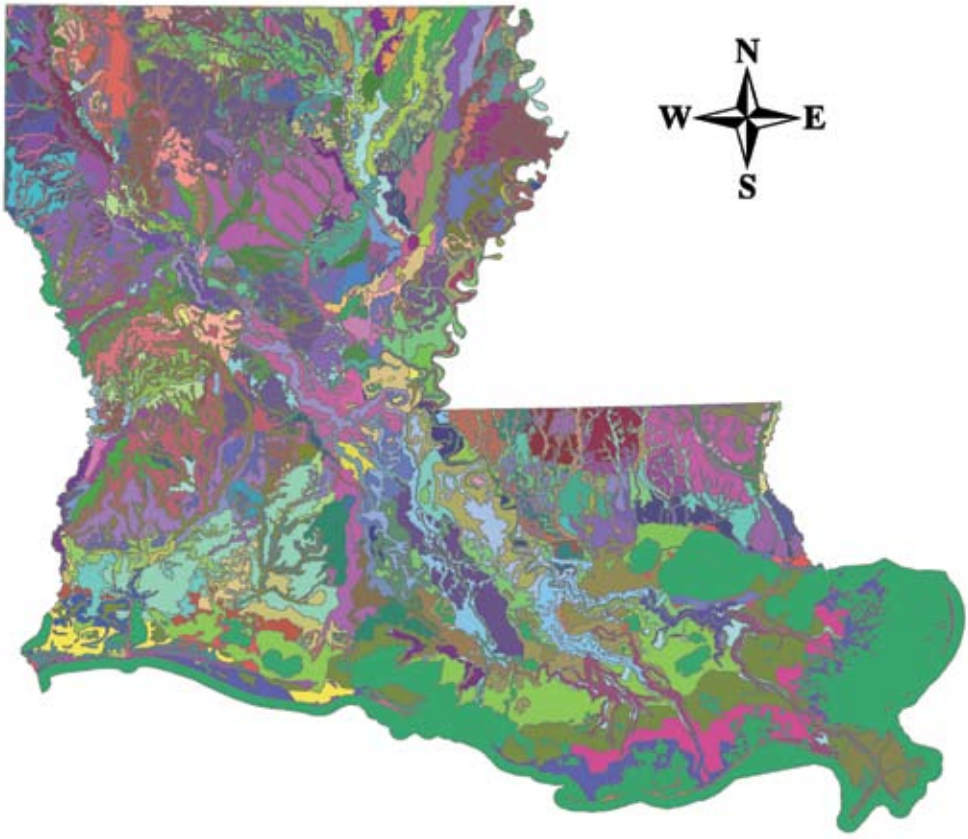
UNDERSTANDING
LOUISIANA SOILS



LSU AgCenter
Research & Extension

Understanding Louisiana Soils

How much do you know about the soil beneath your feet? We depend on soils to support our homes, grow our food and fiber, and even clean our water. Yet many people know remarkably little about one of our most vital natural resources: our soil.

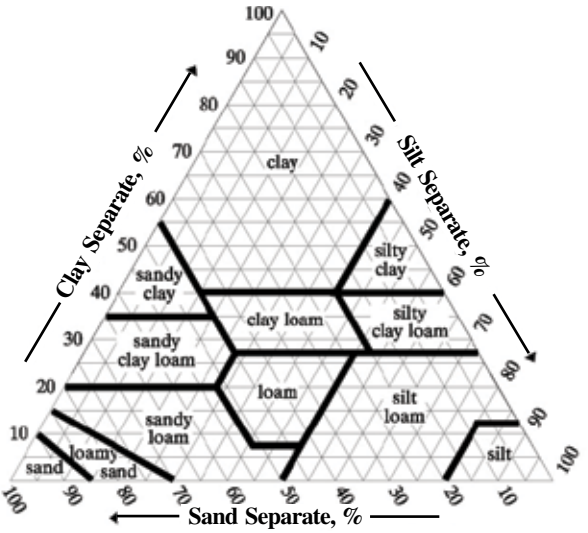
While many definitions of soil exist, it is generally defined as a collection of natural bodies in the earth's surface in places modified or even made by man of earthy materials, containing living matter and supporting or capable of supporting plants out of doors. Many people use the terms "dirt" and "soil" interchangeably, but the former indicates soil out of its natural habitat while the latter describes soil in its natural condition.

Soil profile with multiple horizons; Photo by David Weindorf

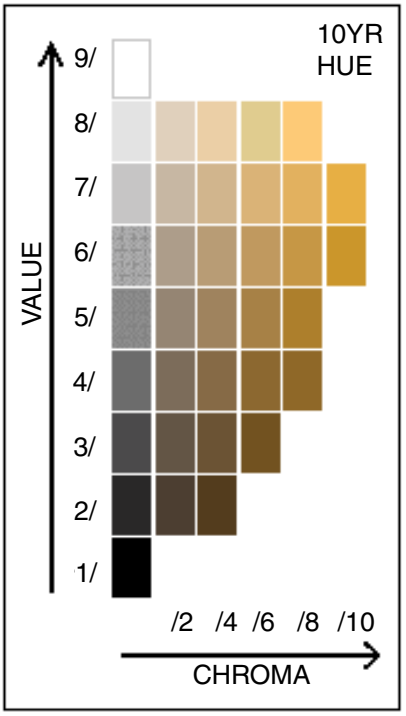
Soils are not merely masses of sediment. Rather, they undergo development or genesis over time. Five factors chiefly govern the development of soil: climate, biota, parent material, topography and time. Climate includes factors such as rainfall and temperature. Biota refers to organisms that live in the soil such as earthworms, bacteria, fungi and actinomycetes. Parent material is the source of matter for the soil and can either be organic (peat, leaves, pine straw) or inorganic (rocks, minerals, sediment). Topography refers to the relative slope of a soil and influences water runoff. Time is a key requirement for soil genesis, with many soils developing over hundreds or thousands of years. The result is a soil with pronounced layers (horizons) or features that influence its use and support of vegetation. Horizons can be uniquely split out and identified based on chemical or physical differences from adjacent horizons.

Soil Physical Properties

At its most fundamental level, soil consists of sand, silt and clay particles of mineral material as well as incorporated organic matter. Various combinations of these materials give rise to soil texture. Twelve soil textures are recognized in the United States. Soil texture is one of the most fundamental soil physical properties and often influences a variety of soil processes such as aeration, water infiltration, compaction, etc.



Soil color is another commonly observed feature that can provide clues into certain soil properties. For example, darker colors near the surface can indicate high levels of organic matter and reddening of the soil with depth can indicate advanced soil age.



Soil color is described using three variables which are displayed on color chips in the Munsell Soil Color Charts. Hue is a measure of the chromatic composition of light that reaches the eye. Hues most often used when describing soils are red, yellow or a combination of the two (for example, 10YR or 5Y). In the Munsell color book, hue is always given in the top, right-hand corner of the page. Value indicates the degree of lightness or darkness of a color in relation to a neutral gray scale. Pure black and pure white have values of (0/) and (10/), respectively. Lighter soils have values of 5-10 while darker soils have values of 0-5. In the Munsell book, value is always given along the vertical axis on the left side of the page. Chroma refers to the relative purity or strength of the spectral color. Soil chromas range from (/0) for neutral colors to (/8) for strongly expressed color. In the Munsell book, chroma is always given across the horizontal axis at the bottom of the page. The Munsell book can be obtained from a variety of outdoor resource companies and online retailers.

Soil Chemical Properties

Soil pH is a commonly determined chemical property. Simply defined, pH is the negative logarithm of the hydrogen ion activity in soil solution. Soil pH is expressed on a scale from 0-14. The U.S. Department of Agriculture's Natural Resource Conservation Service uses a simple scale when notating soil pH. The pH desired by plants is species specific, but slightly acidic pH values (6.1 – 6.5) are generally considered desirable because this allows for the ready uptake of most soil nutrients.

Term	pH Range
Ultra acid	<3.5
Extremely acid	3.5-4.4
Very strongly acid	4.5-5.0
Strongly acid	5.1-5.5
Moderately acid	5.6-6.0
Slightly acid	6.1-6.5
Neutral	6.6-7.3
Slightly alkaline	7.4-7.8
Moderately alkaline	7.9-8.4
Strongly alkaline	8.5-9.0
Very strongly alkaline	>9.0

Soil salinity is another commonly determined chemical property. It is the amount of salt dissolved in soil solution. High levels of salinity can be detrimental to plant growth because plants have to expend extra energy in order to draw water from salty soils. Salinity is often determined via electrical conductivity (EC) and expressed in units of deciSiemens per meter (dS/m). Soils with an EC of >4.0 dS/m are considered saline; however, as in the case of pH, plant tolerance of salinity is species-specific.

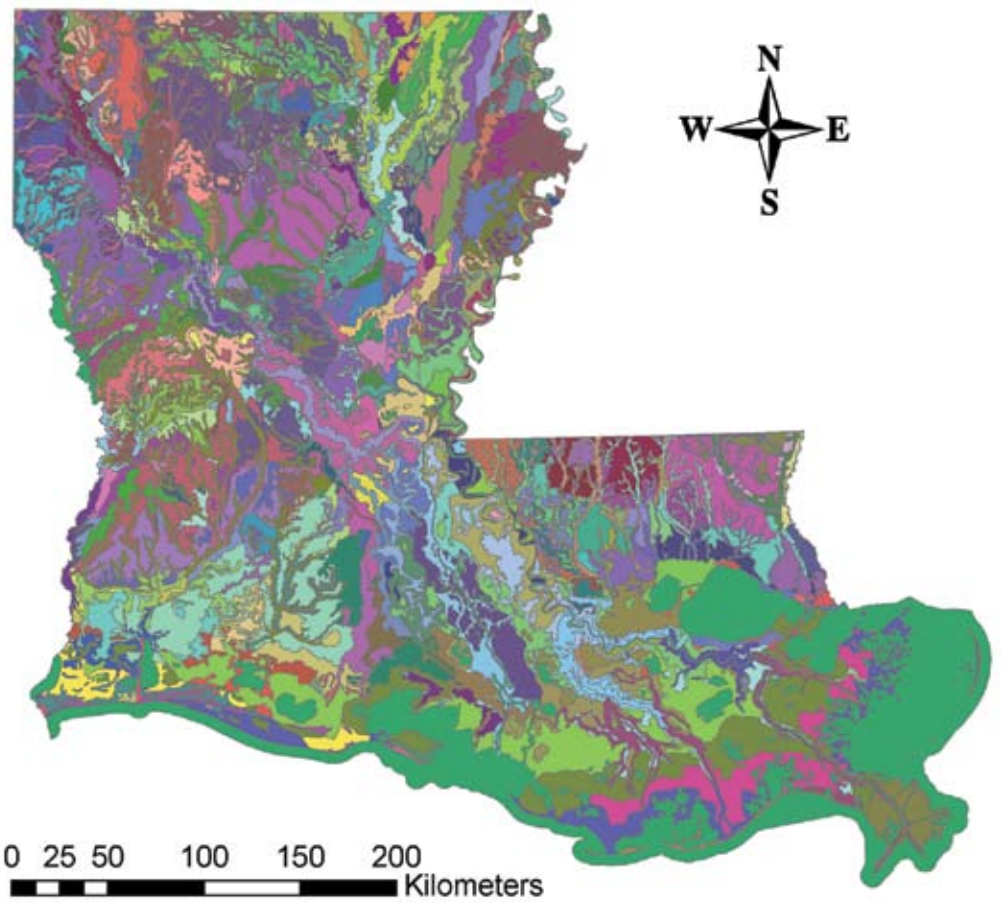
Cation exchange capacity (CEC) is an indicator of soil nutrients available in solution. Cations are positively charged elements that float around in soil solution. Many plant-essential elements such as potassium (K+), copper (Cu2+), magnesium (Mg2+), iron (Fe2+) and calcium (Ca2+) exist as cations. These positively charged nutrients tend to be attracted to negative charges found in certain clays and highly degraded organic matter (humus). Thus, soils containing negatively charged clays or humus tend to have high levels of plant nutrients and high CEC. CEC is expressed in milliequivalents per 100 grams of soil (meq/100g). Soils with CEC levels of less than 10 meq/100g may require the application of fertilizer to obtain optimum production. Soils with CEC levels of greater than 10 meq/100g tend to be somewhat naturally fertile and require only periodic fertilization and good land management to maintain their fertility.

Soil type	CEC range meq/100g
Sand (light color)	3-5
Sand (dark color)	10-20
Loam	10-15
Silt loam	15-25
Clay and clay loam	20-50
Organic soils	50-100

Soil testing can be performed by a variety of commercial labs. The LSU AgCenter offers a variety of soil tests and can help you interpret the results. For more information, contact the Soil Testing and Plant Analysis Laboratory (STPAL) at the LSU AgCenter.

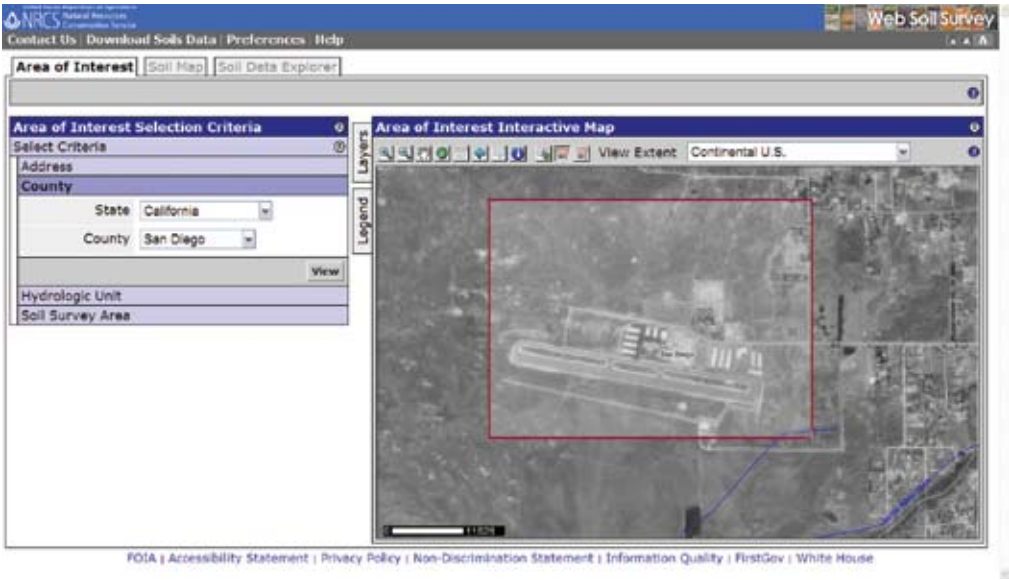
Louisiana Soils

The soils of Louisiana are incredibly diverse. Many soils near one of the many rivers in Louisiana were derived from sediments left behind by flooding. This material, termed alluvium, tends to be rich in nutrients due to the high amount of organic matter mixed into it during deposition. However, Louisiana is also a state of abundant rainfall. With most areas of the state receiving 50-65 inches of precipitation annually, nutrients can be readily leached out of the root zone, causing poor soil fertility. Soil texture varies dramatically across the state. Clay soils such as the Sharkey, Schriever, Barbary and Fausse series are common in areas of recent Mississippi River alluvium. Silty soils found in deep loess deposits include the Frost, Memphis and Calhoun series. Sandy soils in uplands or coastal plains sediments include the Betis and Briley series, respectively. Finally, freshwater and saltwater marsh soils of Louisiana include the Allemands, Scatlake and Creole series. Full descriptions of these and other soils mapped in Louisiana can be found online at http://ortho.ftw.nrcs.usda.gov/cgi-bin/osd/osdname.cgi. The state soil of Louisiana is the Ruston soil series, covering 733,714 acres. Ruston soils are very deep, well-drained and moderately permeable soils; however, they are strongly acid and have low natural fertility.

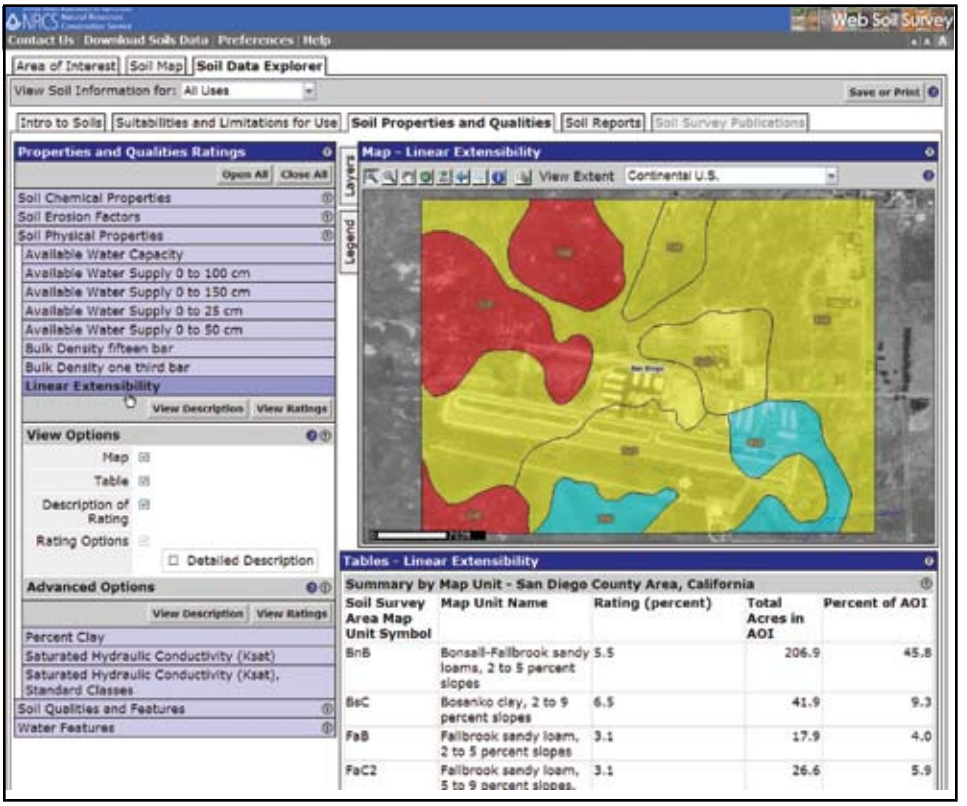


Web Soil Survey

Don't know what soil to look up? Use the USDA-NRCS's new web-based soils information system: Web Soil Survey. Go to http://websoilsurvey.nrcs.usda.gov/app/ to get started. Follow the on-screen directions to select an area of interest (AOI) to query. The search can be started by address, GPS coordinates, county/state and other specifications, then refined using aerial photographs to precisely identify the AOI.



Once you've selected an area, select "soil map" to view what soils are mapped in the defined area. Next, select "soil data explorer" to generate custom maps of chemical and physical soil properties, suitability and limitations for use, and soil reports. Each map has many customizable options and can be printed directly to a .pdf format. Important note: the maps and soils data generated through web soil survey represent the best interpolated values available from the USDA-NRCS; however, on-site sampling and lab analysis of soil properties are highly recommended to confirm soil properties.



Conclusions

The soils of Louisiana are diverse. Careful consideration of chemical and physical soil properties, periodic soil testing and use of soils data currently available will enable landowners to make informed decisions regarding land use. LSU AgCenter and USDA-NRCS personnel are ready to assist you with any questions you may have related to soils in Louisiana.

Recommended Reading

Brady, N.C. and R.R. Weil. The Nature and Properties of Soils 14th ed. Prentice Hall. (ISBN: 013227938X)

California Plant Health Association. 2002. Western Fertilizer Handbook 9th ed. Prentice Hall. (ISBN: 0813432103)

Kohnke, H. and D.P. Franzmeier. 1994. Soil Science Simplified 4th ed. Waveland Press. (ISBN: 0881338133)

Sugarcane production on the Cancienne silt loam in Assumption Parish, La.; Photo by David Weindorf

Author

David C. Weindorf
Assistant Professor
Soil Classification/Land Use
School of Plant, Environmental and Soil Sciences

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Louisiana State University Agricultural Center
William B. Richardson, Chancellor
Louisiana Agricultural Experiment Station
David J. Boethel, Vice Chancellor and Director
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