2005 Soils Planner
Lewis & Clark Bicentennial: Soils and Ecology
On February 28, 1803, President Thomas Jefferson received money from Congress to fund a small expedition to explore the West. He asked his Secretary, Meriwether Lewis and Lewis' friend, William Clark, to be in charge of the journey. Jefferson told them to travel and find out whatever they could about the land. This assignment would become one of the most symbolic events in agricultural and American history. During the 2003-2006 bicentennial observance of the Lewis and Clark Expedition, the Natural Resources Conservation Service and its partners continue to honor those who went on this historic journey. The Natural Resources Conservation Service is pleased to participate in the bicentennial observance of this historic event. It is our hope that without any reserve, you too, will take part in honoring the achievements of Captains Meriwether Lewis and William Clark.

Bruce I. Knight  
Chief, Natural Resources Conservation Service
Following the purchase from the French of the enormous Louisiana Territory drained by the Mississippi and the Missouri Rivers, Meriwether Lewis was instructed by President Jefferson on June 20, 1803, to explore the Missouri river regions and the most direct and practical water passage across the continent for the purposes of commerce. From May 14, 1804, to September 23, 1806, Lewis and Clark traveled over 8,000 miles exploring the extraordinary, vast, and beautiful lands. They meticulously recorded their observations and experiences in incredible detail, documenting the cultural diversity of native peoples and the immense diversity in natural resources. Throughout their journal, Lewis and Clark often described soil properties and characteristics important to productivity. For example, in the region near present-day Mandan, ND, they wrote "...The soil appears fertile and deep; it consists generally of dark rich loam intermixed with a small proportion of fine sand." These detailed reports encouraged farmers in the Eastern United States to settle on these productive lands and grow a young nation.

The Soil Science Society of America (www.soils.org) is dedicated to the discovery and application of science to understand and protect our precious soil resources that sustain agricultural productivity, environmental quality, and life on Earth. We are proud to participate with our USDA Natural Resources Conservation Service partners in celebrating the bicentennial of the "Corps of Discovery" that opened a new territory and provided detailed descriptions of the beauty and bounty of the diverse natural resources in the midwest, high plains, and western regions of the United States. We hope you enjoy the 2005 Soils Planner and participate in celebrating the Lewis and Clark bicentennial.

Dr. Mort Kothmann
Professor of Rangeland Ecology and Management,
Texas A & M University
President, Society for Range Management
At the turn of the 19th century, the U.S. population was growing quickly, and there was concern that there might not be enough farmland to sustain the Nation. The new immigrants from Europe were curious about the West and about the land’s value for agriculture. Many land assessment surveys were being sponsored and conducted for the U.S. Government. President Thomas Jefferson instructed Lewis and Clark to report on the Western Lands of the Louisiana Purchase and their potential for agricultural purposes. Was it a garden or a desert? The Spanish explorers from the Southwest described a desert. The French of the Northwest described a garden.

At the time, most American pioneers associated good-quality soils with hardwood trees and would have regarded the interior prairies of the Great Plains as poor agricultural land. Observations along the trail by Lewis and other expedition members contradicted these views and supported the vision of the agricultural bounty that the Great Plains would later produce. In truth, the reports were that the West was both a "desert" and a potential garden.

By the end of the 1800s the U.S. saw the need for a national inventory to document the potential productivity of the land. The result was the National Cooperative Soil Survey. The National Cooperative Soil Survey (NCSS) is now a joint effort by several Federal agencies, the 1862 land-grant universities’ experiment stations, the National Association of Consulting Soil Scientists, and the 1890 land-grant universities and western tribal colleges. The Natural Resources Conservation Service (NRCS), formerly the Soil Conservation Service, coordinates the NCSS and maintains the standards of the U.S. Soil Survey.

In this 2005 Soils Planner the soil scientists and range conservationists of the NRCS highlight some of the ecological relationships between soils, vegetation, animals, and land management along the Lewis & Clark Trail. Observations from the Lewis and Clark journals support and substantiate interpretations that field scientists see today. Scientists have found an inextricable link between the specific soils on the landscape and the resultant expression of the plants. Formerly called range site descriptions and woodland suitability group descriptions, ecological site descriptions contain information about the ecological dynamics of each site and are used as the standard of reference for resource evaluations and assessments such as trend, similarity index, and rangeland health. The NRCS is now developing Ecological Site Descriptions with the U.S. Soil Survey to assist land managers in sustaining rangeland, forestland, and wildland resources.

Communities and local governments work with NRCS State Offices and local USDA Service Centers to help them protect their natural resources. For more information about natural resources and conservation in your own backyard, contact the NRCS at http://www.nrcs.usda.gov or volunteer locally by calling 1-888-LANDCARE.
Ecological Regions

Dec. 1805-March 1806
Fort Clatsop
Waluski Soil
December

September 1805
Weippe Prairie
Nez Pierce Indians teach the Expedition to eat Camas bulbs
Lewhand Soil
November

Oct. 1804-March 1805
Wintered at Fort Mandan
Grail Soil
September

August 1804
Council Bluffs
Marshall Soil
June

June 1804
Missouri River
Mentro Soil
April

Spring 1803
Lewis prepares for Expedition at the Academy of Natural Sciences
February

July 1806
Return by Yellowstone River
Lambert Soil
October

EPA Ecological Regions Level 1
- Eastern Temperate Forests
- Great Plains
- Marine West Coast
- Mediterranean California
- North American Deserts
- Northern Forests
- Northwestern Forested Mountains
- Southern Semi Arid Highlands
- Temperate Sierras
- Tropical Wet Forests

1750-1802 Cradle of the Presidents
Davidson Soil
January

Lewis & Clark Expedition
- Preparation
- Recruitment
- Expedition
- States
The Davidson Series consists of very deep, well-drained, moderately permeable soils that formed in materials weathered from dark-colored rocks high in ferromagnesian minerals. These soils are on gently sloping to moderately steep uplands in the Piedmont. Slopes are commonly 2 to 15 percent but range up to 25 percent.

Use and Vegetation
Cleared areas are used for small grain, corn, cotton, soybeans, grain sorghum, hay, and pasture. The original forest consisted of white oak, red oak, post oak, hickory, yellow-poplar, and cedar; reforested areas are in shortleaf and loblolly pine.

Below: Monticello, home of Thomas Jefferson, located in the Piedmont uplands of Virginia. Jefferson met with Meriwether Lewis here during the planning stages of the expedition. The area is dominated by Davidson Soil.

Davidson Loam Profile

Taxonomic Class
Fine, kaolinitic, thermic Rhodic Kandiudults

Surface Layer
0 to 7 inches; dark reddish-brown (5YR 3/3) loam; weak fine granular structure; friable; strongly acid pH.

Subsoil Layer
7 to 72 inches; dark-red (2.5YR 3/6, 10R 3/6) clay loam and clay; moderate medium subangular blocky structure; firm; strongly acid pH.

Below: Soil Scientists take a profile of Davidson Loam (right) near Monticello.
CRADLE OF THE PRESIDENTS

The correlation of the Davidson soils in central Virginia to the homes of U.S. Presidents and other prosperous farmer/planters is quite strong. Jefferson at the time of the Lewis & Clark expedition had been farming the Davidson soil at Monticello for many years. It is no accident that three of the first five U.S. presidents came from Virginia farms with Davidson soil. Davidson soils possessed favorable qualities for agriculture in an era when external fertilizers were scant. Successful farming in the 18th century depended on the natural fertility of the soil.

Douglas Helms, Historian, NRCS
In the spring of 1803, Meriwether Lewis began preparation for the expedition in Philadelphia where he met with leading scientists of the day and bought more than 3,500 pounds of supplies. It was important for Lewis to gain certain scientific skills and to buy equipment that would be needed on the journey. Andrew Ellicott taught Lewis map making and surveying. Benjamin Smith Barton tutored Lewis in botany and biological collection, Robert Patterson in mathematics, Caspar Wistar in anatomy and fossils, and Benjamin Rush in medicine. Barton’s book, *Elements of Botany* (published in 1803), was amongst Lewis’s essential supplies during the expedition. Lewis arranged for a wagon and driver to haul all the items to Pittsburgh, PA, where it would be loaded onto a keelboat.

Right: From the Lewis & Clark Herbarium preserved in the Philadelphia Academy of Natural Sciences. At right, a colored engraving published in the first comprehensive catalog of American plants by Frederick Pursh in 1813. The plant is *Clarkia pulchella*, named for William Clark. A pressed specimen, or *lectotype*, of the same plant, appears in the accompanying photograph.

Above: Description of *Clarkia pulchella* from Meehan’s 1898 study of the Lewis & Clark Herbarium.

Above: *Penstemon fruticosus*, one of the engravings from the Pursh catalog, with a pressed specimen, or *lectotype*, at right. Pursh said the species grows in “great abundance in the pine-forests of the Rocky mountains.” The lectotype was collected along the Lolo Trail in Idaho Co., Idaho, on June 15, 1806.
THE LEWIS & CLARK HERBARIUM

Philadelphia played a prominent role in the disposition of material brought back by the Corps of Discovery. The American Philosophical Society, founded by Benjamin Franklin in 1743, became the repository for the journals kept by Lewis and Clark. This is the origin of the Lewis & Clark Herbarium now housed in Philadelphia's Academy of Natural Sciences.

The Academy's Lewis & Clark Herbarium includes 226 sheets of dried, pressed specimens, derived from two sets of plants: 179 that were transferred to the Academy in 1897 for curation by the American Philosophical Society and 47 others from different sources.
Wilbur Silt Loam

The Wilbur Series consists of very deep, moderately well drained soils that formed in alluvium redeposited from loess. Wilbur soils are on nearly level floodplains and floodplain steps. These soils are subject to brief periods of flooding. Mean annual temperature ranges from about 50 to 57 degrees F., mean annual precipitation from about 35 to 46 inches, and the frost-free period ranges from 150 to 210 days.

Use and Vegetation
Most areas are used to grow corn and soybeans. Some of the narrow floodplains are used for forest or pasture. The native vegetation is deciduous forest, chiefly of beech, elm, hickory, hackberry, buckeye, sugar maple, oak, and sycamore.

Below: Wilbur is a common soil at the site of Camp DuBois, Lewis & Clark's first encampment. This is a photo of soybeans planted on Wilbur soils. The field is located below a bluff (in the distance) and depicts the landscape and a common agricultural use of land in the area.

Wilbur Silt Loam Profile

Taxonomic Class
Coarse-silty, mixed, superactive, mesic Fluvaquentic Eutruderts

Surface Layer
0 to 7 inches; brown (10YR 4/3) silt loam, moderate medium granular structure; friable; neutral pH.

Subsoil Layer
7 to 32 inches; dark yellowish brown (10YR 5/3) silt loam; weak medium subangular blocky structure; friable; neutral pH.

Substratum Layer
32 to 60 inches; light brownish gray (10YR 6/2) silt loam; massive; friable; many fine prominent brown (7.5YR 4/4) and common fine distinct dark yellowish brown (10YR 4/4) masses of iron accumulation in the matrix; neutral pH.
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**CAMP DUBOIS—THE EXPEDITION’S BEGINNING AND END**

Lewis and Clark embarked on and returned from their epic journey across the American West from Camp DuBois, north of St. Louis in Illinois. On today’s maps, Camp DuBois is located in Wood River, IL.
The Menfro Series consists of very deep, well-drained, moderately permeable soils formed in thick loess deposits on upland ridgetops, backslopes, and benches adjacent to the Missouri and Mississippi Rivers and their major tributaries. Slopes range from 2 to 60 percent. Mean annual temperature is 56 degrees F, and mean annual precipitation is 36 inches. Menfro soils formed in loess deposits ranging from 6 to 20 feet or more thick.

Use and Vegetation
Natural vegetation is deciduous hardwoods. The cleared areas are cropped to soybeans, small grain, corn, hay, and pasture. Most of the steeper areas remain in timber.

Below: The Missouri Capitol and Governor's Mansion. Many of the upland areas of Kansas City, St. Louis, Jefferson City, Hermann, Hannibal and Cape Girardeau are located on Menfro soil.
CORDELLING

In 1804 the Missouri was considered the most unruly river in America, and it didn’t take the corps long to find out why. Keelboats were pulled along by hand with a 1,000-foot line called a cordelle tied to the mast. The keelboat often had to be towed against a strong current, and it typically took at least 20 men to cordelle a keelboat along most sections of the Missouri. At times, sandbars made cordelling impossible. In those instances, the boat would be poled or even rowed upstream.
A great number of wolves of the small kind, hawks and some polecats were to be seen. Found the country in every direction, for about three miles, intersected with deep ravines and steep irregular hills 100 to 200 feet high. At the tops of these hills, the country breaks off as usual into a fine level plain extending as far as the eye can reach. From this plain I had an extensive view of the river below, and the irregular hills which border the opposite sides of the river and creek. The surrounding country had been burnt about a month before, and young grass had now sprung up to a height of 4 inches, presenting the live green of the spring; to the west a high range of hills stretch across the country from N. to S., and appeared distant about 20 miles. They are not very extensive, as I could plainly observe their rise and termination. No rock appeared on them, and the sides were covered with verdure similar to that of the plains. This scenery, already rich, pleasing, and beautiful, was still further heightened by immense herds of buffalo, deer, elk, and antelopes, which we saw in every direction, feeding on the hills and plains. I do not think I exaggerate when I estimate the number of buffalo which could be comprehended at one view to amount to 3,000.

Captain Lewis, September 17, 1804
SOILS IN ECOLOGY, ECOLOGY IN SOILS

Almost all features of terrestrial ecology are shaped directly or indirectly by processes and organisms that are found in the soil. The response of grasses to droughts depends in part on the storage of water in the soil. The ability of an antelope to outrun a wolf depends on the overall health of the antelope, which depends in large part on the quantity and quality of food consumed by the antelope, which in turn is a function of the plant community's interactions with soil. Dependent interactions between soils, plants, and animals were recognized and appreciated by scientists before we had names for the scientific disciplines of ecology and soils.

Dan Binkley, Colorado State University, 2004
The Marshall Series consists of very deep, well-dained soils formed in loess. These soils are on interfluves and side slopes on uplands and on risers and treads on stream terraces in eastern Nebraska. Slopes range from 0 to 20 percent. Mean annual air temperature is about 11 degrees C (51 degrees F). Mean annual precipitation is about 76 centimeters (30 inches).

**Use and Vegetation**

Most areas are cultivated. The principal crops are corn, soybeans, small grains, clover, and alfalfa. The native vegetation is big bluestem, little bluestem, indiangrass, and other grasses of the tall grass prairie.

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**Marshall Silty Clay Loam Profile**

**Taxonomic Class**
Fine-silty, mixed, superactive, mesic
Typic Hapludolls

**Surface Layer**
0 to 22 inches; black and very dark brown (10YR 2/1, 2/2) silty clay loam; moderate fine and medium subangular blocky structure; friable; slightly and moderately acid pH.

**Subsoil Layer**
22 to 65 inches; brown (10YR 4/3) and very dark grayish brown (10YR 3/2) silty clay loam; moderate medium subangular blocky structure; friable; moderately acid pH.

**Substratum Layer**
65 to 71 inches; grayish brown (2.5Y 5/2) silt loam; weak coarse prismatic structure; friable; neutral pH.

**Ecological Site**
Silty - Veg. zone 4
R107XY075NE
The Lewis and Clark Expedition held its first official council with Native Americans on August 3, 1804, at a site in what is now Washington County, Nebraska. Clark’s map of the Missouri River in this area identifies this site as “Councell Bluff.”

Clark’s journal entry for July 30 identifies the various levels of the landscape at Council Bluff. It also identifies the kind of vegetation, including grasses that are 10 to 12 inches tall on a “high Prairie” above their camp and 5 to 8 feet tall on a prairie below the camp. The journal indicates that the soil is “of good quality.” (*The Journals of the Lewis and Clark Expedition*, Gary E. Moulton, ed., 1987, University of Nebraska Press, vol. 2, pp. 430 and 434).
The Sansarc Series consists of shallow, well-drained soils formed in clay residuum weathered from shale within the dissected shale plain in central South Dakota. Slopes range from 2 to 60 percent or more. Mean annual precipitation is about 17 inches, and mean annual air temperature is about 47 degrees F.

**Use and Vegetation**

These soils are mostly in native range. Native vegetation is little bluestem, western wheatgrass, sideoats grama, green needlegrass, blue grama, big bluestem, sedges, and forbs.

*Below:* Lewis and Clark passed by here on Sept 19, 1804. They described this area as the "Seoux pass of the 3 rivers." Elsewhere, the journals call them creeks, and the notes indicate that these became, in ascending order, Crow Creek, Wolf Creek, and Campbell Creek. Wolf Creek was later often called Thompson Creek. Clark says that the area is "of peace for all of the Sioux Nations." It was apparently an area of asylum.

**Sansarc Clay Profile**

**Taxonomic Class**
Clayey, smectitic, calcareous, mesic, shallow Typic Ustorthents

**Surface Layer**
0 to 4 inches; light brownish gray (2.5Y 6/2) clay; moderate very fine granular structure; hard, friable; many fine roots; slight effervescence; slightly alkaline.

**Substratum Layer**
4 to 14 inches; light brownish gray (2.5Y 6/2) clay; weak medium subangular blocky structure; slightly hard, friable, fragments of shale; slight effervescence; slightly alkaline pH.

**Soft Bedrock**
14 to 50 inches; light olive gray (5Y 6/2) and olive gray (5Y 5/2) bedded shale; slight effervescence; slightly alkaline pH.

**Ecological Site**
Shallow Clayey
MLRA 063A
R063AY017SD
The hills extend through the gorge and are about 200 feet above the water. In the bend as also the opposite sides, both above and below the bend, is a beautiful inclined plain, in which there are great numbers of buffalo, elk, and goats in view, feeding and sipping on those plains. Grouse, larks, and the prairie bird are common in those plains. ...We proceeded on, past a willow island below the mouth of a small river, called Tylor's River, about 35 yards wide, ...The shore on each side is lined with hard rough gulley stones of different sizes, which have rolled from the hills and out of small brooks. Cedar is common here. This day is warm. The wind, which is not hard, blows from the S.E. ...The prairies in this quarter contain great quantities of prickly pears.

Captain Lewis, September 21, 1804
A very cold morning. Wind S.E. Set out at daylight. We landed after proceeding 5 1/2 miles, near the foot of a round mountain, which I saw yesterday, resembling a dome. Captain Lewis and myself walked up to the top, which forms a cone and is about 70 feet higher than the high lands around it. The base is about 300 feet. In descending this cupola, discovered a village of small animals that burrow in the ground. (Those animals are called by the French petit chien.) Killed one, and caught one alive, by pouring a great quantity of water in his hole...We attempted to dig to the beds of one of those animals. After digging 6 feet, found, by running a pole down, that we were not halfway to his lodge. ...The village of those animals covered about 4 acres of ground on a gradual descent of a hill, and contains great numbers of holes on the top of which those little animals sit erect, and make a whistling noise, and, when alarmed, step into their hole. We poured into one of the holes 5 barrels of water without filling it.

Captain Clark, September 7, 1804

I saw a village of barking squirrels [prairie dogs], 970 yards long and 800 yards wide, situated on a gentle slope of a hill.

Captain Clark, September 11, 1804

Above: Painting made with soil pigments—
Prairie Dogs, by Janis Lang, 2004
A VILLAGE OF SMALL ANIMALS...

"Discovered a Village of Small animals that burrow in the grown [ground]—those animals are Called by the french Petite Chien—Killed one and Caught one a live by poreing a great quantity of Water in his hole we attempted to dig to the beds of one of those animals, Contains great numbers of holes on the top of which those little animals Set erect make a Whistleing noise and whin allarmed Step into their hole."

(The prarie-dog—Cynomys ludovicianus—then unknown to scientists)

Joseph Whitehouse, September 12, 1804
The Grail Series consists of deep and very deep, well- or moderately well-drained soils that formed in local alluvium from soft siltstone or shale in western North Dakota and eastern Montana. These soils are on terraces, fans, swales, and foot slopes on uplands and have slopes ranging from 0 to 15 percent. Mean annual air temperature is 42 degrees F, and mean annual precipitation is 15 inches.

Use and Vegetation
Most areas are used for cultivated crops such as wheat, oats, and barley. Native vegetation includes mixed grasses such as western wheatgrass, big bluestem, green needlegrass, and needleandthread.

Below: On October 24, 1804, the men ran into the Mandan's and Hidatsa's villages (north of what is currently Bismarck, North Dakota) which were inhabited by an estimated 4,500 people, living in earth huts like that pictured here. Across the river from the main village, the captains built Fort Mandan.

Grail Silt Loam Profile

Taxonomic Class
Fine, smectitic, frigid Pachic Vertic Argiuustolls

Surface Layer
0 to 10 inches; dark grayish brown (10YR 4/2) and dark-gray (10YR 4/1) silt loam; weak coarse and medium subangular blocky structure; soft, friable; neutral pH; abrupt boundary.

Subsoil Layer
10 to 52 inches; dark-gray (10YR 4/1) silty clay loam and grayish brown silty clay; weak medium prismatic structure; strong effervescence and small masses of carbonates; moderately alkaline pH in the lower part.

Substratum Layer
52 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam; weak medium subangular blocky structure; strong effervescence; few small masses of carbonates; moderately alkaline pH.

Ecological Site
Clayey
R054XY020ND
**MANDAN VILLAGES**

We are situated in a point of the Missouri, north side, in a cottonwood timber. This timber is tall and heavy, containing an immense quantity of water; brittle and soft. Fine food for horses to winter, as is said by the Indians. The Mandans graze their horses in the day on grass, and at night, give them a stick [an armful] of cottonwood boughs to eat. Horses, dogs, and people all pass the night in the same lodge, or round house, covered with earth, with a fire in the middle. Great number of wild geese passed to the south. Flew very high.

*Captain Clark, November 9, 1804*

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**September 2005**
The Lambert Series consists of very deep, well-drained soils formed in alluvium on uplands, fans, and terraces in eastern and central Montana. They are on 0 to 65 percent slopes. Mean annual precipitation is about 14 inches and mean annual air temperature is about 42 degrees F. The climate is semiarid.

Use and Vegetation
The moderately sloping areas are cropland and native pasture. The steep areas are all range. Uncultivated areas are chiefly in western wheatgrass, blue grama, threadleaf sedge and needleandthread grass.

Below: "The plains are butifull and leavel but the Soil is but thin Stoney and in many parts of the plains & bottoms there are great quantity of prickly pears." Clark, July 21, 1806
Profile and landscape pictures are of a Lambert soil in Yellowstone County, Montana, just above the Yellowstone River.

Lambert Silt Loam Profile

Taxonomic Class
Fine-silty, mixed, superactive, calcareous, frigid Typic Ustorthents

Surface Layer
0 to 5 inches; grayish brown (2.5Y 5/2) silt loam; fine granular structure; slightly effervescent carbonates; moderately alkaline pH.

Substratum Layer
5 to 60 inches; light brownish gray (2.5Y 6/2)to light olive gray (5Y 6/2) silt loam and very fine sandy loam; prismatic structure; strongly effervescent carbonates; moderately alkaline pH.

Ecological Site
Silty-Steep
10 to 14 inch Ppt zone
R058AE004MT
WHAT IS AN ECOLOGICAL SITE?

Ecological sites are the subdivisions of forest land and rangeland landscapes, which are used for inventory and analysis. Each ecological site description will contain information about physiographic features, climatic features, soils, associated hydrologic features, and plant communities that occur on the site. Plant community dynamics, annual production estimates, growth curves, associated wildlife communities, and interpretations for use and management of the site are also part of each site description.
The Lewhand Series consists of poorly drained hydric soils, formed in mixed alluvium and volcanic ash in north-central Idaho. They are in drainage-ways and basins at elevations of 2,900 to 3,400 feet. These soils are subject to frequent flooding. Slopes range from 0 to 3 percent. The average annual precipitation is about 35 inches. The frost-free season is 50 to 110 days.

**Use and Vegetation**

Used mainly for livestock grazing, watershed and some crop production. The main crops are hay and oats. Potential native vegetation is camas, black hawthorn, scattered lodgepole pine, snowberry, sedges and rushes.

Below: Camas in a silty alluvial soil near Smith Meadows, in Latah County, Idaho. Areas of the Weippe Prairie probably appeared like this prior to clearing for crop production.

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**Lewhand Ashy Silt Loam Profile**

**Taxonomic Class**
Fine-silty, mixed, active, frigid Vitrandic Fragiudalfs

**Surface Layer**
0 to 18 inches; very dark brown (10YR 2/2) and very dark grayish brown (10YR3/2) ashy silt loam over a very pale brown and gray (10YR 7/3, 7/2) silt loam; strong, very fine subangular blocky structure; strongly acid (pH 5.2-5.4).

**Fragipan Layer**
18 to 32 inches; very pale brown (10YR 7/3) silt loam; strong coarse and very coarse prismatic structure; extremely hard, very firm; moderately acid (pH 5.8).

**Subsoil Layer**
32 to 60 inches; light gray (10YR 7/2) stratified silt loam to sandy loam; weak, very coarse prismatic structure; lightly to moderately acid (pH 5.7-6.1).

**Ecological Site**
Wet Meadow
R009XY018ID
### CAMAS

*Right: A camas bulb growing about 2 inches below the soil surface in the A horizon of the Lewhand soil. The bulb is about 1 inch in diameter. These bulbs were collected by the Indians, roasted in pits, and eaten as a delicacy. The Corps of Discovery lived on Camas bulbs for a lengthy period after the difficult crossing of the Bitteroot Mountains.*

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**November 2005**

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**Events**

- **6-10**: ASA-CSSA-SSSA Annual Meetings, Salt Lake City, UT

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**Above: Camas flower**
The Wallusi Series consists of very deep, moderately well drained soils in Clatsop County, Oregon, on stream terraces at elevations of 20 to 100 feet. Slopes are 0 to 20 percent. The climate has cool, wet winters and cool, moist summers. The annual precipitation is about 85 inches and the annual temperature is about 50 degrees F. The frost-free period is 145 to 245 days.

**Use and Vegetation**

These soils are used for pasture, home sites, timber production, recreation, and wildlife habitat. Native vegetation includes western hemlock, Sitka spruce, Douglas-fir, red alder with an understory of vine maple, salmonberry, and western swordfern.

Below: This is the point along the Lewis and Clark River, which is a tributary of the Columbia River, where the Corps of Discovery landed their canoes while searching for the site to build their winter shelter. This winter shelter became known as Fort Clatsop.

### Walluski Silt Loam Profile

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<td>0 to 15 inches; loose litter of slightly decomposed needles, twigs, and leaves over very dark grayish brown (10YR 3/2) silt loam, extremely acid (pH 4.4).</td>
<td>15 to 61 inches; dark-brown (10YR 4/3) and yellowish brown (10YR 4/4, 5/4) silt loam, silty clay loam and clay, extremely acid (pH 4.4).</td>
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**Walluski Silt Loam**

**Oregon**
Fort Clatsop was constructed along the west bank of the Lewis and Clark River, which is a tributary of the Columbia River. The Fort is located about 3.5 miles inland from the Pacific Coast and about 3.5 miles southwest of Astoria, Oregon. The Corps of Discovery was wise in selecting the site as it is on a soil that is better drained than most of the surrounding soils. This provided for better drainage during the long, rainy winter and is high enough above sea level that it is not subject to flooding. Also, by locating away from the coast, they were protected to some extent from the high wind velocities that accompany many of the winter storms along the Pacific coast of Oregon and Washington.
### Calendar 2006

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All paintings featured in this planner were produced by Janis Lang, a Physical Science Technician with the NRCS’s Soil Survey Laboratory in Lincoln, Nebraska. Janis took her inspiration from photographs she had seen and from descriptions of soils and landscapes that NRCS soil scientists had discovered in the Lewis and Clark journals.

The color and texture of soil painting is fascinating and a creative opportunity for all ages of students. Samples of soils of many colors are gathered. The basic material is dried and crushed with a mallet. The soil is then ground with a mortar and pestle until it becomes a fine powder. This powder is then sifted to refine it further. The pigment is now ready to mix with clear acrylic paint, producing a paint whose colors derive directly from the natural landscape.

"The trick with painting with landscapes is that it's normally hard to get the color right. But when I paint with soil, the color comes right from nature—and it's exactly right."
—Janis Lang

Above: Still Life with Pot and Squash, by Janis Lang, 2003


Description of Louisiana, 8th Congress, 1st Session, November 14, 1803, American State Papers, Class X, Miscellaneous, vol. 1.


The PBS Lewis and Clark Archives available at:
http://www.pbs.org/lewisandclark/

The USDA Plants Database available at:
http://plants.usda.gov/

The NRCS Soils website available at:
http://soils.usda.gov/

The NRCS Painting with Soils website, available at:

For more information about natural resources and conservation in your own backyard, contact the NRCS at http://www.nrcs.usda.gov or volunteer locally by calling 1-888-LANDCARE.
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January
Cephas Hobbs, NRCS
Jeff Vanuga, NRCS

February
National Academy of Sciences, Philadelphia, PA

March
NRCS Staff, Illinois State Office

April
NRCS Staff, Missouri State Office

June
Pat McGrane, Patrick Cowsert, Zacharias Riggs, Luis A. Hernandez, NRCS Staff, Nebraska State Office

July
NRCS Staff, South Dakota State Office, and USDA Plants Database

September
NRCS Staff, North Dakota State Office

October
NRCS Staff, Montana State Office

November
NRCS Staff, Idaho State Office, and USDA Plants Database

December
NRCS Staff, Oregon State Office

Soils and Ecology
Hari Eswaran, NRCS Staff, Washington, D.C.
Stanley Anderson, NRCS Staff, National Soil Survey Center
NRCS Staff, Iowa and Montana State Offices

Above: Painting made with soil pigments—
Bears Feeding on Salmon, by Janis Lang, 2004

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October 2004