

Land Judging

in South Dakota



South Dakota State University
College of Agriculture & Biological Sciences
in cooperation with the USDA-National Resources
Conservation Service

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This publication was prepared by the AgBio Communications Unit, College of Agriculture and Biological Sciences.

ABS8-01: xxxx copies printed at a cost of \$x.xx. Revised August 2002.

Coarse (limiting property)

Sands and loamy sands will not hold together. Often such soils can not retain sufficient water or plant nutrients for crop production and are subject to erosion by wind. A coarse-textured soil is gritty, loose, and single-grained. When dry soil is squeezed in the hand, it will fall apart when the pressure is released. If squeezed when moist, it will form a cast that will fall apart when touched. Coarse soils will not ribbon.

Moderately Coarse (limiting property)

This soil texture can be recognized in the field, since it is predominantly sand but has enough silt and clay to make it slightly coherent; that is, it will somewhat hold a shape. Such surface soils are sandier than desirable for ordinary field crops and many plants because of low moisture holding properties. They are subject to wind erosion.

Moderately coarse soils generally have weak structure that is easily broken. When moist, these soils can be squeezed in the hand to form a cast that will withstand careful handling without breaking. Ribbons do not form readily when moist soil is pressed between the fingers.

Medium (nonlimiting property)

This group represents a favorable mixture of sand, silt, and clay particles, neither too fine nor too coarse. It includes silt loam, loam, and silt-textured soils.

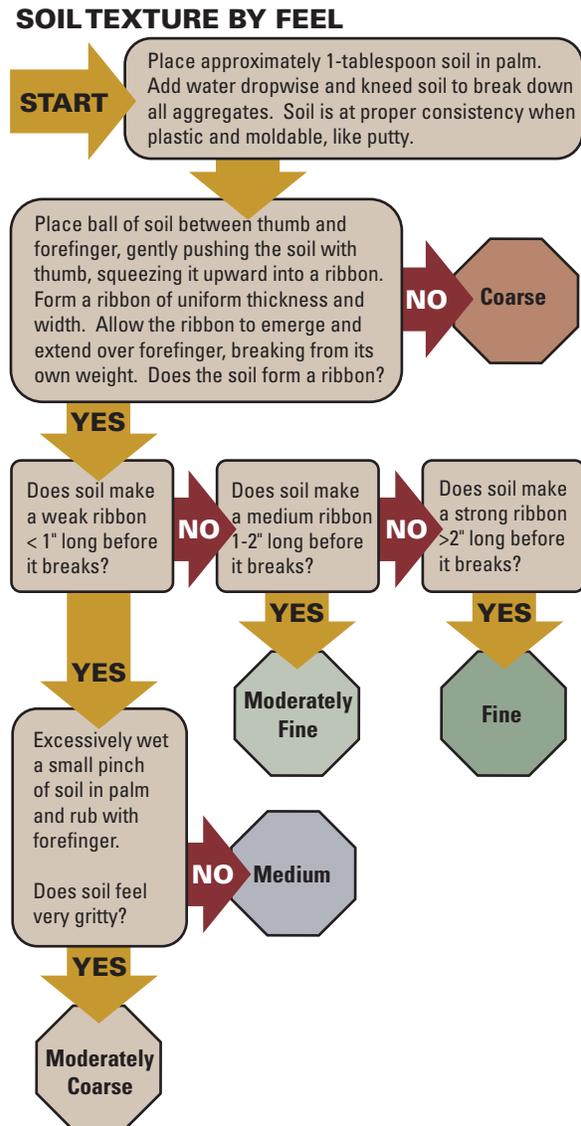
Medium-textured soils generally have moderate structure that is soft and can be easily broken when moist. When pulverized, the silts and silt loams feel soft and floury, but the loams contain enough sand to feel somewhat gritty.

Moist, medium-textured soils, when pressed between thumb and fingers, form a short ribbon up to about one inch in length that breaks easily if shaken. If squeezed when dry, medium soils form a cast that will withstand careful handling. If a handful is squeezed when moist, it will form a cast that can be freely handled without breaking.

Moderately Fine (nonlimiting property)

This texture group includes clay loam, sandy clay loam, and silty clay loam. They are often hard when dry, firm when moist, and sticky and plastic when

Figure 6. A flow chart to place soil into a textural group using the feel method.



wet. In addition, sandy clay loams feel quite gritty, silty clay loams feel smooth, and clay loams contain some grit.

Moderately fine-textured soils easily ribbon to about one to two inches when squeezed between the fingers. The ribbon supports its own weight when shaken slightly. The moist soil is plastic and forms a hard cast when compressed.

Fine (limiting property)

The fine-textured group includes sandy clay, silty clay, and clay. Fine textured soils have strong structure, but, if worked wet, will become very sticky and plastic like modeling clay.

Fine-textured soils form a flexible ribbon more than two inches long when worked out between the fingers in a moist state. The ribbon is pliable and resists breaking even when shaken. In the sandy clay ribbon, the sand is easily visible. The silty clay and clay are particularly shiny or waxy on moist ribbons and smooth cut surfaces.

Soil Depth Favorable for Plant Roots

The total thickness of soil material available for plant root growth is important in planning an agricultural or natural resource management system. Plant roots obtain water and nutrients from the root zone. A deep root zone provides a large storehouse of nutrients and water and strong mechanical support for the plant. Most plant roots respire, requiring oxygen, so air must be available.

The roots of many plants will penetrate more than 40 inches (1 meter) under normal conditions if no obstruction exists. Soils shallower than 40 inches (1 meter) limit root growth, reducing storage capacity for water and nutrients.

Examples of restrictive materials/layers are coarse sand (>1 millimeter); gravel/cobbles (>15 %) with coarse textures, sodium affected subsoil (e.g. columnar

structure), and bedrock (e.g. sandstone, shale). Sodium-affected soils typically have columnar structure 6 to 14 inches (15 to 26 centimeters) from the soil surface. The color of the soil immediately above the columnar structure is generally lighter than the color in the columns. Tillage may remove the tops of the columns. In these cases, the depths to columns will be listed in “other considerations”. If the depth to columns is equal to a depth break, use the least limiting group.

Soil depth favorable for plant root growth is determined by measurement of the distance from the soil surface to the limiting layer. A depth exactly on the borderline between two categories belongs to the deeper category (Table 1 and Fig. 7). The thickness of the topsoil should also be determined from the soil profile. Most normal soils have three major horizons: (1) the topsoil, or “A” horizon; (2) the subsoil, or “B” horizon; and (3) the unconsolidated parent material, or “C” horizon. The subsurface may consist of subsoil and/or parent material. There are more horizons and subdivisions used in soil classification, but these three are concentrated on in land judging.

Soil horizons vary in texture, structure, and color. Structure and color are the key characters separating topsoil (A horizon) from subsoil (or subsurface material) in South Dakota.

Unless a restrictive layer is present, all three horizons (A, B, and C) are favorable for rooting depth.

Figure 7. Depth of root zone.

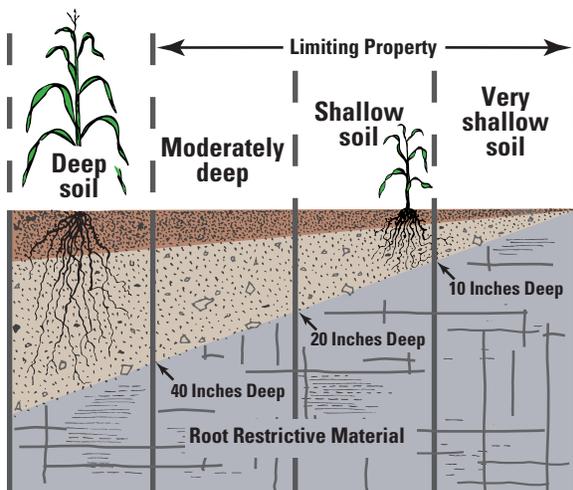


Table 1. Soil depth favorable for plant roots.

Category	Soil Depth (inches)	Property
Deep	>40	Non-Limiting
Moderately Deep	20-40	Limiting
Shallow	10-20	Limiting
Very Shallow	<10	Limiting

Slope

Slope is the angle of inclination of the soil surface from horizontal (flat). Slope refers to the number of feet (meters) fall in each 100 feet (30 meters) of horizontal distance (Fig. 8). Slope has a tremendous effect on water runoff, erosion, and the ability to use farm machinery. Even gentle slopes (> 3%) increase the erosion potential of a field.

Any slope greater than 3% is considered a limiting factor and should be indicated on the Land Judging Score Card.

Slope categories:

Nearly level (0 to 3 %)

Gently sloping (3 to 6 %)

Moderately sloping (6 to 9 %)

Strongly sloping (9 to 15 %)

Steep (15 to 25 %)

Very steep (> 25 %)

Depression (limiting property) A depression is an area with a concave or bowl-shaped slope where water and sediments from the surrounding area drains to and accumulates.

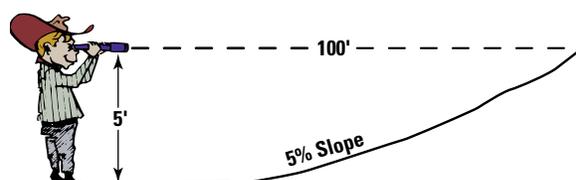
The contest field slope is determined by using the slope stakes. The slope stakes are normally 100 feet (30 meters) apart and at an equal height from the soil surface so that each foot (0.3 meter) of elevation change equals 1%. The slope stakes may, if necessary, be placed 50 feet (15 meters) apart at which time each foot (0.3 meter) of elevation must be multiplied by 2 to arrive at the slope percent. If the slope stakes are set at the alternate distance of 50 feet (15 meters), it will be announced by the contest officials and listed under "Field conditions, other considerations."

A slope that is exactly on the borderline between two categories is considered to belong to the lesser category (Table 2).

Table 2. Slope categories.

Category	Slope	
	Percent	Property
Depression	–	Limiting
Nearly level	0-3	Non-Limiting
Gently sloping	3-6	Limiting
Moderately sloping	6-9	Limiting
Strongly sloping	9-15	Limiting
Steep	15-25	Limiting
Very steep	>25	Limiting

Figure 8. Shooting the slope.



Permeability (Movement of Air and Water in the Soil)

Permeability refers to the capacity of the soil to permit air and water movement through the soil profile (non-bedrock materials). Proper water-air relationships are necessary for favorable root development and

normal plant growth. The subsoil or B horizon often influences water and air movement, because it usually contains more clay and/or less porous structure than the topsoil. This contest will use subsoil (sub-surface material if no B horizon is present) properties to determine soil permeability.

The physical properties of texture, structure, and density largely influence the rate of air and water movement through the soil. Soil structure refers to the arrangement of the soil particles. The individual grains may be held together in aggregates of different sizes and shapes. Soils with no apparent structure are either massive or single-grain.

The principal types of structures are listed in Fig. 9. The size, shape, and stability of these soil structural units have a major influence on plant growth and offer clues to the permeability of the soil. Structure can be modified by tillage, but texture cannot be changed.

Permeability categories:

Rapid (limiting property) – These soils are coarse-textured and generally have single grain structure. Water and air move through these soils rapidly. Such soils hold less water than is desirable, causing them to be droughty.

Moderate (non-limiting property) – These soils are moderately coarse, medium, or moderately fine-textured with blocky or prismatic structured subsoils.

Slow (limiting property) – These soils are either fine-textured with blocky or prismatic structure or moderately fine-textured with columnar structure subsoils. These soils are usually sticky and plastic when wet.

Very slow (limiting property) – These soils are generally fine-textured, with columnar structure or dense clay materials. The subsoil tends to be very firm even when moist. **Root growth is generally restricted to along the faces of the structural units and along cracks.** These soils may remain wet for some period of time. They are usually sticky and plastic when wet and hard when dry.

Figure 9. Types of soil structure and effects on permeability.

Permeability Rating:

Rapid



Descriptions

Single Grain

This represents a soil condition consisting of primary sand sized particles and gravels which tend to remain separated. This type of condition is common in the more coarse textured soils, both surface and subsurface depths.

Rapid



Crumb or Granular

This type of structure consists of small, porous aggregates which tend to be somewhat rounded in shape. Granular aggregates form very desirable seed beds for crops and allow rapid entry of water in the soil. This type of structure is common for many surface soils in South Dakota.

Moderate to Slow



Blocky

This type of structure consists of aggregates clinging together in nearly square or angular blocks having sharp edges. Large blocks normally do not allow rapid entry of water in the soil. This condition is commonly found in the subsoil.

Moderate to Slow



Prismatic

This type of structure consists of aggregates in which the vertical faces or axes are longer than the horizontal faces or axes. The tops of the units are flat. This type of structure is common under conditions of moderate permeability and associated with the subsoil.

Slow to Very Slow



Columnar

This type of structure is similar to prismatic. The main difference is that the columnar units have rounded biscuit like tops. This type of structure indicates conditions of slow permeability, in fact it is an indication of a soil layer in the subsoil that is not readily penetrated by plant roots.

Slow



Platy

This type of structure consists of aggregates that have longer horizontal faces or axes than vertical faces or axes. The fragments are flat and thin. This type of structure is usually associated with an underlying impermeable layer of the subsoil.

Very slow



Massive

This represents a soil condition where there is no evidence of aggregation. The soil particles tend to stick together in no definite pattern or arrangement. This condition is usually found in the lower part of the subsoil in wet spots of the surface soil, and in compacted soil materials.

Table 3. Surface runoff category based on slope and topsoil texture.

Category	Topsoil Texture	
	Coarse	Other
Ponded	depression	depression
Slow	0-6%	0-3%
Moderate	6-9%	3-6%
Rapid	> 9%	> 6%

Surface Runoff

Runoff is the movement of water across the surface of the soil. It is the relative rate of water removal that is in excess of the amount that can be absorbed by soil. Runoff is affected by topsoil texture, vegetation/cover, and slope. Non-vegetated (bare) soil conditions are assumed in this contest. Use Table 3 to determine surface runoff categories.

Surface runoff categories:

Rapid (limiting property) – Water is removed from the surface at a rapid rate. A large part of the water received on these fields moves rapidly over the surface. It may run off as soon as it falls. Fields with slopes above 6% and topsoil textures finer than coarse would be in this category. Fields with a coarse-textured topsoil need a slope of greater than 9% to be in this category.

Moderate (limiting property) – Surplus water is not a problem on these fields. Water loss from the surface by runoff can reduce the supply available for plant growth. Fields with gentle slopes (3% - 6%) and topsoil textures finer than coarse would be in this category. Fields with a coarse-textured topsoil need a slope of 6% to 9% to be in this category.

Slow (non-limiting property) – Free water stands on the surface of these soils for moderate periods, usually not more than a day or two. Coarse-textured soils have slower runoff because of their rapid permeability. This increases the moisture supply but may occasionally interfere with farming operations. Most of the water received passes through the soil, is used by plants, or evaporates. Fields with slopes between 0 and 3% and topsoil textures finer than coarse would be in this category. Fields with a coarse-textured topsoil can have a slope between 0 and 6% and still be in this category.

Ponded (limiting property) – Free water stands on the surface for long periods of time, often for several days or almost continuously during wet periods. Surplus water presents a problem for most agricultural uses. Ponded soils are depressional, with concave (dish-shaped) slopes.

Depth to Water Table

Seasonal high water table depth is the depth of free water after wet periods such as snow melt or heavy rainfall. For cropland, a high water table during the growing season restricts planting and the growth of many crop plants. Wetness at anytime is damaging to a building structure in the saturated layer. Seasonal water table height is estimated by the contest officials and given under “Field Conditions.” See Table 4 for the effects of seasonal water depth on land capability classification in the defined regions of the state.

Limiting Factors

Any soil property that eliminates a field from Class I capability must be marked as a limiting factor.

Consider each soil property separately, and mark all which limit the land class (Table 4). The contestant must know the climate factor for the field location (Fig. 4).

Land Capability Class

If any limiting factor exists, the field is eliminated from Land Capability Class I (Table 5). Often, there is more than one limiting factor. Evaluate each of the limiting factors, and determine which is the most restrictive, causing the land to be placed in the highest numerical class.

The Capability Class can be no higher than the class of the most limiting soil property. **In South Dakota land judging, a combination of limitations does not place the land in a higher numerical class.** Class I-IV lands are suitable for cultivation. Class V lands are too wet for cultivation. Class VI and VII lands are suitable for grazing and forestry. Class VIII land is suited only for recreation, wildlife, and water conservation.

Table 4E. Guide to selecting Land Capability Class in Eastern South Dakota (Area 1 in Figure 4).

Soil Property	Capability Class							
	I	II	III	IV	V	VI	VII	VIII†
Climate*								
Texture: Topsoil or Subsoil	Medium, Mod. Fine	Fine, Mod. Coarse	Coarse					
Soil depth	Deep	Mod. deep		Shallow		Very Shallow		
Past erosion	None, Deposition		Moderate			Severe		
Slope	0-3%	3-6%	6-9%	9-15%	Depression	15-25%	>25%	
Stoniness	None			Moderate			Excessive	
Permeability	Moderate	Slow	Rapid	Very Slow				
Surface Runoff	Slow	Moderate	Rapid		Ponded			
Depth to Seasonal Water Table	>20"	10-20"		0-10"	Ponded			
Land Use	Crop Land				Pasture-Hayland-Wetlands			Wildlife Wetlands

*Climate is not a limiting factor in eastern South Dakota

†Class VIII; non-agricultural land; best suited for wildlife, recreation, and water conservation. Characteristics of Class VIII land generally include one or more of the following: stones less than 2 feet apart, slopes exceeding 40%, ponding for 3 months or more, and/or extremely gravelly/stony soil.

Table 4C. Guide to selecting Land Capability Class in Central and Black Hills South Dakota (Area 2 in Figure 4).

Soil Property	Capability Class							
	I	II	III	IV	V	VI	VII	VIII [†]
Climate	*							
Texture: Topsoil or Subsoil	Medium, Mod. Fine	Fine, Mod. Coarse	Coarse					
Soil depth	Deep		Mod. deep	Shallow		Very Shallow		
Past erosion	None, Deposition		Moderate			Severe		
Slope	0-3%	3-6%	6-9%	9-15%	Depression	15-25%	>25%	
Stoniness	None			Moderate			Excessive	
Permeability	Moderate	Slow	Rapid	Very Slow				
Surface Runoff	Slow	Moderate	Rapid		Ponded			
Depth to Seasonal Water Table	>10"			0-10"	Ponded			
Land Use	Crop Land				Pasture-Hayland-Wetlands			Wildlife Wetlands

*Due to climatic conditions in South Dakota, Class I land is not found the Central part of the state.

[†]Class VIII; non agricultural land; best suited for wildlife, recreation, and water conservation. Characteristics of Class VIII land generally include one or more of the following: stones less than 2 feet apart, slopes exceeding 40%, ponding for 3 months or more, and/or extremely gravelly/stony soil.

Table 4W. Guide to selecting Land Capability Class in Western South Dakota (Area 3 in Figure 4).

Soil Property	Capability Class							
	I	II	III	IV	V	VI	VII	VIII [†]
Climate	*							
Texture: Topsoil or Subsoil	Medium, Mod. Fine	Fine, Mod. Coarse				Coarse		
Soil depth	Deep			Mod. Deep		Shallow	Very Shallow	
Past erosion	None, Deposition			Moderate		Severe		
Slope	0-3%	3-6%		6-9%	Depression	9-25%	> 25%	
Stoniness	None			Moderate			Excessive	
Permeability	Moderate	Slow		Very Slow		Rapid		
Surface Runoff	Slow	Moderate		Rapid	Ponded			
Depth to Seasonal Water Table	>10"			0-10"	Ponded			
Land Use	Crop Land				Pasture-Hayland-Wetlands			Wildlife Wetlands

*Due to climatic conditions in South Dakota, Class I and II lands are not found in the western part of the state.

[†]Class VIII; non agricultural land; best suited for wildlife, recreation, and water conservation. Characteristics of Class VIII land generally include one or more of the following: stones less than 2 feet apart, slopes exceeding 40%, ponding for 3 months or more, and/or extremely gravelly/stony soil.

Table 5. Land Capability Classes.

<p>Suited for cultivation.</p>	<p>Class I Very good land; few or no limitations; can be cultivated safely with ordinary good farming practices. There are no serious climatic hazards.</p> <p>Class II Good land; moderate limitations or hazards due to land characteristic or climatic environment; can be cultivated safely with moderately intensive treatments.</p> <p>Class III Moderately good land; severe limitations or hazards due to permanent land characteristics; can be cultivated safely with intensive treatments.</p> <p>Class IV Fairly good land; very severe limitations or hazards.</p>
<p>Land limited in use—generally is not suited for cultivation; suited for grazing, forestry or wildlife food cover.</p>	<p>Class V Good hay or pasture land, but too wet for cultivation. Normally bottomland soils with high water tables (ponded) or subject to frequent flooding.</p> <p>Class VI Growth or utilization of vegetation moderately limited by steep land characteristics or a shallow restrictive layer; generally good to moderately good grazing lands.</p> <p>Class VII Growth or utilization of vegetation severely limited by extremely steep land characteristics, excessive stoniness, incoherent sandy soils, or very salty lowland; generally fair to poor grazing land.</p>
<p>Land not suited for cultivation, grazing, or forestry.</p>	<p>Class VIII Suited for wildlife, recreation, or watershed protection. Consists of semi-permanent wetlands, badlands, and saline barren lands.</p>

Land Treatments

The Land Capability Class determines the most intensive use the field can sustain. Through proper soil management practices, land may be used at its most intensive use without degradation for an unlimited period of time. Caution: Land can never be used more intensively than its class allows without the danger of permanently lowering its productivity and future use. Humans have great influence on land through the treatments applied.

Vegetative Treatments

Use an occasional soil conserving crop in rotation
Legumes and grasses are excellent soil conserving crops. This treatment is used on Class I and II lands.

Use frequent soil conserving crops in rotation
This treatment is used on Class III and IV lands.

Return crop residue to the soil
Crop residues contain valuable nutrients and greatly improve the soil's tilth. This treatment is used on all tillable Class I-IV lands.

No-Till/Reduced Tillage
Both practices keep adequate crop residues on the surface to help protect the surface from wind and water erosion. It also aids in moisture conservation by reducing surface evaporation. This treatment is used on all tillable Class I-IV lands.

Establish vegetative/tree wind barriers
These barriers protect coarse- and moderately coarse-surface-textured soils from wind erosion. Vegetative barriers may be annual crops such as flax, corn, forage sorghum, etc. or perennials such as wheatgrasses. Any plants that reach some height create a barrier that protects the soil surface from wind. Trees, where feasible, are an excellent permanent choice. This treatment is used on Class III and IV lands with coarse or moderately coarse surface texture.

Establish recommended grasses and/or legumes

Use on land not suitable for cultivation. This treatment is used on Class V, VI, and VII lands.

Use proper pasture and range management

Proper management of pasture and rangeland requires the control and timing of livestock grazing. Planned placement of livestock water and fences is required to establish uniform usage. This treatment is used on Class V, VI, and VII lands.

Mechanical Erosion Treatments

Diversion terrace

A channel with a supporting ridge on the lower side is a diversion terrace. It is built across the slope on a gentle grade. A diversion terrace intercepts water from the slope or land above and carries the water off to a safe outlet. Use with lands where overhead water or where water flowing from adjacent land is a problem. Overhead water will be listed as another consideration of "Field conditions."

Farm on the contour

Perform field operations such as tillage, planting, and cultivation on the contour or at right angles to the slope. Use on tillable lands of 3% to 6% slope.

Terrace and farm on the contour

A terrace is a channel and ridge of earth constructed across the slope approximately on the contour to intercept runoff and reduce erosion. Terraced land should be farmed parallel to the terrace. Use on tilled land with more than 6% slope.

Establish grass waterway

Establish grass waterways in drainageways where overland flowing water on tilled land is a problem. The grass waterway will protect the drainageway from erosion and from forming a gully. Overland water will be listed as an other consideration under "Field conditions."

Glossary

- Aggregate, soil.** Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms are called peds. Clods are aggregates produced by poor tillage or compaction.
- Alkali (sodic) soil.** A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15% or more of the total exchangeable bases), or both that plant growth is restricted.
- Aspect.** The direction in which a slope faces.
- Bedrock.** The solid rock that underlies the soil and other unconsolidated material or that is exposed at the Earth's surface.
- Bottom land.** The normal flood plain of a stream.
- Boulders.** Rock fragments larger than 2 feet (60 cm) in diameter.
- Clay.** *As a soil separate*, the mineral soil particles <.002 mm in diameter. *As a soil textural class*, soil material that is 40% or more clay, <45% sand, and <40% silt.
- Claypan.** A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic to stiff when wet.
- Coarse fragments.** If round, mineral or rock particles 2 to >600 mm (>24 inches) in diameter; if flat, mineral or rock particles 2 to 380 mm (15 inches) long.
- Cobblestone (cobble).** A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 cm) in diameter.
- Conservation tillage.** A tillage system that does not invert the soil and that leaves a protective cover of plant residue on the soil surface throughout the year.
- Contour farming.** Growing crops in strips that follow the contour.
- Contour strip-cropping.** Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.
- Depth, soil.** The thickness of weathered soil material over bedrock.
- Diversion (or diversion terrace).** A ridge of earth, generally a terrace, built to protect down slope areas by diverting runoff from its natural course.
- Drainage, surface.** Runoff, or surface flow of water, from an area.
- Erosion.** The wearing away of the land surface by wind, water, ice, or other geologic agents and by such processes as gravitational creep.
- Erosion (geologic).** Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains. Synonym: natural erosion.
- Erosion (accelerated).** Erosion much more rapid than geologic erosion, mainly as a result of the activities of humans, animals, or of a catastrophe in nature, for example, a fire that exposes the soil surface.
- Fallow.** Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of organic matter.
- Fertility, soil.** The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.
- Fine-textured soil.** Sandy clay, silty clay, and clay.
- Flood plain.** A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially. It is usually a constructional landform built of sediment deposited during over-flow and lateral migration of the streams.
- Footslope.** The inclined surface at the base of a hill.
- Grassed waterway.** A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.
- Gravel.** Rounded or angular fragments of rock as much as 3 inches (2-760 mm) in diameter. An individual piece is a pebble.
- Gravelly soil material.** Soil material that is 15 to 50 percent by volume, rounded or angular rock fragments, not flattened, up to 3 inches (7.6 cm) in diameter.
- Groundwater.** Water filling all the unblocked pores of underlying material below the water table.
- Hillslope.** The steeper part of a hill between its summit and the drainage line, valley flat, or depression floor at the base of the hill. In descending order, the landform positions of a simple hillslope include: summit, shoulder, backslope, footslope, and toeslope. Complex hillslopes may have two or more shoulder to toeslope sequences.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon. An organic layer of fresh and decaying plant residue.

A horizon. The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with mineral material.

B horizon. The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as

- (1) accumulation of clay, iron/aluminum oxides, humus, salts, or a combination of these;
- (2) granular, blocky, prismatic, or columnar structure;
- (3) redder or browner colors than those in the A horizon; or
- (4) a combination of these.

C horizon. The mineral horizon or layer, excluding hard bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum is formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is the movement of water through soil layers or material.

Landscape. All natural features, such as fields, hills, forests, and water, that distinguish one part of the Earth's surface.

Loam. A soil texture that is about equally influenced by sand, silt, and clay. It does not have equal amounts of sand, silt, and clay.

Medium-textured soil. Very fine sandy loam, loam, silt, silty clay loam, sandy clay loam, and clay loam.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage (e.g. prevent wind erosion).

Neutral soil. A soil having a pH value between 6.6 and 7.3.

No-till. A conservation tillage system in which the surface is disturbed only in the immediate area of the planted seed row. The disturbed area is approximately 1 to 3 inches (3 to 8 cm) wide. Weeds are controlled primarily by herbicides.

Nutrient, plant. Any element taken in by the plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, chlorine, and molybdenum obtained from the soil and carbon, hydrogen, and oxygen obtained from the water and air.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Overland flow. Shallow runoff water standing or flowing during or shortly after rainfall or snowmelt from adjacent or surrounding slopes.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil". A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 to 10 square meters), depending on the variability of the soil.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil.

pH value. A numerical designation of acidity and alkalinity.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Productivity, soil. The capacity of the soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all the genetic horizons and into the parent material.

Relief. The elevations or inequalities of a land surface, considered collectively.

Ridge-till. A conservation tillage system in which seeds are planted on ridges that generally are 4 to 6 inches (10 to 15 cm) higher than the area between the rows. The surface is not disturbed prior to planting. Approximately one-third of the surface is tilled with sweeps or row cleaners at planting time. Weeds are controlled by a combination of herbicides and cultivation. Cultivation helps to rebuild the ridges.

Rock fragments. Rock or mineral fragments having a diameter of 2 mm or more (e.g. gravel, cobbles, stones, and boulders).

Root zone. The part of the soil that can be readily penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called groundwater runoff or seepage flow from groundwater.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants ($EC > 4$ mmhos/cm). A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 to 2 mm in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85% or more sand and not more than 10% clay.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper clay limit (0.002 mm) to the lower limit of very fine sand (0.05 mm). As a soil textural class, soil that is 80% or more silt and less than 12% clay.

Slickspot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, slippery when wet, and very low in productivity.

Slope. The inclination of the land surface from the horizontal. Percent slope is the vertical distance divided by the horizontal distance, then multiplied by 100. Thus, a slope of 20% is a drop of 20 feet in 100 feet of horizontal distance.

Sodic soil. A soil containing exchangeable sodium in an amount that impairs plant growth and significantly alters soil physical and chemical properties ($SAR \geq 13$).

Soil. A natural, three-dimensional body at the Earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Stones. Rock fragments 10 to 24 inches (25 to 60 cm) in diameter if rounded and 6 to 15 inches (15 to 38 cm) in length if flat.

Stony. Refers to soil containing stones in numbers that interfere with or prevent tillage.

Strip cropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are: platy (laminated), prismatic (vertical axis longer than horizontal), columnar (prism with rounded top), blocky (angular or subangular, roughly equal dimensional), and granular. Structureless soils are either single grain (each grain by itself is a structural unit) or massive (the particles adhering without any regular cleavage, as in plowpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved by tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10-25 cm). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, or EB horizons. It includes all subdivisions of these horizons.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand*, *loamy sand*, *sandy loam*, *loam*, *silt loam*, *silt*, *sandy clay loam*, *clay loam*, *silty clay loam*, *sandy clay*, *silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seeding emergence, compaction, and root penetration.

Topography. The relative position and elevation of the natural or man-made features of an area that describe the configuration of its surface.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to top-dress road banks, lawns, and land affected by mining.

Upland. Land at a higher elevation, in general, than the alluvial plain or low stream terrace; land above the lowlands along streams.

