4BA-08MJ

University of Kentucky
College of Agriculture, Food and Environment
Cooperative Extension Service

4-H Agricultural Land Judging and Homesite Evaluation in Kentucky

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Land judging is a way of appraising the physical nature and capability of soils. Certain soil properties, such as slope, depth, and color, that can be seen, felt, or measured, are reliable indicators of soil characteristics that impact crop growth and productivity. Land judging does not replace soil testing. Laboratory tests that determine the chemical and physical nature of soil help us predict plant response to lime and fertilizer, estimate the amount of a waste product that can be safely applied to the soil, and determine the limitations for uses such as homesites and roads.

In one way or another, people have always judged soil. Early settlers observed the kinds of trees predominant in the forest. They knew that a poplar forest indicated a different soil than a beech or red oak forest. People judge soil for many different reasons: Farmers judge soil when buying land and planning farm operations; a house builder judges soil for its suitability for a good foundation and for septic tank operation; road builders judge soil in designing stable roadbeds; and a regulatory agency may judge soil for its suitability as an environmentally safe landfill.

This publication provides instruction on basic soil concepts that can be easily applied to agricultural, industrial, residential, and recreational land uses in Kentucky. It provides characteristics to be judged as well as a good working knowledge of soil.

Digging a pit or cleaning away a road cut is a good way to see the different horizons in a soil profile (Figure 1). Soil scientists do this to describe and study each type of soil. Soil core samplers also provide a good method for studying soil (Figure 2). The soil profile can be lifted out in sections in the form of soil cores. These can be laid out to show the whole profile. If a core sampler is not available, a shovel or spade can be used to get samples of soil at different depths.

Evaluating the land and soil characteristics has many similarities regardless of its application, agricultural or homesites. This manual will be divided into two major sections, Agricultural Land Judging and Homesite Evaluation. References to earlier sections will be made when appropriate for the individual contest. Values reported in the Kentucky manual may differ from those used in the National manual and the appropriate manual should be used for the respective contests.

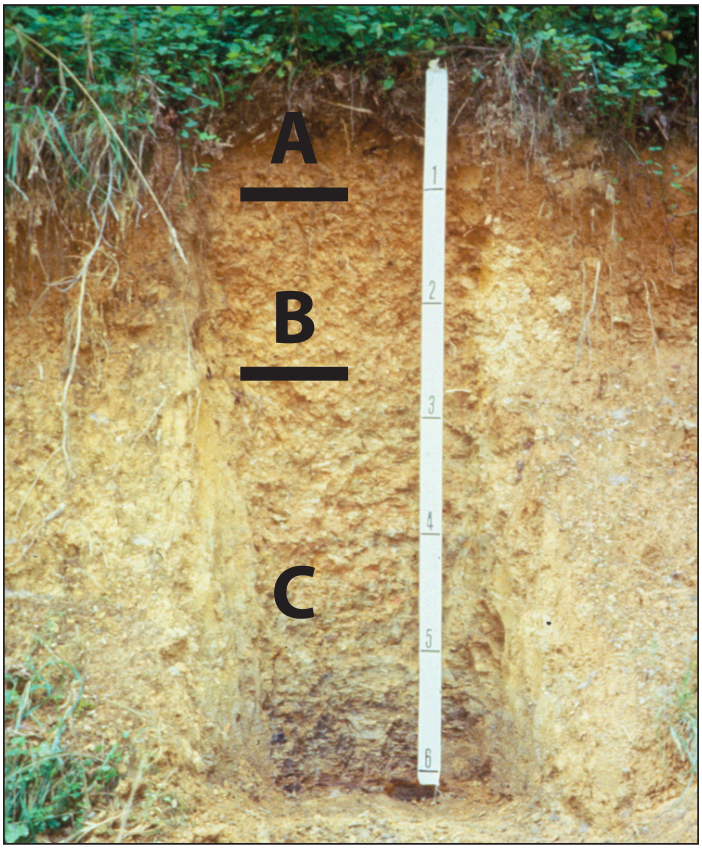
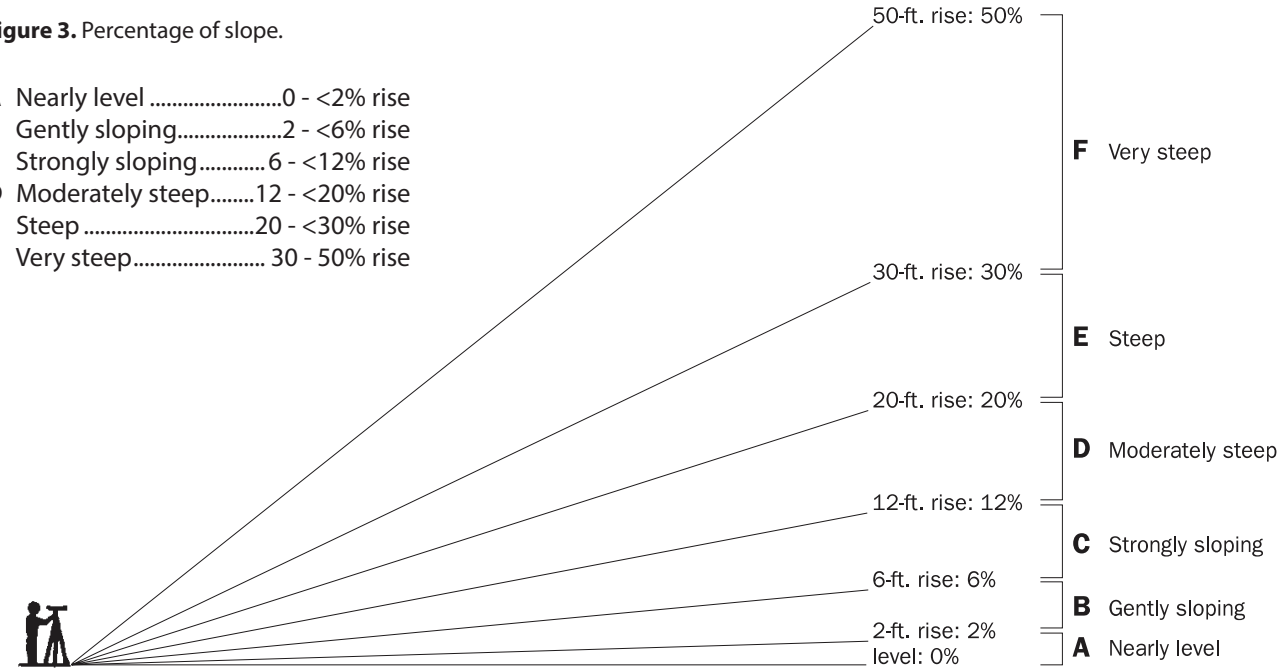


Figure 1. A pit or road bank provides good ways to see the different horizons in a soil profile.

Figure 2. Soil probes can be used to collect soil profile samples.

Figure 3. Percentage of slope.

A Nearly level .....0 - <2% rise
B Gently sloping.....2 - <6% rise
C Strongly sloping.....6 - <12% rise
D Moderately steep.....12 - <20% rise
E Steep .....20 - <30% rise
F Very steep..... 30 - 50% rise



Slope

The percentage of slope is the number of feet rise or fall in 100 feet of level distance (Figure 3). Slope should always be determined in the line of natural water flow.

Slope is a very important soil characteristic that affects the soil in many ways. It is helpful to learn to estimate slope just by observation without any special devices.

Using a Slope Finder

A slope finder is useful in training the eye to estimate slope. A slope finder template is in the back of this book for your use. To use it, you should:

- Cut it out of the book and mount it on stiff cardboard, plywood, or another light board (Figure 4).
- Place nails or pegs for sighting pins and weight support.
- Suspend a weight, such as a small bolt by a string, as indicated.
- Attach a handle, such as a piece of board sawed out in the shape of a hand grip, to hold the finder steady (Figure 4).
- To find the percentage of slope:
  - Hold the finder so that the sighting pins and an object at your eye level (either up or down the slope) align (Figure 5).
  - Allow the weight to swing freely.
  - Press the string down with your finger (while it still registers slope), or tilt the finder so the weight brings the string tight against the finder; then lower the finder and read the percentage of slope directly from the scale. The percentage of slope is shown where the string crosses the degree line.

Figure 4. A slope finder is useful to determine slope.

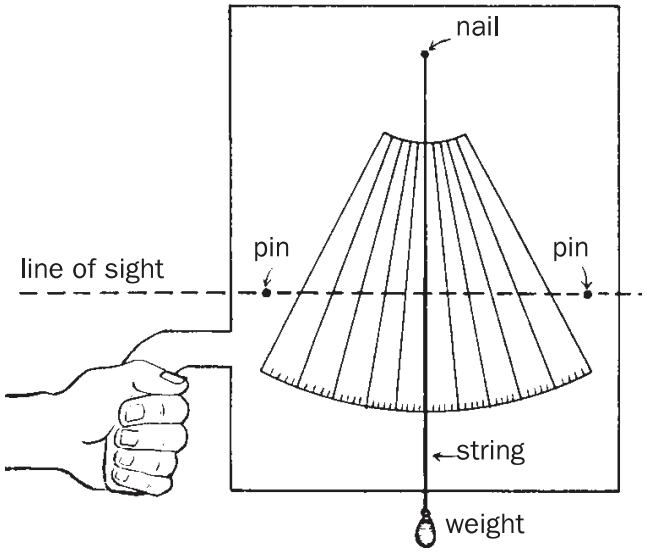
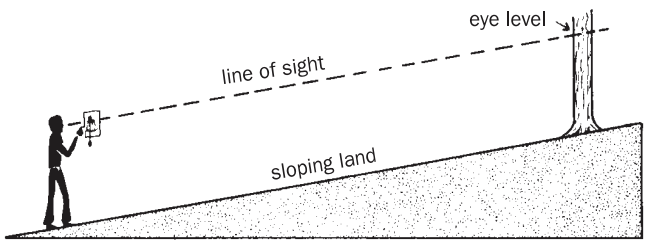


Figure 5. Align the slope finder with an object at eye level.



Amount of Erosion

Erosion is the wearing away of land by detachment and transport of soil by water or wind. In Kentucky, most erosion is the result of water falling and flowing over the land. Sloping land that has been disturbed by cultivation or construction usually has subsoil material mixed with the topsoil because of erosion.

An upland topsoil forms over many centuries as organic matter from decaying vegetation becomes a part of the soil. The best soils have 7 inches or more of topsoil material. On the other hand, some steep land has never formed as much as 7 inches of topsoil due to the relatively rapid natural erosion.

The amount of erosion affects the physical properties of the surface soil and influences the productivity potential of the land. In land judging, the amount of erosion is determined by measuring or estimating the amount of topsoil and subsoil contained in the top 7 inches of soil (Figure 6).

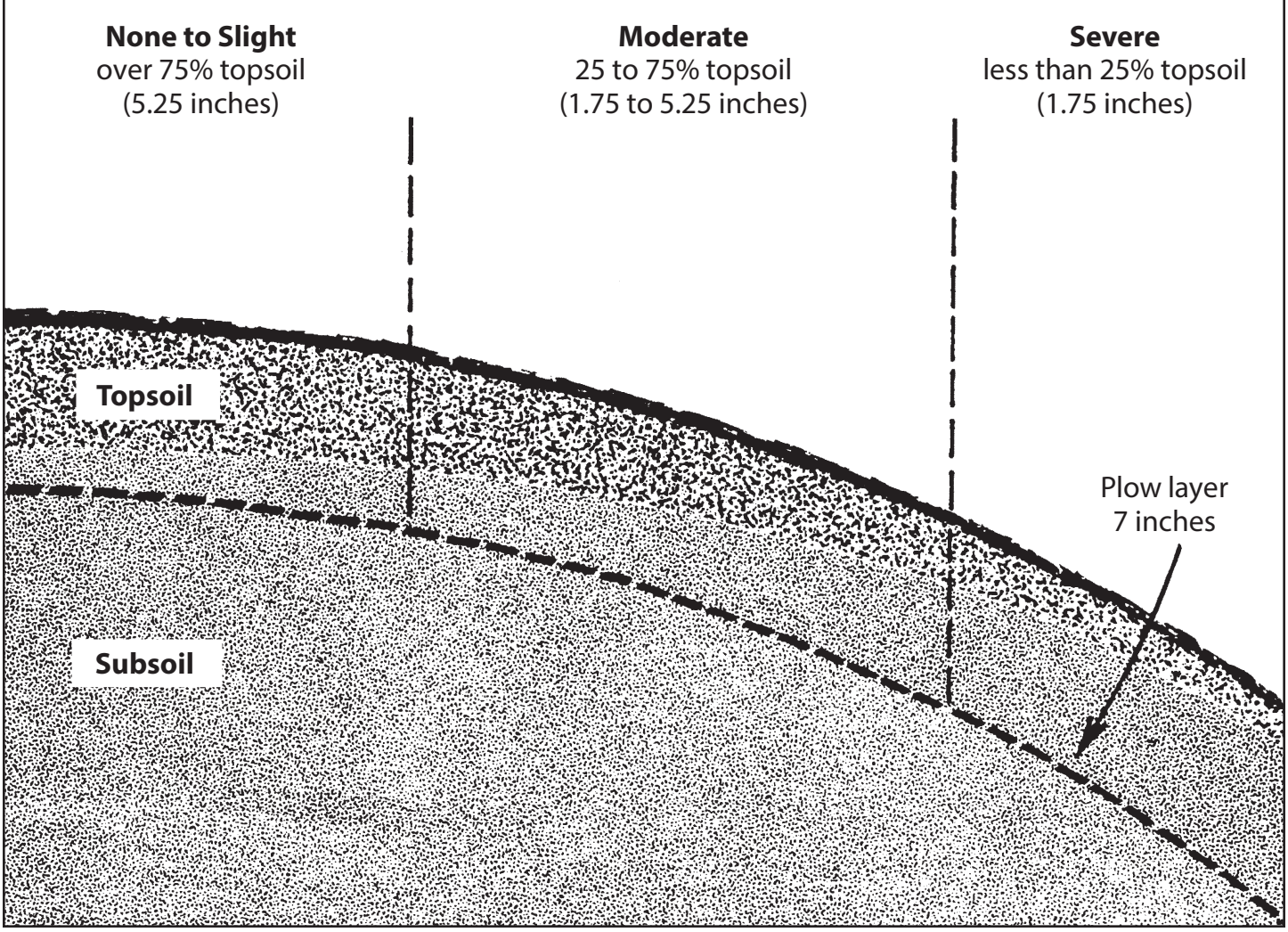
Amount of Erosion

None to slight
Topsoil: at least 75%
(5.25 in the top 7 inches)
Subsoil: not over 25%
(1.75 in the top 7 inches)

Moderate
Topsoil: 25% to 75%
(1.75 to 5.25 in the top 7 inches)

Severe
Topsoil: less than 25% topsoil
(1.75 in the top 7 inches)
Subsoil: over 75%
(5.25 in the top 7 inches)

Figure 6. Amount of erosion is determined by estimating the proportion of topsoil to subsoil in the top 7 inches of soil.



Texture (Topsoil and Subsoil)

Soil texture (such as loam, sandy loam, or silt loam) refers to the proportion of sand, silt, and clay sized particles that make up the mineral fraction of the soil (Figure 7). You can estimate this in the field by observing how the soil feels and reacts when soil is rubbed between your thumb and finger. For more information on determining soil texture see University of Kentucky Cooperative publication *Determining Soil Texture by Feel* (AGR-217). Topsoil texture influences water infiltration. Subsoil texture influences the amount of plant available water throughout the growing season.

- Individual **clay** particles are too small to be seen without the aid of an electron microscope. Too much clay in a soil causes it to be sticky when wet, slow to dry and hard and cloddy when dry. Tillage tools are harder to pull through soil with too much clay.
- Individual **silt** particles, though larger than clay particles, are still very small, and they must be viewed with the aid of a microscope. When dry, the soil has a floury feeling. A silty soil crumbles better than a clay soil. Many topsoils in Kentucky are silt loams.
- **Sand** particles are large enough to give soil a gritty feeling. A sandy soil is loose, breaks up easily and dries out rapidly.

Organic matter, although not considered as a part of texture, improves soil structure by aiding in the formation of aggregates of the individual particles. Soil structure influences water infiltration, permeability, root penetration, and overall crop productivity.

There are many soil texture classifications, but for the purpose of this competition we will use three major textural groups (Figure 7). For the National Land Judging Contest, the medium texture used for Kentucky contests is separated into moderately coarse, medium, and moderately fine textures.

Coarse texture: Soil will not form a ribbon or stain fingers, has very gritty feel and individual grains can readily be seen and felt. Coarse texture soils include sand and loamy sand.

Medium texture: Soil forms ribbons from very poor to a short (1-2 inch ribbon) with a shiny surface, has somewhat gritty to smooth feel, and can crush moist clods with little to slight effort. Medium texture soils include sandy loam, loam, silt loam, silt, clay loam, sandy clay loam, and silty clay loam.

Fine texture: Soil will form a long ribbon (2 inches or longer) that will support itself. It is sticky when moist, but usually forms hard clods when dry that will only crush with considerable effort. Fine texture soils include sandy clay, silty clay, and clay.

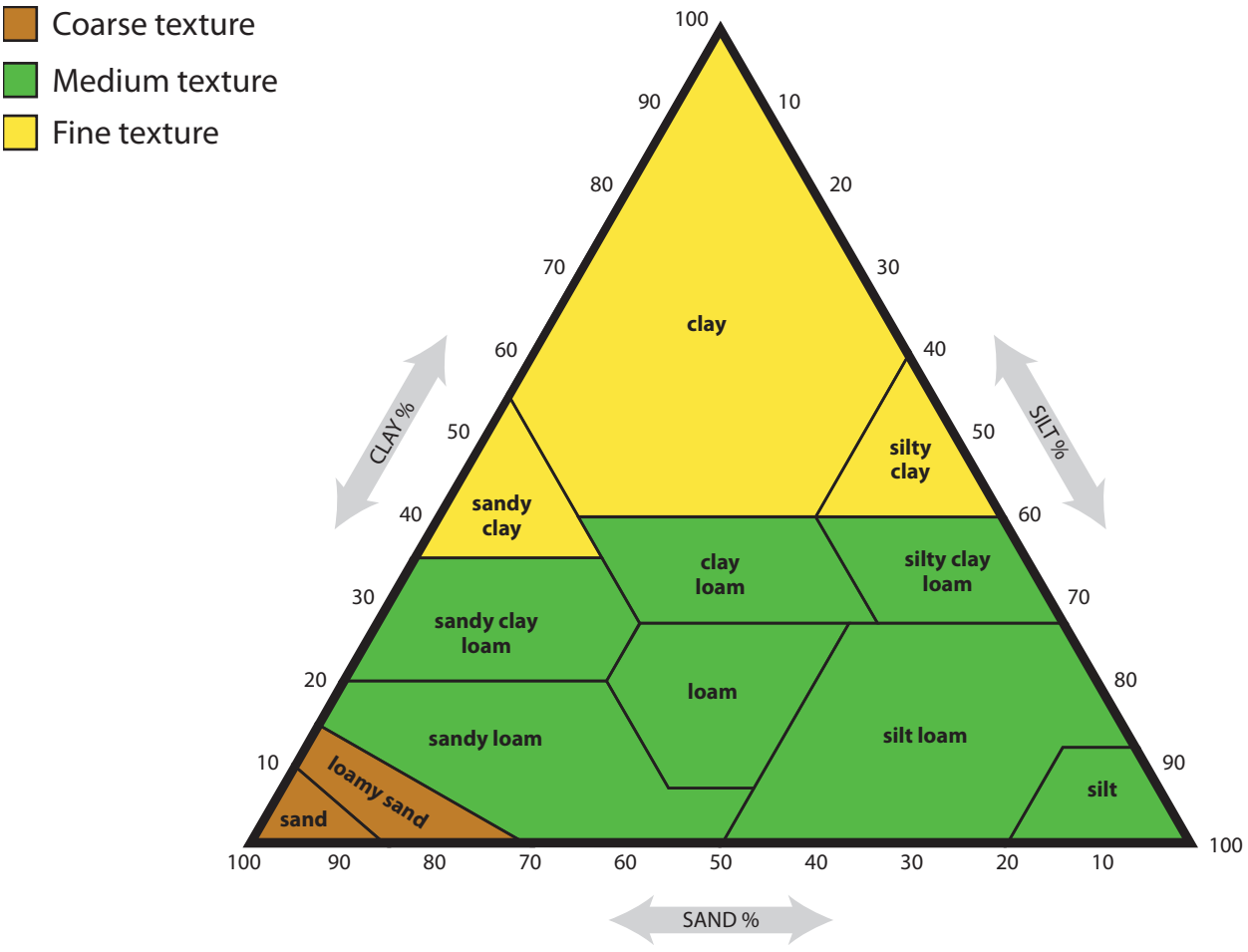


Figure 7. *Guide for textural classification.*

Depth of Root Zone/Soil Depth

Depth of root zone or soil depth is the depth to which roots will readily penetrate the soil material to obtain water and nutrients (Figures 8, 9, 10, and 11). Some conditions that interfere with root growth are:

Fragipan: A fragipan is a dense, brittle soil layer below the topsoil and in the subsoil. Silt particles in fragipans are cemented together and restrict root penetration similar to solid rock. This layer is a combination of dark brown and reddish-brown soil with gray streaks intermingled (Figure 8). The brown and reddish-brown soil in a fragipan is brittle, while the gray soil is not. Roots will grow only in these gray streaks. A fragipan can be easily detected when forcing a soil probe into the ground and is considered a limitation to the depth of root zone. **Though a fragipan is restrictive to root penetration, it is not restrictive to mechanical excavation for dwellings and basements.**

Bedrock: Depth of bedrock can be a limitation to plant root development as well as construction projects such as sites for houses with basements, lakes or ponds and swimming pools. This condition limits the depth of root zone. Rock fragments may not limit root growth but will interfere with penetration of the core sampler.

Try several spots or do a little digging with a spade if bedrock is suspected. A very gravelly layer will limit the nutrient- and moisture-holding capacity but is not considered a root-limiting layer.

A shallow water table can limit root growth; however, this is not considered a limitation of root zone in land judging because:

- Most water tables vary in depth during the growing season, and it is difficult to determine a definite depth.
- Most water tables can be lowered by drainage, which would increase the depth of root zone.

Figure 8. Soil profile of a fragipan beginning at 60 cm (24 inches) and extending to the bottom of the pit.

Root Zone Definitions

Deep—Over 40 inches to a limiting layer (Figure 9).

Moderately Deep—Limiting layer 20 to 40 inches deep (Figure 10).

Shallow—Less than 20 inches to a limiting layer (Figure 11).

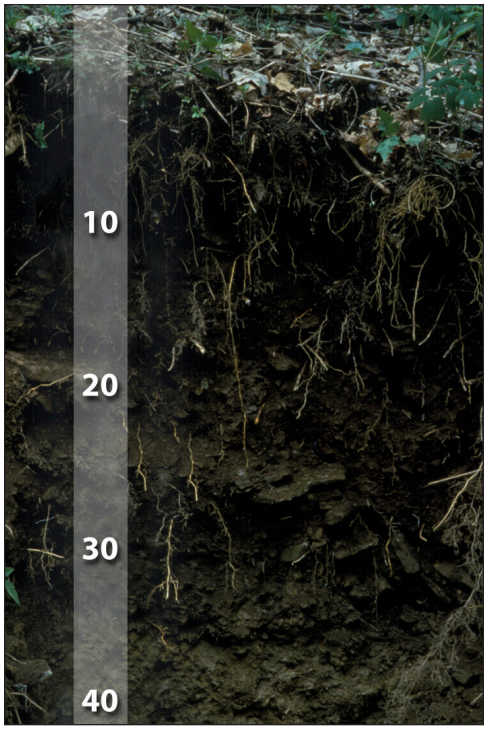


Figure 9. Deep root zone; roots grow deep to more soil moisture and plant food. Over 40 inches to a limiting layer.

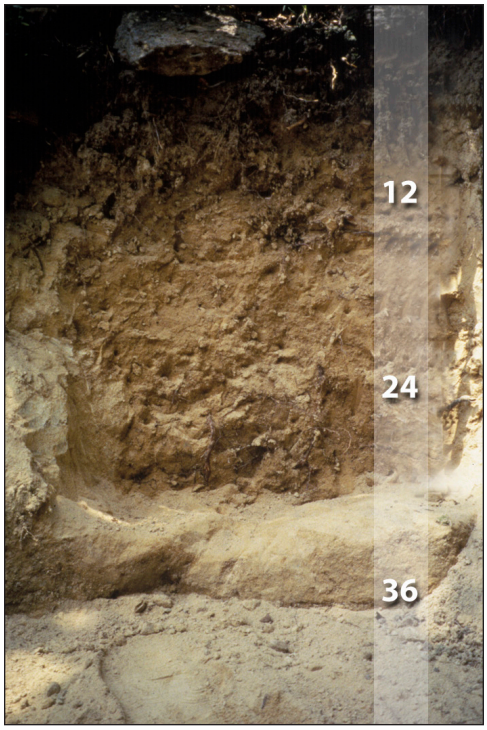


Figure 10. Moderately Deep root zone; bedrock stops roots and shuts off moisture and plant food below. Limiting layer is present 20 to 40 inches from soil surface.

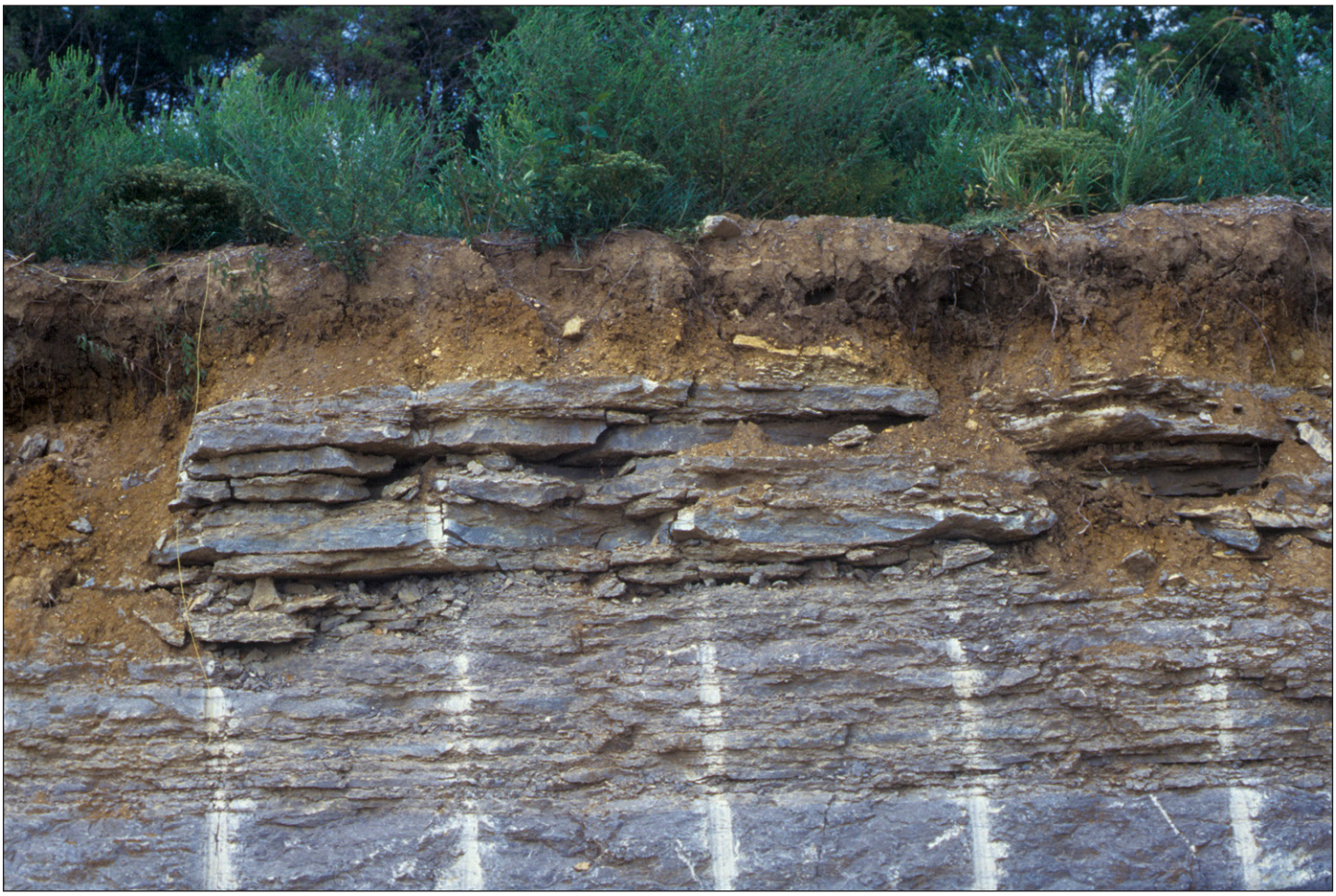


Figure 11. Shallow root zone; very little soil over bedrock. Soil dries out quickly and plant-food area is small. Less than 20 inches to a limiting layer.

Figure 12. There is little or no water erosion hazard on level, "A" slope land.

Erosion Potential

When judging erosion potential, consider the risk of damage to the production capacity of the soil if erosion should occur (Figures 12 and 13). The following factors influence the erosion potential:

Steepness of slope: The same rain will wash more soil from a steep slope than from a gentle slope, other things being equal.

Depth of root zone: An equal amount of soil lost from both a shallow and a deep soil is more damaging to the shallow soil since it has less soil to lose.

Amount of erosion: On severely eroded soils infiltration of rainfall is slower, runoff is greater and erosion potential is increased.

*Increase erosion potential one category on severely eroded soils

Erosion Potential = **None to Slight***

	Slope	Soil Depth
A	0 - <2%	Deep, Mod Deep, Shallow
B	2 - <6%	Deep, Mod Deep

Erosion Potential = **Moderate***

	Slope	Soil Depth
B	2 - <6%	Shallow
C	6 - <12%	Deep, Mod Deep

Erosion Potential = **Severe***

	Slope	Soil Depth
C	6 - <12%	Shallow
D	12 - <20%	Deep, Mod Deep, Shallow
E	20 - <30%	Deep, Mod Deep, Shallow

Erosion Potential = **Very Severe**

	Slope	Soil Depth
F	30 - 50%	Deep, Mod Deep, Shallow

Figure 13. This "D" slope land would be judged as "severe" erosion potential.

Aeration and Drainage

Aeration is the exchange of air in the soil with air from the atmosphere. Since air is a source of oxygen for the plant roots, air movement within the soil is essential for most crops. When all the porous space in the soil has become filled with water, the soil is saturated (waterlogged) and there is no air movement.

As a soil condition, **drainage** means the frequency and duration of periods when the soil is free from saturation. In a soil where the water moves freely throughout the soil profile, the excess water moves out soon after heavy rains cease. Water moves very slowly through soils that are compacted or have a high clay content and remains saturated for a much longer period. Slow water infiltration can also result in increased surface runoff and greater soil erosion potential.

Some crops can survive longer than others in a water-saturated soil. For example, tobacco is sensitive to "wet feet," while fescue will withstand soil saturation for a much longer period. The stage of growth also will influence the length of time the plant can survive without air getting to the root system.

Color of the soil is a good indicator of aeration and drainage. With good aeration, the iron and other minerals in the subsoil are well oxidized (iron rust is iron oxide), and results in a red-colored soil. As aeration is more limited, oxidation is reduced, and other changes produce a gray color. When gray and other colors are more or less mixed in irregular patterns, the soil is "mottled," and this is an indication of poor aeration and drainage.

The depth of the mottling in the soil profile is used as a guide in judging and an indication of drainage. Some soils have gray colors and mottles because of the parent material of the soil. **This is most likely to be in soils that have steep slopes** and soils that formed in parent material from different kinds of bedrock (shale). Soils may have seepage out of the hill that causes some mottling, but it is difficult to distinguish drainage mottling from parent material mottling in these soils.

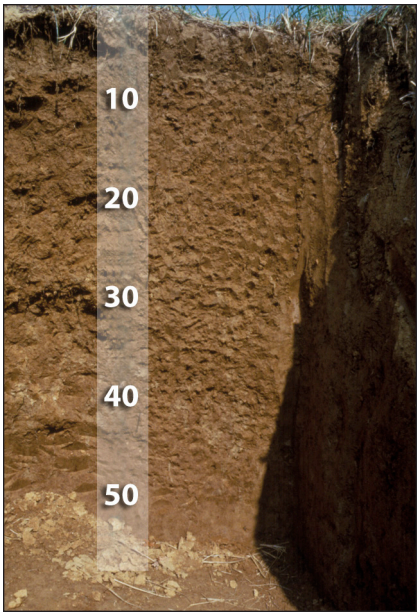


Figure 14. Well-drained. No gray mottling above a 30-inch depth.

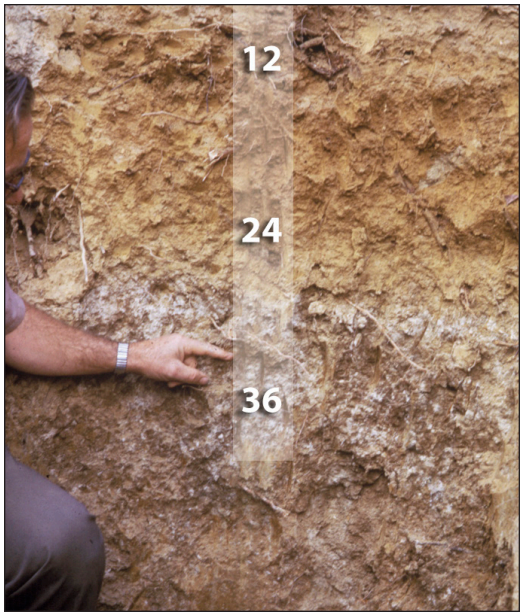


Figure 15. Moderately well-drained. Subsoil shows gray mottling between 20- to 30-inch depth.

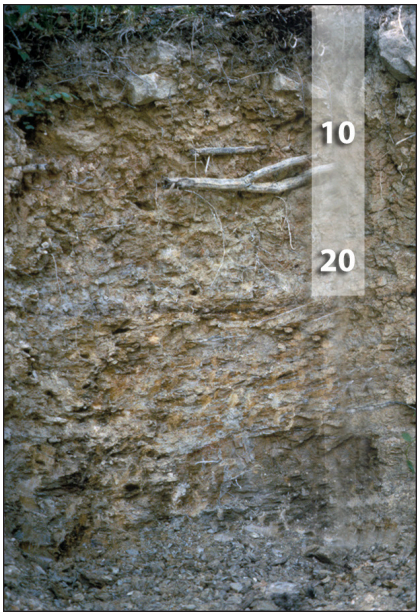


Figure 16. Somewhat poorly drained. Gray mottling or solid gray color develops between 10- and 20-inch depth.

Drainage Conditions

Well-drained: No gray drainage mottling above a 30-inch depth. Subsoil color is usually dark brown, red, or yellow, depending on the soil's parent material (Figure 14).

Moderately well-drained: Subsoil shows gray drainage mottling between the 20- and 30-inch depth (Figure 15).

Somewhat poorly drained: Gray drainage mottling or solid gray color develops between the 10- and 20-inch depth (Figure 16).

Poorly drained: Gray drainage mottling or solid gray color develops in the top 10 inches from the soil surface. Poor surface drainage may cause the gray color. Surface soil may be very dark gray or black (Figure 17).

Caution: Mottling is more difficult to detect in dark soils

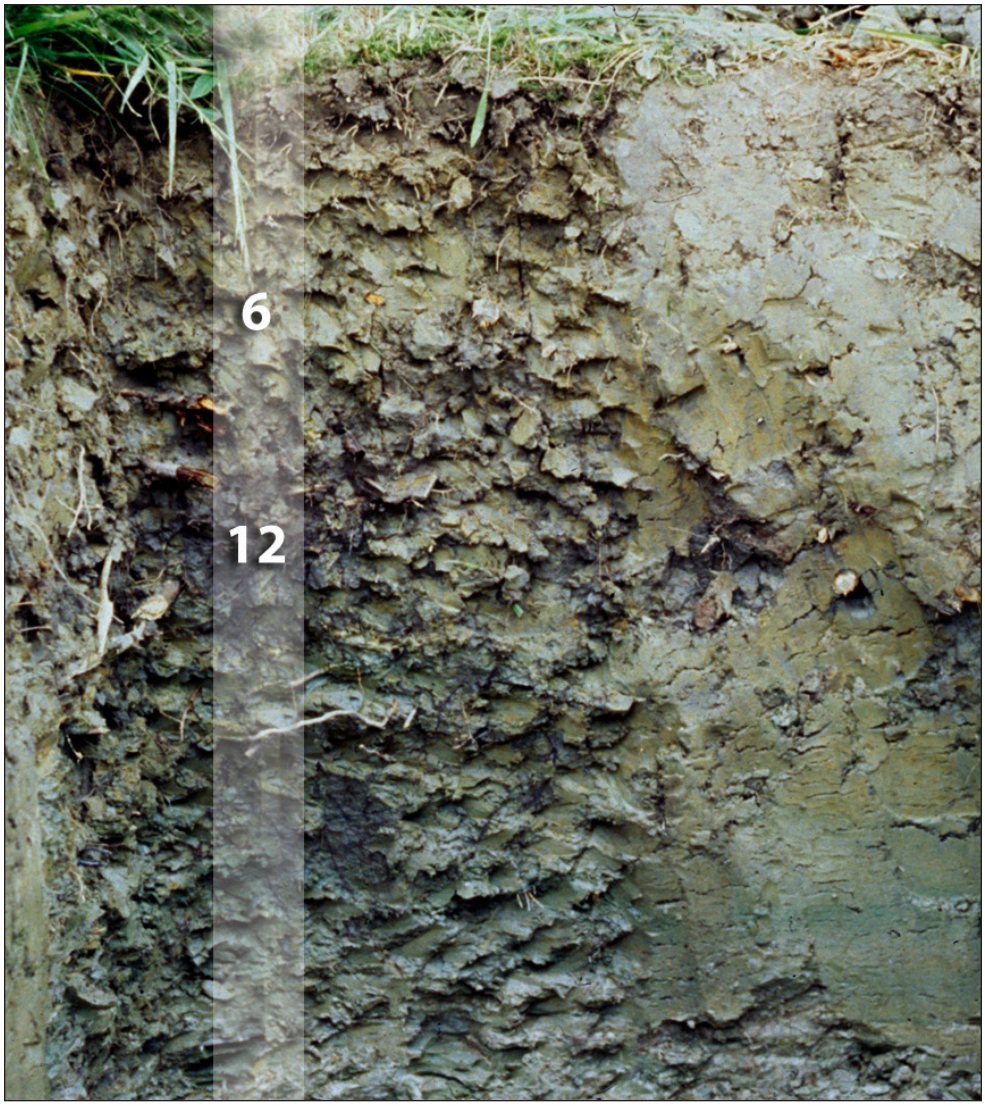


Figure 17. Poorly drained. Gray mottling or solid gray color develops in the top 10 inches from the surface.

Ability to Supply Moisture

Lack of moisture limits plant growth to some extent nearly every year. Short dry periods may come at critical stages of plant development, such as when ears are forming on corn. Plant growth is affected much more severely in some soils than others, even within the same field. These differences, during dry periods, are related to the ability of the soil to supply moisture.

The following physical characteristics of the soil influence water infiltration, storage and release and are considered when judging the ability of soil to supply moisture.

Depth of Root Zone: The capacity for storing soil moisture is affected by the depth of the root zone.

- The deeper a given soil, the more water it will hold. A soil 5 feet deep will naturally store more water than the same type of soil only 2 feet to bedrock or a fragipan condition.
- The deeper the root zone the more extensive the root system, which results in more moisture being available to the plant.

Amount of Erosion: Eroded soils generally will not allow water to penetrate as rapidly, and there will be more runoff. Here's why:

- The organic matter in the topsoil improves soil structure, keeping the soil porous and leaving openings that allow the water to go into the soil instead of running off. Organic matter also has a higher water holding capacity than the mineral component of the soil.
- When topsoil containing organic matter is lost due to erosion, water moves into the soil more slowly due to poorer soil structure, and less water is held in the soil profile.
- Erosion often exposes subsoil that has a finer texture than the original topsoil. Soils with finer texture have smaller pore spaces, which reduces water movement into the soil profile and increases surface water runoff and erosion potential.

Slope: Runoff is greater on steeper slopes, infiltration is lower, and the soil moisture supply is thereby reduced.

Soil Texture-Subsoil: Infiltration, storage and release of soil moisture are affected by a soil's texture, particularly the subsoil texture. Coarse-textured soils (sand and loamy sand) allow water to move in rapidly and will release much of the moisture held, but they store relatively little water and tend to be droughty. On the other hand, soils with fine texture (high clay content) will store a lot of moisture but do not release it as readily to plant roots. Soil textures that fall between these two extremes are best for supplying moisture.

Ability to Supply Moisture	Subsoil Texture	Root Zone Depth	Slope	Amount of Erosion
			A	All categories
Good	Medium	Deep	B	None to Slight or Moderate
			C	None to Slight
	Medium	Mod Deep*	A, B, or C	None to Slight or Moderate
	Medium	Deep	D or E*	None to Slight or Moderate
Moderate	Medium	Deep	C	Moderate to Severe*
	Medium	Deep	B	Severe*
	Fine*	Deep	A, B, or C	None to Slight or Moderate
		Shallow*	All slopes	All categories
		Mod Deep*	All slopes	Severe*
Poor	All textures	Mod Deep*	D or E*	None to Slight or Moderate
		Deep	D or E*	Severe*
		All depths	F	All categories

*Denotes limiting factor for ability to supply moisture.

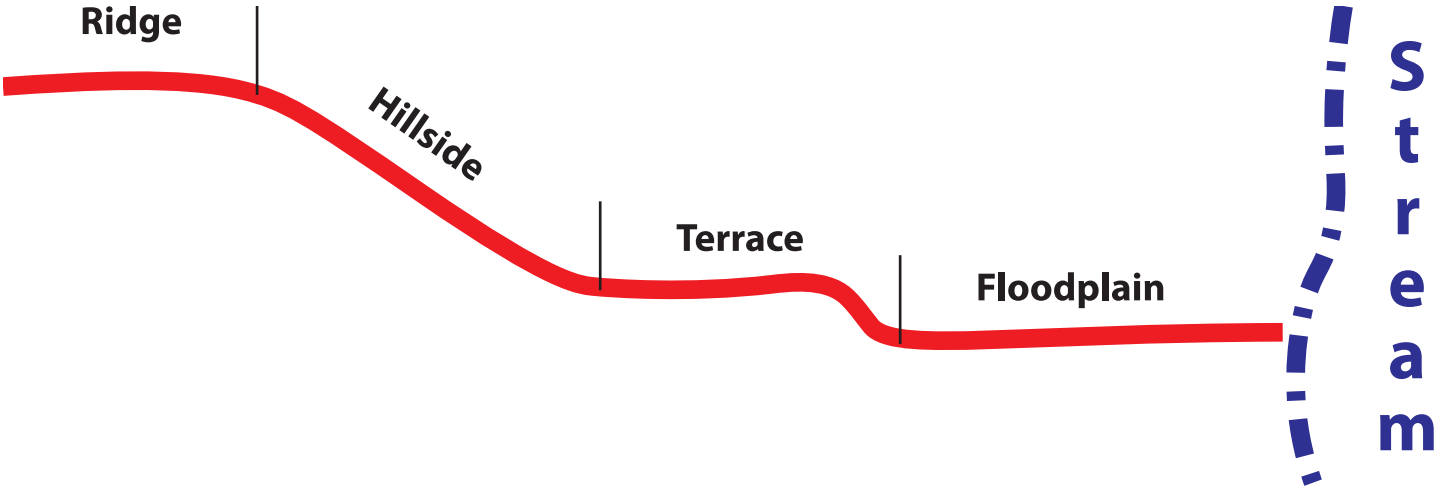


Figure 18. Landform positions.

Landform

Only check one landform on the score card.

Landforms are distinctive physical features on the earth's surface formed by natural causes (Figure 18). They are characterized by their location on the landscape, their topography, and their proximity to streams or rivers. Landforms influence the potential limitations for use.

Flood plains and terraces are associated with streams or rivers. Flood plains form from alluvial depositions (deposited from water) and experience occasional or frequent flooding and a shallow seasonal water table. Flood plains can be productive farmland but risk crop losses or delayed planting of crops. Flooding can bring in undesirable material such as sand, natural debris (wood and excessive crop residues), and trash that cause management concerns. Flood plains are not suitable for permanent structures or septic systems due to a shallow seasonal water table and flooding potential.

A terrace also is associated with a natural waterway, but rarely or never floods due to its higher elevation relative to a flood plain. Terraces are often productive and have fewer limitations than flood plains. They are suitable for construction of permanent structures, but may have limitations for septic systems or basements due to depth to the water table.

Upland hillsides and ridges are formed from loess (windblown silty materials) and/or residuum (soils weathered from bedrock). Upland ridges are found above an upland hillside at the summit of the hill. Karst features develop in landscapes underlain with limestone rock (Figure 19). Over time sinkholes and caves are dissolved by water to create these features.

Upland ridge: The uppermost, comparatively level or gently sloping area of a hill. Topographically, it is generally the highest part of the landscape.

Upland hillside: The steeper, sloping portion of an upland landscape between the ridge and lower-lying floodplain or stream terrace.

Karst: A terrain, generally underlain by limestone or dolomite, in which the topography is chiefly formed by the dissolving of rock and which may be characterized by sinkholes, sinking streams, closed depressions, subterranean drainage, and caves. If there is not a karst basin or sinkhole within the site boundary, then there is not a karst landform.

Stream or river terraces: A nearly level to gently sloping landform that is adjacent to but higher than the modern-day floodplain. Terraces are remnants of the former floodplain of a stream or river. Most stream or river terraces in Kentucky occur between the lower-elevation floodplain and the higher elevation upland hillside. Stream or river terraces are subject to rare or no flooding.

Flood plains: The nearly level plain that borders a stream, creek or river and is subject to flooding. Topographically, it is generally the lowest part of the landscape. Flood plains are subject to occasional or frequent flooding.

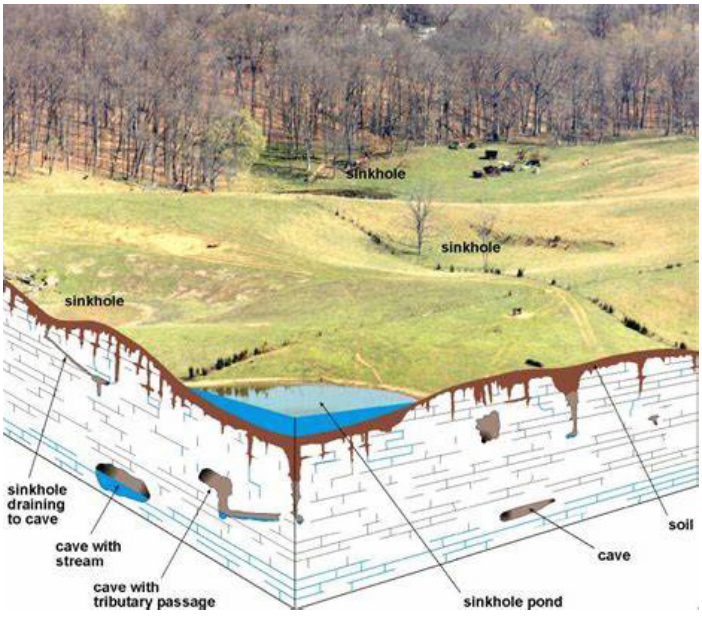


Figure 19. Karst landform.

Agricultural Land Capability and Use

Soils are grouped into capability classes to indicate limitations in use and risks of damage by farming practices. The capability class of a soil indicates its maximum safe use in planning conservation and cropping programs. The most unfavorable soil characteristic usually governs capability.

The land use coupled with each capability (listed below) is the most intensive safe use. (There are exceptions to the capability and use pairings as given here; however, the exceptions depend on technical determinations and are not included in this land judging program.) All needed conservation measures must be used with each land use.

Agricultural Land Capability Classes

Class I—Soils in Class I have few limitations that restrict their use.

Class II—Soils requiring moderate conservation practices or having some limitations restricting choice of crops.

Class III—Soils that require special conservation practices or have severe limitations that reduce the choice of crops.

Class IV—Soils in this class require very careful management and special conservation practices or have very severe limitations that restrict the choice of crops.

Class V—Soils that are not likely to erode but have other limitations, impractical to remove, that limit their use (flooding, stoniness, etc.). Due to limited acreages, this class will not be used in contests.

Class VI—Soils having such severe limitations that they are generally unsuitable for cultivation; they are limited largely to pasture and hay production.

Class VII— Very severe limitations that make soils unsuitable for cultivation and that restricts their use primarily to forest.

Land Capability Chart

Slope		
A	0 - <2%**	Class I
B	2 - <6%	Class II
C	6 - <12%	Class III
D	12 - <20%	Class IV
E	20 - <30%	Class VI
F	30 - 50%	Class VII
Amount of Erosion		
None to Slight		Class I
Moderate		Class II
Severe*		Class III
Erosion Potential		
None to Slight		Class I
Moderate		Class II
Severe		Class III
Very Severe		Class IV
Depth of Root Zone		
Deep—over 40"		Class I
Mod Deep—20-40"		Class II
Shallow—under 20"*		Class III
Aeration and Drainage		
Well Drained		Class I
Moderately Well Drained		Class I
Somewhat Poorly Drained		Class II
Poorly Drained		Class III
Ability to Supply Moisture		
Good		Class I
Moderate		Class II
Poor		Class III

**Severely eroded or shallow soils: lower capability one class below that indicated by slope. Example: Place a C slope that has severe erosion in Class IV instead of Class III. A combination severely eroded and shallow soil lowers capability one class, not two.*

***Frequent flooding: no higher than Class II. If frequent flooding exists, this information will be given to contestants.*

Conservation Practices and Limitations

Practices

When completing your judging sheet, check "yes" for each practice needed, whether present or not. Check "no" for all other practices.

1. Soil Amendments

All soils except Class VII land should be soil tested. Soil pH, phosphorus (P) and potassium (K) levels will be provided on the site card. The decision to apply lime and fertilizer is based on the University of Kentucky Cooperative Extension Publication AGR-1 for corn production. Proper soil fertility is key to good vegetative cover that protects soil on crop and pasture lands, as well as profitable levels of production. Class VII land should mark "No" for all soil amendments regardless of the values given.

Lime – If pH is 6.1 or less mark "Yes," otherwise mark "No."

P – If phosphorus is 60 lb/acre or less mark "Yes," otherwise mark "No."

K – If potassium is 300 lb/acre or less mark "Yes," otherwise mark "No."

2. Contour or Across-slope Cultivation

Applies to Class II, III, IV, and VI land on slopes greater than 2%.

This practice protects land from erosion when cultivation is used.

3. Cover Crops or Residue Management

Applies to Class I, II, III, and IV land.

The use of cover crops and proper management of crop residues protect the soil surface from the impact of raindrops, slow surface water movement, increase soil organic matter, and reduce soil erosion. Additionally, some cover crops can be managed to break disease and pest cycles, provide additional nitrogen fixation (legumes), scavenge nutrients, and conserve soil moisture.

4. No-tillage

Applies to Class I, II, III, IV, and VI land that is NOT poorly drained. The primary benefits of No-Tillage are: 1) reducing erosion and runoff, 2) improves aggregate stability and soil health, and 3) increases infiltration and plant available water.

5. Grass Waterway, Mechanical Drains or Other Safe Water Disposal System

Applies to Class I, II, III, and IV land where slope, land use and good water management indicate a problem in safe water disposal (Figure 20).

Grass waterway areas may vary from a well-defined gully to a slight depression that concentrates water flow. Besides natural drains, this practice is required for safe water disposal any time practice seven (diversion channels) is used.

Figure 20. Proper use of a grass waterway will reduce soil erosion and aid in water management.

Figure 21. This site would require forest management to be marked "yes" as it is a Class VII soil.

6. Filter Strip

Applies to Class I, II, III, and IV land including or within 50 feet of streams, ponds and sinkholes. A strip of close-growing, permanent, herbaceous vegetation that filters sediment, organic material, nutrients and chemicals from field drainage water. If karst landform is marked, then filter strip should be marked as "yes."

7. Diversion Channel

A constructed channel that catches runoff water and diverts it away from the area being judged. This should be checked if the site boundary is within 50 ft of areas with slopes greater than or equal to 2%. The most common need for this practice is where surface water from an upland hillside must be diverted to prevent damage to the floodplain. For this practice to be recommended, the sloping area above the floodplain should be within 50 ft of the site boundary

In this case, the diversion channel may be constructed on the slope adjacent to the floodplain but would be needed to provide protection for the area being judged. For this reason, the diversion channel practice should be marked "yes" for the floodplain though it may not be built in the area being judged. On the other hand, if the area being judged is sloping land higher than the floodplain, the practice should be marked "no." Although the channel may be at the foot of the slope of the area being considered, it is a practice necessary for protection of the lower ground beyond the area being judged.

8. Drainage Tile or Open Ditch

Tile or open ditch drainage applies when aeration and drainage are somewhat poorly or poorly drained on A or B slopes.

9. Proper Pasture Management

Applies to Class VI land without regard to present use. Includes seeding, liming, fertilizing, and good management practices. Pasture improvement for production also improves conservation values of pasture.

10. Proper Forest Management

Applies to Class VII land (Figure 21). Includes new planting, interplanting, protection from fire and grazing, and other good forest management.

Limitations

Each factor that would prevent the site from being in Class I capability must be checked.

Check if:

Slope—over 2%

Erosion—moderate, severe

Erosion Potential—moderate, severe, or very severe

Depth of Root Zone—less than 40 inches

Aeration and Drainage —gray mottling less than 20 inches from surface

Ability to Supply Moisture—moderate or poor

Frequent flooding

Career Opportunities

Two of the basic needs of all people are adequate food and clothing. A productive soil, along with water, air, light and temperature, is essential in supplying these needs. The treatment, efficient use and conservation of land resources is controlled by people and is of vital concern to everyone as the world faces an increasing population. Many career opportunities are available in this field.

Soil scientists are needed to teach people to assess the productive capabilities of their land and the treatment, natural resources, cropping systems, and conservation practices needed for efficient production and maintenance of the productive capacity of soil.

Job opportunities for soil scientists are many and varied, including:

- Cooperative Extension Service
- Teaching in high schools, colleges, and universities
- Natural Resources Conservation Service
- Research (private or public)
- Agribusiness
- Consulting (agronomic or environmental)
- Landscape architecture

Land-judging Terms

The terms defined below are used in land judging. To fully understand land judging, you may need other terms defined for you. You can find many of these definitions in the Soil Science Society of America publication *Glossary of Soil Science Terms.*

Aeration

The exchange of air in soil with air from the atmosphere.

Aggregate

Many fine soil particles held together in one mass or cluster, such as a clod or crumb.

Bedrock

Solid rock underlying soil.

Clay

The very fine mineral soil particles.

Clod

A hard mass of soil produced by plowing or digging; it melts when wet.

Concretion

A hard pellet of soil particles cemented together by compounds in the soil.

Contour

A line across a slope that is level throughout its course.

Erosion

Wearing away of land by detachment and transport of soil by water or wind.

Fertility

Ability of soil to provide plant nutrients in sufficient amounts and proper balance for plant growth.

Flood Plains

The nearly level plain that borders a stream, creek or river and is subject to flooding. Topographically, it is generally the lowest part of the landscape. Flood plains are subject to occasional or frequent flooding.

Fragipans

Dense and brittle pans or layers in soils that owe their hardness mainly to high silt content and cementation.

Horizon

A layer of soil with distinct characteristics produced by soil-forming processes that distinguish it from other layers in a soil profile.

Humus

Well-decomposed organic material in mineral soils (often referred to as organic matter).

Karst

A terrain, generally underlain by limestone or dolomite, in which the topography is chiefly formed by the dissolving of rock and which may be characterized by sinkholes, sinking streams, closed depressions, subterranean drainage, and caves.

Land

The whole environment of growing plants, including soil, water supply, plant cover, works of improvement and other characteristics.

Land Capability Classification

Grouping of soils into units according to their capabilities for use in farming and treatments required for sustained use.

Leaching

The downward movement of materials through soil pore space by water.

Mineral Soil

Composed mostly of mineral matter, not organic matter.

Mottled

Soil irregularly spotted with gray colors.

Pan

A soil layer that is firmly compacted. Fragipans, high in silt, are common in Kentucky. Claypans, high in clay, are less common. Traffic pans result from soil usage, not soil-forming processes.

Parent Material

The material from which the soil profile develops.

Plow Layer

The soil ordinarily moved in tillage, about 7 inches thick.

Pore Space

The space between solid particles that is filled with either air or water.

Profile

A vertical section of soil extending from the soil surface into parent material.

Runoff

Surface flow of water from an area.

Silt

Soil particles of a size between clay and very fine sand.

Slope

The incline of the soil surface measured as the amount of rise or fall in 100 feet in the general direction of natural water flow.

Stream or River Terraces

A near-level to gently sloping landform that is adjacent to but higher than the modern-day floodplain. Terraces are remnants of the former floodplain of a stream or river. Most stream or river terraces in Kentucky occur between the lower-elevation floodplain and the higher elevation upland hillside. Stream or river terraces are subject to rare or no flooding.

Stoniness

Stony land has a high percentage of small stones that prevents mechanical tillage.

Terrace Soil

Second bottom soil, deposited by running water, with some degree of profile development.

Upland Hillside

The steeper, sloping portion of an upland landscape between the ridge and lower-lying floodplain or stream terrace.

Upland Ridge

The uppermost, comparatively level or gently sloping area of a hill. Topographically, it is generally the highest part of the landscape.

Water Table

The upper portion of the soil profile where all pore space is saturated with water. Location of a water table is determined by the level at which water stands in a shallow open pit and will vary with season.

Land Evaluation for Homesites

A home is a major investment for most people. Individual families and communities can avoid construction and maintenance problems if a study of soil conditions is made before construction begins. Soil information can be used to predict potential problems associated with planned or existing homesites. Before building or buying a home, consider whether:

- There is a flood hazard; avoid homes in a flood plain unless there is adequate flood protection.
- Drainage is a problem.
- The soils have high shrink-swell properties.
- Slope and unstable soil make erosion and soil movement a major problem.
- Soil conditions exist that corrode pipes easily and require frequent replacement.
- Grading and soil removal were extensive. Was the surface soil replaced?
- The soil properties are favorable for lawn, shrubs, trees, flowers, and vegetables without extensive soil modification.
- A septic sewage system is to be utilized. Will it properly work?

This contest is designed to emphasize the importance of soils and their limitations for homesites. The importance of a soil's suitability for parks, playgrounds, roads, streets, and other uses can also be considered. Many of the properties important for agricultural uses are also important for urban uses. While the properties are the same, a different set of criteria may be used to evaluate sites for urban uses.

Defining Limitations

Soils have limitations in use depending on their inherent properties. In homesite evaluations, the soils are rated as having none to slight, moderate, severe, or very severe limitations as follows:

None to slight limitations: Soils or sites have properties favorable for the planned use and present few or no problems. Low maintenance can be expected.

Moderate limitations: Soils or sites have one or more properties considered somewhat restrictive for the planned use. Limitations may be overcome or modified with special planning, design, treatment, or maintenance.

Severe limitations: Soils or sites have one or more properties unfavorable for the planned use. Limitations are very difficult and expensive to modify or overcome for the desired use. A severe rating means that extensive, costly work needs to be done to overcome the soil limitations for the use desired.

Very severe limitations: Soils or sites have features so unfavorable for a particular use that overcoming the limitations is very difficult and extremely expensive and generally should not be used for the purpose being rated.

Defining Land Uses

Limitation ratings will be made for four homesite uses: (1) foundations for buildings, (2) lawns and landscape plantings, (3) septic system absorption field, and (4) buildings with basements. Ratings for other uses can be made but are not included in this contest.

Foundations for buildings: This determination reflects the suitability of the soil to support buildings without basements. Some important soil properties that affect building foundations are soil depth, slope, shrink-swell potential, water table, and flooding.

Lawns and landscape plantings: This rating reflects the use of the soil for growing lawns, shrubs, trees, and vegetable gardens.

The important soil properties are those that affect establishment and maintenance of planting. They include texture (surface and subsoil), permeability, soil depth, aeration and drainage, plant response when fertilizer is applied, and soil erosion.

Septic tank absorption field: Subsurface systems of tile or perforated pipe that distribute wastewater (effluent) from a septic tank into the soil for purification.

Properties and features that affect the absorption of the effluent are permeability, slope, soil depth, and flooding. Bedrock and shallow depth may interfere with installation and excessive slope can affect the operation of the system.

Buildings with Basements: This determination reflects the suitability of the soil to support buildings with basements. Some important soil properties that affect building foundations with basements are soil depth, slope, shrink-swell potential, aeration and drainage, and flooding.

Factors Affecting Suitability

Texture (Topsoil and Subsoil)

Topsoil texture is a main factor for foundations and lawns and landscaping. Topsoil texture is not a factor for septic systems and basements because basements and lateral lines are dug below the surface. Subsoil texture will be provided to determine subsoil texture for feel. For the purposes of the State Contest subsoil texture will be used estimate the shrink-swell potential of the soil as described in the shrink-swell section below. Limitations to homesite land use will be determined by shrink-swell potential (derived from subsoil texture) and permeability rate (provided on site card).

Topsoil Texture

Coarse: (Sand and loamy sand). Moderate limitations for all uses — May require stabilization with organic material and/or loamy topsoil to improve moisture and nutrient holding and supplying capacity for desired plant growth. Water and wind erosion may be a problem during construction.

Medium: (sandy loam, loam, silt loam, silt, clay loam, sandy clay loam and silty clay loam) None to slight limitations for all uses — Care should be exercised during construction to be sure the topsoil is not covered by less desirable material.

Fine: (sandy clay, silty clay, and clay). Severe limitations for all uses— Soil is sticky when wet, hard when dry, and difficult to work with in flower beds and gardens. The soils crack when dry, swell when wet, requiring frequent and low rate of watering for plant growth.

Permeability (Subsoil)

This refers to the rate water or air moves through the most restricted layer in the subsoil. The permeability rate will be given on the site card.

Laterals for septic systems may be located below such layers in some soils. The health department in Kentucky is responsible for approving septic placement. They consider soil depth, permeability, seasonally high-water tables and soil color. A standard percolation test to determine infiltration rates where soils are slow or very slowly permeable is used in many states (not Kentucky) and for the national Home Site Evaluation Contest and will NOT be used in the Kentucky contest. These investigations are important factors in deciding between septic tank absorption fields or a community sewage system. For septic systems, evaluate the permeability of soil layers below 30 inches.

Rapid: Permeability greater than 2 inches per hour.

Septic Absorption Field: Very severe limitation for septic adsorption fields when permeability is greater than 6 inches per hour. Slight limitation for septic absorption fields when permeability is 2 to 6 inches per hours. Rapid permeability can result in seepage from septic systems and could contribute to ground water pollution.

Lawns and landscaping: Moderate limitation for lawns and landscaping.

Moderate: Permeability ranges from 0.6 to 2 inches per hour.

Septic Absorption Field: Moderate limitations for septic system absorption fields. The soils are moderate textured.

Lawns and Landscaping: None to slight limitations for lawns and landscape plantings.

Slow: Slow permeability is 0.06 to 0.6 inches per hour.

Septic Absorption Field: Severe limitations for septic system absorption field. .

Lawns and Landscaping: None to slight limitations for lawns and landscape.

Very Slow: Very slow permeability is less that 0.06 inches per hour. Subsoils are fine textured.

Septic Absorption Field: Very severe limitations for septic system absorption field.

Lawns and Landscaping: Severe limitations for lawns and landscape plantings .

Table 1. Impact of soil permeability on land use limitations for potential homesites.

	Lawns/Landscape	**Septic**
Rapid (>2 inches per hr)	Moderate	>6"/hr - Very Severe 2-6"/hr - Slight
Moderate (0.6-2 inches per hr)	None-Slight	Moderate
Slow (0.06-0.6 inches per hr)	None-Slight	Severe
Very Slow (<0.06 inches per hr)	Severe	Very Severe

Soil Depth

This refers to the vertical depth of a soil to bedrock such as sandstone, limestone, or fragipans that restrict roots and excavations. Severity of limitations because of depth vary greatly for different uses. Table 2 is a guide for evaluation of soil depth for homesite uses. Soil Depth as it relates to **foundations** and **basements** is governed only by Depth to Bedrock. Depth to fragipan does not impact interpretations for a Foundation or Basement.

Slopes

The percentage of slope is the number of feet rise or fall in 100 feet of level distance (Figure 3). Slope should always be determined in the line of natural water flow.

Slope is a very important soil characteristic that affects land use in many ways. It is helpful to learn to estimate slope just by observation without any special devices. Table 3 is a guide for evaluation of slope impacts on homesite uses

Amount of Erosion

Erosion of the soil can increase the expense of landscaping and require additional topsoil to be brought onto the site. Erosion will only be a factor for lawns and landscape plantings.

None to slight erosion has none to slight limitations for lawns and landscape plantings.

Moderate erosion has moderate limitations for lawns and landscape plantings

Severe erosion has severe limitations for lawns and landscape plantings.

Table 2. Impact of soil depth on land use limitations for potential homesites.

	Depth in Inches	Foundation	Lawns/Landscape	Septic	Basement
Shallow	< 20″	Severe	Severe	Very Severe	Severe
Mod. Deep	20-40″	Moderate	Moderate	Severe	Moderate
Deep	> 40″	None to Slight	None to Slight	None to Slight	None to Slight

Table 3. Impact of slope on land use limitations for potential homesites.

Slope	Foundation	Lawns/Landscape	Septic	Basement
0-<2%	None-Slight	None-Slight	None-Slight	None-Slight
2-<6%	None-Slight	None-Slight	None-Slight	None-Slight
6-<12%	Moderate	Moderate	Moderate	Moderate
12-<20%	Severe	Severe	Severe	Severe
20-<30%	Severe	Severe	Severe	Severe
30% or more	Very Severe	Very Severe	Very Severe	Very Severe

Shrink-Swell (Subsoil)

This factor is implied in the permeability, texture, and mineralogy of a soil. Because it is important in foundation and basement design, it should have special consideration. The most clayey (fine) layer in the profile is generally considered in shrink-swell limitations. The texture of the subsoil provided will be used to evaluate shrink-swell. Shrink-swell is not generally a factor for lawns and landscape plantings.

Low: Coarse-textured soils have none to slight limitations for all uses.

Moderate: Medium-textured soils have moderate limitations for all uses.

High: Fine-textured soils have severe limitations for all uses.

Aeration and Drainage

Aeration is the exchange of air in the soil with air from the atmosphere. Since air is a source of oxygen for the plant roots, air movement within the soil is essential for most plants. When all the porous space in the soil has become filled with water, the soil is saturated (waterlogged) and there is no air movement.

As a soil condition, **drainage** means the frequency and duration of periods when the soil is free from saturation. In a soil where the water moves freely throughout the soil profile, the excess water moves out soon after heavy rains cease. Water moves very slowly through soils that are compacted or have a high clay content and remains saturated for a much longer period. Table 4 gives the degree of limitation for land use for the aeration and drainage. For basements use the following, depth to gray mottling, instead of drainage classes.

Drainage Conditions

Well: No gray drainage mottling above a 30-inch depth. Subsoil color is usually dark brown, brown, red, or yellow, depending on the kind of material from which the soil was formed.

Moderately Well: Subsoil shows gray drainage mottling between the 20- to 30-inch depth.

Somewhat Poorly (SWP): Gray drainage mottling or solid gray color develops between the 10- and 20-inch depth.

Poorly: Gray drainage mottling or solid gray color develops in the top 10 inches from the surface. Poor surface drainage may cause the gray color. Surface soil may be very dark gray or black.

Flooding

The occurrence of floods is a factor frequently overlooked in planning the use and management of land. Flooding may not occur on an area for many years, then a serious flood can occur. Urban development on the watershed of a small stream can increase runoff up to 75%, thus greatly increasing the flood hazards. Soils may give an indication of flooding, but records must be studied to determine the true condition. Position in the landscape and proximity to nearby streams are good indicators of frequency of flooding. In contests this is normally given information.

None: None to slight limitations for all uses.

Occasional: Flooding less frequent than one year in two. Severe limitations for Foundations for Buildings and Basements. Moderate limitations for septic absorption field. None to Slight limitations for Lawns and Landscapings

Frequent: Flooding more frequent than one year in two. Severe limitations for all uses.

Table 4. Impact of aeration and drainage on land use limitations for potential homesites.

Depth to Gray Mottles	Foundation	Lawns/Landscape	Basement
0-10″	Severe	Severe	Severe
10-20″	Severe	Moderate	Severe
20-30″	Moderate	None-Slight	Severe
30-40″	None-Slight	None-Slight	Moderate
>40″	None-Slight	None-Slight	None-Slight

Final Evaluation

If all factors are rated as none to slight, then the overall final evaluation is rated none to slight. If one or more factors are moderate and none are severe then the final evaluation is marked as moderate. If one or more factors are rated as severe and none are very severe then the final evaluation is marked as severe. If one or more factors in part 2 are marked as very severe then the final evaluation shall be marked as very severe.

Soil Amendments

Soil fertility is extremely important to lawns and landscape plantings. Too often, homeowners over fertilize their yards and cause surface and subsurface water pollution. Soil tests should be routinely conducted to measure and track the fertility levels in the soil. Certain landscape plantings survive in acid soils, whereas others survive in neutral soils. For this contest, soil amendments will only be considering fertility for turf application and will consist of 3 items: lime, phosphorus and potassium which will all be given on the site card.

Lime: Mark "Yes" for lime if the pH level is 6.1 or less, otherwise mark "No."

Phosphorus (P): Mark "Yes" for phosphorus application if the soil test P is 30 lbs/acre or less, otherwise mark "No."

Potassium (K): Mark "Yes" for potassium application if the soil test K is 200 lbs/acre or less, otherwise mark "No."

Conducting Homesite Evaluation

Homesite evaluation contests are conducted in the same manner as land judging. Additional items must be added to the given information site card. The contestant should be given 15 minutes to fill out a scorecard for each site. Sites are 100'x100'. Students shall conduct an evaluation of four sites at 100 points per site for a total score of 400 points per person. A team may consist of four members, however the lowest score will be dropped. A total team score will total to 1,200 total points. In the event of a tie, the dropped score will be used. Four points will be awarded for each land factor for a total perfect score of 36 points. With the exception of shrink-swell and permeability, the factors are similar to land judging. After completing land factors, determine the severity of limitation that the existing soil conditions impose on the planned use and check the appropriate one, in "Degree of Limitation" of the scorecard. Two points are assigned for each correct answer. Using information given on the site card, mark the answer for each of the soil amendments if they are needed, which are worth two points each. The final evaluation is determined by the worse degree of limitation found for the particular planned use and is also assigned three points for the correct answer.

Setting Up and Conducting a Land Judging and Home Site Contest

To have a successful land-judging event, planning and coordination are necessary from the beginning. The Extension agent usually chairs the event, but another interested party could serve in this capacity. Persons most likely to be involved are sponsoring groups, Cooperative Extension Service and Natural Resources Conservation Service personnel, vocational agriculture groups or local leaders.

Here's how to prepare for an event:

Before the Event

1. Set the date of the contest.
2. Determine expected participation, if possible.
3. Locate a comfortable classroom setting for organization, instruction, etc.
4. Locate a farm or adjacent farms where different conditions can be found to study and judge.
5. Secure permission from the owner to use the selected area.
6. The day before the contest, have designated soil scientists select sites and locations for sampling profile and make official scorings and placings.
7. Soil texture boxes will be provided for the subsoil for texture determination.
8. Provide a site information sheet with agronomic characteristics for each site. Any site relevant notes will be included here. An example site card is provided in Figure 20.
9. Prepare land-judging score cards for each individual. Combine cards in packages of four when judging by teams. Number the cards so teams can be easily separated and scores regrouped.
10. Select group leaders and tabulators (graders).
11. Allow about 1½ hours for judging.
12. Arrange for transporting contestants to the fields.

Selection and Scoring of Sites

Individual score cards will be provided for each site and contest (Land Judging and Home Site Evaluation). Score cards will be turned in to the instructor once the site has been evaluated by the student.

The contestants or students must be able to see the soil to determine important characteristics. While suitable roadside cuts and ditches may be used for training purposes, a site away from a road or ditch is preferable for a contest.

Four sites are used in judging. The sites used in the contest should be selected and scored by soil scientists of the Natural Resources Conservation Service, Cooperative Extension Service, etc., using the Land Capability Classification as defined in this publication.

All scoring should be kept confidential by the judges until after the contest is completed. It is beneficial to the students if, after the contest, the judges explain their scores to the contestants.

Site Size

The sites to be judged should be a minimum of 100 feet x 100 feet, or fit within the landform being judged. Flags or stakes must be set to indicate the boundary of the area to be considered and where the profile sample is to be taken.

A different color flag or stake should be used to indicate a 100-foot distance for estimating slope (Figure 20).

Core Sample

At each site, have the official sample of the soil profile laid out on a board or holder. All measurements should be taken from the official soil core. Additional cores may be pulled for students to handle. Contestants are not allowed to handle the official core sample. A measuring device will be affixed to each official core.

Provide probes or augers at each site so the contestants can take and handle their own samples. Water bottles will be provided for moistening the soil if needed.

The Day of Event

1. Break the contestants into four groups.
2. Arrange for a grading place and someone to bring in the cards as contestants finish a site.
3. Allow 20 minutes at each of the four sites and have groups move to the next site on a predetermined signal.

Tie Breaker

In the event of a total score tie, use the following land judging category score to determine winners:

1. Conservation Measures
2. Limitations
3. Land Capability
4. Soil Characteristics

Homesite Tie Breakers are:

1. Final Evaluations
2. Limitations
3. Land Factors

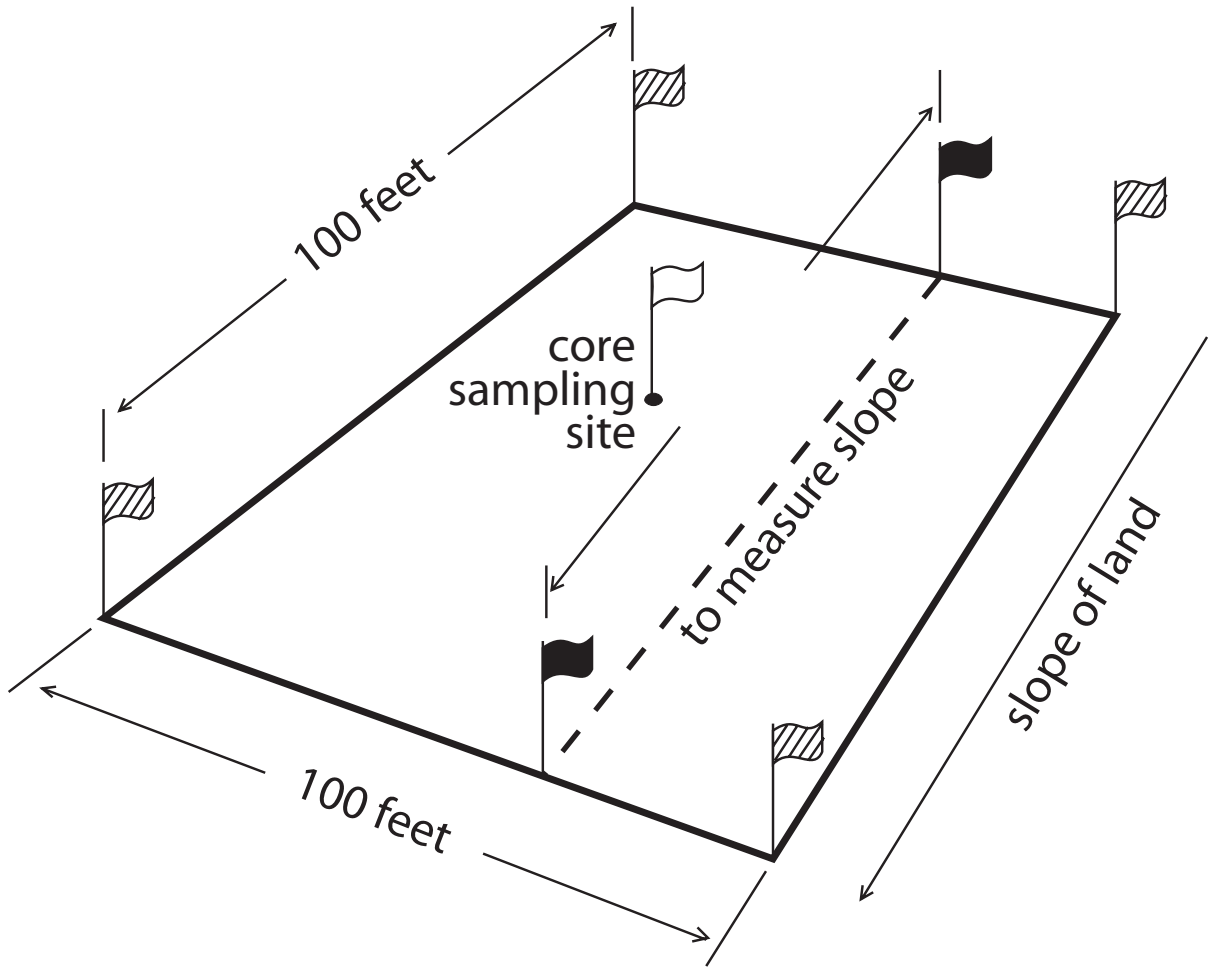


Figure 20. Select a group of four fields for judging. Within each field, select a uniform sample area marked by a flag or stake to represent the field. Sample areas do not have to be square. Set slope stakes.

Land Judging in Kentucky Site #_____

5 points for each correct answer

Slope	A 0 - <2%	
	B 2 - <6%	
	C 6 - <12%	
	D 12 - <20%	
	E 20 - <30%	
	F 30 - 50%	
Amount of Erosion	None to slight	
	Moderate	
	Severe	
Topsoil Texture	Coarse	
	Medium	
	Fine	
Sub Soil Texture	Coarse	
	Medium	
	Fine	
Depth of Root Zone	Deep	
	Moderate	
	Shallow	
Erosion Potential	None to Slight	
	Moderate	
	Severe	
	Very Severe	
Aeration & Drainage	Well-Drained	
	Moderately Well Drained	
	Somewhat Poorly Drained	
	Poorly Drained	
Ability to Supply Moisture	Good	
	Moderate	
	Poor	
Landform	Flood Plain	
	Stream Terrace	
	Upland Hillside	
	Upland Ridge	
	Karst	

Name _____

School _____

Soil Characteristics 45 Pts _____

Land Capability 5 Pts _____

Conservation 48 Pts _____

Limitations 5 Pts _____

Total Score 103 Points _____

5 points per site

Class	Land Capability	
I	Very Intense Cropping	
II	Intense Cropping	
III	Moderate Cropping	
IV	Occasional Cropping	
~~**V**~~	~~Continuous Cover~~	
VI	Continuous Cover	
VII	Continuous Cover (Forest)	

4 points each

Conservation Measures		
1a. Add Lime	Yes	
	No	
1b. Add phosphorus	Yes	
	No	
1c. Add potassium	Yes	
	No	
2. Contour or across-slope cultivation	Yes	
	No	
3. Cover crops or residue management	Yes	
	No	
4. No-tillage	Yes	
	No	
5. Grass waterway mechanical drains, etc.	Yes	
	No	
6. Filter Strip	Yes	
	No	
7. Diversion Channel	Yes	
	No	
8. Drainage tile or open ditch	Yes	
	No	
9. Proper pasture management	Yes	
	No	
10. Proper forest management	Yes	
	No	

Major factors that keep site out of Class I. Correct answer must include each factor preventing the site from bring Class I.

5 points per site

Limitations	
Slope	
Erosion	
Depth of Root Zone	
Erosion Potential	
Aeration & Drainage	
Ability to Supply Moisture	
Flooding	

Homesite Score Card

Site #_____

Name _____ School/County _____

Land Factor (4 pts each) — **Degree of Limitation (2pts each)**

Slope		Foundation	Lawn	Septic	Basement
A- 0-2%	None-Slight				
B- 2%-6%	Moderate				
C- 6%-12%	Severe				
D- 12%-20%	V Severe				
E- 20%-30%					
F- 30% or More					

Amount of Erosion		Foundation	Lawn	Septic	Basement
None to Slight	None Slight				
Moderate	Moderate				
Severe	Severe				

Surface Texture		Foundation	Lawn	Septic	Basement
Coarse	None-Slight				
Medium	Moderate				
Fine	Severe				

Permeability		Foundation	Lawn	Septic	Basement
Very Slow	None-Slight				
Slow	Moderate				
Moderate	Severe				
Rapid	Very Severe				

Final Evaluation (3 pts each)	Foundation	Lawn	Septic	Basement
None to Slight				
Moderate				
Severe				
Very Severe				

Land Factor

Subsoil Texture
Coarse
Medium
Fine

2pts each

Soil Amendments	Yes	No
Lime:		
Phosphorus (P):		
Potassium (K):		

Degree of Limitation (2pts each)

Flooding		Foundation	Lawn	Septic	Basement
None	None-Slight				
Occasional	Moderate				
Frequent	Severe				

Shrink-Swell		Foundation	Lawn	Septic	Basement
Low	None-Slight				
Moderate	Moderate				
High	Severe				

Soil Depth		Foundation	Lawn	Septic	Basement
Shallow	None-Slight				
Mod Deep	Moderate				
Deep	Severe				
	V Severe				

Aeration & Drainage		Foundation	Lawn	Septic	Basement
Well	None-Slight				
Mod Well	Moderate				
SWP	Severe				
Poorly					

Score

Land Factors:	36 pts	_____
Limitations:	46 pts	_____
Soil Amendments:	6 pts	_____
Final Evaluation:	12 pts	_____
TOTAL:	100 points	_____

Site # 1

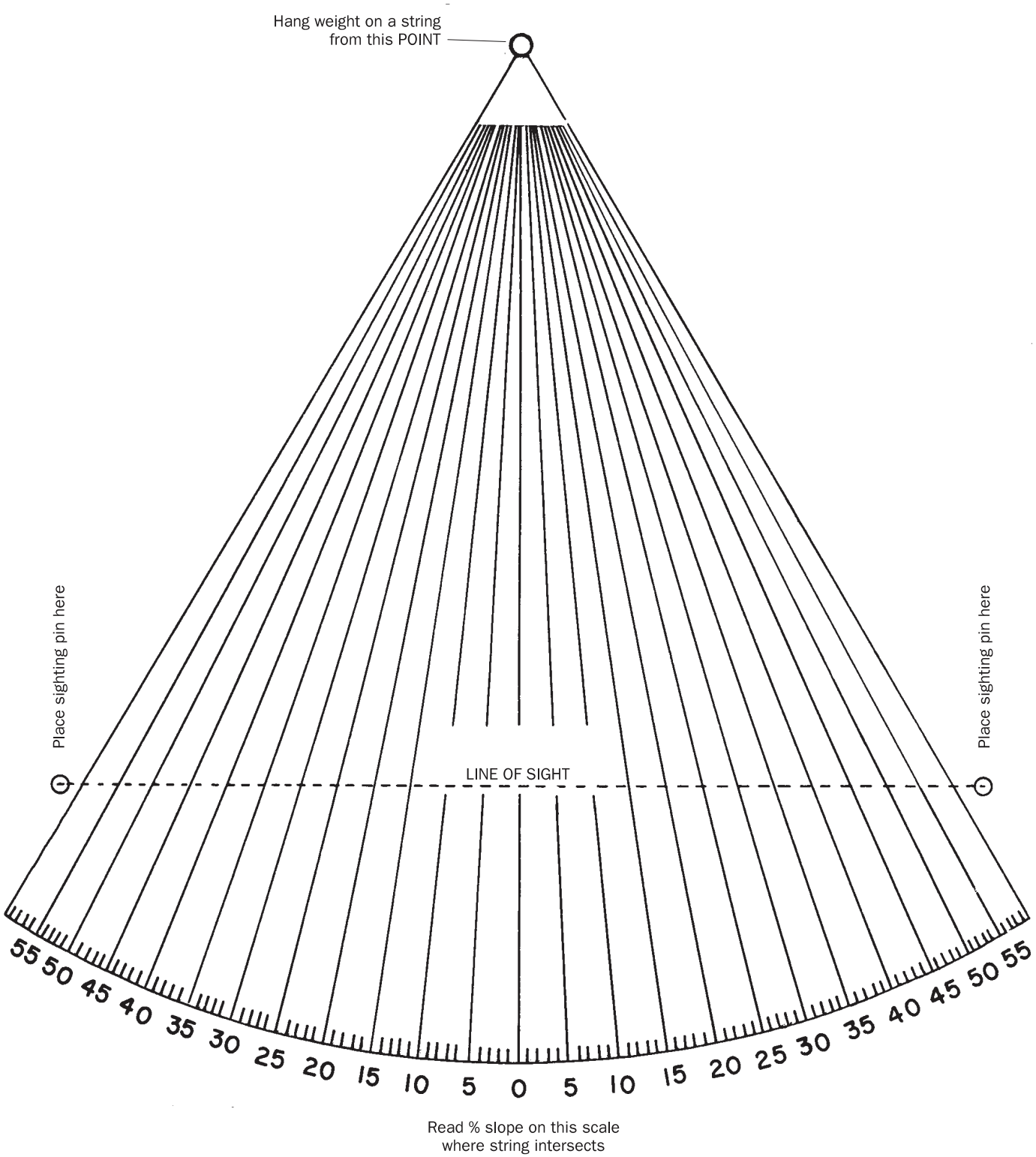
Soil Test Results:

pH = 5.9
P = 65 lbs./A
K = 250 lbs./A

Permeability: 1.5 inches/hour
Flooding: None

Slope Finder

For farm mapping project.



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