A GUIDE FOR LAND JUDGING IN MICHIGAN

Michigan FFA Association
in cooperation with
Michigan State University
USDA Natural Resources Conservation Service
Michigan Chapter of the Soil and Water Conservation Society

The study of land, and its wise use, is becoming more and more important to all citizens.

We do not have a surplus of high quality agricultural land or prime farm land. Such land helps the farmer sustain the production of large quantities of high quality food and fiber for a long period of time with low investment in capital and labor and with little or no negative impact on the environment. Prime farm land, when used properly, may also mean lower prices to the consumer.

A farmer may risk reducing the value of their land by over-cropping or by leaving fields exposed to erosion. This may be avoided by using land within its capability, protecting it from deterioration, and continually trying to improve its productivity for sustained use.

Expanded uses of productive farm land for other purposes presents another problem. Fertile soils cannot produce food and fiber when occupied by factories, highways, shopping centers, airports, subdivisions and other residential, industrial and commercial developments.

Many soil properties which affect the growth of plants also affect the use of soil for septic system drainage fields, residential development, playgrounds, paths, trails, golf courses, wildlife, streets and roads.

The use and management of different soil types varies, depending largely on how the soil was formed by natural processes and by the needs of the individual owner or operator. The natural characteristics may be good or bad depending on the intended use. We need to learn how to take advantage of the good features and overcome or adjust to the unfavorable ones.

JUDGING LAND

Land is defined as the solid part of the earth's surface plus water, vegetation, temperature and light.

In judging land, we:

- inventory land conditions.
- appraise these conditions in terms of the long-term capability of the soil to support the intended agricultural use, ie the Land Capability Class.
- decide on the management practices needed based upon this use.
- evaluate for non-agricultural uses.

Land judging requires close attention to such characteristics as soil properties, degree of erosion, steepness, type and length of slope and natural drainage. Factors, such as precipitation, length of growing season, sunshine, humidity and wind are also important, but are not included in land judging.

Land judging involves appraising the important soil properties. This appraisal is based on several key factors, some of which are seen in the soil profile, and interpreting them for crop production, non-crop uses and non-agricultural uses. Some key factors are soil texture, soil color, steepness of slope, amount of erosion, natural drainage and stoniness.

THE SOIL PROFILE

We need to look both into the soil and at its surface to determine all of the soil's physical properties. **Part One** of the land judging scorecard deals with the physical features evident in the soil profile, where information about the soil's strong and weak physical and chemical points are found. We determine this by examining the texture of the surface and subsoil layers; the color of the surface and subsoil layers; the steepness and type of slope; and the amount of erosion.

A soil profile is the vertical cross section of the soil through all its horizons or layers as observed when you dig a pit, look at a road bank or an excavation for a building. The soil profile (Figure 1) has three main parts:

(1) *The surface layer* (the O and A layers in Figure 1) contains most of the organic matter and furnishes the most favorable conditions for soil organisms and chemical activity. In cropped and formerly cropped areas it represents the plow layer. The 0 layer represents the organic layer that exists in non-cropped areas like woodland, and is composed mostly of decomposing vegetation and animal remains.

(2) *The subsoil* (the B layer in Figure 1) usually has the most clay and is variable in thickness. It is important from the standpoint of nutrient and water holding capacity (porosity), water moving capacity (permeability) and bearing capacity (ability to hold weight).

(3) *Parent material* (the C layer in Figure 1) is the material from which the soil is formed. This layer is not judged in the present scorecard but does affect soil characteristics and the range of possible land uses.

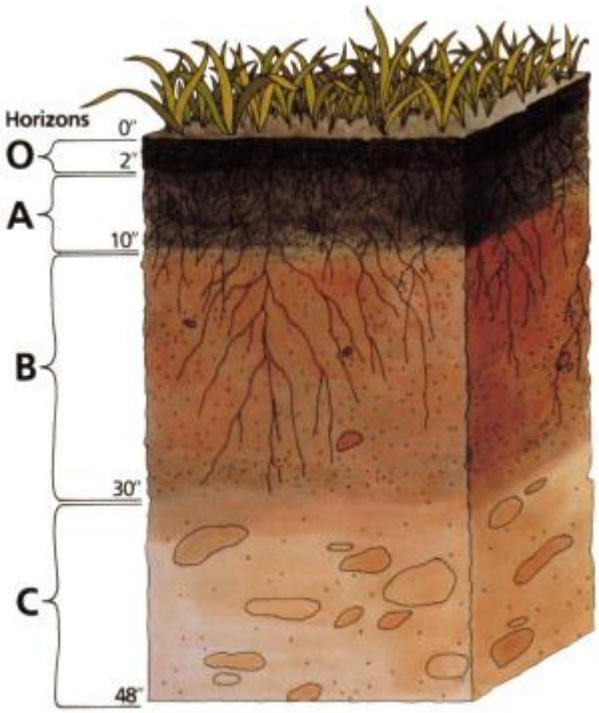


Figure 1. A soil profile.

PART ONE: PHYSICAL FEATURES OF SOIL

The "Michigan Land Judging Scorecard" has been developed to guide people through the many considerations needed to determine the capability of the land to support the intended use of the land and the treatment needed to protect the land. Part One represents the inventory phase.

SOIL TEXTURE

Soil texture is very important in land judging. Texture, in combination with soil structure, affects water holding capacity (porosity), permeability, capacity to hold and furnish nutrients, tillage operations, bearing capacity and erosion. Only the textures of the surface and subsoil layers are used on the present scorecard. Texture and structure of underlying parent material are also important, especially for trees, deep-rooted crops, septic system drainage fields and building foundations.

Texture refers to the relative proportions of sand, silt and clay present in a soil sample. The percentage of these variable sized particles present (Figure 2) determines soil texture (Figure 4). Available water holding capacity is greatest in silt loam soils, least in sands and intermediate in clay soils. As the clay content increases, soil permeability decreases and nutrient holding capacity increases.

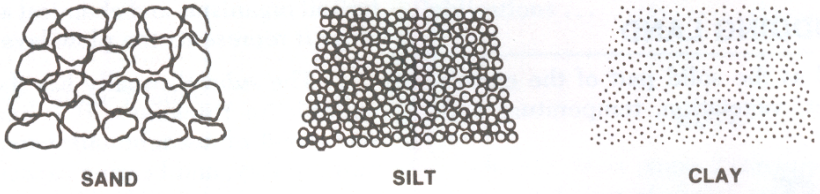


Figure 2. Soil horizons contain individual particles or grains. Usually soils have different combinations of the three sizes – sand, silt and clay. The combination of these is referred to as soil texture. A sand particle may be as much as 625 times larger than a clay particle.

Texture is determined by rubbing a small amount of moist soil between the thumb and forefinger (Figure 3). The soil should be moist, which makes it easier to estimate the clay content. When moist, clay is sticky and plastic, silt is smooth and floury and sand is gritty. See "Soil Texture 'Feel' Method on page 45.



Figure 3. Soil texture is determined by rubbing a small amount of moist soil between the thumb and forefinger.

Textural Triangles

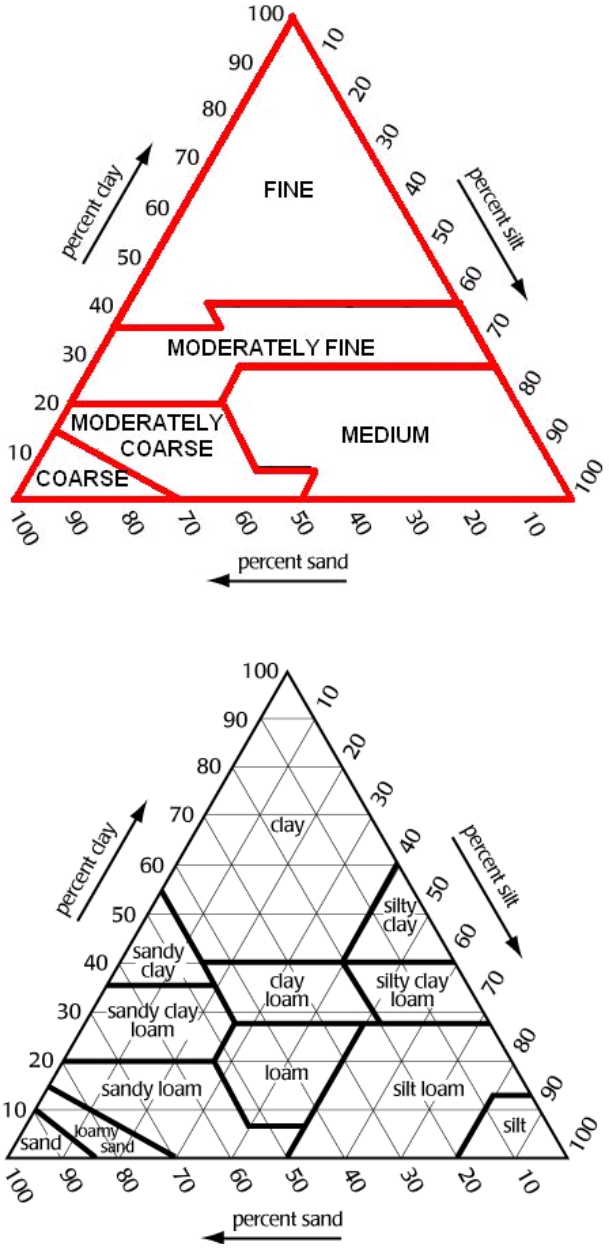


Figure 4. The textural triangle shows the common soil texture classes. The corners of the textural triangle represent 100 percent sand, clay or silt. (Gravel and organic soils are not included). The triangle is divided into 10 percent portions of clay, silt and sand. Heavy lines show the divisions between 12 basic soils textural classes. The triangle can be used only when the percentages of clay, silt and sand have been determined in the laboratory. If you know that a soil is 20 percent clay and 40 percent silt, you can follow the 20 percent line from the left hand (clay) side of the triangle to the point where it meets the 40 percent line from the right hand side (silt) side of the triangle. You will see, then, that the soil is a loam.

The texture groups used on the scorecard follow:

Fine-textured soils include clay, sandy clay, and silty clay textural classes. They are made up of a high percentage of clay, 35% or more, with sandy clay containing as much as 65% percent sand. They are sticky and plastic when moist and can be formed readily into a ribbon when pressed between the thumb and forefinger. The soil forms a strong ribbon at least two inches long, often times longer. Clay has over 40 percent clay particles.

Moderately fine-textured soils include clay loam, sandy clay loam and silty clay loam textural classes. Clay loam and silty clay loam have between 27 and 40 percent clay particles, while sandy clay loam has between 20 and 35 percent clay and over 45 percent sand. They are also sticky and plastic when moist and can be formed readily into a ribbon between 1 and 2 inches long when pressed between the thumb and forefinger .

Medium-textured soils include silt, silt loam and loam textural classes. Silt loam has more than 50 percent silt particles and feels smooth, like flour, not gritty or sticky. Loam consists of about equal parts of sand, silt and clay particles. These textures form a short ribbon, less than one inch long. This textural group represents a favorable mixture of sand, silt and clay particles, neither too fine nor too coarse.

Moderately coarse textured soils include sandy loam and loamy sand textural classes. They can contain anywhere between 43 and 85% sand with less than 20% of clay particles present. They are difficult to mold when moist and do not readily form a ribbon.

Coarse-textured soils include coarse and medium sands with some gravel. They contain 85 percent or more sand particles with a harsh, gritty feel even when moist. They will not form a stable mold when moist.

Organic soils are mucks and peats. They are made up largely of decomposed woody and fibrous plant materials.

SOIL COLOR

Color is one of the most noticeable characteristics of the soil. (Figure 5.) Organic matter and iron are the main coloring agents in Michigan soils. **Color should be determined for moist soil since true color is harder to determine when soil is dry**. The colors of surface and subsoil layers are used in land judging.

Color of Surface Layer

The moist color of the surface layer is determined mainly by the organic matter content.

Dark – Black or very dark brown colors indicate high organic matter content. The darkest colored surface layers have the highest organic matter content and were usually developed under native grasses or naturally poorly drained conditions. The dark colors indicate a potential source of nitrogen, good tilth (soil aggregation) and often good natural fertility.

Medium – Dark gray or dark grayish brown colors indicate a moderate amount of organic matter present. Most well and somewhat poorly drained soils having fine and medium textures are in this color group.

Light – Light gray, light grayish brown or pale brown colors indicate soils that are low in organic matter. Most of the well drained, sandy soils are in this color group.

Color of the Subsoil

The color of the subsoil is determined mainly by the length of time that the subsoil is saturated or below the water table because it influences iron content and oxidative state of iron (Figure 5). Soil drainage refers to the depth and duration of the water table. Permeability is the rate at which water and air move through soil.

Bright – Reds, yellows and browns are the principal colors. These bright solid colors indicate a soil which has formed under naturally well drained conditions (deep water table). Artificial drainage is not usually needed for field crops.

Mottled – Mixed yellow and brown colors with some grays and many rust-brown and orange streaks and spots. This color pattern indicates the soil developed under somewhat poorly drained conditions. Artificial drainage is usually needed for field crops on these soils. The seasonally high water table also interferes with many non-agricultural uses.

Dull – Mainly gray colors usually with many yellow, rust-brown and orange streaks and spots. These dull colors indicate that the soil developed under poorly drained conditions with the water table at or near the surface of the ground during part of the year. Under natural conditions, soils with dull subsoils support hydrophytic vegetation and are approximately equivalent to wetlands. Artificial drainage is necessary for field crops. The high water table near the soil surface limits the usefulness of these soils for most non-agricultural uses.



Figure 5. Subsoil color: the soil on the left has a bright subsoil, the soil in the middle has a mottled subsoil, and the soil on the right has a dull subsoil.

SLOPE

The slope (lay of the land) is important in determining the best land use. The steepness and length of the slope influences the speed with which water runs off a field and the amount of soil carried away in the run-off water. The steepness of the slope also affects the ease of cultivation, use of farm machinery, and suitability of the site for septic tank disposal fields, home sites, playgrounds, paths, trails, golf courses, streets and roads.

Steepness, length and type of slope must be evaluated to determine the best land use and conservation practices for an area. Steepness and length are most important from a water erosion standpoint. Use of some large farm machinery is more difficult and expensive on slopes which are over 12 percent. Septic system drainage fields are more difficult to construct and maintain on slopes that are greater than 12 percent. Construction of homes, playgrounds, and roads are more expensive on slopes which are greater than 12 percent. Paths, trails and golf courses are more desirable on slopes greater than 6 percent but are more expensive to construct and maintain on slopes greater than 12 percent.

On the land judging scorecard, only steepness and type of slope are determined. Length of slope, however, is important in selecting the best land use and soil conservation practices for an area. Contour tillage and strip cropping may be used on long uniform slopes with up to 18 percent steepness. Contour tillage, strip cropping and terraces are very difficult to use on short, irregular slopes typical of Michigan's glacially deposited landscapes.

Steepness of slope is expressed in percent, which represents the number of feet of rise or fall in a 100-foot distance. With the same crops or vegetation, velocity of run-off water increases with steepness and length of slope.

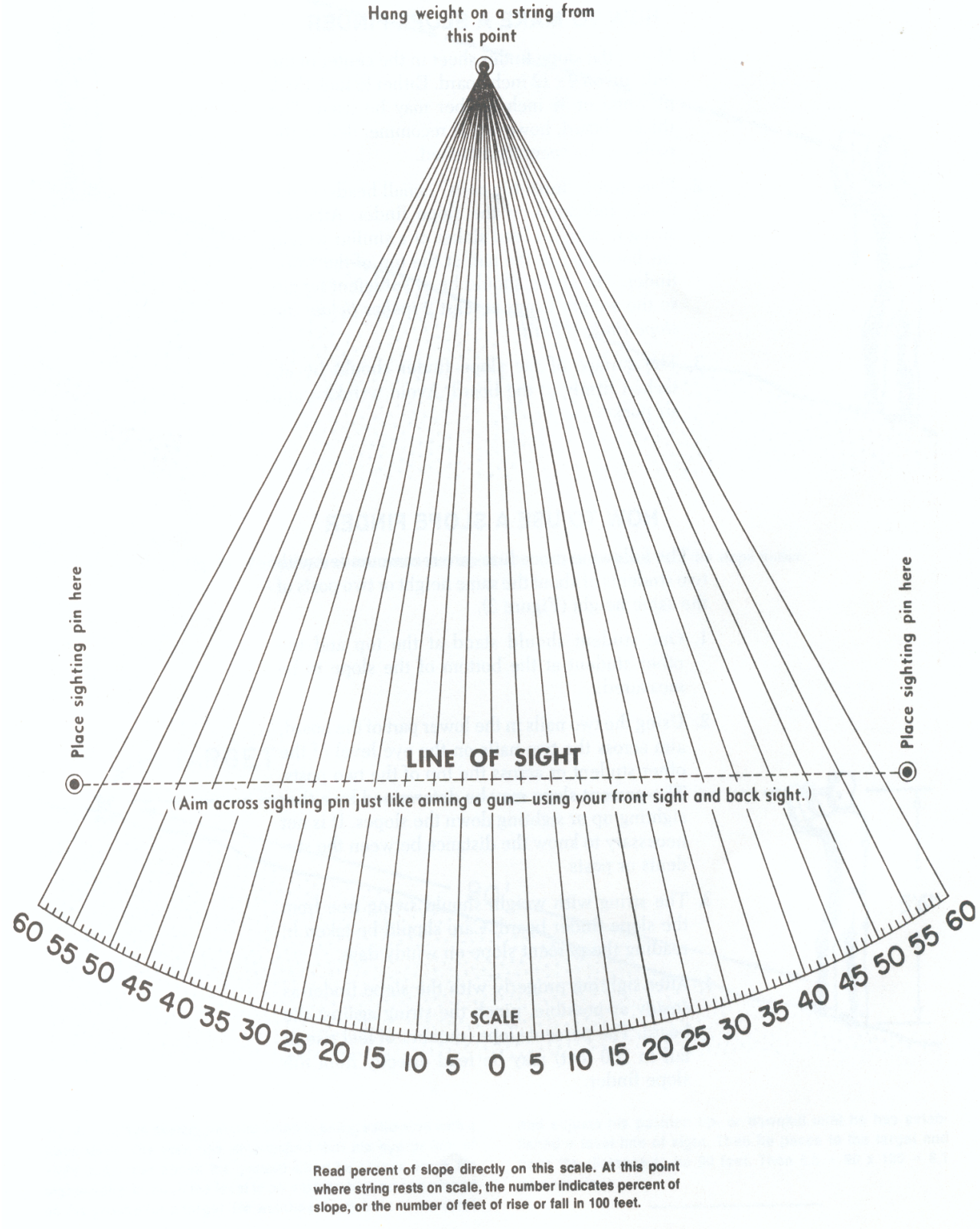
SIX DIFFERENT SLOPE CLASSES ARE USED IN MICHIGAN FFA LAND JUDGING

Slope Class	**Percent Slope**	**Steepness**
Nearly level	(0-2)	less than 2 ft. fall in 100 ft.
Gently sloping	(2-6)	2 to 6 ft. fall in 100 ft.
Moderately sloping	(6-12)	6 to 12 ft. fall in 100 ft.
Strongly sloping	(12-18)	12 to 18 ft. fall in 100 ft.
Steep	(18-25)	18 to 25 ft. fall in 100 ft.
Very steep	(Over 25)	more than 25 ft. fall in 100 ft.

Steepness of slope is determined by using a slope finder (next page), clinometer or Abney level (Figure 6). A clinometer, Abney level or slope finder should be used to determine the percent of slope. **Steepness of a slope is easy to misjudge**. In most contests, a specific slope is designated as being representative of the land area. Occasionally, the average of all of slopes of the land area will be used to determine steepness. Clinometers are used by soil scientists making detailed soil surveys.

All slope measuring tools should be checked for accuracy. The best way to do this is by measuring the slope in both directions, looking uphill for one measurement and downhill for the second. (See Figure 6) If those two measurements are different, add the two measurements together and divide by 2. That will give you the actual slope. For example: if an uphill measurement gives you 5%, but the downhill measurement gives you 11%, 11% plus 5% equals 16. Divided by 2 equals 8%. If the two measurements are the same, your tool is accurate. If the tool isn't perfect, use this uphill plus downhill measurements averaging method.

SLOPE FINDER



Read percent of slope directly on this scale. At this point where string rests on scale, the number indicates percent of slope, or the number of feet of rise or fall in 100 feet.

HOW TO MAKE A SLOPE FINDER

1. Mount the slope finder sheet on a 9 x 12 inch board. Either ½ inch thick plywood or ¾ inch lumber may be used. The thicker board, however, is recommended so the nails can be securely attached.
2. The surface of the slope finder should be attached firmly to the board. Avoid wrinkles and air pockets
3. Place three "finishing nails" (small heads) at the points indicated on the slope finder. Attach a string to which a lead sinker or a similar weight has been tied to the nail at the top of the slope finder. The string must be of sufficient length so the weight hangs at least *2 inches below the slope finder board*.

HOW TO USE A SLOPE FINDER

The following procedures are recommended with two students of about the same height or two posts of the same height (Figure 6).

1. One student should stand at the top of the slope and the other student at the bottom of the slope to be measured.
2. Using the two nails in the lower part of the slope finder sight across the two nails to the eye level of the other student or across the top of the two posts. The percent slope may be determined by either sighting up or sighting down the slope. It is not necessary to know the distance between the students or posts.
3. The string with the weight should swing free from the slope finder board. Care should be taken in reading percent slope on windy days.
4. After sighting properly with the slope finder as steady as possible, pinch the string against the board. The percent slope (number of feet rise or fall in 100 feet) may be read from the slope finder.

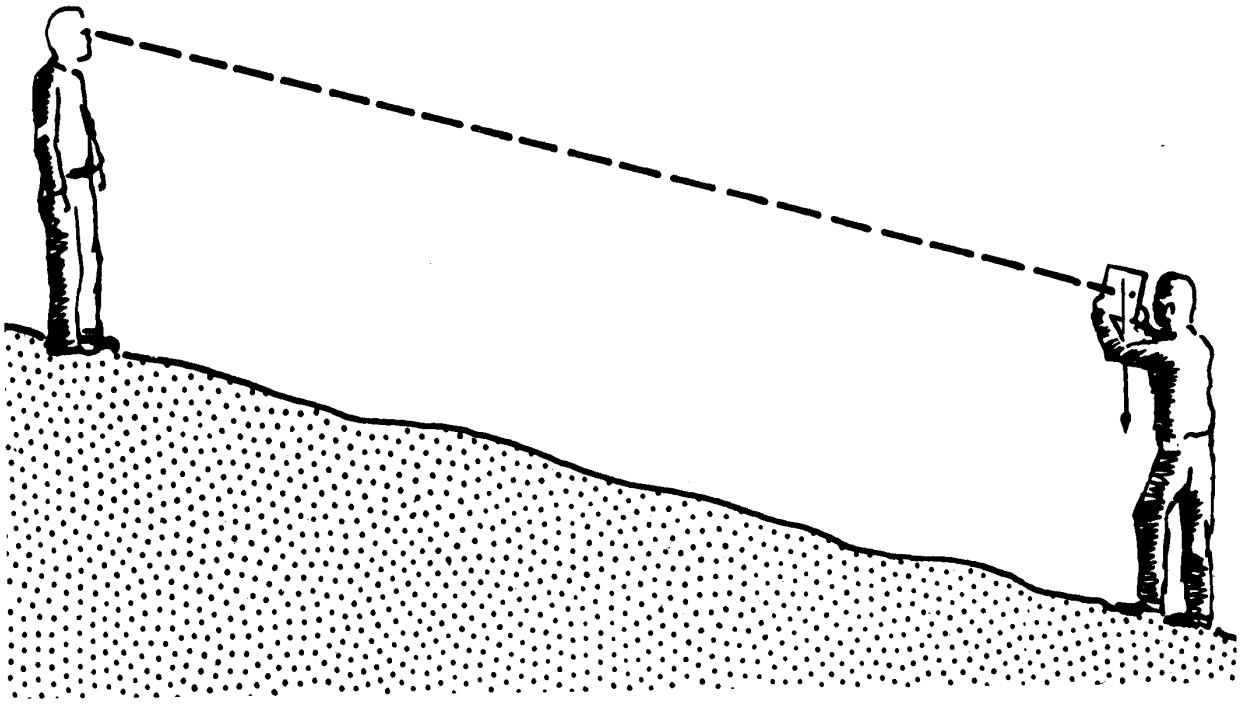


Figure 6. Two people or two posts may be used to determine slope with a slope finder.

TYPE OF SLOPE

Type of slope is extremely important in selecting crop rotations and soil conservation practices. On uniform slopes (Figure 7), strip cropping and other soil conservation practices are easy to use. On slopes that are irregular, establishment and use of practices like strip cropping and contour tillage are more difficult. With steeper, irregular slopes, land use should be selected which will keep land in permanent vegetation most of the time. Contestants/teams will select either a regular or irregular slope pattern for each land area.

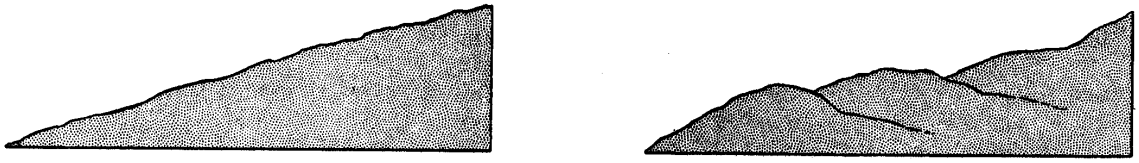


Figure 7. Slope types: Left is regular-smooth-uniform; Right is irregular-rough-wavy.

EROSION

The amount of soil which has been removed by erosion is important in determining the use and treatment for an area. Special care is required in selecting recommended conservation practices, especially in areas which are classified as having severe or very severe erosion.

Erosion by wind and water is a gradual process. In earlier erosion stages, a considerable amount of material can be removed without the loss being detected. This is known as sheet erosion. Small rills are relatively easy to observe when they start to form. When fields are cultivated, however, the rills are filled and erased. Erosion is frequently not recognized until the more productive surface soil is gone or critical gully or blow-out stages are reached.

With a protective grass or tree cover, serious water erosion does not necessarily occur on sloping areas.

Severe and very severe wind erosion can occur on both level and steep areas.

Erosion may be rather difficult to recognize and classify in many places. In Michigan, where forest vegetation once existed, the thin original dark colored surface layer and the lighter colored subsurface layer have been mixed together in plowing. The amount of subsoil material in the present surface layer is important in determining the erosion class. Careful attention should be given to the presence of either gullies or blow-outs in the land area which is being judged.

The four erosion classes used on the scorecard are:

Slight – The surface layer consists of all, or nearly all, the original surface soil.

Moderate – The surface layer consists of a mixture of original surface soil and subsoil.

Severe – The surface layer consists of mainly subsoil. Gullies or shallow wind blow-outs may be present.

Very severe – The surface soil has been entirely removed. The land is severely gullied or has deep wind blow-outs.

PART TWO: PROBLEMS WHICH AFFECT THE USE AND MANAGEMENT OF THE AREA.

You must know your land to manage it for sustained food production or for any other land use. You should have some knowledge of the chemical and physical properties of soils. Know the percent slope, degree of erosion and other characteristics visible at the surface. Study each land area to determine the most important problems which affect its use and management. **The total number of problems occurring at each contest site will be posted.**

In land judging, it is important to determine these problems. The important soil properties have been selected in Part One of the scorecard. For example, a combination of (1) medium textured surface and subsoil layers; (2) medium or dark colored surface layer; (3) bright or mottled subsoil; (4) nearly level land; and (5) slight erosion indicates a land area with excellent general farming possibilities with only a few hazards for sustained intensive land use.

In Part Two, contestant/teams select the most important problems which affect use and management of each land area from the following list:

1. Soil structure
2. Droughty
3. Stony
4. Drainage
5. Wet spots
6. Seasonal flooding
7. Slope
8. Wind erosion
9. Water erosion
10. Organic matter
11. Permeability

Recognition of major problems is important in determining the Land Capability Classification in Part Three, the recommended management and conservation practices for sustained production in Part Four, and the suitability for non-agricultural uses in Part Five.

1. **Soil structure** is often a problem in fine, moderately fine, medium and moderately coarse textured soils (such as loamy sand, sandy loam, loam, silt loam, sandy clay loam, silty clay loam, clay loam, sandy clay or clay) with surface layers that have medium or light colors. In addition soil structure is often a problem in soils with dull subsoils. Light and medium colored soils are low in organic matter, which holds particles together in aggregates. Cover and green manure crops, conservation tillage and returning crop residues help to maintain soil structure. Using conservation tillage and tilling at the proper soil moisture content help to maintain soil structure. Subsurface drainage may help improve or maintain soil structure in soils with mottled or dull subsoils.

2. Soils with moderately coarse or coarse textured subsoil (such as sandy loam, loamy sand or sand) have a **droughty** problem.

3. Soils with sufficient stones to impede use of most farm equipment or to interfere with construction or site development are considered to have a **stony** problem.

4. Soils with poor **drainage** are “cold,” lack oxygen, have poor micro-organism growth and are slow in releasing plant nutrients. The pores in these soils are filled with water, which warms more slowly than soil material and prevents oxygen from entering the soil. These soils have mottled or dull subsoils. Artificial drainage is required for sustained agricultural production. Poor drainage interferes with the operation of septic tank disposal fields, causes wet basements and hinders the use of these soils for playgrounds, paths, trails, golf courses, streets and roads.

5. Low **wet spots,** also known as Vernal pools, are seasonal depressional wetlands that are unproductive and hazardous for good general crop growth and many non-agricultural uses (Figure 8). Wet spots are small areas of soils with mottled or dull subsoils in a large area of soils with bright subsoils. They are in depressional areas and usually have water standing in them in the spring. It is usually not practical or economical to drain these spots, and they may be beneficial to wildlife and even to adjacent crops.



Figure 8. The wet spot in this figure is unproductive for crop growth, but beneficial to many kinds of wildlife.

6. Flood plains that are subject to **seasonal flooding** do not consistently produce satisfactory crop yields. Seasonal flooding is hazardous for septic tank disposal fields, residential development, streets and roads. Flood plains provide temporary storage for seasonal high runoff water events.

7. Land with **slopes** greater than 12 percent is too steep for most large farm equipment, residential development, septic tank disposal fields and playgrounds.

8. Soils with coarse or moderately coarse textured surface soil (such as sand, loamy fine sand, loamy sand , fine sandy loam or sandy loam) generally have a serious **wind erosion** problem. Organic soils that are drained and cropped are also subject to severe wind erosion. (Figure 9).



Figure 9. Wind erosion on a soil with a loamy sand surface layer.

9. Fine, moderately fine, medium and moderately-coarse textured soils which have more than 2 percent slopes are considered to have **water erosion** problems (Figure 10) when used for cultivated crops, when closely pastured or when disturbed during construction activities.



Figure 10. Rill water erosion on a soil with a 4 to 6 percent slope.

10. Soils with medium and light colored surface layers usually have a low **organic matter** problem.

11. Soils with fine and moderately fine textured subsoils (such as sandy clay, sandy clay loam, silty clay, silty clay loam, clay loam, or clay) usually have slow **permeability**, which increases susceptibility to erosion and severely limits the operation of septic system drainage fields.

PART THREE: LAND CAPABILITY CLASSIFICATION

Land Capability Classification is a widely used system to classify soils for agricultural purposes. Land Capability Classification shows, in a general way, the suitability of soils for most kinds of field crops (USDA Soil Conservation Service, 1961). The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used to classify Land Capability are land slope, soil texture, depth of soil material and drainage.

Land Capability Classification groups soils in eight capability classes, Class I through VIII. *See Figure 11*. The higher the number, the greater the risk of soil damage or limitations for use. With good soil conservation management soils in Classes I, II, III and IV are suitable for cultivation. Soils in Classes VI and VII, with good conservation management, are suitable for pasture, woodland and wildlife. Soils in Class VIII are generally non-productive for agricultural purposes and are recommended for wildlife habitat. Soils in Class V have little or no erosion hazard, but have other limitations impractical to remove that limit their use largely to pasture, range, woodland or wildlife.

In the **Land Capability Classification** System soils are generally grouped in three levels: Capability Class, Subclass and Unit. Only Capability Class is used in the Michigan FFA Land Conservation Contest. Land judging contestants will not have to differentiate between Class I and Class II if either of those Classes are appropriate for the site. Full credit will be given if the contestant designates that land area as either Class I or Class II.

LAND CAPABILITY CLASSES
(The following are broad definitions)

LAND SUITED FOR CULTIVATION AND OTHER USES SUCH AS GRASSLAND, FORESTRY, WILDLIFE AND RECREATION

Class I – These soils have few limitations that restrict their use. May be safely used for intensive production, such as continuous row crops, pasture, woodland or wildlife habitat. These soils are nearly level and the erosion hazard is slight. They are deep, generally well-drained, and easily worked. They hold water well and are naturally fertile or responsive to additions of fertilizer. They are not subject to damaging overflow.	

Class II – These soils have some limitations that reduce the choice of plants, or require special conservation practices or both. Requires general soil conservation systems which may require special tillage methods. Soils in this class have slight limitations and conservation practices are easy to apply. These soils may be used for crops, pasture, woodland or wildlife habitat. The soils have one or more limitations: slight hazard of wind or water erosion; occasional damaging overflow; moderate soil depth; wetness; or gentle slopes.



Class III – These soils have severe limitations that reduce the choice of plants, or require special conservation practices, or both. Requires specific practices and conservation measures. Soils in this class have moderate limitations and conservation practices are usually more difficult to apply and maintain. These soils may be used for cultivated crops, pasture, range, woodland or wildlife habitat. The soils have one or more limitations: high susceptibility to wind or water erosion; very slow permeability of the subsoil wetness; shallow rooting depth; low moisture holding capacity and moderately steep slopes.



Class IV – These soils have very severe limitations that restrict the choice of plants, or require careful management, or both. Requires intensive soil conservation systems and practices. Soils in this class have severe limitations and conservation practices are more difficult to apply and maintain. These soils may be used for cultivated crops, pasture, woodland or wildlife habitat. The soils have one or more of the limitations: severe hazard of wind or water erosion; wetness; shallow rooting depth; very low moisture holding capacity; or steep slopes.



LAND SUITED FOR GRASSLAND, FORESTRY, WILDLIFE, AND RECREATION NOT SUITED FOR CULTIVATION

Class V – These soils have little or no erosion hazards (nearly level slopes), but they have very poor drainage and other limitations, impractical to remove, which limits their use largely to grassland, rangeland, wildlife habitat, or wetlands area. They include floodplains and natural wetlands that should be preserved and protected.



Class VI – These soils have severe limitations that make them generally unsuited for cultivation and limit their use largely to grassland, woodland, or wildlife habitat. They may be cultivated sufficiently to establish permanent cover. Recommend permanent pasture, woodland or wildlife habitat. Use conservation practices for all land uses. These soils have one or more limitations: severe wind or water erosion; are stony; have shallow rooting depth; excessive wetness; low moisture capacity or steep slopes.



Class VII – These soils have very severe limitations that restrict their use mostly to grassland, woodland, or wildlife habitat. Use is restricted to pasture grasses, wildlife, recreation, woodland watershed, and aesthetics. Needs careful conservation. Soils in this class have severe limitations that restrict their use to pasture, woodland or wildlife habitat. The soils are stony or sandy on moderate slopes, or any soil on very steep slopes (>30%). With proper management these soils can be used for limited pasture, woodland and wildlife production but it is seldom practical to apply pasture improvements such as seeding and fertilizing.



Class VIII – These soils and land forms have limitations that preclude their use for commercial plant production and restrict their use to wildlife, recreation, water supply, or aesthetic purposes. Limitations that cannot be overcome consist of one or more of the following: erosion or erosion hazard; stones; or very low moisture capacity.	

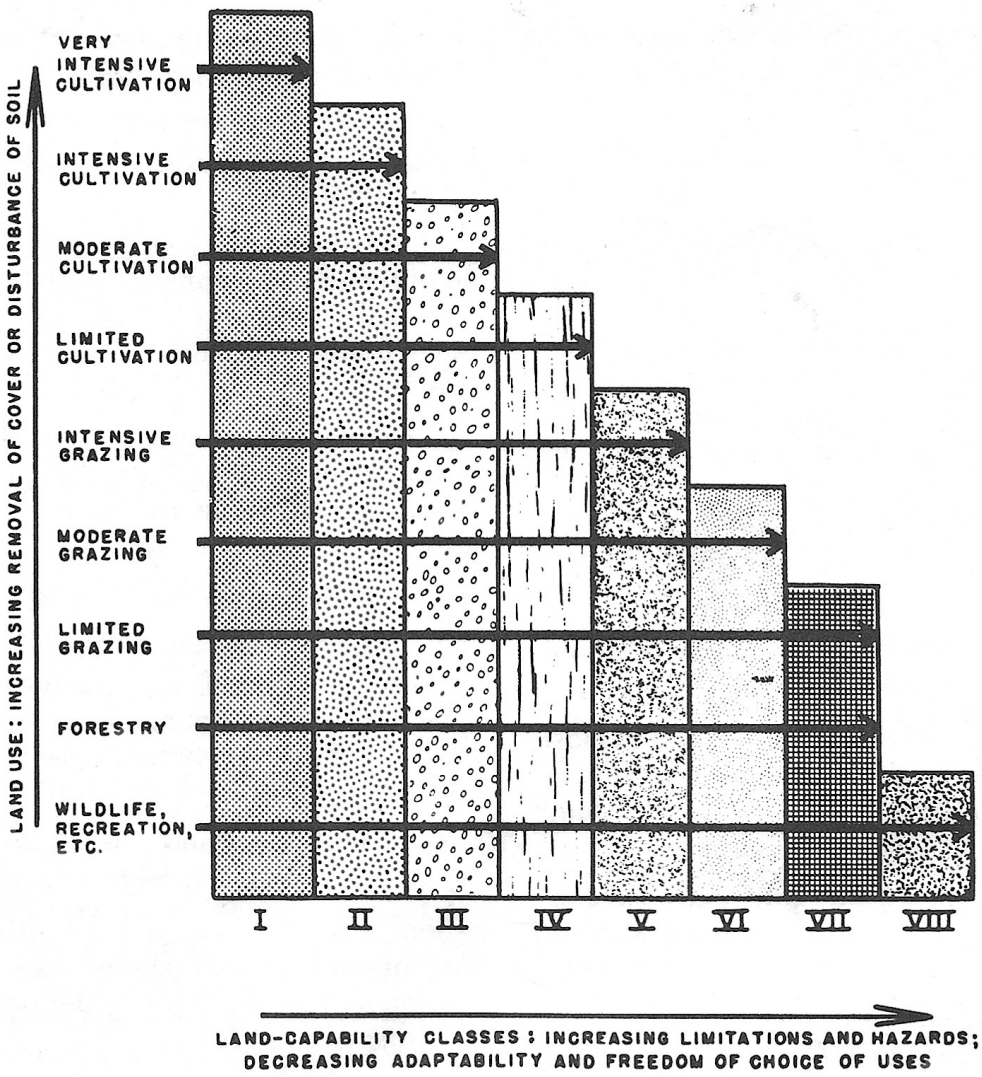


Figure 11 - Types of land use possible with different Land Capability Classes

FIND THE LAND CAPABILITY CLASSIFICATION ON YOUR LAND

If you would like to find the Land Capability Classifications of the soils on land you live on, go to https://websoilsurvey.nrcs.usda.gov/app/ and cliick on the Start WSS button. Then follow instructions to close in on that piece of land in the aerial map. Once there use the "Area of Interest" tab to find the land area you want. Once you have the Area of Interest defined, select the "Soil Data Explorer" tab, and then the "Suitabilities and Limitations for Use" tab. It may take a little time to find your way around Web Soil Survey.

PART FOUR: RECOMMENDED MANAGEMENT AND CONSERVATION PRACTICES FOR AGRICULTURAL USES.

This part of the land judging scorecard lists management and conservation practices that may be required with the Land Capability Class selected in Part Three.

The total number of recommended management and conservation practices needed for the Land Capability Class selected in Part Three will be posted at each judging site.

First is a list of the eight **MANAGEMENT PRACTICES** to be considered for the Land Capability Class selected in Part Three.

MANAGEMENT PRACTICES

1. **APPLY BARNYARD MANURE** - If barnyard manure is available, it should be used on fields to provide organic matter and some plant nutrients. This practice builds up organic matter. Manure application should be based on soil test and manure analysis. Barnyard manure should **not** be applied to land areas that have very high phosphorus levels, 300 lbs. per acre or more, to reduce the risk of contaminating surface waters. Availability of manure will be posted at each judging site.



Figure 12 – Apply manure if available and needed for nutrients and organic matter

2. **APPLY LIMING MATERIALS.** Liming materials **should be** applied if soil test results are pH 6.5 or lower, or when growing legumes if soil test results are pH 6.8 or lower. Plant nutrients and micronutrients are affected by soil pH. Soil Test results will be posted at each judging site.

3. **APPLY PHOSPHORUS FERTILIZER.** Phosphorus is an essential macronutrient that promotes overall plant growth and productivity and encourages strong root development. Plant macronutrients are needed in relative large quantities compared to other nutrients. Although phosphorus fertilizer recommendations vary from crop to crop, phosphorus fertilizer should be added if soil test shows 79 lbs. or less phosphorus per acre. If the soil test shows 300 lbs. per acre or more phosphorus, phosphorus fertilizer and manure **should not** be applied because of potential pollution of surface waters. Soil Test results will be posted at each judging site.

4. **APPLY POTASSIUM FERTILIZER** - Potassium is an essential macronutrient that helps plants with stress resistance, water regulation and overall plant growth and productivity. Although potassium fertilizer recommendations vary from crop to crop, potassium fertilizer should be added if soil test shows 299 lbs. or less of potassium per acre. Soil Test results will be posted at each judging site.

5. **TOPDRESS ESTABLISHED LEGUMES WITH PHOSPHORUS -** When legume grass crops are used for more than one year, topdressing of phosphorus, based on soil test, is recommended every year. If the soil test shows 300 lbs. per acre or more phosphorus, phosphorus fertilizer **should not** be applied because of potential pollution of surface waters. Soil Test results will be posted at each judging site.



Figure. 13 – Topdress established legumes according to Soil Test recommendations

6. **TOPDRESS ESTABLISHED LEGUMES WITH POTASSIUM.** When legume grass crops are used for more than one year, topdressing of potassium, based on soil test, is recommended every year. Soil Test results will be posted at each judging site.

7. **TOPDRESS PERMANENT GRASS VEGETATION WITH COMMERCIAL NITROGEN.** Commercial nitrogen should be applied annually to forage crops which are mainly grass.

8. **DEVELOP AND IMPLEMENT A NUTRIENT MANAGEMENT PLAN.** A nutrient management plan should be developed for all cropland and pasture land in Land Capability Classes I through IV. A nutrient Management Plan should include all sources of plant nutrients in the agricultural operation.



Figure 14 – A Nutrient Management Plan must include Soil Tests and Manure Analysis

CONSERVATION PRACTICES – Starting on the next page is a listing of 17 Conservation Practices to be considered for the Land Capability Class selected in Part Three.

CONSERVATION PRACTICES

1. **CONSERVATION CROP ROTATION:** A planned sequence of crops grown in the same location over a period of time. (Figure 15) For example: erosion prone crops (row crops) alternated with erosion resistant crops (small grains or hay) as needed for the Land Capability Class selected in Part Three.

   PURPOSE:

   This practice is applied to support one or more of the following purposes:
   - Reduce sheet, rill, and wind erosion.
   - Maintain or increase soil organic matter quantity.
   - Improve soil organic matter quality.
   - Improve soil aggregate stability.
   - Improve soil moisture management.



Figure 15. Alternating row crops like corn and soybeans with close sown crops like small grains and legume/grass crops can reduce sheet and rill erosion and wind erosion.

2. RESIDUE AND TILLAGE MANAGEMENT (REDUCED TILL AND NOTILL):
Managing the amount, orientation, and distribution of crop and other plant residue on the soil surface year-round while limiting soil-disturbing activities used to grow and harvest crops. (Figure 16)

PURPOSE:

- Reduce sheet, rill, and wind erosion and excessive sediment in surface waters.
- Reduce tillage-induced particulate emissions (air quality impact).
- Improve soil health and maintain or increase organic matter content.
- Reduce energy use.



Figure 16. Planting soybeans in wheat stubble leaves the maximum amount of residue on the soil surface.

3. **COVER CROPS:** Grasses, legumes, and other forbs planted for seasonal vegetative cover. Cover Crops are grown primarily to prevent or reduce soil erosion, to sequester plant nutrients and to build up organic matter with field crops, (Figure 17) or between vines and trees in vineyards or orchards. Rye, buckwheat, rye grass and sweet clover are examples of cover crops. Cover Crops are typically terminated chemically, not harvested, or tilled into the soil just prior to planting the next crop.

   PURPOSE:
   This practice is applied to support one or more of the following purposes:
   - Reduce sheet, rill, and wind erosion.
   - Maintain or increase soil organic matter.
   - Improve soil aggregate stability.
   - Improve habitat for soil organisms.
   - Reduce water quality degradation by utilizing excess soil nutrients.
   - Reduce weed and plant pest pressure.
   - Improve moisture management.
   - Reduce soil compaction.
   - Supply nitrogen to the subsequent crop.
   - Improve habitat for pollinators, beneficial organisms, or natural enemies of crop pests.



Figure 17. Rye cover crop to build up organic matter in the soil.

4. **GRASSED WATERWAYS:** Natural or man-made water courses or drainage ways protected against erosion by a grass cover (Figure 18). They are a shaped or graded channel that is established with suitable vegetation to convey surface water at a nonerosive velocity to a stable outlet. They serve as safe outlets for diversions and contour rows. They also serve to protect natural storm water drainage ways from gully erosion.

   PURPOSE:

   This practice is used to accomplish one or more of the following purposes:

   - Convey runoff from diversions and other water concentrations without causing erosion or flooding.
   - Prevent gully formation.
   - Protect/improve water quality.



Figure 18. Grass cover protects the soil in this natural drainage way.

5. **CONTOUR FARMING:** Plow, plant and cultivate on the contour or at right angles to the natural direction of the slope (Figure 19) to reduce soil erosion by water. The whole field may be planted to one crop, or may be planted in alternating strips. (See Practice 5, Strip Cropping.)

   DEFINITION:

   Aligning ridges, furrows, and roughness formed by tillage, planting and other operations at a grade near the contour to alter the velocity or the direction of water flow.

   PURPOSE:

   - Reduce sheet and rill erosion.
   - Reduce sediment transport to surface waters.
   - Reduce excess nutrients in surface waters.
   - Reduce pesticide transport to surface waters.
   - Improve the efficiency of moisture management.



Figure 19. Contour Farming to reduce soil erosion by water.

6. **STRIP CROPPING:** A systematic arrangement of alternating strips of crops susceptible to erosion and erosion resistant crops to reduce wind and water erosion (Figure 20). The strips are laid out either across the slopes or at right angles to the prevailing winds. With *contour strip cropping* for water erosion control, the strips are laid out so that that crop rows are on the contour or as near so as practical. With *field strip cropping* for water erosion control, the strips are of uniform width laid out across the slopes. For wind erosion control the strips are laid out as nearly perpendicular to the predominant wind direction as practical.

   PURPOSE:

   This practice supports one or more of the following purposes:

   - Reduce water erosion.
   - Reduce wind erosion.
   - Reduce the transport of sediment and other water and wind borne contaminants.
   - Protect growing crops from damage by wind-borne soil particles.



Figure 20. Crop strips to reduce soil erosion by wind or water.

7. **DIVERSION: A** channel with an earth ridge constructed on a slight grade across a slope to intercept runoff water from uphill areas to protect areas located downhill, and to reduce erosion. (Figure 21). The diversion will carry water slowly to a grass waterway or other safe outlet.

   PURPOSE:

   This practice is used to accomplish one or more of the following purposes:

   - Intercept surface and shallow subsurface flow to reduce runoff and erosion.•
   - Divert water away from sensitive areas, conservation practices, agricultural waste systems, infrastructure, and other improvements.
   - Collect or direct water for storage, water spreading, water-harvesting systems, or treatment.

   Diversions may be located at the edge of the field, at property lines or even within fields. They must be located close to the contour of the land in order to limit land shaping costs. Their primary purpose is to intercept excess runoff water to protect down slope land areas.



Figure 21. Diversion channel located at the edge of a field.

NOTE: If two or more Diversions are located on the contour at uniform spacing within a field, it's called a Terrace within a Terrace System. (Figure 22). Terraces or Terrace Systems are not common in Michigan because the landscapes deposited by glaciers are not uniform enough to support Terracing. Terraces or Terrace Systems will not be included as a practice in the Land Conservation Contest Scorecard.



Figure 22. Terraces across the uniform field slope reduce water erosion. These Terraces outlet into a Grassed Waterway on the right side of this picture.

8. **WINDBREAK-SHELTERBELT ESTABLISHMENT AND RENOVATION:**
Establish, enhance, or renovate windbreaks, also known as shelterbelts, which are single or multiple rows of trees and/or shrubs in linear or curvilinear configurations to control soil erosion by wind. (Figure 23) Windbreaks should be planted as near as possible in strips at right angles to the prevailing winds.

PURPOSE:

Use this practice to accomplish one or more of the following purposes:

- Reduce soil erosion from wind.
- Enhance plant health and productivity by protecting plants from wind related damage.
- Manage snow distribution to improve moisture utilization by plants.
- Improve moisture management by reducing transpiration and evaporation losses and improving irrigation efficiency.
- Improve air quality by intercepting airborne particulate matter, chemicals, and odors, and/or by reducing airflow across contaminant or dust sources.



Figure 23. Trees planted at right angles to the prevailing winds to reduce wind erosion.

9. **HERBACEOUS WIND BARRIERS:** Rows or narrow strips of herbaceous vegetation planted at right angles to prevailing winds to reduce the removal of soil from fields by wind erosion. Tall wheat grass and annual rye grass are common examples of grasses used for vegetative barriers (Figure 24).

PURPOSE:

This practice is used to accomplish one or more of the following purposes

- Reduce soil erosion from wind.
- Reduce soil particulate emissions to the air.
- Protect growing crops from damage by wind or wind-borne soil particles.
- Enhance snow deposition to increase plant-available moisture.



Figure 24. Grass strips planted at right angles to the prevailing winds to reduce wind erosion.

10. **MAINTAIN AND/OR UPDATE ARTIFICIAL DRAINAGE:** Different kinds of drainage that may be needed are: (1) open ditches to carry off surplus surface water; (2) tile or tubing for subsurface drainage to remove excess soil water (Figure 25); and (3) outlets for subsurface drainage into open ditches or streams (Figure 26).

PURPOSE:

Use this practice to accomplish one or more of the following purposes:

- Remove or distribute soil water.
- Remove salts and other contaminants from the soil profile.
- Mitigate degraded plant health and vigor and undesirable plant productivity due to saturated soil, ponding, and flooding.
- Mitigate degraded animal health productivity due to saturated soil, ponding, and flooding.



Figure 25. Installation of plastic tubing to remove excess soil water.



Figure 26. Outlet for subsurface drainage into an open ditch.

11. **PASTURE AND HAY PLANTING**: Establish and/or maintain a legume-grass mixture for continuous forage crops, reseeding only when necessary. This practice is recommended for areas which are used continuously for hay or pasture because the land area has a very serious erosion problem. When necessary to re-establish vegetation, the area is prepared using conservation tillage methods and reseeded, generally with a nurse crop.

    PURPOSE:
    This practice is used to accomplish one or more of the following purposes:
    - Improve or maintain livestock nutrition and health.
    - Provide or increase forage supply during periods of low forage production.
    - Reduce soil erosion.
    - Improve water quality.
    - Improve soil health.

12. **GRAZING MANAGEMENT: .** Pastures should be managed to prevent erosion (Figure 27). Management practices include using a rotation system of grazing, not grazing too early in the spring, clipping weeds, not over-grazing and establishing watering facilities.

PURPOSE:

Apply this practice as a part of a conservation management system to achieve one or more of the following:

- Improve or maintain desired species composition, structure and/or vigor of plant communities.
- Improve or maintain quantity and/or quality of forage for grazing and browsing animal's health and productivity.
- Improve or maintain surface and/or subsurface water quality and/or quantity
- Reduce soil erosion and maintain or improve soil health.
- Improve or maintain the quantity, quality, or connectivity of food and/or cover available for wildlife.



Figure 27. Over grazing may kill grass and cause soil erosion.

13. **BRUSH MANAGEMENT:** Brush and shrubs should be removed from forage crops.

PURPOSE:
This practice is used to accomplish one or more of the following purposes–

- Restore or release desired vegetative cover to protect soils, control erosion, reduce sediment, improve water quality, or enhance hydrology.
- Improve forage accessibility, quality, and quantity for livestock and wildlife.

14. **CONSERVATION COVER:** Shrubs or trees should be planted that will furnish food and cover for birds and small animals (Figure 28). These plantings may be either in corners of fields or along field borders. These special plantings should be recommended where continuous forage crops or woodlands are the most intensive use.

PURPOSE:
This practice may be applied to accomplish one or more of the following purposes:

- Reduce sheet, rill, and wind erosion and sedimentation.
- Reduce ground and surface water quality degradation by nutrients and surface water quality degradation by sediment.
- Enhance wildlife, pollinator and beneficial organism habitat.
- Improve soil health.



Figure 28. Special plantings, like this Field Border between different land uses, furnish food and cover for birds and small animals.

15. **TREE/SHRUB ESTABLISHMENT:** Tree species should be planted that are adapted to the site. This should be recommended where woodland is the **existing** use, or the best use based on the Land Capability Class.

    PURPOSE:
    This practice is used to accomplish one or more of the following purposes:
    - Maintain or improve desirable plant diversity, productivity, and health by establishing woody plants.
    - Improve water quality by reducing excess nutrients and other pollutants in runoff and ground water.
    - Restore or maintain native plant communities.
    - Control erosion.
    - Create or improve habitat for target wildlife species, beneficial organisms, or pollinator species compatible with ecological characteristics of the site.
    - Sequester and store carbon.
    - Provide livestock shelter.

16. **FOREST STAND IMPROVEMENT:** Merchantable trees should be harvested and cull trees removed from existing woods. Prune desirable trees. Undesirable species and deformed trees should be cut. Some cull, undesirable species or deformed trees, such as den trees, may be left for wildlife benefits. Existing woodlands and new plantings of either trees or shrubs should be protected from grazing and burning.

    PURPOSE:
    This practice is used to accomplish one or more of the following purposes:
    - Maintain or improve forest health and productivity.
    - Maintain or improve forest structure and composition.
    - Maintain or improve wildlife, fish, and pollinator habitat.
    - Reduce forest pest pressure.

PART FIVE: SUITABILITY FOR NON-AGRICULTURAL USES

This part of the land judging scorecard lists the suitability of the land area for uses other than agriculture. The number of other land uses for which the area is especially satisfactory will be posted at each test site.

When evaluating for non-agricultural uses, you must consider many of the same soil properties as are used in judging soils for agricultural uses. When determining the suitability of a soil for these uses, consider texture of the different layers, natural drainage as indicated by the color of the subsoil and whether the soil is subject to droughty, stony, seasonal-flooding and permeability problems.

The characteristics of the soils which affect these uses follow:

(1) Soils most suitable for conventional septic system drainage fields are nearly level to moderately sloping, with moderately coarse to medium textured and bright subsoils. They should not have permeability (Figure 29) or seasonal flooding problems (Figure 30). A conventional septic tank disposal field consists of a septic tank and a disposal field with distribution lines on the contour.



Figure 29. Septic system drainage fields will fail and basements may be wet on soils with mottled or gray subsoil and slow permeability.



Figure 30. Residential development will fail on soils with seasonal flooding problems.

(2) Soils most suitable for residential development **without** sanitary or storm sewers are nearly level to moderately sloping. They should also have moderately coarse or medium textured and bright subsoils. They should not have seasonal-flooding problems (Figure 30).

(3) Soils most suitable for residential development **with** sanitary and storm sewers are nearly level to moderately sloping. They also have coarse to fine textured and bright subsoils. They should not have seasonal-flooding problems (Figure 30).

(4) Soils most suitable for local streets and roads are nearly level to moderately sloping with coarse or moderately coarse textured and bright subsoils. They should not have seasonal-flooding problems (Figure 30).

(5) Soils most suitable for playgrounds have regular slopes which are nearly level or gently sloping with moderately coarse textured surface layers and medium or moderately coarse textured, bright subsoils. They should not have stony problems.

(6) Soils most suitable for paths and trails or golf courses are nearly level to strongly sloping, having moderately coarse to fine textures, bright or mottled subsoils. They may have scattered stony or drainage problems.

(7) Soils most suitable for woodland wildlife areas are nearly level to strongly sloping and have coarse to fine textured surface layer with bright or mottled subsoils. The areas should currently be in woodland or woodland is the most intensive safe use.

(8) Soils most suitable for open land wildlife areas are nearly level to strongly sloping with medium or moderately coarse textured surface layers and bright, mottled or dull subsoils. They may have seasonal-flooding problems. The areas are used for cropland, pasture, meadow and former cropland that is overgrown with grasses, herbs, shrubs and vines.

(9) Soils most suitable for wetland wildlife areas have regular, nearly level slopes with organic, fine, medium or moderately coarse surface layer textures and dull subsoils. They should have areas of standing water or should be suitable for excavated ponds. They may be subject to seasonal flooding. They should have no droughty problems. These are not wet spots in soils with bright or mottled subsoils.

(10) Soils most suitable for excavated ponds are nearly level with dull subsoils.

This publication is based on Extension Bulletin E326, Seventh Revision published January, 1982, by D.L. Mokma, Dept. of Crop and Soil Science, MSU; E. Dersch, Department of Resource Development, MSU and D.J. Schaner, Michigan Department of Agriculture.

Scorecard revised 2004

Revised – December 2008 by D.L Mokma, E. Dersch and D. F. Kesselring

Revised (new photos added) – December 2010 by D. L. Mokma

Revised – September 2026 (Changed Part Three to Land Capability Classes; Edited Parts One and Two; Updated and Edited Part 4)
By Land Judging Guide Ad Hoc Committee
Michigan Chapter of the Soil and Water Conservation Society
Chair, Daniel F. Kesselring, USDA-NRCS Retired and Secretary, Michigan Chapter SWCS
Co-Chair, Stacey Smith, Area Resource Soil Scientist, USDA-NRCS
Members: Steve Schaub, Lapeer Conservation District
Heather Varboncouer, District Conservationist, USDA-NRCS
Aaron Saari, FFA Advisor, Maple Valley Schools
Martin Rosek, State Soil Scientist, USDA-NRCS
Victoria Yackle, FFA Advisor, Bad Axe High School
Erin Segar, Area Resource Soil Scientist, USDA-NRCS
Kevin Nugent, FFA Contest and Recognition Coordinator, MSU
Clark Brock, FFA Land Conservation Contest Coordinator
Gaylynn Kinter, Area Resource Soil Scientist, USDA-NRCS Retired
Zachary Curtis, President, Michigan Chapter SWCS

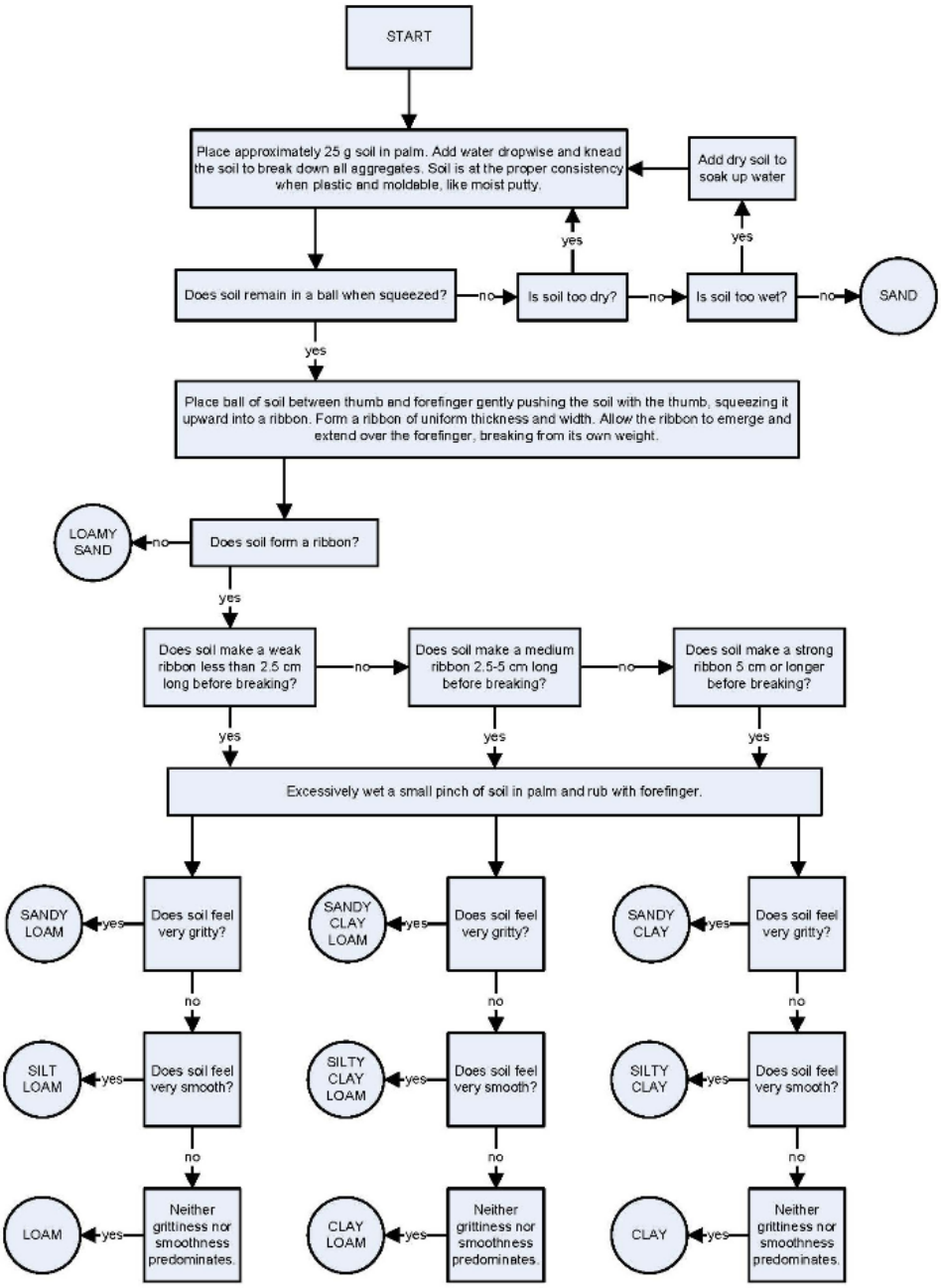
REFERENCES

Figure 1 - A Soil Profile, USDA Natural Resources Conservation Service, https://www.nrcs.usda.gov/resources/education-and-teaching-materials/a-soil-profile

Figure 4 – Soil Study and Land Evaluation Handbook, Wisconsin Association of Agricultural Educators

Soil Health - Soil Texture and Structure

Soil Texture "Feel" Method



This is a copy of the first page of the USDA-NRCS Texture and Structure Soil Health Guide. To get the entire 3 page Guide, use the following link.

https://www.nrcs.usda.gov/sites/default/files/2022-11/Texture%20and%20Structure%20-%20Soil%20Health%20Guide_0.pdf