A Guide for Land Judging in Michigan
Michigan State University Extension Service
D.L. Mokma, Crop and Soil Science; E. Dersch, Resource Development; D. J. Schaner, Soil and Water Conservation, Michigan Department of Agriculture
Revised January 1982
20 pages

60¢

EXTENSION BULLETIN E-326
Seventh Revision
Natural Resources Series
January 1982

A guide for

LAND JUDGING IN MICHIGAN

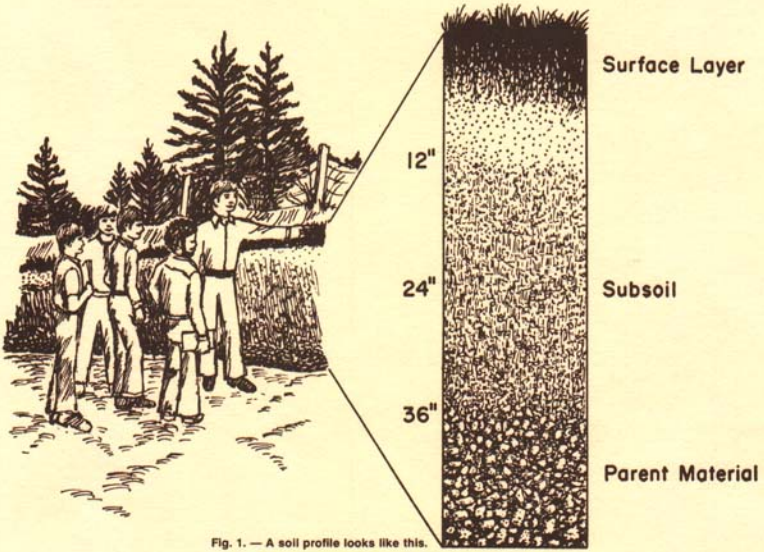


Fig. 1. — A soil profile looks like this.

CONTENTS

NOTE

The charts on pages 2 (texture); 3 (color); 7 (slope and type of slope); and 8 (erosion) are taken from the score card used in Michigan and land judging contests.

A guide for

LAND JUDGING IN MICHIGAN

By D. L. Mokma, E. Dersch and D. J. Schaner, Dept. of Crop and Soil Sciences, Dept. of Resource Devel., Michigan State University and Soil and Water Conserv. Div., Mich. Dept. of Agric.

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. Such land helps the farmer produce large quantities of high-quality food and fiber for a long period of time with low investment in capital and labor. High-quality land, when used properly, may also mean lower prices to the consumer.

The farmer often reduces the value of his land by over-cropping and by leaving fields exposed to erosion. He can avoid this by using land within its capability, protecting it from deterioration, and continually trying to improve its productivity for sustained use.

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

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

The use or management varies from one kind of soil to another, 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 long-time, safe intensive land use.
- 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. Weather factors, such as precipitation, length of growing season, sunshine, humidity and wind are also important.

Land judging involves appraising the important soil properties and interpreting them for crop production and non-agricultural uses. These decisions depend on many factors such as the texture of the soil profile, steepness of slopes, amount of erosion, natural drainage and stoniness.

SOIL PROFILE

We need to look both into the soil and at its surface to determine all of the soil's physical properties. The physical features of the soil included in Part One of the land judging score card will provide information about the soil's strong and weak physical and chemical points. We determine this by 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 has three main parts:

(1) *The surface layer* contains most of the organic matter and furnishes the most favorable conditions for soil organisms and chemical activity. In cropped areas it represents the plow layer.

(2) The *subsoil* usually has the most clay and is variable in thickness. It is important from the standpoint of nutrient and water-holding capacity, permeability, and bearing capacity.

(3) *Parent material* is the material from which the soil is formed. This layer is not judged in the present score card. A soil profile with three main horizons is shown in Figure 1.

PART ONE: PHYSICAL FEATURES OF SOIL

The "Michigan Land Judging Score Card" has been developed to guide people through the many considerations needed to determine the safest intensive land use for an area. Part One represents the inventory phase of the score card.

SOIL TEXTURE

Soil texture is very important in land judging. Texture, in combination with soil structure, affects moisture-holding capacity, 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 score card. Texture and structure of underlying parent material are also important, especially for trees, deep-rooted crops, septic tank disposal 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 determines soil texture (Figure 2).

1 SURFACE TEXTURE	2 SUBSOIL TEXTURE
FINE Clay, clay loam, silty clay loam, sandy clay loam	
MEDIUM Silt loam, loam	
MODERATELY COARSE Sandy loam, loamy sand	
COARSE Sand	
ORGANIC Mucks and peats	

Texture is determined by rubbing a small amount of moist soil between the thumb and forefinger. 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 harsh and gritty.

The texture groups used on the present score card follow:

Fine-textured soils include clay, clay loam, silty clay loam and sandy clay loam textural classes. They are made up mostly of clay and silt but sandy clay loam contains between 45 and 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. Clay has over 40 percent clay particles, 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.

Medium-textured soils include silt loam and loam textural classes. Silt loam has more than 50 percent silt particles. Loam consists of about equal parts of sand, silt and clay particles. 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 consist of mostly different sized sand particles with less than 20 percent of clay particles present. These soils are difficult to mold when moist.

Coarse-textured soils include coarse and medium sands with some gravel. They contain 85 percent 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 woody and fibrous materials.

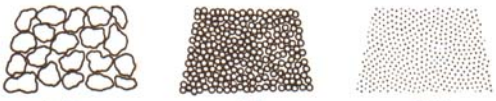


Fig. 2. — Soil horizons contain individual particles or grains. Usually soils have different combinations of the three sizes — sand, silt and clay. The combination of these is referred to as soil texture. A sand particle may be as much as 625 times larger than a clay particle.

SOIL COLOR

Color is one of the most noticeable characteristics of the soil. Color should be determined for moist soil since true color is harder to determine when soil is dry. The color of the surface and the subsoil layers are used in land judging.

The color of the surface layer is an indication of the amount of organic matter present. Subsoil colors are a reflection of the natural drainage condition under which the soil developed. Subsoil color is usually not affected by organic matter.

Color of Surface Layer

Dark-Very dark brown or black colors indicate a high organic matter content. The darkest colored surface layers have the highest organic matter content and were usually developed under naturally poorly drained conditions. The dark colors indicate a potential source of nitrogen, good tilth, and often good natural fertility.

3 COLOR OF SURFACE LAYER
☐ **DARK** High organic matter content, very dark brown or black
☐ **MEDIUM** Moderate organic matter content, dark gray or dark grayish brown
☐ **LIGHT** Low organic matter content, light gray, light grayish brown or pale brown

Medium-Dark gray or dark grayish brown colors indicate a moderate amount of organic matter present. Most well and somewhat poorly (formerly imperfectly) 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 Subsoil

Bright-Reds, yellows, and browns are the principal colors. These bright solid colors indicate a soil which was formed under naturally well-drained conditions. Artificial drainage is not recommended for field crops.

4 COLOR OF SUBSOIL
☐ **BRIGHT** Solid red, yellow or brown colors predominate. Indicates naturally well-drained conditions and artificial drainage usually not needed
☐ **MOTTLED** Mixed yellow and brown colors with some grays. Rust brown and orange spots are common. Indicates naturally somewhat poorly drained conditions and artificial drainage usually needed if cropped.
☐ **DULL** Grays predominate with some rust brown spots. Indicates naturally poorly drained conditions and artificial drainage most always needed if cropped

Mottled-Mixed yellow and brown colors with some grays and many rust-brown and orange streaks and spots. This color pattern indicates the soil was developed under somewhat poorly drained conditions. Artificial drainage is usually needed for field crops on these soils. The seasonally high water table 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 naturally poorly drained conditions with the water table at or near surface of the ground during part of the year. Artificial drainage is necessary for field crops. The high water table limits the usefulness of these soils for most non-agricultural uses.

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, suitability of the site for homesites, playgrounds, paths, trails, golf courses, streets and roads.

Steepness, length and type of slope must be evaluated to determine the best land use for an area. The steepness and length are the most important from the water erosion standpoint. The use of some

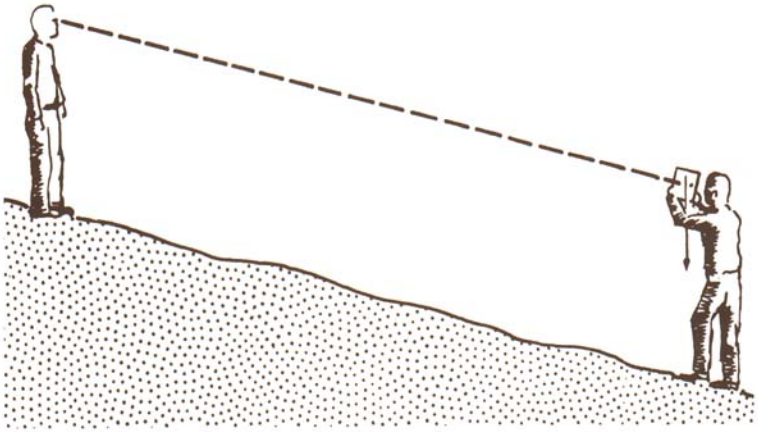


Fig. 3 — Two people or two posts may be used to determine slope with the slope finder.

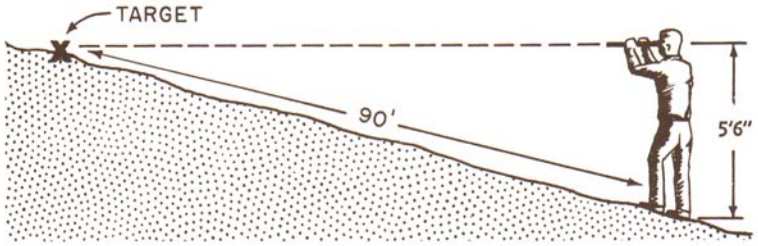


Fig. 4. — In this sketch, percent slope is being estimated with a hand level. The man has established that his eye or line of sight is 5.5 feet above the ground when he stands erect. He sights uphill through the level to an object which he has placed on the ground for a target. He watches the bubble in the level and adjusts his position up- or downhill until he has established a level line of sight. Then he paces to the target and finds the distance to be 90 feet. Then 5.5 ÷ 90 x 100 = 6.1 percent slope.

HOW TO MAKE A SLOPE FINDER

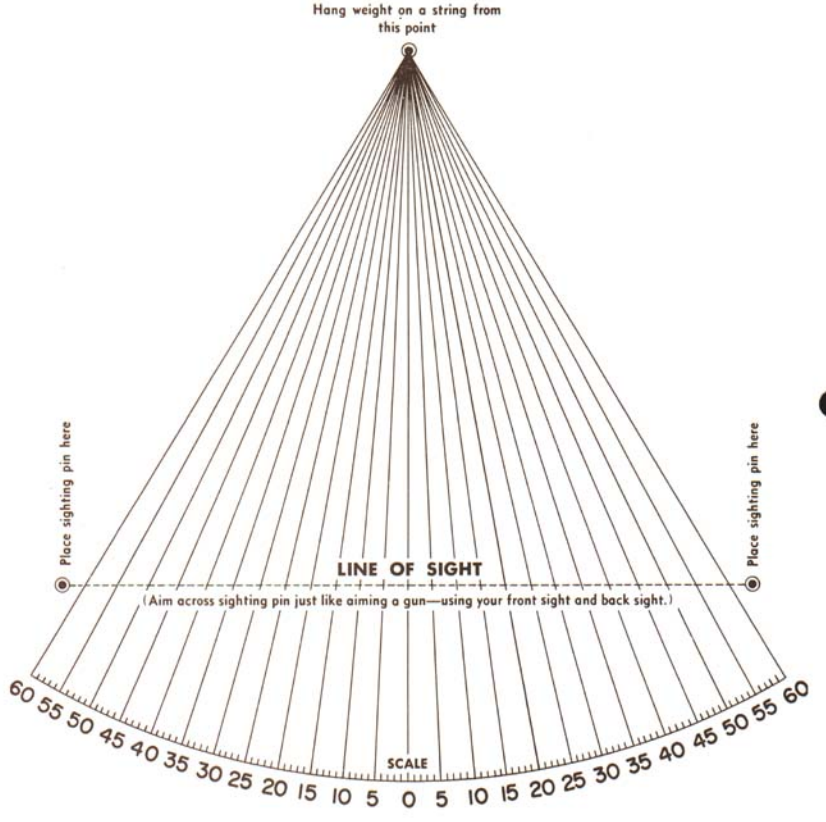
1. Mount the slope finder sheet in the center of the bulletin on 9 x 12 inch board. Either ½ inch thick plywood or ¾ inch lumber may be used. The thicker board, however, is recommended so the nails can be securely attached.
2. Place three "finishing nails" (small heads) at the points indicated on the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

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 3).

1. One student should stand at the top and the other student at the bottom of the slope to be measured.
2. Using the two nails in the lower part of the board, aim across the two nails on 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 slopes. It is not necessary to know the distance between the students or posts.
3. The string with weight should swing free from the slope finder board. Care should be taken in reading the 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 directly from the slope finder.

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.

5 SLOPE Steepness
☐ NEARLY LEVEL 0 to 2 ft. fall in 100 ft.
☐ GENTLY SLOPING 2 to 6 ft. fall in 100 ft.
☐ MODERATELY SLOPING 6 to 12 ft. fall in 100 ft.
☐ STRONGLY SLOPING 12 to 18 ft. fall in 100 ft.
☐ STEEP 18 to 25 ft. fall in 100 ft.
☐ VERY STEEP Over 25 ft. fall in 100 ft.

large farm machinery is more difficult and expensive on slopes which are over 12 percent. The construction of homes, playgrounds, streets 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 score card, 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 slopes. Terraces are difficult to maintain on slopes which are steeper than 12 percent. Contour tillage, strip cropping and terraces are more difficult to use on short, irregular slopes.

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, the velocity of the run-off water increases with the steepness and length of slope.

The steepness of slope is determined by using a slope finder, an abney level or a hand level (Figures 3 and 4). A level or a slope finder should be used to determine the percent of slope. The 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 slopes of the land area will be used to determine steepness. The slope finder on page 6 has been extensively used in Michigan land judging contests to determine the steepness of slopes. Directions on construction and use of a slope finder appear on page 5. Abney levels are used by the soil scientists making detailed soil surveys.

Type of Slope

The type of slope is extremely important in selecting crop rotations and soil conservation practices. On long, uniform slopes, strip cropping and other soil conservation practices are easy to use (Figure 5). On slopes that are irregular, the establishment and use of terraces, strip cropping and contour tillage is more difficult. Especially with steeper, irregular slopes, land use should be selected which will keep land in permanent vegeta-

Fig. 5. — Slope patterns: Left, regular-smooth-uniform; Right: Irregular-rough-wavy.

SIX DIFFERENT SLOPE CLASSES ARE USED IN LAND JUDGING IN MICHIGAN

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.

tion most of the time. Contestants will select either a regular or irregular slope pattern for each land area.

7 TYPE OF SLOPE
☐ **REGULAR** Uniform, simple, smooth
☐ **IRREGULAR** Uneven, complex, wavy

EROSION

The amount of soil which has been removed by erosion is important in determining the most intensive safe use for an area. Special care is required in selecting recommended conservation practices, especially in areas which are classified as 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 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 is rather difficult to recognize and classify in many places. In Michigan under forest vegetation, 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 score care 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.

6 EROSION Based on Present Surface Layer
☐ **SLIGHT** Mainly original surface soil
☐ **MODERATE** Mixture of original surface soil and subsoil
☐ **SEVERE** Mainly subsoil. May have gullies or blowouts
☐ **VERY SEVERE** Severely gullied or deep blowouts

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

You must know your land to use it wisely and manage it successfully. 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.

In land judging, it is important to determine these problems. The important soil properties have been selected in Part One of the score card. For example, a combination of (1) medium-textured surface and subsoil layers; (2) medium-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, contestants select the most important problems which affect use and management of each

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 land capability classification, most intensive safe use, recommended management and conservation practices and suitability for non-agricultrual uses.

Soil structure may often be a problem in fine, medium, and moderately coarse textured surface layers.

Soils with moderately coarse or coarse textured subsoil may have a droughty problem.

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.

Soils with poor drainage are "cold", lack oxygen, have poor micro-organism growth and are slow in releasing plant nutrients. 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.

Low, wet spots are unproductive and hazardous for good general crop growth and most non-agricultural uses.

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.

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

Soils classified as coarse or moderately coarse texture generally have a serious wind erosion problem.

Fine, medium and moderately-coarse soils which have more than a 2 percent slope are considered to have water erosion problems when used for cultivated crops, closely pastured or under construction.

Soils with medium- and light-colored surface layers usually have an organic matter problem.

Soils with fine textured subsoils usually have a slow permeability which increases susceptibility to erosion and severely limits the operation of septic tank disposal fields.

PART THREE: LAND CAPABILITY CLASSIFICATION

Land capability classification is a system developed by the Soil Conservation Service of the United States Department of Agriculture. This is a grouping to emphasize the relative suitability of soils for general farm crops, grazing, forestry and wildlife. Land capability classification is an interpretive grouping based on the needs and limitations of soils, on risks of damage when they are used and their responses to management.

Eight land capability classes have been recognized (Figure 6). They are further divided into two broad groups. The classes (I-II-III-IV) are best suited for cropland, while classes (V-VI-VII-VIII) are best suited for permanent vegetation. The present vegetative cover and the presence or absence of artificial drainage does not influence determination of the land capability class unless flooding is a problem or unless artificial drainage is impractical.

Four main physical characteristics which are used to determine land capability class are:

(1) Dominant texture of soil profile.

(2) Natural drainage.

(3) Slope of land.

(4) Amount of erosion.

Texture of the different layers of the soil profile and percent of slope are most important. Land capability classes are lowered for severe or very severe erosion classes.

The percent, length and type of slope are also important in determining the land capability class. The capability class increases as the slope increases. A well-drained soil with medium-textured surface layer and fine-textured subsoil would be Class I on 0 to 2 percent slopes, Class II on 2 to 6 percent slopes, Class III on 6 to 12 percent slopes, Class IV on 12 to 18 percent slopes, Class VI on 18 to 25 percent slopes, and Class VII on slopes over 25 percent.

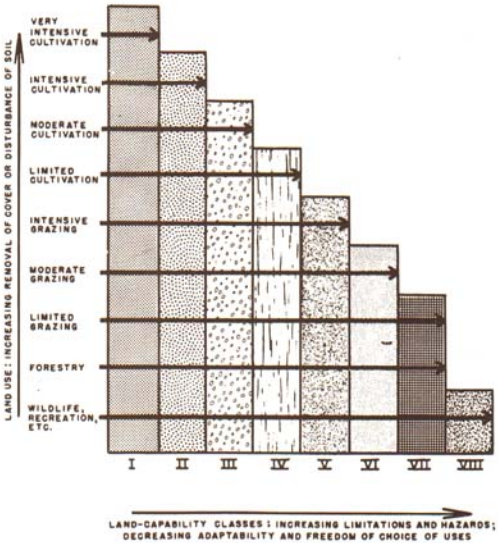


Fig. 6. — Types of land use possible with the different land use capability classes.

Land judging contestants will not have to differentiate between Capability Classes I and II. Full credit will be given if he designates that the land area is either Class I or Class II.

LAND CAPABILITY CLASSES*

Best Suited for Cropland

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

Soils in this class may be used safely for cultivated crops, pasture, range, woodland, and wildlife.

The soils are nearly level and erosion hazard (wind or water) is low. They are deep, generally well-drained, and easily worked. They hold water well and are either fairly well supplied with plant nutrients or highly responsive to inputs of fertilizer.

The soils in Class I are not subject to damaging overflow. They are productive and suited to intensive cropping. The local climate must be favorable for growing many of the common field crops (Figure 7).

Class II – Soils in Class II have some limitations that reduce the choice of plants or require moderate conservation practices.

Soils in Class II require careful soil management, including conservation practices, to prevent deterioration or to improve air and water relations when the soils are cultivated. The limitations are few and the practices are easy to apply. The soils may be used for cultivated crops, pasture, range, woodland, or wildlife food and cover.

*From "Land-Capability Classification," Agricultural Handbook No. 210, Soil Conservation Service, U.S. Department of Agriculture.

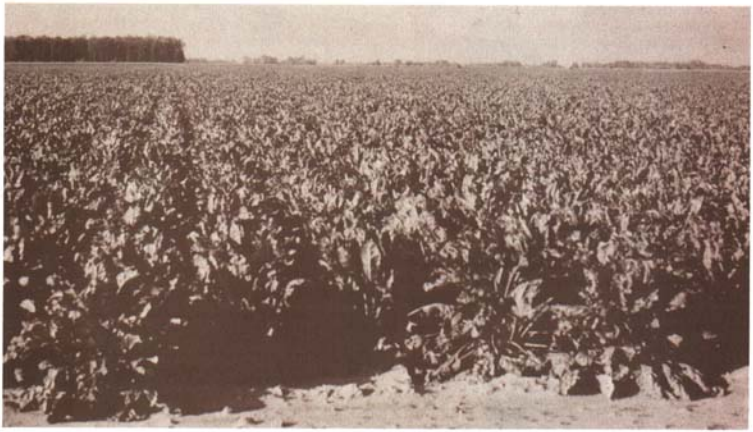


Fig. 7. — Class I land — good productive land with few hazards for intensive use.

Limitations of soils in Class II may include singly or in combination the effects of (1) gentle slopes, (2) moderate susceptibility to wind or water erosion or moderate adverse effects of past erosion, (3) less than ideal soil depth, (4) somewhat unfavorable soil structure and workability. (5) occasional damaging overflow, (6) slight climatic limitations on soil use and management.

Land judging contestants will not have to differentiate between Capability Classes I and II. Full credit will be given if he designates that the land area is either Class I or Class II.

Class III – Soils in Class III have severe limitations that reduce the choice of plants or require special conservation practices, or both.

Soils in Class III have more restrictions than those in Class II, and when used for cultivated crops the conservation practices are usually more difficult to apply and to maintain. They may be used for cultivated crops, pasture, woodland, range, or wildlife food and cover.

Limitations of soils in Class III restrict the amount of clean cultivation; timing of planting, tillage, and harvesting; choice of crops; or some combination of these limitations. The limitations may result from the effects of one or more of the following: (1) moderately steep slopes; (2) high susceptibility of water or wind erosion or severe adverse effects of past erosion; (3) frequent overflow accompanied by some crop damage; (4) very slow permeability of the subsoil; (5) wetness or some continuing waterlogging after drainage; (6) shallow depths to bedrock, hardpans that limit the rooting zone and the water storage; (7) low moisture-holding capacity; (8) low fertility not easily corrected; (9) moderate climatic limitations.

Class IV – Soils in Class IV have very severe limitations that restrict the choice of plants, require very careful management or both.

The restrictions in use for soils in Class IV are greater than those in Class III and the choice of plants is more limited. When these soils are cultivated, more careful management is required and conservation practices are more difficult to apply and maintain. Soils in Class IV may be used for crops, pasture, woodland, range, or wildlife food and cover.

Soils in Class IV may be well suited to only two or three common crops or the harvest produced may be low in relation to inputs over a long period of time. Use for cultivated crops is limited as a result of the effects of one or more permanent features such as (1) strongly sloping land; (2) severe susceptibility to water or wind erosion; (3) severe effects of past ero-

sion; (4) shallow soils; (5) very low moisture-holding capacity; (6) frequent overflows accompanied by severe crop damage; (7) moderately adverse climate.

Best Suited for Permanent Vegetation

Class V – 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 food and cover.

Soils in Class V have limitations that restrict the kind of plants that can be grown and that prevent normal tillage of cultivated crops. They are nearly level but some are wet, are frequently overflowed by streams, are excessively bouldery or stony or have some combination of these limitations. Drainage is impractical.

Class VI – Soils in Class VI have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife food and cover.

Physical conditions of soils in Class VI are such that it is practical to apply range or pasture improvements, if needed, such as seeding, liming, fertilizing and water control with contour furrows, drainage ditches or diversions.

Soils in Class VI have continuing limitations that cannot be corrected, such as (1) steep slopes; (2) severe erosion hazard; (3) effects of past erosion; (4) stoniness; (5) shallow rooting zone; (6) excessive wetness or overflow; (7) low-moisture capacity; (8) severe climate. Because of one or more of these limitations, these soils are not generally suited to cultivated crops. They may, however, be used for controlled pasture, woodland, or wildlife cover, or for some combination of these uses.

Class VII – Soils in Class VII have very severe limitations that make them unsuited to cultivation and that restrict their use largely to controlled grazing, woodland or wildlife.

Physical conditions of soils in Class VII are such that is it impractical to apply such pasture or range improvements as seeding, liming, fertilizing, and water control. Soil restrictions are more severe than those in Class VI because of one or more continuing limitations that cannot be corrected, such as (1) very steep slopes; (2) severe or very severe erosion; (3) shallow soils; (4) stones; (5) wet soil; (6) unfavorable climate. They can be used safely for limited grazing or woodland, or wildlife food and cover, or for some combination of these under proper management.

Class VIII – Soils and landforms in Class VIII have limitations that prevent their use for commercial plant production and restrict their use to recreation, wildlife or water supplies or to esthetic purposes.

Soils and landforms in Class VIII cannot be expected to return significant on-site benefits from management for crops, grasses, or trees, although benefits from wildlife use, watershed protection or recreation may be possible.

PART FOUR: AGRICULTURAL LAND USE

In Parts One, Two and Three the physical soil features, major problems and land capability classes were determined.

The next step is to determine the *most intensive, safe use*. Land must be used intensively to obtain sufficient volume of business and high income under most Michigan conditions.

It also provides the reasons from which to select suitable management and conservation practices in Part Five of the score card.

ROTATIONS

What kind of rotation is necessary on the area judged? Can we grow crops continuously without the benefit of legumes, grasses and pasture? What supporting management and conservation practices are necessary?

In soil and water conservation programs, continuous row cropping is the most intensive safe use. Continuous grass or tree cover with nothing harvested, coupled with the complete protection from fire and grazing, is the least intensive safe use.

For a general farming program, we can select the most intensive safe use from the following choices:

1. Continuous row crops (no legumes and grass crops in rotation). Fine-and medium-textured mineral and organic soils, relatively level in topography, well-drained, or capable of being drained, may be considered for continuous row crops providing adequate supporting practices are selected in Part Five.

2. Rotations that include legumes and grasses 1/4 or 1/3 of the time. (One rotation hay crop every three or four years.)

3. Rotations that include legumes and grasses 1/2 or 3/5 of the time. (Two years of hay crops in a four year rotation or three years of hay crops in a five year rotation.)

4. Rotations that include legumes and grasses 3/4 of the time. (May have an occasional row crop.)

5. Rotations that include legumes and grasses 3/4 of the time with no row crops. (A small grain crop may be used in the rotation.)

6. Continuous sod crops. Land on which a legume-grass mixture or grass should be established and/or maintained for hay or pasture. (No row or small grain crop in rotation.)

7. Woodland. Land on which trees should be maintained or planted.

In Part Five, the necessary conservation practices to support the choice will be selected.

PART FIVE: RECOMMENDED MANAGEMENT AND CONSERVATION PRACTICES FOR AGRICULTURAL USES

This part of the land judging score card lists management conservation practices that are required with the *most intensive safe land use* selected in Part Four.

The contestants will be provided with the number of practices to be selected from the list on the back of the score card. The management and conservation practice numbers are placed in the boxes of Part Five on the front of the score card, starting on the left side of the score card.

For the most intensive safe land use selected for the land area in Part Four, the needed practices are selected.

A discussion of 23 management and conservation practices listed on the back of the score card follows:

1. Grass waterways are natural or man-made water courses protected against erosion by a grass cover. They serve as safe outlets for terraces, diversions and contour rows. They may also serve as safe passageways for surface water that comes from other farm land.

2. Contour tillage is to plow, plant and cultivate on the contour or at right angles to the natural direction of the slope. The whole field is usually planted to one crop.

3. Conservation tillage is the least amount of tillage necessary to obtain quick germination and a good stand. Leave maximum amount of residue on surface.

4. Strip cropping is a systematic arrangement of crops to create vegetative barriers to reduce wind and water erosion. The strips are laid out either across the slopes or at right angles to the prevailing winds. With *contour strip cropping*, the strips are laid out so that the top and bottom of the strips 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.

5. Terraces or diversions are an earth ridge or embankment usually constructed on a slight grade across a slope to control runoff water and reduce erosion. Several terraces on a slope are called a "terrace system." A diversion is a channel running across a slope to intercept water and carry it slowly to a grass waterway.

6. **Windbreaks and/or vegetative barriers for erosion control.** Shrubs, trees, or grass strips should be planted at right angles to prevailing winds to reduce the removal of soil from fields by wind erosion. Tall wheat grass and annual rye are used for vegetative barriers.

7. Install and/or maintain artificial drainage. Different kinds of drainage that may be needed are: (1) open ditches to carry off surplus surface water; (2) outlets for tile drainage; (3) tile drainage; and (4) bedding to remove surface water in fine-textured soils.

8. Barnyard manure if available. If barnyard manure is available, it should be used on fields to provide organic matter and some plant nutrients.

9. 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.

10. Apply phosphorus fertilizer. 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. Soil test for phosphurus will be given to the contestants.

11. Apply potasium fertilizer. 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 for potassium will be given to the contestants.

12. Cover and green-manure crops. Cover crops are grown primarily for soil protection and to build up organic matter with field crops or between vines and trees in vineyards or orchards. Rye, buckwheat, rye grass, and sweet clover are examples of cover crops.

Green-manure crops are plowed under or worked into the soil while either green or soon after maturity. Sweet clover, red clover or a legume-grass mixture are examples of green-manure crops.

13. Return all crop residues to the soil. The portion of the plant or crop left after harvest should not be returned to the soil. Crop residues should not be burned or removed from the fields.

14. Establish and/or maintain legume-grass mixture for continuous sod crops, reseeding only when necessary. This practice is recommended for areas which are used continuously for hay or pasture. When necessary to re-establish vegetation, the area is prepared using minimum tillage methods, and reseeded, generally with a nurse crop.

15. Establish and/or maintain grasses for permanent cover, reseeding only when necessary. This practice is recommended for wet areas where a permanent grass cover is needed. When reseeding, the area should be prepared for seeding using minimum tillage.

16. Managed grazing of pasture for erosion control. Pastures should be managed to prevent erosion. Management practices include using a rotation system of grazing, not grazing too early in the spring, clipping weeds, and not over-grazing.

17. Topdress established legumes with phosphorus and potassium. When legume-grass crops are used for more than one year, a topdressing of phosphorus and potassium is recommended every year.

18. Topdress permanent grass vegetation with commercial nitrogen. Commercial nitrogen should be applied annually to sod crops which are mainly grass.

19. Eradicate brush. Brush and shurbs should be removed from sod crops.

20. Special plantings for wildlife food and cover. Shrubs or trees should be planted that will furnish food and cover for birds and small animals. These plantings may be either in corners of fields or along field borders.

21. Plant adapted species of trees. Tree species should be planted that are adapted to the site.

22. Protect trees and shrubs from grazing and burning. Present woodlands and new plantings of either trees or shrubs should be protected from grazing and burning.

23. Manage woods. Merchantible trees should be harvested and cull trees removed. Prune desireable trees. Undesirable species and deformed trees should be cut.

PART SIX: SUITABILITY FOR NON-AGRICULTURAL USES

This part of the land judging score card lists the suitability of the land area for uses other than agriculture. The contestant will be provided with the number of other land uses for which the area is especially satisfactory. The non-agricultural land uses (Part Six listed on the back of score card) are placed in the boxes at the bottom of the first page of the score card, starting on the left side of the card.

When evaluating land for non-agricultural uses, you must look at many of the soil properties 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 septic tank disposal fields are nearly level to moderately sloping, with moderately coarse to medium textured and bright subsoils. They should not have permeability or seasonal-flooding problems.

(2) Soils most suitable for residential development without sanitary or strom 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 8).

Fig. 8 — Septic tank disposal fields will fail and basements may be wet on soils with mottled or gray subsoil and slow permeability.

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

(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.

(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 textured, bright 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 surface layer textures with bright or mottled subsoils.

(8) Soils most suitable for openland wildlife areas are nearly level to moderately sloping with medium or moderately coarse textured surface layers and bright, mottled or dull subsoils. They may have seasonal-flooding problems.

(9) Soils most suitable for wetland wildlife areas have regular, nearly level slopes with 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 not have droughty problems.

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

LAND JUDGING CONTESTS

Land appreciation schools and land judging contests are valuable for young people, farmers, business and professional men and women's groups. Land appreciation training may be held indoors or out-of-doors and at any season of the year. Land appreciation training and land judging contests go well together. Appreciation training should come first, followed by judging. Land judging should be done in the field when weather conditions are suitable.

The judging area selected should be of such size as to be a management unit. Insofar as possible, the land characteristics of the unit should be uniform. In early training, it is desirable to use an area having an unquestionable capability. A recommended training technique is to have the participants make all judging arrangements — stake off the area, expose the soil profile, take samples of surface layer and subsoil and test samples for pH, phosphorus and potassium requirements in the laboratory. Training should include slope measurements and determination of erosion classes.

A highly recommended training procedure is to require oral reasons after the score card has been completed. This is time consuming but requires the student to give more careful attention to judging. Likewise the group as a whole benefits from oral reasons and discussions.

In most Michigan contests,four manageable areas are judged. In local contests or training sessions, the number of areas judged will depend upon the time available. Sufficient time for discussion of the areas judged should be allowed.

A suggested procedure for conducting a land judging contest follows:

1. Select an area with a variety of problems.

2. Obtain the owner's permission to hold the contest.

3. Work out parking space areas with owner.

4. Select the areas to be judged a sufficient time ahead of the contest to allow ample time to expose soil profiles, collect soil samples, and develop a master score card for each area.

5. In large contests, a committee of agricultural leaders should assist in planning and conducting the contest.

One or two signs (Figure 9) should be placed at each area to be judged giving the following information:

1. Land Area No. _____
2. Number of problems in Part Two _____
3. Number of practices in Part Five _____
4. Number of Land Uses in Part Six _____
5. pH _____
6. Phosphorus test _____
7. Potassium test _____
8. Barnyard manure available _____

Fig. 9. —Suggested sign for each judging site.

At registration before the contest starts, each contestant is given a number. The contestants are then divided into as many groups as there are areas in the contest. A leader is appointed for each group. He is provided with a rotation schedule for his group and can also assist in collecting score cards at each area. In some contests, group instructions are given to all contestants.

If you are planning a land judging contest, consult your County Extension Director, your District Conservationist of the U.S.D.A. Soil Conservation Service or your local soil conservation district for additional information.

Copies of the Land Judging Score Card may be obtained from:

Agriculture and Natural Resources
Education Institute
410 Agriculture Hall
Michigan State University
East Lansing, MI 48824

PUBLICATIONS THAT WILL HELP YOU JUDGE AND USE LAND WISELY

(Check with your county extension office for availability and prices)

Extension Bulletin E-550: *Fertilizer Recommendations – Vegetable and Field Crops in Michigan*

Extension Bulletin E-498: *Sampling Soils for Fertilizer and Lime Recommendations*

Extension Bulletin E-1169: *Soil Erosion by Water – An Unsolved Problem*

Extension Bulletin E-1229: *Wind Erosion Control on Organic Soil*

Extension Bulletin E-1354: *Conservation Tillage*

Extension Bulletin E-909: *Tile Drainage for Improved Crop Production*

Extension Bulletin E-1295: *Surface Drainage for Improved Crop Production*

Extension Bulletin 904: *No-till Corn: 3-Soils*

Extension Bulletin E-1460: *Compact Soil – Visual Symptoms*

Extension Bulletin E-1041: *Tillage Systems for Michigan Soils and Crops. Part 1: Deep, Primary, Supplemental and No-Till*

Extension Bulletin E-1042: *Tillage Systems for Michigan Soils and Crops. Part 2: Secondary Tillage and Cultivation*

(Copies of the above publications may be obtained from your County Cooperative Extension Service Office)

USDA Farmers Bulletin No. 2035: *Making Land Produce Useful Wildlife*

USDA-SCS PA 1029: *A Conservation Plan for a Developing Area*

USDA-SCS Agriculture Information Bulletin No. 320: *Know the Soil You Build On*

USDA-SCS Agriculture Information Bulletin No. 347: *Controlling Erosion on Construction Sites*

USDA-SCS Agriculture Information Bulletin No. 349: *Soils and Septic Tanks*

USDA-SCS Agriculture Information Bulletin No. 260: *Soil Erosion, the Work of Uncontrolled Water*

USDA-SCS Agriculture Information Bulletin No. 267: *Know Your Soil*

USDA-SCS Agriculture Information Bulletin No. 339: *Windbreaks for Conservation*

USDA-SCS Farmers Bulletin No. 2171: *How to Control a Gulley*

USDA Farmers Bulletin No. 2256: *Building a Pond*

USDA-SCS Leaflet No. 447: *Grass Waterways in Soil Conservation*

USDA-SCS Leaflet No. 554: *Mulch Tillage in Modern Farming*

USDA-SCS Leaflet No. 562: *Maintaining Water Courses*

USDA-SCS Leaflet No. 557: *Maintaining Subsurface Drains*

(The above United States Department of Agriculture publications are available from the Soil Conservation Service Office in your county)

MICHIGAN STATE UNIVERSITY

COOPERATIVE EXTENSION SERVICE

Issued in furtherance of cooperative extension work in agriculture and home economics, acts of May 8, and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Gordon E. Guyer, Director, Cooperative Extension Service, Michigan State University, E. Lansing, MI 48824.

1P-7R-10M-1:82-ST-KMF, 60¢, For Sale Only