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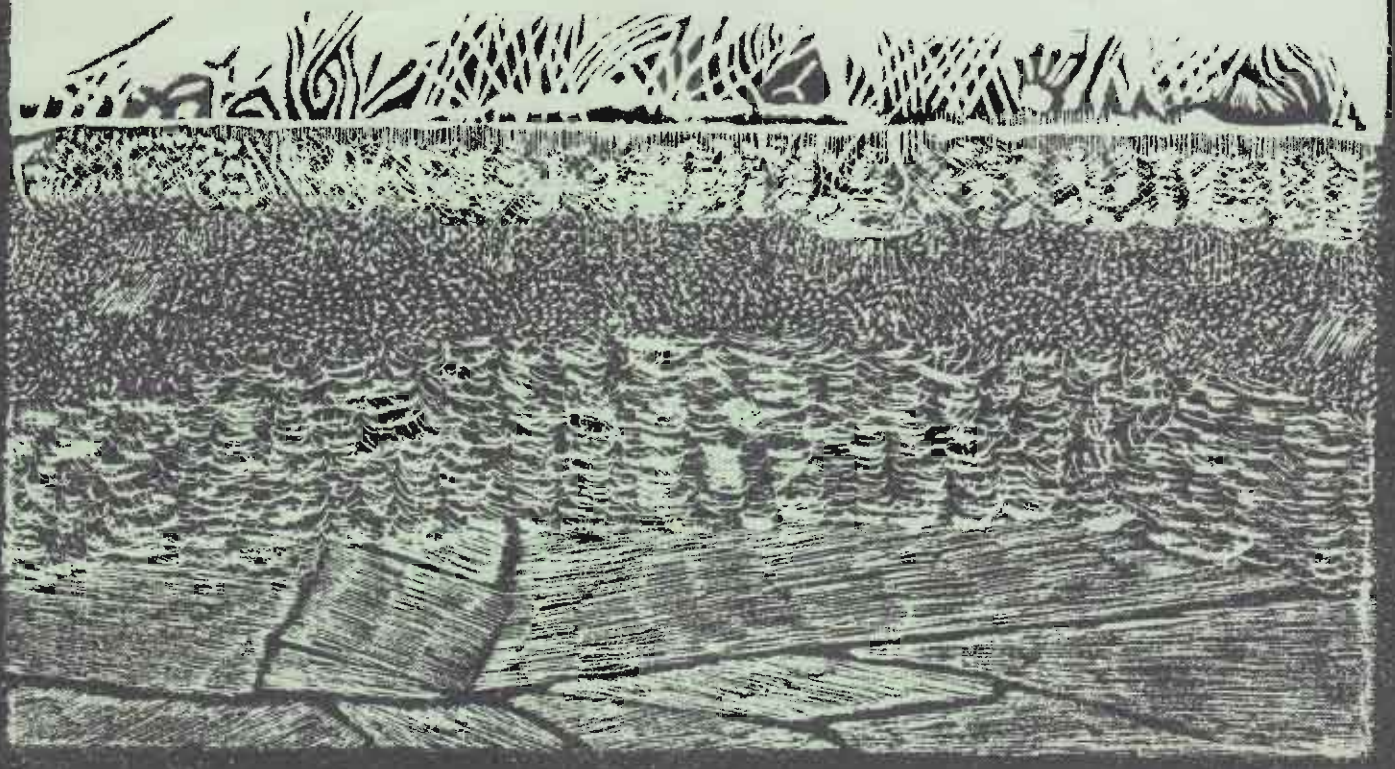
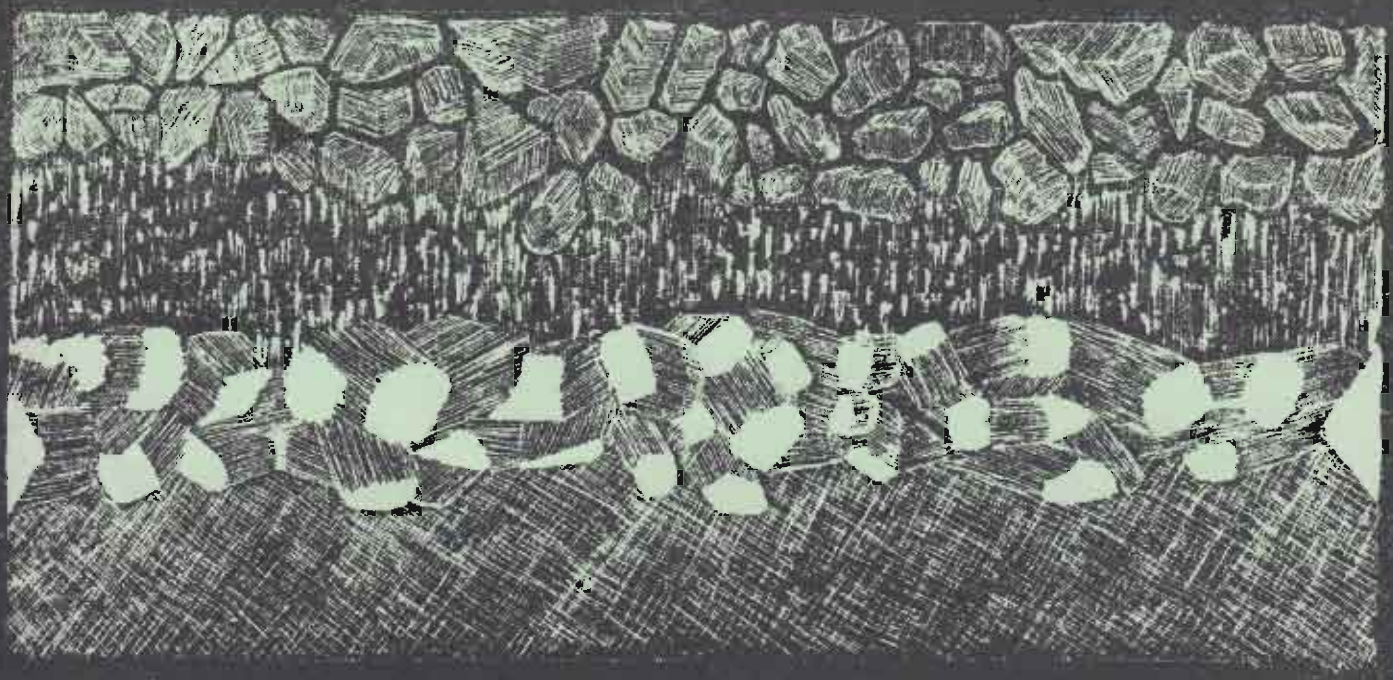


LAND JUDGING IN TEXAS



TEXAS AGRICULTURAL EXTENSION SERVICE
THE TEXAS A&M UNIVERSITY SYSTEM
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LAND JUDGING IN TEXAS

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CONTENTS

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Land judging is one of the most recent judging events in the field of agriculture. For many years people in animal science, farm crops and horticulture have been judging, grading and classifying their products.

Land is the product or resource involved and is indeed one of the state's most valuable resources. The growing interest in land judging is evidence of the tremendous educational value of this activity.

In order to classify land into capability classes, one must first learn several things about soils. Soils differ according to texture, structure, depth, permeability, erosion damage, slope and drainage.

Land judging can help to:

- Understand basic soil differences.
- Know how soil properties affect crop growth.
- Know why soils respond differently to management practices.
- Realize the influence of land features on production and land protection.
- Select suitable soil and water conservation practices.
- Determine land capability class.
- Determine proper use and treatment.

LAND, A NATURAL RESOURCE

Land is a natural resource economically usable by man to meet one or more of his needs. It provides many raw materials and enables us to produce food and fiber for clothes and shelter, and to collect and store water for future use. It also provides a place to stand, room for cities, highways, recreation and room for many other things requiring space. The total quantity is limited and its quality varies from place to place. Thus, decisions on using and managing lands must be constantly reconsidered as the population increases and new technology develops.

Land resources are really soil resources under man's influence. How soils are used and managed reflects a certain knowledge, or lack of it, about soils and soil-related factors at any given time.

Soils result from the interaction of climate and organisms on geologic materials as conditioned by topography over a period of time. These soil forming factors vary widely over Texas producing many kinds of soils, differing as to profile features and other properties (figure 1). Soils vary in the kind, number and degree of development of major horizons and many subhorizons that may form. Very few soils have all the major and minor horizons, but all soils exhibit some of them. Therefore, we may define soil as a collection of natural bodies occupying portions of the earth's surface. It is capable of supporting plants and has properties due to the interaction of climate and living matter acting upon parent material as conditioned by relief over periods of time.

Organic horizon of undecomposed (01) and decomposed (02) organic matter. Absent in cultivated and many other soils.

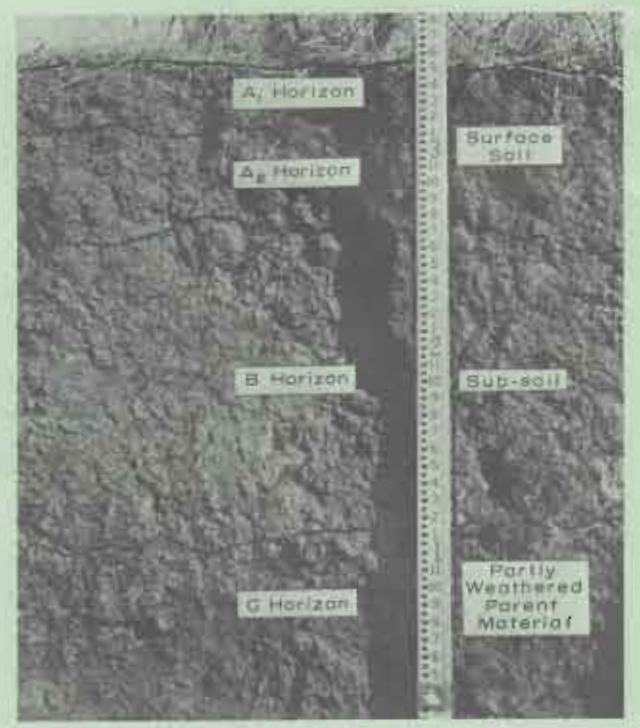
Mineral surface soil which has accumulated decomposed organic matter and is usually darker colored than lower layers. It is also the horizon that has lost organic matter, clay, iron and aluminum due to downward movement.

Mineral horizon that usually has a finer texture, or a darker, stronger, redder color and a distinctly different developed structure. Structure is often more distinct than in the A horizon.

Mineral horizon of weathered parent material like the material from which the soil developed or other substratum of unconsolidated material not related to the above soil.

Underlying consolidated bedrock. Absent under many soils.

Fig. 1. Hypothetical soil profile showing the letter designation used in describing the major kinds of horizons usually present.



Soil profile with horizons delineated.

SOIL FACTORS

TEXTURE

Soil texture refers to the relative proportions of various size groups of individual soil particles—sand, silt and clay particles (figure 2). To determine soil texture, rub or squeeze a mass of moist soil between thumb and forefinger.

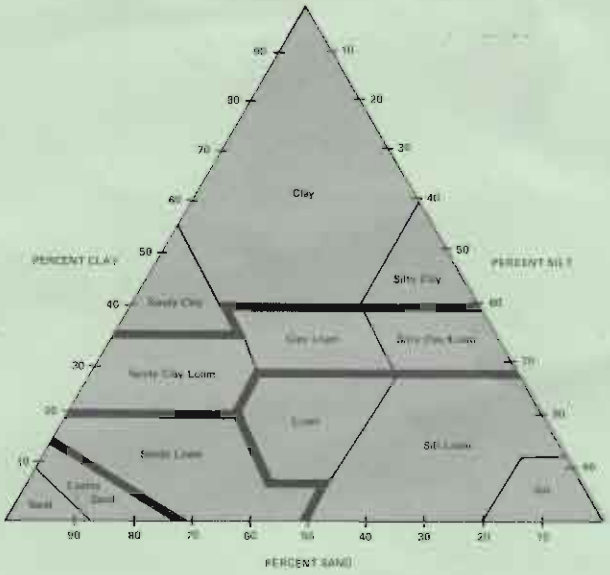


Fig. 2. Soil textural classes shown in five diffetent categories.

Coarse-textured soils are loose, very friable and the individual grains can be readily seen or felt. When squeezed between thumb and forefinger it is very gritty. Squeezed when dry it will fall apart as pressure is released whereas when moist, a cast may be formed which is unstable and crumbles as the soil is handled.

Moderately coarse-textured soils are gritty but contain enough silt and clay to make moist soil hold together. The individual sand grains can readily be seen and felt. Squeezed when dry, it will form a cast which breaks readily upon handling, but if squeezed when moist a cast can be formed which can be carefully handled without breaking.

Medium-textured soils have a slightly gritty, smooth or velvety feel when moist. Squeezed when dry, it forms a cast that will bear careful handling, while the cast formed by squeezing when moist can be handled freely, without breaking. When the moistened soil is squeezed out between thumb and forefinger it will not "ribbon.'

Moderately fine-textured soils usually break into clods or lumps when dry. When the moist soil is squeezed out between thumb and forefinger it will form a short "ribbon" which will tend to break or the ribbon will bend downward. The soil may also have a slightly gritty or velvety feel when moist.

Find-textured soils form very hard lumps or clods when dry and are quite plastic and sticky when wet. When the moist soil is squeezed out between thumb and forefinger it will form a long ribbon which will support itself. The soil may also have a slightly gritty or velvety feel when moist.

STRUCTURE

Soil aggregates are clusters of individual particles separated from adjoining clusters by surfaces of various lines of weakness. The aggregate type refers to the shape and arrangement of the predominate soil aggregates or lack of aggregation in a soil (figure 3).

Single grained—Each soil particle functions as an individual unit due to the lack of binding material. This structureless condition is usually found in coarse-textured soils.

Granular and/or subangular blocky—Granular is sphere-like or rounded aggregate with no flat surfaces due to contact pressure from the faces of surrounding aggregates. Subangular blocky is block-like or tending toward six-faced aggregates having mixed, rounded and flat surfaces with many rounded vertices or corners.

Blocky—Block-like or tending toward six-faced aggregates having flat surfaces with mostly sharp, angular vertices or edges that are mold casts formed by surrounding aggregates.

Prismatic—prism-like or vertically-oriented aggregates with the vertical axis much greater in length than the horizontal axis. Flat surfaces or faces are well defined.

Platy—Plate-like or relatively thin horizontal plates or leaflets.

Massive—Medium to fine-textured soils with indistinct aggregates or no apparent aggregation.

CONSISTENCE

Soil consistence when moist is the tendency of soil to crumble or to hold together when pressure is applied to a mass of undisturbed soil.

Loose—Noncoherent even when pressed together.

Very friable—Soil material crushes under very gentle pressure but coheres when pressed together.

Friable—Soil material crushes easily under gentle to moderate pressure between thumb and forefinger and coheres when pressed together.

Firm—Soil material crushes under moderate pressure between thumb and forefinger but resistance is distinctly noticeable.

Very firm—Soil material crushes under strong pressure; barely crushable between thumb and forefinger.

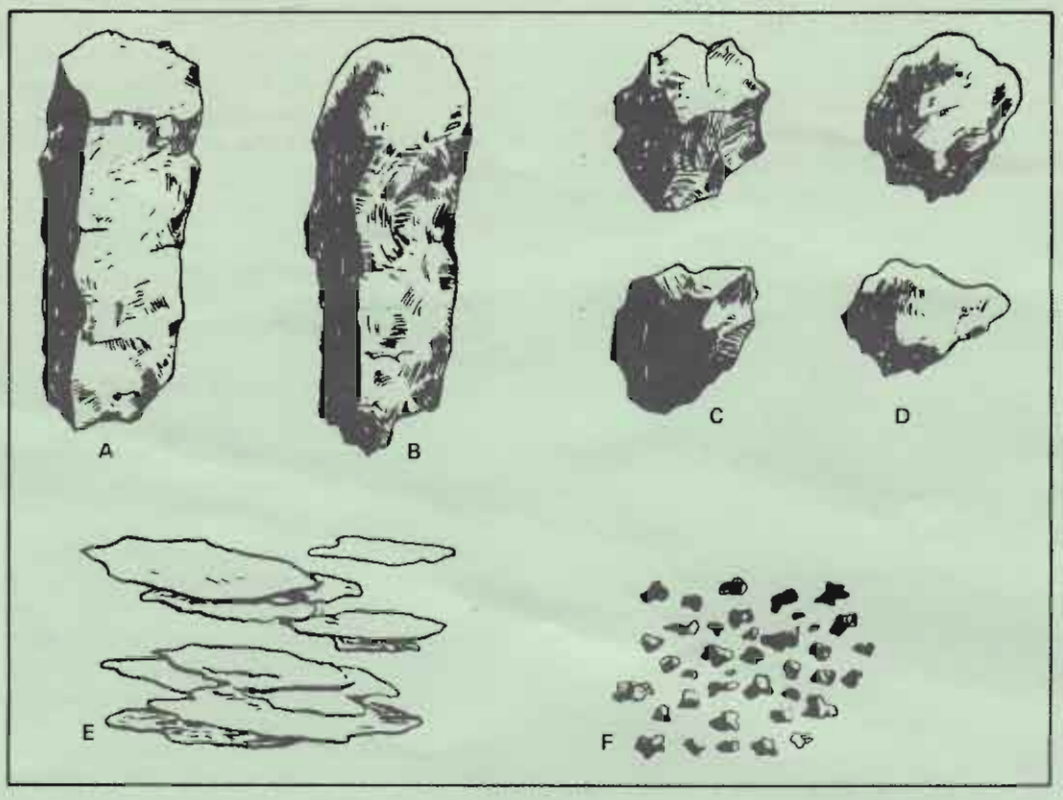


Fig. 3. Drawings illustrate some of the types of soil structure: A, prismatic; B, columnar; C, angular blocky; D, subangular blocky; E, platy; and F, granular.

Extremely firm—Soil material crushes only under very strong pressure; cannot be crushed between thumb and forefinger and must be broken apart bit by bit.

SOIL DEPTH

Depth refers to surface and subsoil thickness plus any parent material that is favorable for root development and available moisture retention. Parent material may be either like or unlike the material from which the above horizons developed. It may come from bedrock or may have been transported and deposited upon the bedrock.

Deep soils have over 36 inches of soil that can be penetrated by plant roots.

Moderately deep soils have over 20 but less than 36 inches of soil that can be penetrated by plant roots.

Shallow soils have over 10 but less than 20 inches of soil that can be penetrated by plant roots.

Very shallow soils have less than 10 inches of soil that can be penetrated by plant roots.

SOIL SLOPE

Soil slope is expressed in percent. It is the change in elevation in feet for each 100 feet horizontal distance. For example, a slope between two points which are 100 feet apart with a difference in elevation of 3 feet would have a 3 percent slope (figure 4).

Nearly level—This class of slope ranges from 0 to 1 percent and runoff is very slow to slow.

Profile of a deep prairie soil.

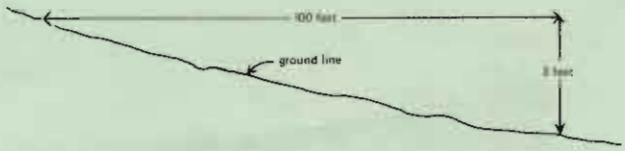


Fig. 4. Diagram showing a 3 percent slope. Over a distance of 100 feet the ground line drops 3 feet.

Gently sloping—This class consists of gentle slopes of 1 to 3 percent on which runoff is slow to medium. (Common exceptions are soils with coarse-textured surfaces).

Moderately sloping—This class consists of moderate slopes of 3 to 5 percent on which runoff is slow to rapid for most soils.

Strongly sloping—This class of slope consists of 5 to 8 percent on which runoff usually ranges from medium to rapid on coarse and moderately coarse-textured soils and rapid to very rapid on the medium, moderately fine and fine-textured soils.

Steep—This class of slope consists of 8 to 12 percent on which runoff is rapid to very rapid.

Very steep—This class of slope consists of 12 percent or more where runoff is very rapid.

Soil particles transported by water.

Detachment of soil particles by rain drop.

EROSION

Soil erosion is the detachment and movement of soil materials by wind or water. Erosion consists of two distinct processes—detachment and transportation. Raindrops falling on unprotected soil, wind striking unprotected soil particles and the bombarding action of moving particles are detachment forces. Flowing water and air currents are the transportation forces.

None to slight: Soils of this class show no obvious effect of erosion. Less than 25 percent of the surface soil has been removed and no gullies are present.

Moderate: Soils of this class have 25 to 75 percent of original surface layer present, but the plow layer may consist of a mixture of surface and underlying horizons. Some small, occasional, crossable gullies may be present.

Severe: Soils of this class have been eroded to the extent that over 75 percent of the original surface layer is removed. Frequent crossable gullies or occasional uncrossable gullies may be present. An occasional blow-out area may be present with from 0 to 36 inches of soil accumulations occurring.

Very severe: Soils of this class have over 75 percent of surface soil removed with frequent uncrossable gullies and/or severe accumulations by wind. If wind is the main erosion force, blow-outs are numerous and deep. Often over 36 inches of soil accumulations occur between the blow-outs. In either case areas are mostly unfit for crop production without extensive reclamation.

The term "gullies" includes both crossable and uncrossable, unless otherwise specified. A crossable gully is one that can be crossed with the usual farm machinery in operation. Frequent gullies are less than 100 feet apart. Occasional gullies are more than 100 feet apart.

INTERPRETATION OF SOIL FACTORS

SURFACE RUNOFF

Runoff refers to the relative rate water flows over the soil's surface. Six runoff classes are recognized based on properties of soil profile, soil slope and climate.

Ponded—No water added by precipitation or by flow from surrounding land escapes as runoff.

Very slow—Surface water flows away so very slowly that free water lies on the surface for long periods or it infiltrates into the soil immediately. Soils with very slow runoff are usually nearly level or very open and porous.

Slow—Surface water flows away so slowly that free water lies on the surface for significant periods of time or it infiltrates into the soil rapidly. Normally there is little or no erosion hazard if soils are cultivated.

Medium—Surface water flows away at such a rate that a moderate proportion of the water enters the

profile. The erosion hazard may be slight to moderate if soils are cultivated.

Rapid—A large proportion of the precipitation moves rapidly over the soil's surface nearly as fast as it is added. Soils of this class have a moderate to high erosion hazard when cultivated.

Very rapid—A very large part of the precipitation moves rapidly over the surface as fast as it is added. The erosion hazard is high to very high when cultivated.

SITE DRAINAGE

Soil drainage is based upon the relative runoff rate, soil permeability and the addition of water from adjacent slopes that influence the presence or absence of excess water within the root zone.

Poor—Water is removed so slowly that the soil remains wet for a large part of the time. The water table is commonly at or near the surface during a considerable part of the year. Artificial drainage is generally necessary for crop production.

Fair—Water is removed from the soil slowly enough to keep it wet for significant periods of time. Nearly level soils with fair drainage normally will be mottled in lower surface or subsoil.

Good—Water is removed from the soil readily but not rapidly. Well-drained soils will wet deep and normally retain optimum moisture amounts after rains or irrigation. Normally soils are intermediate in texture and are free of surface or subsoil mottling caused by wetness.

Excessive—Water is removed from the soil rapidly to very rapidly as runoff or percolation. These soils are deep, coarse-textured and very porous, moderately sloping, fine-textured, strongly sloping, medium-textured or steep, moderately coarse-textured soils.

INFILTRATION RATE

The infiltration rate is defined as the rate at which water moves into the surface soil. Surface layer texture and structure are of primary importance in determining infiltration rate.

Very slow—Fine-textured soils with no apparent aggregation or with platy or barely visable, blocky aggregates in surface soil.

Slow—Moderately fine-textured soils with indistinct aggregates or distinct platy or angular blocky aggregates and fine-textured soil with distinct, subangular blocky or granular aggregates in the surface have slow infiltration rates.

Moderate—Medium or moderately coarse-textured soils and moderately fine-textured soils with distinct, subangular blocky or granular structure tend to have moderate infiltration rates.

Rapid—Coarse-textured soils tend to have rapid infiltration rates.

PERMEABILITY OF SUBSOIL

Permeability is defined as the property which permits a soil to transmit water and air through the subsoil. Subsoil texture and structure are of primary importance in determining permeability. Also, compaction, either natural or induced, is important.

Permeability is affected by all soil characteristics. It is extremely important because it affects the supply of air, moisture and soil nutrients, in the root growth zone available to the plant. A soil's permeability is determined by permanent characteristics such as texture, structure and consistence. It may be increased or decreased and still remains within the range of each permeability rating.

Each soil layer has a permeability rating but the soil's permeability is determined by the relative rate of moisture and air movement through the most restricting layer within the upper 36 inches of the effective root zone.

Very slowly permeable—Soils with claypans, or heavy, dense, clay subsoil layers are very slowly permeable. The structure is massive or angular blocky and generally free from visible pores. These subsoils tend to be very firm when moist. Horizontal "cracks" are longer than vertical ones, giving the profile a brickwall appearance.

Slowly permeable—Soils that have fine and moderately fine-textured subsoils with subangular blocky and granular structures are slowly permeable. These subsoils tend to be friable to firm when moist. Length differences of vertical and horizontal cracks is not noticeable. Soil units tend to break more easily along the vertical axis than in the very slow, permeable soils.

Moderately permeable—Soils with moderately fine-textured subsoils that are prismatic, subangular blocky or granular are moderately permeable. Also most medium and moderately coarse-textured subsoils are moderately permeable regardless of structure. These subsoils tend to be friable to very friable with visable pores larger and more numerous than in the previous groups.

Rapid permeable—Soils with coarse-textured subsoils that are granular or single-grained are rapid permeable. Subsoils tend to be very friable or loose when moist.

FACTORS LIMITING LAND USE AND TREATMENT

- Moisture Holding Capacity—Soil characteristics such as texture, structure, organic matter content, layers limiting root growth, relative thickness of surface and subsoil horizons, slope and internal drainage determine

the soil's ability to store water for plant growth. These inter-related characteristics make it most difficult to determine the soil's ability to store water for plants during periods of moisture stress. Therefore, for contest purposes, it will be assumed that moisture holding capacity of the soil will be based strictly on depth and texture of the horizons to a 36 inch depth.

All deep and moderately deep coarse and moderately coarse-textured surface soils with coarse to moderately coarse-textured subsoils have available moisture holding capacity limitation. All shallow and very shallow soils also have available moisture holding, capacity limitations.

Movement of Air, Moisture and Roots—Moderately and rapidly permeable soils have no limitations to restrict air and moisture movement or root growth.

Water Erosion Hazard—Water erosion is considered a hazard on all slowly and very slowly permeable soils with slopes greater than 1 percent and on moderately permeable with slopes greater than 3 percent and on rapidly permeable soils with slopes greater than 5 percent.

Wind Erosion Hazards—Wind erosion hazards are mainly restricted to areas with less than 30 inches annual rainfall. Wind erosion is considered a hazard on moderately coarse and coarse-textured surface soils in the West Cross Timbers, Rolling Plains, North Central Prairies, Rio Grande Plains, Trans Pecos and the High Plains Land Resource Areas of the state.

Workability—Workability refers to the ease and care required in soil tillage. Texture, structure, consistence and coarse fragments influence workability. Workability is a limitation on very sticky and plastic fine-textured soils and rocky and stony soils.

Depth—Depth refers to surface and subsoil thickness plus any parent material that is favorable for root development and available moisture retention. Depth is a limitation on all soils with less than 36 inches effective depth.

Slope—Slope is a limitation when natural rainfall is removed or there is a possibility that it will be removed at a rate that tends to prevent the soil's moisture holding capacity from being filled. Slope is considered a limitation on soils with very rapid runoff potential.

LAND CAPABILITY CLASSES

Land-capability classification is the systematic arrangement of land types according to properties that determine the land's ability to produce on a virtually permanent basis. Classification is made for the purpose of selection and application of land uses and treatments that will keep it productive for prolonged use.

Land is initially classed as suitable for cultivation and not suitable for cultivation. Further classification is made into eight land-capability classes. Four are for land suited for cultivation and four are for land not suited for cultivation. These land classes are separated according to the degree of permanent limitations and hazards in the land's use and maintenance. For contest purposes, the contestants will only make an interpretation as to whether the land is suitable or not suitable for cultivation.

LAND SUITABLE FOR CULTIVATION

Class I: Few or No Permanent Limitations. There are no hazards to the maintenance of this land. Soils are nearly level with low water or wind erosion hazard. They are deep, well-drained, easily-worked soils not subject to damaging overflows. Class I land is potentially productive cropland that is capable of intensive cultivation.

Class II: Moderate Permanent Limitations or Moderate Hazards to its Maintenance. Limitations of different kinds of Class II land include such problems as (1) slight danger of water or wind erosion; (2) soils with shallow depth; (3) soils with fair to unfavorable soil structure and workability; (4) slightly wet land or (5) slow permeability. These limitations or hazards require attention on the part of the land owner or operator. They may require special practices such as special crops in a rotation, water control practices or tillage methods.

Class III: Severe Permanent Limitations or Frequent Hazards to the Land's Maintenance. Limitations of different kinds of Class III land may be the same as on Class II but are more severe. Therefore, it requires more attention and more specific practices to keep the land productive and prevent damage.

Class IV: Very Severe Permanent Limitations or Very Frequent Hazards. Land in this class may be cultivated only between long-time or irregular periods of permanent vegetation or may be used for limited cultivation. Cropping use is limited by inherent permanent characteristics of the land such as steep slope, unfavorable soil characteristics or adverse climate. Usually it is suited for only occasional cultivation for safe use. Some Class IV land is suited only for specialized grass or tree crops.

LAND UNSUITABLE FOR CULTIVATION

Class V: Soils have little or no erosion hazard, but have other limitations that restrict their use to pasture, range, woodland or wildlife. Cultivation of this class is not feasible because of one or more factors such as overflow hazard, stoniness or wetness. However it can be used safely for permanent vegetation under good management with little or no land damage.

Class VI: Soils with severe limitations that make them unsuitable for cultivation and limit their use to pasture, range, woodland or wildlife. This land requires careful management to prevent damage due to limitations such as steep slopes, severe erosion hazards, stoniness, very shallow depths, severe climate or severe erosion damage.

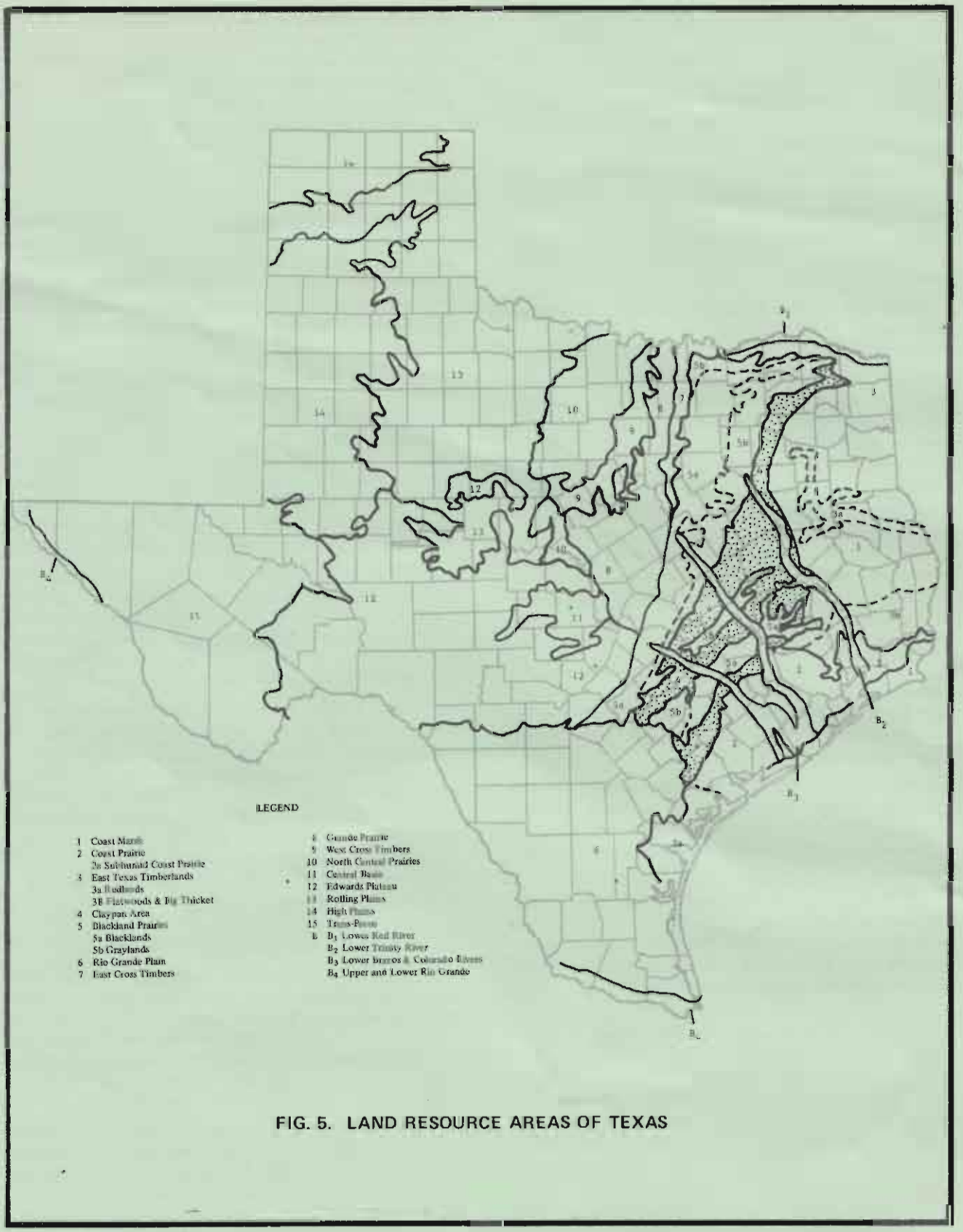


FIG. 5. LAND RESOURCE AREAS OF TEXAS

Class VII: Soils with very severe limitations restricting their safe use to range, woodland or wildlife. Soil conditions in Class VII are so severe that it is impractical to use such pasture and range improvements as seeding, fertilizing and liming.

Class VIII: Land having such extreme limitations or hazards that its use for recreation, wildlife, water supply or aesthetic purposes is restricted.

SUGGESTIONS FOR HOLDING A LAND JUDGING CONTEST

Planning is the first step toward a successful land judging contest. As soon as the date is set, leaders should select judges, guides and graders. In planning consider the number of teams, divisions and number of individuals per team. A team consists of three or four contestants with the three high scores tabulated as the official team score.

Site Selection. Select four sites prior to the contest and prepare an official key for each site so that graders will be able to score the contest in the shortest time possible. In some cases three sites may be satisfactory.

Site Cards. Prepare these cards in advance giving all necessary information to contestant and place them at each site during the contest. Include site number and depth of the original surface soil on each site card.

Boundary and Slope Stakes. Use four stakes to designate the site or area to be judged. Designate two of these stakes as slope stakes or use two additional stakes, but mark them properly.

Conducting the Contest. Register teams by using consecutive numbers and team members by using letters A, B, C and D. When the contest begins, contestants registered with Letter A will proceed to site 1; those with B to site 2; C to site 3 and D to site 4. Allow 20 to 30 minutes to judge each site; then give a signal to move. Each group moves to the next site. Collect cards before leaving a site. Group A will proceed to site 2, B to site 3, C to site 4 and D to site 1. With proper site selection, groups of 20 to 25 people will move without confusion.

Grading. Use a master or talley sheet simplifying the entry of individual scores by listing team members vertically and sites horizontally on the master sheet. Circle the low total score for elimination and team scores can be added quickly.

Each category on the scorecard carries a value of 10 points for a total of 150 points. Prior to the contest judges will establish variable points for the most nearly correct answer in designated areas.

Summary

- Plan all details prior to contest
- Select suitable sites
- Prepare card for each site
- Set boundary and slope stakes
- Instruct contestants on procedure
- Collect cards at each site when completed
- Prepare master talley sheet for scoring