

A Guide for Conservation Awareness Contests in Hawaii



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Introduction

Land is a many-splendored thing. Nothing so completely surrounds us in our day-to-day life. But, like so many things important to life, land goes unnoticed until we learn to appreciate it.

Participants in conservation awareness contests have the opportunity to learn about the land and to value its usefulness. By learning how to judge land, we will begin to understand what controls the use of land, why some types of land can be used for growing food crops while others are better used for forest or pasture. We will also learn what can be done to make land more valuable. After the fun of the contest is over, you will have a sense of appreciation of the land that will stay with you all your life. You will understand why land is one of Hawaii's most important resources. If you find the subject interesting, you may even want to pursue a career as a soil scientist, soil conservationist, agronomist, or a county agent.

You don't have to be an expert to take part in conservation awareness contests, and you can have lots of fun. Anyone, both boys and girls, can join in.

Judging Land

Land can be judged somewhat like animals or farm crops. In judging beef animals, we look for signs that tell us the animal's capacity to produce meat, such as depth of the body, topline, and smoothness. In judging crops, we look at the color of the crop, we note its size and its shape. Similarly, when judging land, we look for clues that tell us how well the land can produce crops or be used for other purposes. Soil characteristics, climate, topography or "lay of the land"—these are clues to soil capability. Most of all though, we examine the soil (not dirt, but soil) to determine

characteristics that control the land's capability.

This guide is divided into five parts that follow the procedures in a conservation awareness contest.

PART I: Physical Features of the Soil. In this section we look at the land and examine soil properties that can be judged by our physical senses. Some of these properties are texture, slope, depth, permeability (ability for water and air to move through the soil), and erosion.

PART II: Major Factors Affecting Land Use. In this section we select the soil properties at a site that is important enough to influence land use. Factors other than soil properties including rainfall, elevation, wind velocity, and flooding are also considered.

PART III: Land Capability Classification. In this section we classify the land according to its potential for agricultural use. The soil at each selected site is placed in one of eight land capability classes. The land capability class will determine the highest, most intensive, safe use of the land.

PART IV: Recommended Conservation Practices. In this section we choose conservation practices to protect the land.

PART V: Judging Land for a Homesite. In this section we evaluate the land for a homesite in terms of limitations of the soils for urban uses.

PART I: Physical Features of the Soil

In Hawaii our soils are formed from lava rocks, volcanic ash and cinders, coral sand, and organic matter. These materials are affected by climate and other soil forming factors that cause weathering or decomposition and form soil. Through the weathering process the soils develop characteristic soil profiles.

The Soil Profile

What is a “soil profile?”

When we look beneath the surface of the soil, we can see layers that differ in color, physical properties, chemical composition, and biological

characteristics. These layers are called “horizons.” When we slice through the soil vertically through all its horizons, we have a cross section of the soil called a soil profile (**Figure 1**).

A soil profile has three major layers. The first and uppermost layer is the topsoil, or “A” horizon.

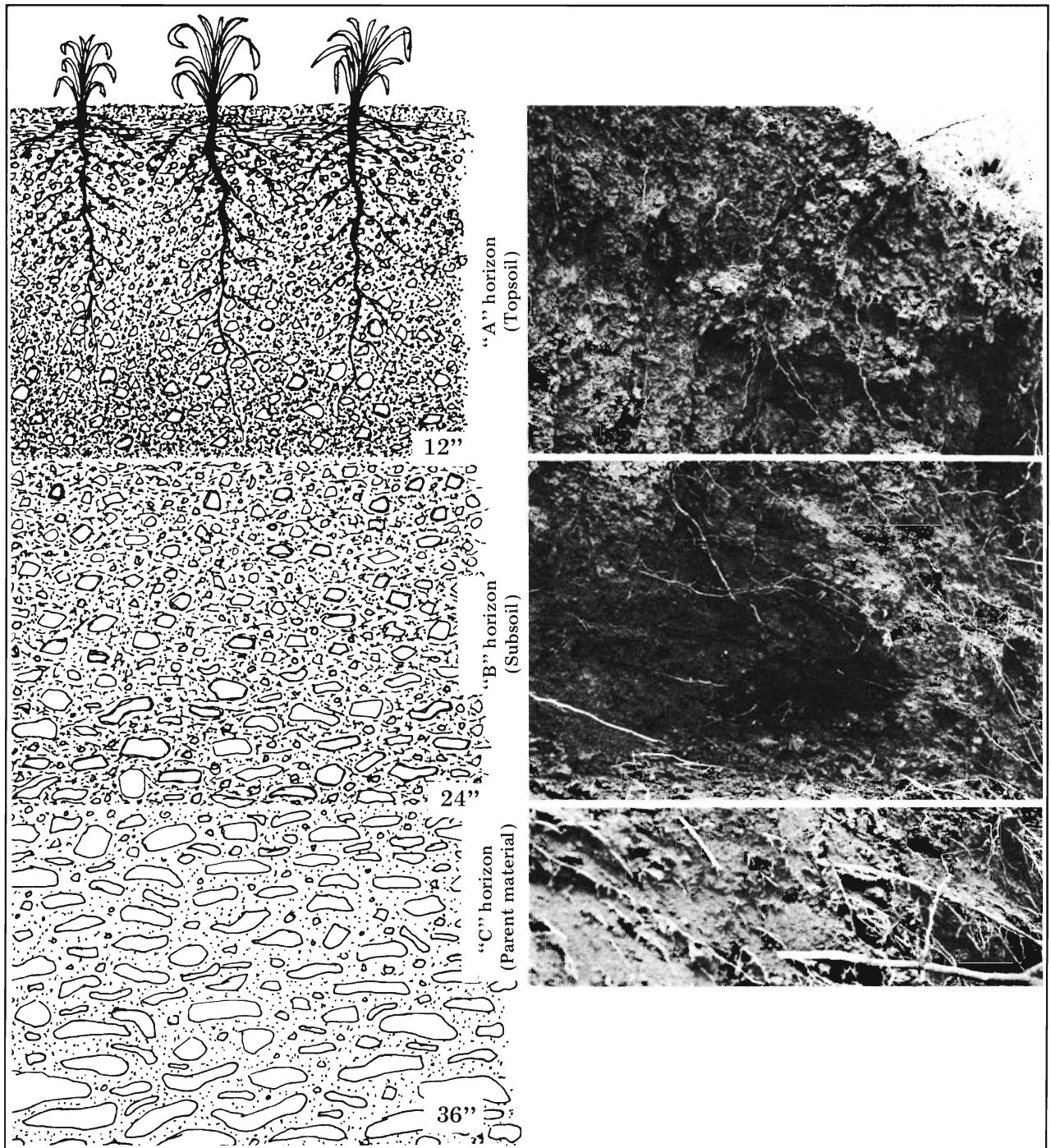


Figure 1. The soil profile shows the layers of the soil. Each layer may vary in color and texture. Where erosion has occurred, the surface layer or topsoil may be missing.

This layer contains most of the organic material that is in the soil. It is the best part of the soil for soil organisms to grow, for chemical activity to take place, and for plants to grow. If the land is farmed, the topsoil is the layer that the plow turns. This is the soil that is lost first when erosion occurs.

The second layer in the soil profile is the subsoil, or "B" horizon. This layer has less organic matter than the "A" horizon and water does not usually pass through as readily. The subsoil may have an accumulation of minerals that are deposited there as they are leached from the "A" horizon. The subsoil is an important part of the soil because it contains nutrients and water for plant growth. This layer is where we might find a hardpan, or a compacted layer, that restricts root growth and water movement.

The third layer and lowest layer in the soil profile is the parent material or "C" horizon. It is the least weathered of all the horizons, and it usually contains fragments of weathered rocks. In Hawaii the parent material or "C" horizon could be from a'a or pahoehoe lava, volcanic ash or cinders, or from coral. The "C" horizon is not judged in our contests, even though we recognize its importance, especially for deep rooted plants.

Physical Properties

If you look at the Hawaii Conservation Awareness Score Card, you will see Part I is called "Physical Features." Six soil features important in land judging are listed:

- (1) Surface texture
- (2) Subsoil texture
- (3) Permeability
- (4) Soil depth
- (5) Slope
- (6) Erosion

(1) and (2) Surface and Subsoil Texture

Texture is a very important property of the soil. It affects the ability of the soil to hold water (water-holding capacity); it affects the movement of air and water through the soil (permeability); and it affects the ability of the soil to retain nutrients for plants. Soil texture also affects the ease of cultivation and the erodibility of the soil.

What do we mean by texture? When talking about soil, texture refers to the proportion of sand-, silt-, and clay-size particles in the soil. **Figure 2** shows the sizes of sand, silt, and clay in relation to

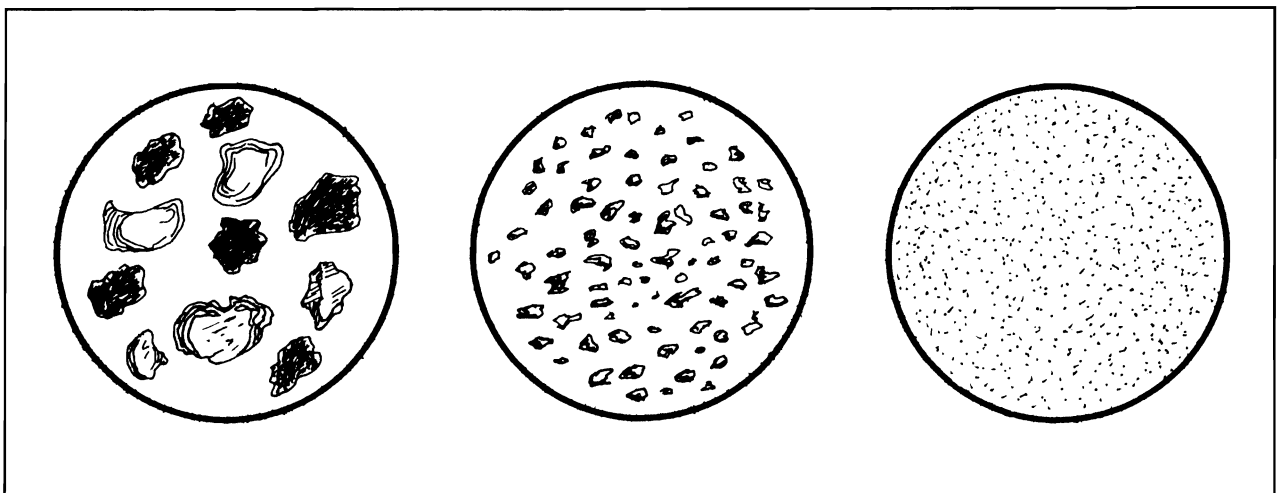


Figure 2. Relative sizes of sand, silt, and clay (shown left to right). The proportion of these vary in each soil and is referred to as soil texture. Sand may be as much as 2,000 times the size of clay and 400 times the size of silt. Clay influences the soil character to the greatest extent.

each other.

When judging land, we determine texture by rubbing a small amount of moist soil in the hand. Use your thumb and fingers to rub and feel the soil particles. The soil should be moist to make it easier to estimate the amount of sand, silt, and clay. Sand feels gritty when rubbed; silt feels smooth and buttery when moist; and clay is sticky when wet and forms a flexible “ribbon” when squeezed between thumb and forefinger.

For convenience, texture classes are placed in broad texture groupings as illustrated in **Table 1**. In land judging we will use the four category groupings (sandy, loamy, clayey, and very clayey) shown in the left column.

Sandy soils are loose and the individual sand

grains can be readily seen or felt. When rubbed between thumb and forefinger, it feels gritty. Squeezed when dry, it will fall apart as pressure is released. When moist, a mold may be formed which is unstable and crumbles as the soil is handled.

Loamy soils have a slightly gritty, smooth or velvety feel when moist. Squeezed when nearly dry, it forms a mold that will bear careful handling. The mold 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”.

Clayey soils are quite sticky when wet. They form hard lumps or clods when dry. When the moist soil is squeezed out between thumb and forefinger, it will form a short “ribbon” which will

Four-Category Group	Six-Category Group	Texture Classes
Sandy	Coarse textured soils	Sands Loamy sands
Loamy	Moderately coarse textured soils	Sandy loam Fine sandy loam
	Medium textured soils	Very fine sandy loam Loam Silt loam Silt
	Moderately fine textured soils	Clay loam Sandy clay loam
Clayey	Fine textured soils	Silty clay loam Sandy clay Silty clay
Very clayey	Very fine textured soils	Clay

Table 1. The categories of soil texture. The four-category group in the left column will be used in the Conservation Awareness Contest.

tend to break or the ribbon will bend downward.

Very clayey soils form very hard lumps or clods when dry and are very 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 moist soil can easily be molded to form different shapes.

For the contest, determine texture of both the surface and the subsoil from samples provided in containers.

(3) Permeability

Permeability refers to the ability of the soil to transmit air and water. It is expressed as inches per hour of water movement through the soil. Both air and water must move freely in the surface

layer and subsoil for plants to grow well. Soils with good permeability usually have about 25 percent air space and 25 percent water storage space.

Two soil properties that have most to do with permeability are texture and structure. The amount of organic matter in the soil and presence of alternating layers of contrasting textures in the soil profile also affect permeability.

A soil can have different permeability in the topsoil and in the subsoil. The permeability class of the whole soil, however, is based on the least permeable of the two layers. For the contest, determine permeability class based on texture of the least permeable layer, either the topsoil or subsoil (Table 2).

Permeability	Soil Texture	Remarks
Slow	Very clayey	<0.2 inches/hour; affects irrigation application and surface runoff
Moderate	Clayey, Loamy	0.2 to 6 inches/hour; favorable for agricultural uses
Rapid	Sandy	>6 inches/hour; frequent application is needed if irrigated

Table 2. Soil Permeability Classes. For the Conservation Awareness Contest, permeability is based on texture of the least permeable layer in the soil profile. For example, if the soil texture is very clayey in either the topsoil or subsoil, then permeability of the soil is slow.

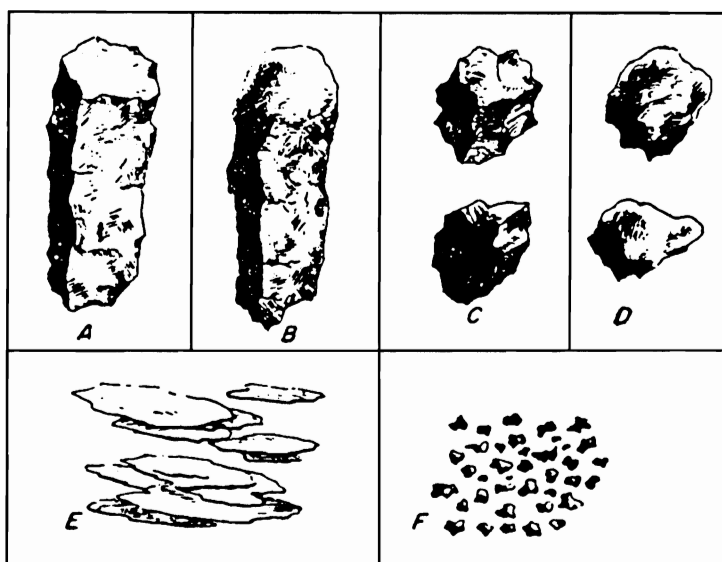


Figure 3. Examples of soil structure:

- A. Prismatic
- B. Columnar
- C. Blocky
- D. Subangular blocky
- E. Platy
- F. Granular

Structure	Remarks
Granular	Sphere-like or rounded aggregates; no flat or contact faces with adjoining aggregates; commonly occurs in the surface layer; most favorable for air and water movement
Blocky	Block-like aggregates with more or less six-faced surfaces; generally sharp or angular edges caused by pressure from surrounding aggregates; commonly occurs in the subsoil
Subangular blocky	Like blocky structure except flat faces have rounded edges and corners
Prismatic	Prism-like structure with vertical axis longer than the horizontal axis and with flat or pointed top surface
Columnar	Like prismatic structure except top surface is rounded
Platy	Plate-like or thin horizontal plates or leaflets; aggregates overlap each other; commonly occurs in the surface layer
Single grain (No real structure)	Individual soil particles do not stick together, but exist as a separate particle or grain; occurs in sandy soils; easily eroded by wind and water
Massive (No real structure)	Commonly occurs in very clayey soils; lacks aggregation and occurs as a dense mass; difficult to manage

Table 3. The types of soil structure.

Soil Structure

Soil structure is the shape and arrangement of soil particles into larger units or aggregates (**Figure 3** and **Table 3**). Soil structure is not judged in conservation awareness contests; however, we should know about this property because it affects permeability and the use and management of the soil.

Soil structure should be observed in the soil profile because the structure may not be easily recognized in the sample container. We determine the type of structure by observing the shape of the aggregates in the soil and by breaking them apart along the natural lines of breakage or separation (cleavage). The common types of structure in Hawaiian soils are granular (round), blocky, and subangular blocky (blocklike). Less common are

platy and prismatic. Also found in our soils are two conditions that are called structureless because they do not form aggregates. These are the single grain and massive soils.

(4) Soil Depth

Soil depth is the combined thickness of the surface layer and the subsoil plus any parent material that is easily penetrated by roots. It is the depth to any layer that restricts roots, generally bedrock (the solid rock under the soil), a “hardpan” such as an ironstone sheet, or a water table (**Table 4**). Depth is an important soil property. It determines the volume of soil available for plant roots, the total amount of water held in the soil, and the supply of nutrients available to plants.

Depth Class	Depth	Remarks
Deep	40 inches or more	Favorable depth for all crops
Moderately deep	20 to 39 inches	Sufficient depth for most commonly grown crops
Shallow	10 to 19 inches	Difficult to use machinery to cultivate; low water storage capacity; need frequent applications if irrigated
Very shallow	Less than 10 inches	Difficult or impossible to cultivate

Table 4. Soil depth to bedrock, hardpan, or water table.

(5) Slope

Slope, or “lay of the land”, has a tremendous effect on water runoff, erosion, and use of machinery for farming. To judge land, we consider three aspects of slope—steepness, length, and regularity or uniformity.

Steepness is measured in percent (Table 5). We can measure percent slope by using a hand level or a slope finder. We can also determine steepness of the slope by estimating the difference in elevation over a 100-foot horizontal distance. In the conservation awareness contest, you may use the slope finder.

Steepness influences how fast water will run off the land. Suppose you had land with little or no vegetative cover. By doubling the percentage of slope, you increase the speed of the water runoff four times. You also increase the cutting power of the water (its erosive power) 64 times! Water runoff not only means loss of soil by

erosion. It also means loss of water that should be stored in the soil for crop use or for replenishing our ground water supply.

You should consider the length of slope when selecting the best use for the land and when recommending conservation practices. Remember that long slopes collect a lot of water and increase erosion. The lower part of the slope is the hardest hit by erosion. You should choose conservation practices such as strip cropping, diversions, and terraces to reduce slope lengths. These practices are suitable for long slopes but are impractical on short, irregular slopes.

Irregular slopes—knobs, hills, water channels, and low spots are the most difficult to farm. Water tends to collect in certain areas and form gullies. On irregular slopes, strip cropping or crop rotation with grasses and legumes is effective. Contouring and terracing is often impossible on irregular slopes.

Slope Class	Percent Slope	Remarks
Nearly level	0 to 2	Land with 0 to 2 feet elevation change in 100 feet
Gently sloping	3 to 7	Land with 3 to 7 feet elevation change in 100 feet
Strongly sloping	8 to 14	Land with 8 to 14 feet elevation change in 100 feet
Moderately steep	15 to 24	Land with 15 to 24 feet elevation change in 100 feet
Steep	25 to 39	Land with 25 to 39 feet elevation change in 100 feet
Very steep	40 to 69	Land with 40 to 69 feet elevation change in 100 feet
Extremely steep	70+	Land with 70 or more feet elevation change in 100 feet

Table 5. Slope.

(6) Erosion

Erosion is the loss of soil caused by water or wind (**Figures 4 and 5**).

Water erosion occurs when raindrops beat the surface of the soil and runoff water carries soil particles away. The loosened soil particles can seal the soil surface, to increase water runoff.

Sheet, rill, and gully erosion are three forms of erosion by water. Sheet erosion is the more-or-less uniform removal of soil from an area without formation of conspicuous water channels. Rill erosion is the removal of soil through cutting of many small channels up to a foot deep. Gully erosion is the vertical cutting of the soil by concentrated water flow. Gullies are channels deeper than one foot.

Wind erosion occurs primarily in low rainfall areas where the vegetation is sparse and does not provide enough cover to protect the soil. Loamy and sandy soils are more susceptible to wind



Figure 4. Erosion on steep slopes where 500 tons (approximately 3 inches) of soil were lost in one rain when the slopes were bare. Slopes must be protected to prevent soil erosion.



Figure 5. Very severe erosion caused by the combination of wind and water. Note the depth of the soil removed as indicated by the soil pedestal.

erosion than clayey soils. Wind erosion can be identified by “blowouts” where the soil has been swept away, and by dunes where the windblown material is deposited. Blowouts are oval-shaped areas that point in the direction of the wind.

Other signs of past erosion are exposed roots, exposed lighter colored subsoil and rock fragments that normally occur below the surface layer, and accumulation of sediment downslope of eroded areas.

On the farm or ranch the effects of soil erosion include loss of topsoil and plant nutrients, and sedimentation of fields, ponds, and streams. Reduced plant vigor and crop yield can be the result of severe erosion. Soil erosion affects not only the site where the soil was removed, but also where the dust or sediment is deposited. Sediment

can clog drainage ditches, and pollute streams, beaches and coastal waters.

In land judging we determine the degree of past erosion by the amount of soil lost (**Table 6**). Calculate the percent of surface soil loss by comparing the present thickness of the topsoil with the original thickness as given on the contest condition sheet.

Example to calculate percent loss:

Thickness of original topsoil is 10 inches (given on condition sheet).

Thickness of present topsoil is 7 inches (measured by contestant).

$$\left[\left(\frac{10 - 7}{10} \right) \right] \times 100 = 30\% \text{ soil loss or } \textbf{moderate erosion}$$

Degree of Erosion	Original Topsoil Removed	Remarks
None to slight	<25%	Little or no evidence of soil loss; small amount of sheet and rill erosion may have occurred; there are no gullies
Moderate	25 to 75%	Surface layer may have rock fragments and light colored material from the subsoil; there may be few spots where the surface layer is completely removed; there may be rills, shallow gullies, and exposed roots
Severe	75% or more	Part of the subsoil has been removed; presence of definite pattern of waterways or blowouts; may have gullies, many of which are not crossable by farming implements
Very severe	About 100%	Most of the subsoil has been removed; may have deep gullies or severe blowouts; not suited for cultivation without extensive reclamation; very difficult to revegetate

Table 6. Erosion.

PART II: Major Factors Affecting Land Use

The farmer or rancher should know the properties of the soils on his farm or ranch and the important factors that affect the use of the land. He should have such information as rainfall, availability of irrigation water, soil pH and fertility, wind conditions, and flood hazard. Then he can properly manage the land for efficient production year after year.

For the contest, there will be a condition sheet that gives the conditions for judging the land. When judging land, we look for faults that limit land use. If you think the area being judged has limitations in any of the factors listed below, check the appropriate items on the Score Card. If there are no major faults, check "none."

(1) Surface texture. If texture of the topsoil is very clayey or sandy, it is a problem. Very clayey soils are difficult to cultivate because they are very sticky when wet and very hard when dry. Sandy soils are loose and do not hold water well for plants, resulting in the need for frequent irrigation.

(2) Permeability. Permeability is a problem if it is rapid or slow. (Note: For the contest, permeability of the soil is based on texture of the least permeable layer, either the topsoil or subsoil.) Permeability affects application rates for irrigation. Slowly permeable soils let water through so slowly that they are prone to more runoff, and ponding may occur in low areas. Rapidly permeable soils take in water so fast that furrow irrigation cannot be used, and fertilizer and pesticides leach more rapidly.

(3) Soil depth. An adequate soil depth is needed for effective rooting. Soil depth is a major factor if it is less than 20 inches.

(4) Slope. Slope is a major factor when it is 8 percent or more.

(5) Erosion. Severely eroded and very severely eroded soils present major problems for growing plants. They have lost most of the topsoil and a large part of the subsoil. With the topsoil

gone, they are low in fertility. These soils are susceptible to more erosion if cultivated.

(6) Wetness. Wetness or poor drainage indicates the presence of excess water in the soil. It is a problem if the soil has a water table within 4 feet of the surface. (A water table is the level of groundwater in the soil below which the soil is wholly saturated with water.) Wetness is also a problem if there is no water table but the soil remains wet for long periods as evidenced by presence of mottles (variegated colors of gray, and reddish brown due to reduced oxygen). Excess water reduces the amount of oxygen in the soil and affects root growth.

(7) Rainfall. Rainfall is part of climate, however, it is important enough that it is considered as a separate factor. Rainfall is a problem if there is too little, too much, or if it is poorly distributed throughout the year. It is a problem if annual rainfall is less than 50 inches, more than 175 inches, or if there is less than 2 inches per month for 2 or more consecutive months. Low rainfall and poor distribution can be overcome with irrigation. Therefore, if there is low or poor distribution of rainfall, but irrigation water is available, do not mark rainfall as a problem.

(8) Elevation and Climate. In Hawaii, climate is generally associated with elevation. At certain elevations, lack of enough sunlight due to cloud cover restricts the growth of crops. At higher elevations, the temperatures may be too low for best growth of crops. If elevation is 3,000 feet or more, if there is cloud cover more than 30 percent of the time, or if average temperature is less than 50 degrees Fahrenheit, it is considered a major problem.

(9) Wind. In many parts of Hawaii, strong winds cause serious crop damage, excessive soil moisture loss, and discomfort to animals and people. In extreme cases, it causes soil erosion. Windbreaks and special cultivation methods are used to control wind damage. Wind is considered a factor if average velocities are greater than 20 miles per hour or if gusts are greater than 40 miles per hour. Wind does not affect land capability because it can be controlled with windbreaks.

(10) **Flooding.** Floods can wash out crops or drown them. It can cover the land with sand, gravel, or stones and reduce the value of the land for agricultural use. Flooding is a major problem if it occurs more often than once in two years.

(11) **Stoniness or Rock outcrop.** This is a problem if 25 percent or more of the surface area is covered with stones or rock outcrop. (Stones here, refer to rock fragments of all sizes, although technically, stones are rock fragments 10 to 24 inches in diameter. Rock outcrop is exposed solid bedrock.) Use of machinery for cultivation will be very difficult or impractical. Only certain crops that require little or no cultivation can be grown on these soils (**Figure 6**).

(12) **Salinity.** Salinity refers to the salt content of the soil. Salinity is a problem if the soil has more than 0.2 percent salt. In Hawaii, the

problem is usually confined to low coastal areas.

(13) **None.** Mark “none” on the score card if none of the factors above is a major problem.

PART III: Land Capability Classification

The land capability classification is a grouping of soils primarily for agricultural uses. There are eight capability classes. Class I soils are the best and Class VIII the poorest. Soils in Classes I through IV are suitable for sustained use for cultivated crops. Soils in Classes V through VIII generally are not suited for cultivation.

How do you know the capability class for the land? Use the guide in **Table 7** to determine the best land class possible based on all the soil factors.



Figure 6. Extremely stony soils are used to grow coffee in Kona.

Soil Factor	Best Land Class Possible	Soil Factor	Best Land Class Possible
Surface Texture		Wetness	
Very clayey	II	Not saturated for long periods	I
Clayey, Loamy	I	Excessively wet (water table >4 ft.)	III
Sandy	III	Excessively wet (water table 1-4 ft)	IV
		Excessively wet (water table <1 ft)	V
Permeability		Rainfall	
Slow	II	<20 inches	VI*
Moderate	I	20 to 49 inches	IV*
Rapid	III	50 to 174 inches	I
		175 inches or more	III
Soil Depth		Poor distribution	IV*
(to bedrock or hardpan; see wetness factor for depth to water table)		*Class I if irrigation water available.	
Deep (40 inches or more)	I	Elevation and Climate	
Moderately deep (20 to 39 inches)	II	Elevation <3000 feet	I
Shallow (10 to 19 inches)	III	Elevation 3000 feet or more	III
Very shallow (0 to 9 inches)	VII	Cloud cover >30 percent of the time	III
Rock outcrop	VIII	Average temperature <50 degrees F.	III
Slope		Flooding	
Nearly level (0 to 2%)	I	None to occasional (once in 2 yr. or less)	I
Gently sloping (3 to 7%)	II	Frequent (more than once in 2 years)	III
Strongly sloping (8 to 14%)	III		
Moderately steep (15 to 24%)	IV	Stoniness or Rock outcrop	
Steep (25 to 39%)	VI	<25 percent	I
Very steep (40 to 69%)	VII	25 to 60 percent	VI
Extremely steep (70% or more)	VIII	>60 percent	VII
		>85 percent rock outcrop	VIII
Erosion		Salinity	
None to slight erosion	I	Non-saline (<0.2% salt)	I
Moderate	II	Moderately saline (0.2 to 0.4% salt)	III
Severe	III*	Strongly saline (>0.4% salt)	VI
Very severe	VII		
*Class IV if strongly sloping (8-14%) or Class VI if moderately steep (15-24%)			

Table 7. Guide to determine land capability classes in Hawaii. This is a general guide for the Conservation Awareness Contest.

The land capability system tells what the highest intensity of land use can be without risk of soil damage. The highest use is cultivated crops for Classes I through IV. They may also be suited for orchard, pasture, or woodland, but the highest use is cultivated crops. Classes V through VIII are generally not suited for cultivated crops because of severe erosion hazards or soil properties that severely affect cultivation. Class V lands are nearly level and have little or no erosion hazard, but they may be excessively wet and best suited for pasture. Classes VI and VII are generally best suited for pasture. If rainfall and soil depth are adequate, they may also be used for certain orchard crops and for forest. Class VIII lands are too steep or have too severe soil problems (bare rock for example) that they are only suitable for wildlife or recreation.

Present use is not a factor in determining land capability. **Figure 7** shows land capability classes on a landscape in Hawaii.

Land Suitable for Cultivation

Class I. Class I lands have few limitations that restrict their use. The soils are productive or potentially productive. They are suitable for intensive crop production and can grow a wide variety of plants. These lands have nearly level slopes (0 to 2 percent slopes).

Class II. Class II lands have some limitations that reduce the choice of plants and require moderate conservation practices. The practices are easy to apply. These lands have gentle slopes (3 to 7 percent slopes) if all other factors are favorable. Other factors that can place soils in this

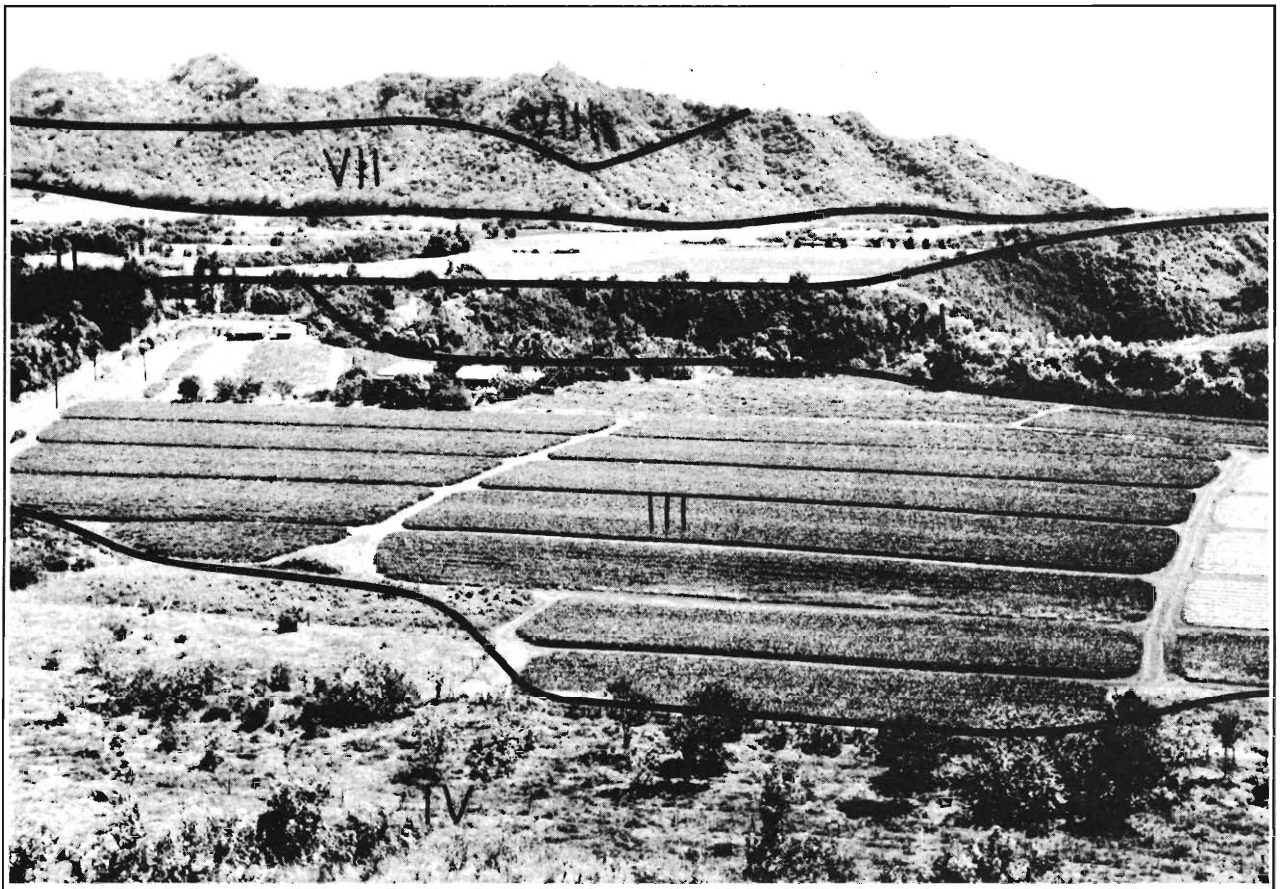


Figure 7. Land capability classification is based upon the most intensive, safe use of the soil for agricultural purposes. Class I through Class IV lands are best suited for cultivated crops. Class V through Class VII lands are best suited for pasture and range. Class VIII land is best suited for wildlife and recreation.

class are very clayey surface texture, slow permeability, moderate depth, and moderate erosion.

Class III. Class III lands have limitations that reduce the choice of plants and require special conservation practices. Their limitations are more pronounced than Class II, and conservation practices are more difficult to apply and maintain. These lands have moderate slopes (8 to 14 percent slopes) if all other factors are favorable. Other factors that can place soils in this class are sandy surface texture, rapid permeability, shallow depth, severe erosion, wetness, high rainfall, adverse elevation and climate, flooding and salinity.

Class IV. Class IV lands have limitations that reduce the choice of crops and require very careful management. Conservation practices are more difficult to apply than on Class III lands. A combination of practices are usually needed. These include green manure or cover crops, mulching, contour farming, terraces, and diversions. These lands are strongly sloping (15 to 24 percent slopes) if all other factors are favorable. Other factors that can place soils in this class are erosion, wetness, and low or poor distribution of rainfall.

Land Not Suitable for Cultivation

Class V. Class V lands have little or no erosion hazard, but they have limitations that restrict their use to perennial vegetation, such as grazing, woodland, wildlife or recreation. The soils may be nearly level (0 to 2 percent slopes), but the water table may be so near the surface that the soils are always wet and drainage is impractical. These lands are best used for grass production and grazing. They may also be used for forestry or wildlife.

Class VI. Class VI lands have limitations that restrict their use to a permanent vegetative cover. Pasture is considered the highest safe use for the land. It can also be used safely for orchards if there is enough rainfall and a good vegetative cover is maintained. Woodland, wildlife, or

recreation are other possible uses. These lands have steep slopes (25 to 39 percent slopes) if all other factors are favorable. Other factors that can place soils in this class are low rainfall, stoniness, and salinity.

Class VII. Class VII lands have very severe limitations that restrict their use largely to pasture, woodland, and wildlife. Pasture is the highest safe use for this capability class. These lands may have very steep slopes (40 to 69 percent slopes), very shallow depth, very severe past erosion, or extreme stoniness or rock outcrop (Note: Certain soils on the Big Island are in Class VII because of extreme stoniness, but are suitable for orchard crops such as macadamia, coffee, and papaya as shown in Figure 6.)

Class VIII. Class VIII lands have very severe limitations and cannot be used for commercial plant production. The highest safe use for this capability class is recreation or wildlife. These lands have extremely steep slopes (70 percent or more), or have 85 percent or more rock outcrops.

PART IV: Recommended Conservation Practices

Erosion can occur when the soil is disturbed or plant cover is removed. It can occur as a result of ordinary farm and ranch operations such as plowing, grazing, and harvesting of crops. Sediment from eroding fields can bury the land below and can pollute streams, beaches, and coastal waters.

The best way to protect the soil from eroding is to provide a good covering for the soil. Vegetation protects the soil from the beating and eroding effects of raindrops and slows or prevents water runoff. Mulches in the form of sugarcane bagasse, grass clippings, or other plant residue can also be used to provide soil cover. Structural measures such as diversions, terraces and grassed waterways can be used to control and convey runoff water. There are also management practices such as managing grazing, farming across the slope or on the contour, and use of irrigation water. Usually a

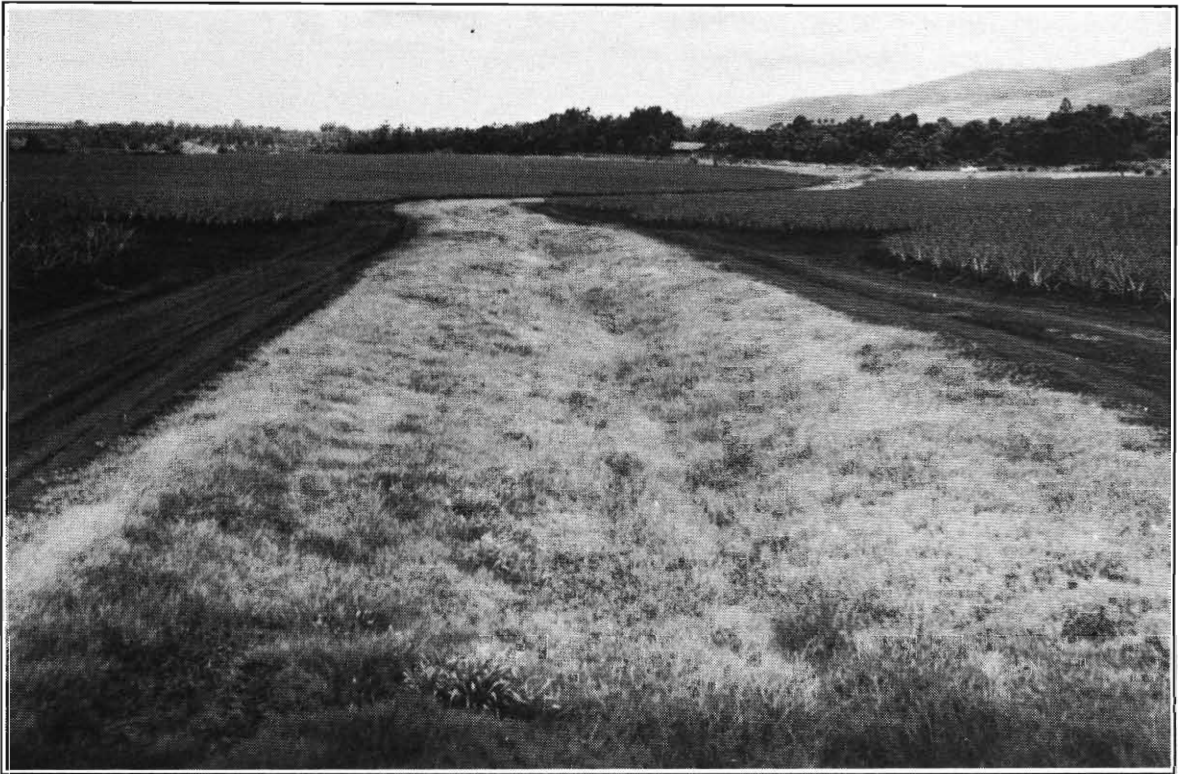


Figure 8. Grassed waterways are used to convey runoff water from fields. The lining of grass prevents gully formation.

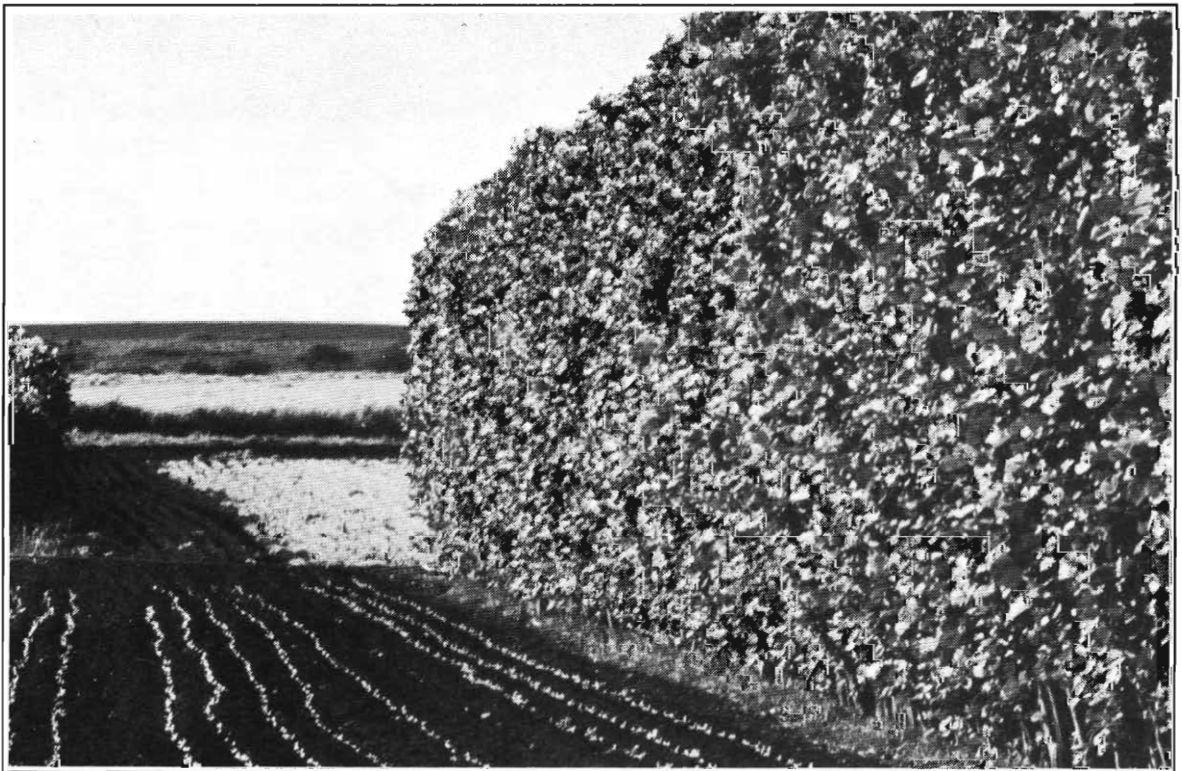


Figure 9. Windbreaks are needed to protect crops. They may be planted windbreaks or mechanical structures such as a saran fence.

combination of practices are needed to effectively control erosion. (Note: Farmers and ranchers can obtain advice on selecting conservation practices on their land from the Soil Conservation Service.)

In part IV of the Conservation Awareness Score Card, select conservation practices that apply to a specific land use. Unless otherwise informed, the land use will be the highest safe use as determined by the land capability class. For the purpose of this contest, the highest safe use is cultivated crops for classes I through IV; pasture for classes V through VII; and wildlife and recreation for class VIII. (As an alternative, judges may select a specific land use such as orchard or woodland).

The practices to be chosen are divided into five major categories: (1) Practices for cropland and orchard, (2) Practices for pasture, (3) Practices for woodland, (4) Practices for recreation and wildlife, and (5) Practices for either cropland and orchard, pasture, or woodland.

The conservation practices listed on the Score Card are described below:

Practices for Cropland and Orchard

1. Use soil conserving or soil improving crop every fourth or fifth year. This practice is needed on Class I land.

Soil conserving crop (cover crop) is a grass, small grain, or legume crop that is grown to protect the soil between periods of regular crop production, or that is grown between trees in an orchard. A close seeded crop, such as wheat and alfalfa, is generally regarded as a soil conserving crop.

Soil improving crop (green manure crop) is a crop that is grown to be plowed into the soil at an early stage of maturity to increase soil organic matter. Organic matter improves structure, fertility, and water holding capacity of the soil. Fast-growing legumes and grasses are used. Legumes are preferred because they have the ability to take nitrogen from the air for plant use,

and they increase nitrogen content of the soil. Well-known legumes are soybeans, peas, beans and clovers. 'Tropic sun' sunn hemp (crotalaria, a legume), ryegrass, and oats are green manure crops commonly used in Hawaii. The amount of time the soil is occupied by the soil conserving or soil improving crop should increase as the erosion hazard increases.

2. Use soil conserving or soil improving crop every third or fourth year. This practice is needed on Class II land.

3. Use soil conserving or soil improving crop every second year. This practice is needed on Class III land.

4. Use soil conserving or soil improving crop every year. This practice is needed for Class IV land.

5. Return crop residue to the soil. All parts of the plant not harvested as a crop should be left in the field. This means that you do not burn the residues or remove such material from the soil. Leaves, stems, and other crop residue help to conserve moisture, reduce erosion, and add organic matter to improve the soil. This practice is needed on all cropland and orchard.

6. Establish grassed waterways. Grassed waterways are natural or man-made water courses that are shaped and planted with a suitable grass (**Figure 8**). The grass-protected waterways convey concentrated flows and prevent formation of gullies. Grassed waterways are needed on cropland and orchards at outlets of terraces and diversions or in natural drains or swales to carry concentrated flows. Maximum slope for use of this practice is 20 percent. If slopes are steeper the high velocity of water will erode a grassed waterway, so a rock- or concrete-lined channel may be needed.

7. Establish recommended windbreaks for erosion control and crop protection. Windbreaks help to reduce physical damage to crops, reduce soil moisture loss, and reduce wind erosion. Trees or shrubs may be planted, or windbreaks may be constructed from various materials (**Figure 9**). Windbreaks reduce the force of the wind and provide protection to crops for a distance

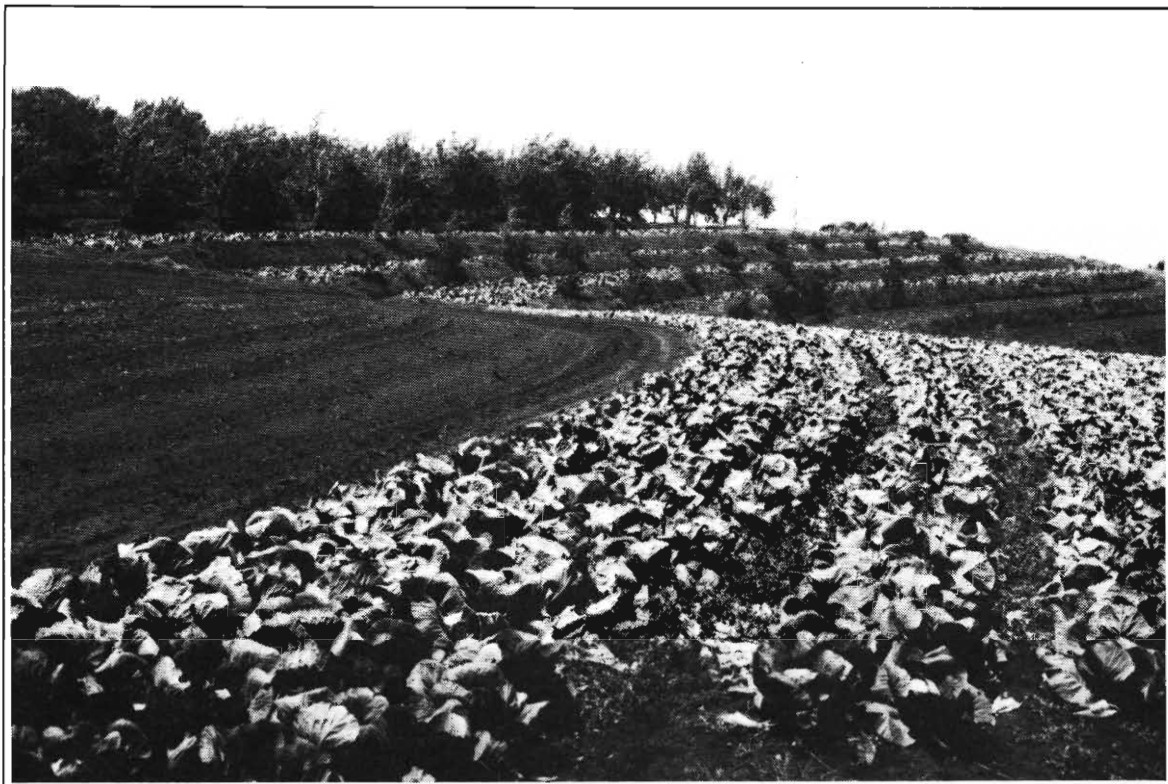


Figure 10. Contour farming is an excellent method of preventing and controlling soil erosion. All farming operations are done on the contour.



Figure 11. Irrigation water management. Drip irrigation is an effective way to apply water where it is needed.

equal to five times or more the height of the tallest part of the windbreak. Windbreaks are needed on all cropland and orchards since damaging winds can occur even where average wind velocities are low. Windbreaks are also needed to protect urban and recreational areas.

8. Cross-slope or contour farming. In cross-slope farming all plowing, planting and other farming operations are done across the slope of the land, rather than up and down hill. In contour farming, all operations follow the contours as close as possible. **Figure 10** shows contour farming, an excellent method of controlling soil erosion. This practice is needed on all cropland and orchards with slopes greater than one percent.

9. Construct and maintain diversions or terraces. Diversions and terraces are constructed across the slope to divert or store surface runoff water instead of permitting it to flow uninterrupted down the slope. Diversions and terraces are similar except diversions are constructed to handle greater flows of water. They are used on cropland and orchards to break the flow of water down long slopes.

Diversions and terraces are not recommended on soils that are shallow (less than 20 inches deep) or very stony (rock fragments cover more than 25 percent of the surface); also on irregular slopes or on slopes 25 percent or more. There should be a place to safely discharge the water from diversions and terraces. For the contest, diversions and terraces are needed on slopes 3 to 24 percent and where slope lengths are 200 feet or more. Assume that there is an adequate outlet for safe disposal of the water. This practice should be chosen even if there is an existing terrace or diversion on the land.

10. Irrigation water management. This refers to the use and management of irrigation water on cropland and orchards (**Figure 11**). Water should be applied at rates and amounts that will not cause significant erosion or water loss through surface runoff or deep percolation. Irrigation should be timed to avoid leaching of recently applied fertilizer and pesticide. Factors that must be considered are water holding capacity and permeability of the soil. This practice is

needed where rainfall is a problem because of low amounts or poor distribution and where irrigation water is available .

11. Use animal manure. Manure from farm livestock applied to the surface or mixed into the soil is an excellent soil management practice as well as an excellent method of disposing of this material. Manure adds organic matter, nitrogen, and other plant nutrients to the soil. Avoid excessive use that could pollute streams or the groundwater. This practice is needed on all cropland and orchards where manure is available.

12. Use green manure crops. A green manure crop is grown specifically to add organic matter to the soil (**Figure 12**). It can be used between vegetable crop rotations to improve the condition of the soil. It can also be used prior to planting a perennial crop, such as orchards. Fast-growing legumes and grasses are used. Legumes are preferred because they have the ability to take nitrogen from the air for plant use, and they increase nitrogen content of the soil . The organic matter improves soil structure, increases water holding capacity, makes the soil easier to plow and cultivate, and increases the ability of the soil to retain plant nutrients. This practice is needed on all cropland and orchards (see practices 1 through 4).

Practices for Pasture

13. Establish recommended grasses and legumes. This practice applies to pasture land where the present grasses or legumes should be replaced by improved species (**Figure 13**).

14. Manage grazing for erosion control. Grazing at an intensity which maintains adequate residues for soil and plant protection is considered proper pasture use. This includes deferred grazing, rotation grazing and proper placement of water facilities, salt and minerals. This practice is needed for all pasture lands.

15. Control noxious plants. Plants such as lantana, cactus, gorse, christmasberry, guava, and sourgrass are undesirable or noxious because they spread rapidly and compete with desirable grasses and legumes. These noxious plants can completely



Figure 12. Tropic Sun, a green manure crop, is plowed into the soil to add organic matter.



Figure 13. Use recommended grasses or legumes for pastures.

cover a pasture if left uncontrolled. They should be destroyed by mechanical, chemical or biological means. This practice is needed on all pasture land to ensure a full stand of quality forage.

16. Improve and maintain water facilities such as pipelines, catchments, reservoirs, and tanks for livestock. There are areas in the state where it is necessary to pump water to high elevations for livestock use. To reduce costs, catchments or rainsheds can be used to collect water. During drought years you may get into trouble unless adequate storage is provided. Tanks, lined reservoirs, and earthen ponds are used to store water. Earthen ponds are feasible on only a few Hawaiian soils because most soils are very porous and difficult to compact. This practice is needed on all pasture land.

17. Establish windbreaks or shelterbelts for animal protection. Shelterbelts are windbreaks that are planted to break up large expanses of pasture to provide protection for animals (**Figure 14**). Animals are seriously affected by high or

continuous winds. Where pasture areas are exposed to winds, protection for animals must be provided. This practice is needed where wind is a major problem.

Practices for Woodland

18. Plant adapted trees. This practice applies to land used for woodland. Trees are planted for commercial wood products, erosion control, or watershed protection. Trees to be planted should be adapted to the soil and climate of the site. The State Division of Forestry and Wildlife makes recommendations for suitable adapted trees.

19. Protect trees from burning and grazing. Fire and grazing animals can damage trees or completely destroy woodlands or forests. Fences should be used to protect trees susceptible to grazing damage. Firebreaks (barriers of cleared land) should be constructed to control fires on planted forests.



Figure 14. Shelterbelts are needed for animal protection in areas exposed to high or continuous winds. The shelterbelt breaks up large expanses of pasture and provides protection.



Figure 15. Mature trees should be harvested periodically on a selective basis.



Figure 16. Developing trails, signs, trash receptacles, etc., are means of increasing recreational opportunities.

20. Harvest trees selectively. Mature commercial and cull trees should be harvested periodically on a selective basis. This allows desired trees to develop and improves the forest stand (**Figure 15**).

Practices for Recreation and Wildlife

21. Wildlife Habitat Improvement. This practice involves planting of food and cover plants for desired wildlife species. This is a means of providing land with possibilities of recreation such as hunting. This practice is needed for areas to be used for wildlife and recreational purposes.

22. Improve water facilities for wildlife and recreation. This includes pipelines or catchments, storage facilities such as tanks, or reservoirs, and protected drinking facilities. This practice is needed for areas to be used for wildlife and recreational purposes.

23. Develop recreational facilities such as access road, trails, shelters, and campsites. Income-producing recreation is a rapidly growing land use. People like an area that is easily accessible, yet dissimilar to their everyday surroundings. Access roads and trails provides this access. Shelters and campsites provide facilities for use by the public. All facilities should be planned to fit into the environment to maintain the aesthetic value of these areas (**Figure 16**). This practice is needed for all areas to be used for recreational purposes.

Practices for Cropland, Orchard, Pasture, or Woodland

24. Control flooding. Construct flood control structures, such as dikes, and levees. Flood control structures should be designed and constructed according to the anticipated stream flow and the level of protection desired. This practice is needed for cropland and orchards where flooding is a major problem. Flood control structures are used to protect crops or high use areas and generally are not used on pasture land.

25. Install and maintain a drainage system. Where the soil remains wet for long periods, excess ground or surface water is removed by installing open ditches, tile drains, pumping stations, levees, floodgates and other structures. Removal of excess water will improve growing conditions for most plants and will improve tillage and harvesting operations. This practice is needed for cropland and pasture land where wetness is a problem except on class V land.

26. Apply lime or soil amendments according to soil test. pH or soil reaction is a term used to indicate the level of acidity (low pH) or alkalinity (high pH) in the soil. The pH of Hawaii soils generally range from 4.0 to 8.0, but commonly are on the acid side, between 4.5 and 6.5. A pH between 6.6 and 7.3 is considered neutral. Plants, including cultivated crops and pasture grasses and legumes grow best within a certain pH range.

If the soil test shows the soil is too **acid** (pH below 6.0), lime should be applied to raise the pH. Lime is thoroughly mixed in the plow layer before planting the crop. Crushed coral is the cheapest and the most commonly used liming material in Hawaii. Dolomite, hydrated lime, and calcium silicate can also be used.

If the soil is too **alkaline** (pH above 8.0), sulfur or a similar acid forming amendment can be applied to reduce the pH to a more favorable level. You can test for pH with a pH kit available in garden shops. Or you can have pH and nutrients tested by the University of Hawaii Cooperative Extension Service for a small fee.

27. Fertilize with nitrogen, phosphorus and/or potassium. If the soil test results are low or moderate for any of these nutrients, fertilizer will be needed for cropland, pasture, and orchards. Experimental work by the University of Hawaii Agricultural Experimental Station and the U.S. Forest Service has shown that these nutrients will also increase tree growth in forests or woodlands.

28. Fertilizer or soil amendments not needed. If the soil test shows high levels for all three major plant nutrients (nitrogen, phosphorus, and potassium), fertilizer is not needed. If pH is between 6.0 and 8.0, soil amendments are not needed.

PART V: Judging Land for Homesites

A home is a major investment for most people. Individual families and communities can avoid construction and maintenance problems if a study of soil conditions is made before construction begins (**Figure17**). Soil information can be used to predict potential problems on planned or existing homesites. Before building or buying a home, here are some questions that should be considered.

1. Is there a flood hazard? Avoid homes in a flood plain.
2. Is drainage so poor that standing water or wetness is a problem?
3. Does the soil have high shrink-swell properties that can damage building foundations, driveways, underground utilities, and other structures?

4. Does slope and unstable soil make erosion and soil movement major problems?

5. Is the soil acid or saline that pipes corrode easily and require frequent replacement?

6. Was grading and soil removal extensive? Was the surface soil replaced?

7. Are the soil properties favorable for lawn grasses, shrubs, trees, flowers, and vegetables without extensive soil modification?

8. Is the land located in a lava flow high hazard zone?

In judging land for homesites, the soil properties important for urban uses are considered. Many of the properties considered in agriculture are also important for urban uses. Although the soil properties are the same, use caution since a different set of criteria is used to evaluate urban uses. Assume that water is available when you rate the soil for homesites.



Figure 17. Knowledge of soil conditions is essential to properly plan for urban development.

Soils have limitations in use depending on their inherent properties. In urban evaluations, the soils are rated as having slight, moderate, or severe limitations as follows:

Slight limitations—soils have properties favorable for the intended use. Good performance and low maintenance can be expected.

Moderate limitations—soils have properties moderately favorable for the intended use. Limitations may be overcome or modified by special planning, design, or maintenance.

Severe limitations—soils have one or more properties unfavorable for the intended use. Limitations are difficult and expensive to modify or overcome. A severe rating does not mean the soil cannot be used for the intended use. It means more work needs to be done to overcome the soil limitations. This increases the cost of development which must be considered when evaluating the site.

Limitation ratings will be made for three homesite uses shown below. Ratings for other uses, including septic tank absorption fields, sewage lagoons and playgrounds, can be made but are not included in this contest.

Foundations for buildings—this rating reflects the suitability of the soil to support buildings. Some important soil properties that affect building foundations are slope, shrink-swell potential, depth to water table, and flooding.

Lawns, shrubs, and gardens—this rating reflects the suitability of the soil for growing lawns, shrubs, trees, vegetable gardens, or other plantings. The important soil properties are those that affect establishment and maintenance of plantings. They include surface texture, permeability, stoniness, water table and past erosion.

Shallow excavations—this rating reflects the ease of digging trenches or holes in the soil to a depth of 5 feet. Excavations are made for uses such as cemeteries, septic tank filter fields, building foundations, and underground utilities including sewerlines, pipelines, and cables. Important soil characteristics affecting shallow excavations are depth to bedrock, texture, slope, stoniness, and flooding.

Factors Important in Evaluating Homesites

1. Surface texture.

Only texture of the surface soil is needed on the Homesite Scorecard. (Note, however, that texture of the subsoil is needed to determine permeability, see 2 below).

Very clayey—severe limitations for foundations and for lawns, shrubs, and gardens; and moderate limitations for shallow excavations. Special planning and design is required for all types of foundations. The soil is sticky when wet, hard when dry and difficult to manage when used for growing plants.

Clayey—slight limitations for all three uses.

Loamy—slight limitations for all three uses.

Sandy—moderate limitations for all three uses. May require addition of organic matter or fine soil material to improve moisture and nutrient holding capacity for plants. Soil blowing may be a problem when the soil is bare during construction.

2. Permeability.

This refers to the rate of water and air movement through the soil. (Note: For the contest, permeability of the soil is based on texture of the least permeable layer, either the topsoil or subsoil. If only one sample is provided base permeability on it).

Slow permeability—very clayey texture, water movement less than 0.2 inches per hour. Moderate limitations for foundations and lawns, shrubs and gardens; slight limitations for shallow excavations. Irrigation of plants must be done at low application rates.

Moderate permeability—clayey or loamy texture, water movement between 0.2 to 6 inches per hour. Slight limitations for all three uses.

Rapid permeability—sandy texture, water movement greater than 6 inches per hour. Slight limitations for foundations. Moderate limitations for lawns, shrubs and gardens due to frequent need for water and plant nutrients. Slight limitations for shallow excavations.

3. Soil Depth.

This refers to depth from the surface of the soil to bedrock.

Deep—depths 40 inches or more. Slight limitations for all three uses.

Moderately deep—depths between 20 inches and 39 inches. Slight limitations for foundations, lawns, shrubs, and gardens. Moderate limitation for shallow excavations.

Shallow—depths between 10 and 19 inches. Slight limitations for foundations. Moderate limitations for lawns, shrubs, and gardens. Severe limitations for shallow excavations.

Very shallow—depths less than 10 inches. Slight limitations for foundations. Severe limitations for lawns, shrubs, and gardens and for shallow excavations.

4. Slope.

The steepness of the land or the change in elevation in 100 feet of distance expressed in percent.

Nearly level—0 to 2 percent slopes. Slight limitations for all three uses.

Gently sloping—3 to 7 percent slopes. Slight limitations for all three uses.

Strongly sloping—8 to 14 percent slopes. Moderate limitations for all three uses.

Moderately steep—15 to 24 percent slopes. Severe limitations for all three uses.

Steep to extremely steep—25 percent slopes or steeper. Severe limitations for all three uses. Generally not recommended for building sites. Very expensive and difficult to modify for urban use.

5. Erosion.

Loss of surface soil increases the cost of landscaping. Gullies increase the cost of leveling and filling for urban use. Determine degree of erosion as in the agricultural section.

None, slight, or moderate erosion—generally slight limitations for all three uses.

Severe erosion—moderate limitations for foundations, and lawns, shrubs and gardens. Slight limitations for shallow excavations. Re-

quires leveling, replacement of topsoil and use of fertilizer for satisfactory plant growth.

Very severe—Severe limitations for all three urban uses.

6. Shrink-swell potential.

Soils shrink and swell with changes in moisture content. The potential for soils to shrink and swell depends on the kind and amount of clay minerals present. Soils that shrink and swell the most have high amounts of clays that expand and contract greatly (montmorillonite clays). When these soils dry out, they shrink, leaving large deep cracks on the surface (**Figure 18**). When they become wet (after irrigation or rain) they expand and the cracks close. Expansion and contraction of the soils can contribute to soil creep or landslides in sloping areas. Movement of the soil can severely damage building foundations, streets, sidewalks, retaining walls, and underground utilities (**Figure 19**).

Low shrink-swell—sandy and loamy soils; and clayey soils that do not have many surface cracks as wide as 1/4 inch and more than 3 inches deep when dry. Slight limitations for all three uses.

Moderate shrink-swell—clayey soils that have many surface cracks 1/4 inch wide or wider and more than 3 inches deep when dry. Moderate limitations for foundations. Slight limitations for lawns, shrubs, and gardens, and for shallow excavations.



Figure 18. Large cracks in high shrink-swell soil.

High shrink-swell—very clayey soils; these soils commonly have many surface cracks 1/4 inch wide or wider and more than 3 inches deep when dry. Severe limitations for foundations. Moderate limitations for shallow excavations. Slight limitations for lawns, shrubs, and gardens.

7. Stoniness.

Rock fragments of all sizes on the surface and in the surface layer. The amount of stones (percent by volume) interferes with urban uses as follows:

0 to 2 percent—slight limitations for all three uses.

3 to 14 percent—slight limitations for foundations; moderate limitations for lawns, shrubs, and gardens and for shallow excavations.

15 percent or more—slight limitations for

foundations; severe limitations for lawns, shrubs, and gardens and for shallow excavations.

8. Water table.

The upper surface of groundwater or the level below which the soil is wholly saturated with water. Depth to the water table may change during different seasons of the year. A high degree of mottling in the soil (variegated colors of browns, yellows and grays due to poor aeration) may indicate the level of the water table. A permanent water table near the soil surface results in wet soils, poor plant growth and poor conditions for construction. For the contest, measure depth from the soil surface to the water level at the time of the contest.

Deep—no water table at depths of 40 inches or more. Slight limitations for all three uses.

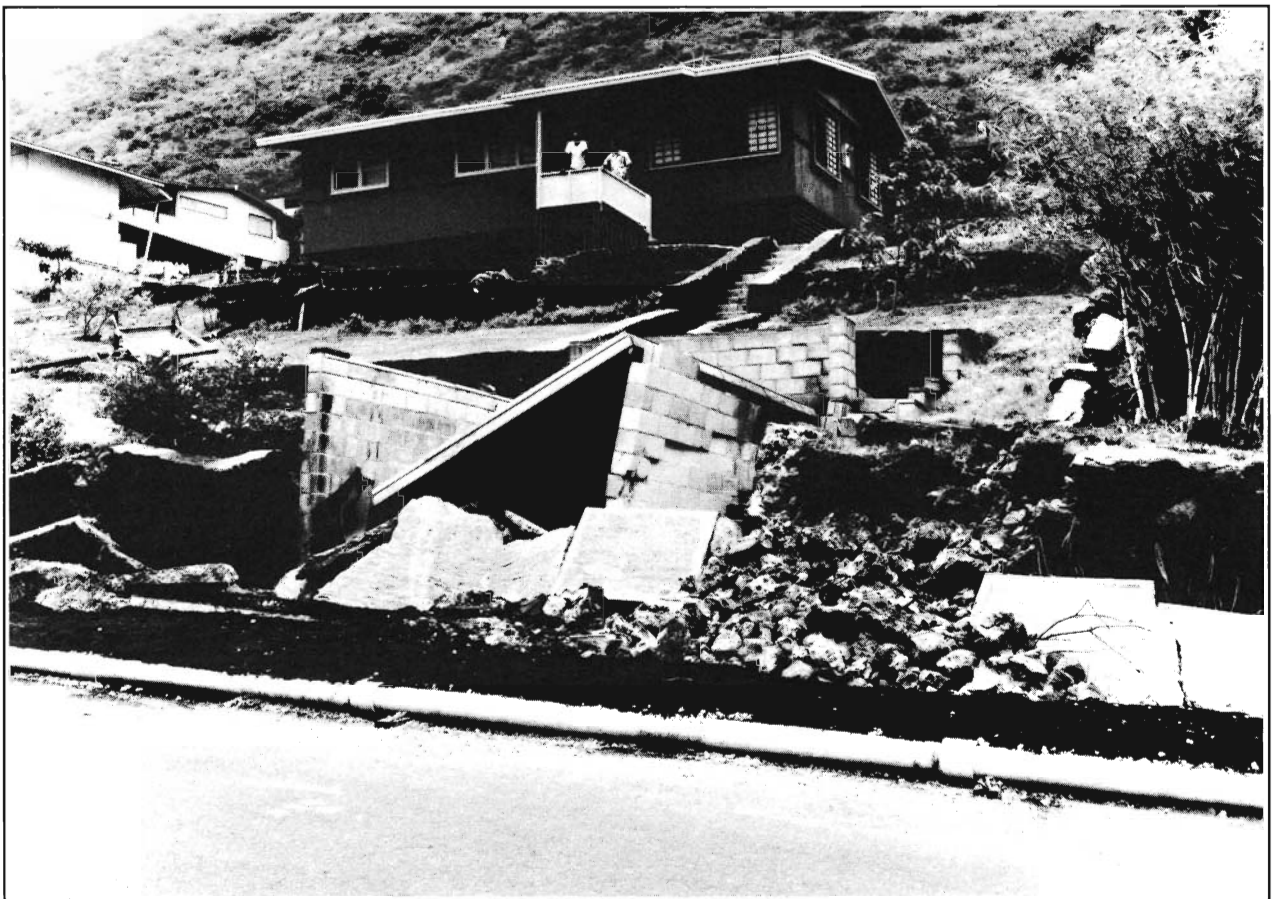


Figure 19. Severe damage to buildings, pavement, underground utilities, and landscaping caused by soil creep on a high shrink-swell soil.

Moderately deep—water table at depths between 20 and 39 inches. This imposes moderate limitations for foundations and shallow excavations but slight limitations for lawns, shrubs, and gardens.

Shallow—water table at depths less than 20 inches. Severe limitations for all three uses.

9. Flooding.

Floods may occur once in a great while, but when they do occur, they can cause severe damage (Figure 20). When an area is converted to urban use, runoff may increase by 75 percent or more, thereby greatly increasing the danger of flooding. A site is likely to flood if it is in a low position on the landscape, it is adjacent to streams, the soil has evidence of being laid down by water, or there are records of past flooding. For the contest, the frequency of flooding will be given on the condition sheet.

No flooding—no indications of past flooding. Consider greater runoff due to urban development in the area. If no flooding, then slight limitation

for all uses.

Occasional flooding—over a long term average, floods occur once in two years or less often. Severe limitations for foundations and shallow excavations, and slight limitations for lawns, shrubs and gardens. If flooding is by sea water, however, there is severe limitations also for lawns, shrubs and gardens.

Frequent flooding—over a long term average, floods occur more often than once in two years. Severe limitations for all uses. These areas should not be developed.

10. Final evaluation.

This is the overall suitability of the site for the urban uses being considered. It is based on the worst degree of limitation for the planned use and is determined as follows:

Slight limitations—all factors slight.

Moderate limitations—one or more factors moderate and none severe.

Severe limitations—one or more factors severe.



Figure 20. Flooding can occur along streams and low lying areas. Damage to homes and property can be very costly.

Hawaii Conservation Awareness Score Card

Form 264, Revised 1993

Cooperative Extension Service
University of Hawaii at Manoa

Name _____ Site No. _____

County or Group (4-H, F.F.A. Chapter, etc.) _____

Soil and Water Conservation District _____

score	PART I. PHYSICAL FEATURES - Place an "X" in the correct square.
	1. Surface Texture <input type="checkbox"/> A. Sandy <input type="checkbox"/> B. Loamy <input type="checkbox"/> C. Clayey <input type="checkbox"/> D. Very clayey
	2. Subsoil Texture <input type="checkbox"/> A. Sandy <input type="checkbox"/> B. Loamy <input type="checkbox"/> C. Clayey <input type="checkbox"/> D. Very clayey
	3. Permeability <input type="checkbox"/> A. Slow - < .2 inches/hr <input type="checkbox"/> B. Moderate - .2 to 6 inches/hr <input type="checkbox"/> C. Rapid - > 6 inches/hr
	4. Soil Depth <input type="checkbox"/> A. Deep - 40 inches or more <input type="checkbox"/> B. Moderately deep - 20 to 39 inches <input type="checkbox"/> C. Shallow - 10 to 19 inches <input type="checkbox"/> D. Very shallow - 0 to 9 inches
	5. Slope <input type="checkbox"/> A. Nearly level - 0 to 2% <input type="checkbox"/> B. Gently sloping - 3 to 7% <input type="checkbox"/> C. Strongly sloping - 8 to 14% <input type="checkbox"/> D. Moderately steep - 15 to 24% <input type="checkbox"/> E. Steep - 25 to 39% <input type="checkbox"/> F. Very steep and extremely steep - 40% or more
	6. Erosion <input type="checkbox"/> A. None to slight <input type="checkbox"/> B. Moderate <input type="checkbox"/> C. Severe <input type="checkbox"/> D. Very severe
	PART II. MAJOR FACTORS --Check most important problems <div style="display: flex; flex-wrap: wrap;"> <div style="width: 50%;"> <input type="checkbox"/> 1. Surface texture <input type="checkbox"/> 2. Permeability <input type="checkbox"/> 3. Depth <input type="checkbox"/> 4. Slope <input type="checkbox"/> 5. Erosion <input type="checkbox"/> 6. Wetness <input type="checkbox"/> 7. Rainfall </div> <div style="width: 50%;"> <input type="checkbox"/> 8. Elevation and climate <input type="checkbox"/> 9. Wind <input type="checkbox"/> 10. Flooding <input type="checkbox"/> 11. Stoniness or rock outcrop <input type="checkbox"/> 12. Salinity <input type="checkbox"/> 13. None </div> </div>
	PART III. LAND CAPABILITY CLASS <div style="display: flex; flex-wrap: wrap;"> <div style="width: 50%;"> <input type="checkbox"/> 1. Class I <input type="checkbox"/> 2. Class II <input type="checkbox"/> 3. Class III <input type="checkbox"/> 4. Class IV </div> <div style="width: 50%;"> <input type="checkbox"/> 5. Class V <input type="checkbox"/> 6. Class VI <input type="checkbox"/> 7. Class VII <input type="checkbox"/> 8. Class VIII </div> </div>

score	PART IV. RECOMMENDED CONSERVATION PRACTICES
	FOR CROPLAND AND ORCHARD <input type="checkbox"/> 1. Soil conserving crop every 4th or 5th year <input type="checkbox"/> 2. Soil conserving crop every 3rd or 4th year <input type="checkbox"/> 3. Soil conserving crop every 2nd year <input type="checkbox"/> 4. Soil conserving crop every year <input type="checkbox"/> 5. Return crop residue to the soil <input type="checkbox"/> 6. Establish grassed waterways <input type="checkbox"/> 7. Establish recommended windbreaks for erosion control or crop protection <input type="checkbox"/> 8. Cross-slope, or contour farming <input type="checkbox"/> 9. Construct and maintain diversions or terraces <input type="checkbox"/> 10. Irrigation water management <input type="checkbox"/> 11. Use animal manure <input type="checkbox"/> 12. Use green manure crops
	FOR PASTURE: <input type="checkbox"/> 13. Establish recommended grasses and legumes <input type="checkbox"/> 14. Manage grazing for erosion control <input type="checkbox"/> 15. Control noxious plants <input type="checkbox"/> 16. Improve and maintain water facilities such as pipelines, catchments, reservoirs, and tanks for livestock <input type="checkbox"/> 17. Establish windbreaks or shelterbelts for animal protection
	FOR WOODLAND: <input type="checkbox"/> 18. Plant adapted trees <input type="checkbox"/> 19. Protect trees from burning and grazing <input type="checkbox"/> 20. Harvest trees selectively
	FOR RECREATION AND WILDLIFE: <input type="checkbox"/> 21. Wildlife habitat improvement, including food and cover plantings <input type="checkbox"/> 22. Improve water facilities for wildlife and recreation such as pipelines, catchments, tanks and ponds <input type="checkbox"/> 23. Develop recreational facilities such as access roads, trails, shelters and campsites
	FOR EITHER CROPLAND AND ORCHARD, PASTURE, OR WOODLAND: <input type="checkbox"/> 24. Control flooding, construct dikes or levees <input type="checkbox"/> 25. Install and maintain a drainage system <input type="checkbox"/> 26. Apply lime or soil amendments according to soil test <input type="checkbox"/> 27. Fertilize with nitrogen, phosphorus and/or potassium <input type="checkbox"/> 28. Fertilizer or soil amendments not needed

Part I score (possible 30) _____

Part III score (possible 10) _____

Part II score (possible 10) _____

Part IV score (possible 50) _____

Total score (possible 100) _____

Hawaii Homesite Score Card

Cooperative Extension Service

University of Hawaii at Manoa

Name _____ Site No. _____

County or Group (4-H, F.F.A. Chapter, etc.) _____

Soil and Water Conservation District _____

score	PART I. SOIL FACTORS - Place an "X" in the correct square	PART II. PLANNED USE - Family dwelling site. Interpretation of limitations in terms of: (2 points each)				score
		Degree of Limitation	Foundations for Buildings	Lawns, Shrubs and Gardens	Shallow Excavations	
	1. Surface Texture <input type="checkbox"/> A. Sandy <input type="checkbox"/> B. Loamy <input type="checkbox"/> C. Clayey <input type="checkbox"/> D. Very clayey	Slight Moderate Severe	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
	2. Permeability <input type="checkbox"/> A. Slow - < .2 inches/hr <input type="checkbox"/> B. Moderate - .2 to 6 inches/hr <input type="checkbox"/> C. Rapid - > 6 inches/hr	Slight Moderate Severe	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
	3. Soil Depth <input type="checkbox"/> A. Deep - 40 inches or more <input type="checkbox"/> B. Moderately deep - 20 to 39 inches <input type="checkbox"/> C. Shallow - 10 to 19 inches <input type="checkbox"/> D. Very shallow - 0 to 9 inches	Slight Moderate Severe	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
	4. Slope <input type="checkbox"/> A. Nearly level - 0 to 2% <input type="checkbox"/> B. Gently sloping - 3 to 7% <input type="checkbox"/> C. Strongly sloping - 8 to 14% <input type="checkbox"/> D. Moderately steep - 15 to 24% <input type="checkbox"/> E. Steep - 25 to 39% <input type="checkbox"/> F. Very steep & extremely steep - 40% or more	Slight Moderate Severe	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
	5. Erosion <input type="checkbox"/> A. None to slight <input type="checkbox"/> B. Moderate <input type="checkbox"/> C. Severe <input type="checkbox"/> D. Very severe	Slight Moderate Severe	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
	6. Shrink-Swell <input type="checkbox"/> A. Low <input type="checkbox"/> B. Moderate <input type="checkbox"/> C. High	Slight Moderate Severe	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
	7. Stoniness <input type="checkbox"/> A. 0-2% <input type="checkbox"/> B. 3-14% <input type="checkbox"/> C. 15% or more	Slight Moderate Severe	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
	8. Water table <input type="checkbox"/> A. Deep - 40 inches or more <input type="checkbox"/> B. Moderately deep - 20-39 inches <input type="checkbox"/> C. Shallow - <20 inches	Slight Moderate Severe	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
	9. Flooding <input type="checkbox"/> A. None <input type="checkbox"/> B. Occasional - once in 2 years or less <input type="checkbox"/> C. Frequent - more than once in 2 years	Slight Moderate Severe	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
	10. FINAL EVALUATION All factors slight One or more factors moderate and none severe One or more factors severe	Slight Moderate Severe	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	

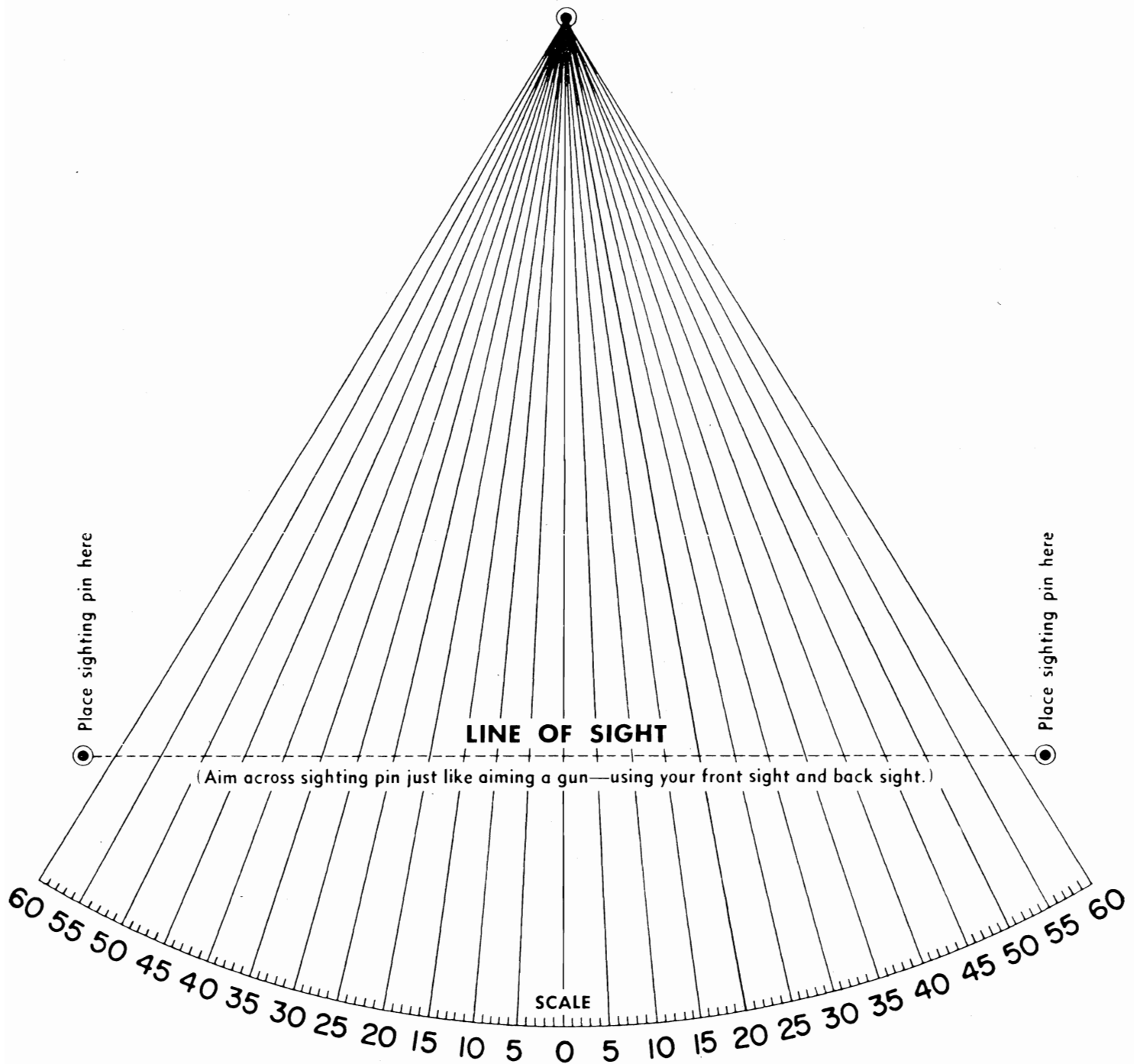
Part I score (possible 40) _____

Part II score (possible 60) _____

Total score (possible 100) _____

SLOPE FINDER

Hang weight on a string from
this point



(Aim across sighting pin just like aiming a gun—using your front sight and back sight.)

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

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