

# LAND EVALUATION

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•3 or 4 Team Members•

## I. PURPOSE

It has been said that the soil is our most basic natural resource. Not only agriculture, but all life on earth is dependent upon the wise use of soil. The Land Career Development Event introduces students to factors involved in the stewardship of soil, which include soil texture, permeability, total depth, percent slope, prior erosion loss, and how quickly surface water moves across the landscape. Students use these factors to determine Land Class, and to recommend certain land management and conservation practices to ensure the sustained productivity of agricultural sites. Instructional objectives related to this event may be found in: AgSc 101, Introduction to World Ag Science and Technology; AgSc 102, Introduction to World Ag Science and Technology; AgSc 231, Plant and Animal Production; AgSc 333, Plant and Soil Science; AgSc 337, Advanced Plant and Soil Science; AgSc 281, Energy and Environmental Technology; AgSc 284, Environmental Technology; and AgSc 382, Range Management and Ecology.

## II. EVENT FORMAT

### A. Team Make-up

1. An entry may consist of four participants. The three high scores will be tabulated as the team score with the low scorer being considered an alternate.
2. Members of teams competing in the National Event are ineligible for further participation.

### B. Equipment

1. Only clear plastic clipboards and clean manila folders will be allowed.
2. No books, paper, rulers or other materials are needed or permitted.
3. Pencils and the most current scan sheet must be brought by the contestants.
4. Knives to assist in locating soil horizons are permitted.
5. No cell phones or pagers are allowed.
6. Please keep papers as clean, neat and dry as possible.
7. An additional information sheet will be provided for each field.
8. Individuals wishing to record their answers may do so on the back of the additional information sheet provided at the site.
9. Answer sheets will be provided when the event is over so that the advisors may review the fields with their team.

### C. Schedule

1. Eligible teams should report to the teaching pavilion at the Tarleton State University Agricultural Center no later than 8:15 am for registration. The Agricultural Center is located approximately 0.5 miles east of intersection of State Highway 8 and 108. The teaching pavilion is located about 0.4 miles north of the entrance to the Agricultural Center, marked by a flagpole.

2. The land event will be conducted concurrently with the range and pasture event. Therefore, it may be necessary to coordinate with other advisors in order to get the students to event sites on time.
3. Twenty minutes will be allowed for evaluation of each field.

#### **D. General Rules**

1. Four different fields will be used and field boundaries will be clearly indicated.
2. The fields to be judged will be selected and scored by staff members of Tarleton State University.
3. Advisors are not permitted to go with participants.
4. A pit will be excavated inside a staked area. The boundaries of the area to be judged will be indicated by four corner stakes flagged in white. Two additional stakes flagged in red and located 100 feet apart will be located inside the area to be judged. Slope judgments should be made on the area between the red flagged stakes. Topsoil and subsoil samples will be labeled for texture and permeability judgments.
5. Land judging consists of two parts: (1) judgment of various land class factors and (2) selection of land treatments.
6. The land class will be determined by characteristics of the soil exposed in the pit and observations of landscape conditions -- slope, gullies, etc. -- inside the staked area.
7. The land treatments will involve three considerations:
  - a. soil characteristics,
  - b. information presented on an "additional information sheet", and
  - c. vegetative conditions inside the staked area.
8. There are a total of 70 points per field in land judging – 40 in Part 1 and 30 in Part 2.

#### **E. Part 1-Land Classes (160 points)**

1. The first six factors are worth 4 points each. The last two factors are worth 8 points each. Credit will be given only when judgments are 100% correct. For example, no credit will be given for major factors if the student checks 2 correct factors and there are 3 correct factors.
2. The value for each correct judgment will be totaled to give the score for Part 1
3. The judgments in Part 1 are made by inspecting the soil profile, the topsoil and subsoil provided in boxes, and the land area inside the stakes. Definitions and explanations that will aid in these judgments follow:

1) Surface texture: Twelve textural classes are recognized in the USDA system of classification. Different members of these 12 classes are sometimes combined to give smaller numbers of textural groupings. We have combined them in a manner to give three classes – sandy, loamy, and clayey. The loamy category has been further subdivided into three classes. These are moderately coarse, medium, and moderately fine. The overall result is a total of five classes – coarse, moderately coarse, medium, moderately fine, and fine. These are the five classes that contestants will be asked to identify in describing surface texture. Relationships between the different groupings are given in the following table.



While contestants will be asked to identify five textural classes, all discussion in relation to interpretations will be in terms of the three broader groupings. For example, permeability will be related to texture by using the terms sandy, loamy, and clayey. Suggestions regarding identification of textural classes follow.

There is no substitute for experience in evaluating soil texture, but there are some generalizations that can serve as useful guidelines. The usual approach is to moisten a soil sample and ribbon it out between the thumb and forefinger. Estimates of the textural class may then be made based on the way the soil feels and on the way it ribbons out. Sand feels gritty, silt feels powdery and floury, and clay feels sticky. Soils that are high in clay tend to form long, stable ribbons. As an approximation, the following guidelines should be useful in evaluating texture.

- A soil that feels very gritty and forms an unstable ribbon no longer than ½" in length is probably in the sandy (coarse) category.
- A soil that is very sticky and forms a stable ribbon exceeding 2" in length is probably in the clayey (fine) category.
- All other soils would be in the loamy category. Those loamy soils not greatly different than sandy will likely be moderately coarse, those fairly closely approaching clayey will be moderately fine, and all other loamy soils will be medium.

2) Movement of air and water in the soil (Permeability): Soils may be placed into the following relative permeability classes based upon the structure, texture, cracking, and other features. The subsoil is emphasized since it is normally the limiting horizon. However, permeability should be *based upon the most limiting horizon regardless of its position in the soil profile*.

- Rapid – These soils have coarse textures throughout the profile.
- Moderate – Includes most soils having moderately coarse, medium, or moderately fine textures with moderate to strong structure in the limiting layer.

- Slow- These soils have a fine texture or moderately fine texture approaching fine in conjunction with weak structure in the limiting layer.
- Very slow – These soils have a fine texture and massive compact conditions in the limiting layer.

3) Depth of Soil: The depth of soil is determined by the total thickness of soil layers readily penetrated by plant roots. Deep – More than 40 inches deep.

- Deep – More than 40 inches deep
- Moderately deep – 20 to 40 inches deep.
- Shallow – 10 to 20 inches deep.
- Very shallow – Less than 10 inches deep.

4) Slope: This is the number of feet fall/100 feet. The following are definitions of slope terms:


- Nearly level- Less than 1 foot fall/100 feet.
- Gently sloping – 1 to 3 feet fall/ 100 feet.
- Moderately sloping – 3 to 5 feet fall/ 100 feet.
- Strongly sloping – 5 to 8 feet fall/ 100 feet.
- Steep – 8 to 15 feet fall/100 feet.
- Very steep – More than 15 feet fall/ 100 feet.

5.) Erosion – Wind and Water: Erosion is the removal of soil by water and wind. The following are definitions of erosion terms:

- None to slight- Less than 25 percent of surface soil removed and no gullies.
- Moderate- 25 to 75 percent of surface soil removed with or without gullies (but not including frequent un-crossable gullies).
- Severe – 75 percent or more of the surface soil removed with or without occasional un-crossable gullies\* and/or severe accumulations by wind.
- Very severe – 75 percent or more surface soil removed with frequent un-crossable gullies\*\* and/ or severe accumulations by wind.

\* Occasional un-crossable gullies: greater than 100 feet apart.

\*\* Frequent un-crossable gullies: less than 100 feet apart.

6) Surface runoff: Refers to the rate water is removed by flow over the surface of the soil. It is the result of a combination of natural factors including land slope and water infiltration rate of the soil. 

- Rapid – Surface water flows away rapidly. A considerable amount of rainfall is lost from the surface, which increases the hazards of erosion and droughty conditions. Soils with a slope of 3 percent or more would go into this category. Rapidly permeable soils are an exception.
- Moderate – This is considered as “normal” runoff from soils with slopes of 1 to 3 percent. Rapidly permeable soils are an exception.

- Slow- Surface water flows away slowly. Surplus water on clayey soils is an occasional problem. This will include most soils with a 0-1% slope and less than rapid permeability.
- Very Slow- Primarily includes soils having rapid permeability, but soils having moderate, slow or very slow permeability and slopes closely approaching zero percent may also be included in this category. Some soils may remain wet for significant periods of time.

7) Major Factors That Keep Area Out of Class I: This section will be left blank on Class I land. Bubble in one or more factors keeping the area out of Class I land. Information relating to the land classes is given on the following page.

8) Land Capability Classes Defined:

SUITED FOR CULTIVATION AND OTHER USES SUCH AS GRAZING, FORESTRY, OR WILDLIFE FOOD AND COVER.

LAND LIMITED IN USE – GENERALLY IS NOT SUITED FOR CULTIVATION: SUITED FOR GRAZING, FORESTRY OR WILDLIFE FOOD AND COVER.

LAND NOT SUITED FOR CULTIVATION, GRAZING OR FORESTRY.

Class I – Soils in Class I have few limitations that restrict their use. Overhead water does not change the land class – treatment is usually on adjacent soils.

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

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

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

Class V - Soils in Class V have little or no erosion hazards, but have other limitations that are impractical to remove that limit their use largely to pasture, range, woodland or wildlife food and cover. These may include very poorly drained or frequently flooded areas, (Frequent flooding will be shown with “other factors” when it occurs.)

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

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

Class VIII – Soils and land forms in Class VIII have limitations that preclude their use for commercial plant production and restrict their use to wildlife, recreation, water supply or aesthetic purposes.

9) Relation of Land Class Factors to Capability Class: Listed below are the major factors and subdivisions of each factor as found on the State Land Judging Scansheet. The number to the right of the subdivisions indicates its degree of limitation upon the land class. Land capabilities can be no better than the limitation placed on the soil by a particular characteristic or combination of characteristics (e.g., Class III for a soil having rapid surface runoff. These are for Cross Timbers and Grand Timbers and Grand Prairie areas of Texas.)

EXAMPLE:

- (1) If a field of sandy texture, then the best possible Land Capability Class is Class III.
- (2) If a field is moderately sloping, this factor, alone, will limit the field to Class III.
- (3) If a field is slowly permeable, of sandy texture, moderately sloping, and these are the limitations to the field, these factors will put the field in Class III.

<u>Surface Texture</u>	<u>Slope</u>
Coarse.....III	Nearly level ..... I
Moderately coarse .....I	Gently sloping ..... II
Medium.....I	Moderately sloping..... III
Moderately fine .....I	Strongly sloping ..... IV
Fine .....I	Steep ..... VI
	Very Steep ..... VII
 <u>Permeability</u>	 <u>Erosion – Wind and Water</u>
Very Slow .....II	None to slight..... I
Slow.....I	Moderate..... II
Moderate .....I	Severe ..... VI
Rapid .....II	Very severe..... VII
 <u>Depth of Soil Profile</u>	 <u>Surface Runoff</u>
Deep.....I	Rapid ..... III
Moderate .....I	Moderate..... I
Shallow.....II	Slow ..... I
Very shallow .....VI	Very slow ..... III

Listed below are combinations of factors that affect the land class for Cross Timbers and Grand Prairie Land Resource Areas. When these factors are combined, they lower the Capability Class more than either of the factors would individually.

1. Very Slowly Perm. & Gently Sloping – III
2. Very Slowly Perm. & Moderately Sloping – IV
3. Very Slowly Perm. & Strongly Sloping – VI
4. Shallow Soil & Gently Sloping – III
5. Shallow Soil & Moderately Sloping – IV
6. Shallow Soil & Strongly Sloping – VI
7. Shallow Soil & Severe Erosion – VII
8. Very Shallow Soil & Strongly Sloping – VII
9. Very Shallow Soil & Severe Erosion – VII
10. Very Shallow Soil & Steeply Sloping – VII

#### **F. Part 2- Land Treatments (120 points)**

1. When possible, equal value will be assigned to all treatments (e.g., 5 points each for 6 treatments). When that is not possible, some treatments will be assigned a 1 point higher value than others. The higher values will arbitrarily be assigned in order beginning with the first treatment selected by the judges (e.g., 5 points for the first 2 treatments and 4 points for the last 5 treatments when there is a total of 7 treatments).
2. The treatments indicated by the student will be considered until the student has selected a number of treatments equal to the number selected by the judges. Example: The judges selected 7 treatments, and treatment 20 represents the participant's 7th selection. No consideration will be given to marked selections below treatment 20. In cases where the student selects fewer treatments than the judges, all marked treatments will be scored.
3. The point value for each correct treatment eligible for consideration will be totaled to give the score for Part 2.
4. The treatments recommended in Part 2 are selected by considering soil characteristics, vegetative conditions inside the staked area (presence or absence of brush), and information presented on an "additional information sheet". The format for the additional information sheet is as follows:

Treatments should be selected by:

1. Soil deficiencies.
2. Do not consider present mechanical practices on the field.
3. Thickness of original topsoil.
4. Size of field.
5. Consider most intensive use of land for treatment purposes.
6. Other conditions.

#### **SPECIAL INSTRUCTION AND INTERPRETATIONS**

1. Assume that Bermuda grass will be established on Class V land. Soil amendments and fertilizer will be used in accordance with soils test.
2. Disregard mechanical practices on the land at the time of the event. In other words, use practices that are needed even though they are already present on the land.
3. Class VIII land will not be used in the state contest.
4. "Other Factors" – When factors NOT OBSERVABLE by the student affect the treatment they will be shown for each field under "other factors". Students then prescribe the correct treatments. These factors may include:
  - a. Wetness – This factor would prevent the capability class from being any higher than Class III. Practice 18 would be a required treatment.
  - b. Frequently flooded – Flooding would place the land in Class V land. Practice 20 would apply under treatments, unless brush and trees are present.
  - c. Overhead water – This condition does not take the land out of Class I, but would require construction of a diversion terrace. In other words, Practice 17 would be recommended.

## **GUIDE TO USE OF TREATMENTS**

### VEGETATIVE

#### *For Cropland – Class I through IV – use soil conserving and/or soil improving crops.*

Soil Conserving Crops – are considered to be those crops that prevent or retard erosion and tend to maintain rather than deplete soil organic matter. Close seeded crops are generally regarded as soil conserving crops.

Soil Improving Crops – improve or replenish rather than deplete soil organic matter. These crops improve soil structure and tilth. They may improve the water intake and in general increase the productivity of the soil.

1. Use Soil Conserving/Improving Crops every 4th or 5th year ..... Use on Class I land
2. Use Soil Conserving/Improving Crops every 3rd or 4th year ..... Use on Class II land
3. Use Soil Conserving/Improving Crops every 2nd year ..... Use on Class III land
4. Use Soil Conserving/Improving Crops every year ..... Use on Class IV land
5. Do not burn crop residue – self explanatory ..... Use on Class I, II, III, IV
6. Residue Management and/or Minimum Tillage – provides for a protective cover by leaving crop residue of any previous crop as a mulch on or mixed in the surface plow layer of the soil. Use on Class I, II, III, IV.

#### *For Pasture, Range, Wildlife, or Commercial Woodland*

7. Establish recommended grasses and legumes. This treatment would be used in practice only when suitable vegetation is not present, but for Career Development Event purposes the treatment will always be used on Class V, VI, and VII.
8. Proper pasture or range management. The application of practices to keep plant growth active over the longest possible period; to encourage growth of desirable grasses and legumes while crowding out weeds, brush, and inferior grasses. Use on Class V, VI, and VII.
9. Protect from burning. Do not burn grass, legumes, or timber. Use on Class V, VI, and VII.
10. Control grazing. Carry out a system of grazing that will maintain or improve desirable vegetation on pasture or range. Deferred grazing, rotational grazing and proper stocking are some of the practices. Use on Class V, VI, and VII.
11. Plant recommended trees. For postlots, farmstead windbreaks, field windbreaks, and commercial woodland plantings. Not applicable to State Career Development Event.

12. Harvest trees selectively. A system of cutting in which single trees, usually the largest, or small groups of such trees are removed and reproduction secured under the remaining stand. Not applicable to State Career Development Event.

13. Use only for wildlife or recreation area. This means protection or development of areas that cannot be used for grazing, forestry, cultivation or urban purposes. Use on Class VIII.

#### MECHANICAL

14. Control brush or trees. This may be accomplished by spraying with chemicals and/or use of machinery. The purpose is to improve the desirable vegetative cover by removing or killing undesirable brush and trees, or to remove timber so the land can be farmed in case of Class I to IV Land. Always use for land Classes V through VII when woody plants are invading or increasing. Do not use for land Classes I through IV if the brush is small enough to be controlled by regular plowing with a farm tractor. Do not check the practice for arable land unless a special (extra) operation is necessary for brush control.

15. Terrace and farm on contour. A terrace is an embankment or ridge of earth constructed across the slope to control runoff and minimize erosion. Conduct farming operation on the contour or at right angles to slope direction. Use on slopes 1% to 5% on Class II, III, and IV with loamy or clayey surface texture. Sandy soils would be terraced in practice if the depth of a loamy or clayey subsoil is not excessive, but for Career Development Event purposes do not check practice 15 if the surface texture is sandy.

16. Maintain terraces. Practices that keep terraces working effectively, use 16 when practice 15 is used.

17. Construct diversion terraces. A diversion terrace is a channel with a supporting ridge on the lower side. It usually has a greater horizontal and vertical spacing and is constructed to handle a larger flow of water than normal field terraces. Use whenever outside or overhead water problems are present (usually on Class I, II, III, and IV) except in sandy soils.

18. Install drainage system. Use on Class III land, if needed.

19. Control gullies. Use when active gullies (those that will erode during periods of significant rainfall) are present. Check practices that would control the gullies which have not previously been checked. Always use when active gullies are present on Class V, VI, or VII land or on arable land that will not be terraced. Use on land that will be terraced only if the judgment is that terracing will not control the gullies.

20. No mechanical treatment needed. Use when no mechanical practices (No.'s 14 to 19) are recommended.

FERTILIZER AND SOIL AMENDMENTS

Use soil analyses as a basis for fertilizer and some soil amendment recommendations. Used on cultivated classes and on improved tame pastures where the conditions below are present.

21. Apply Lime. Lime acid soils if pH is less than 6.0.(Usually in areas receiving about 35 inches rainfall or higher.)

22. Apply Phosphate (P). Soils with less than 60 lbs/Ac require the addition of phosphorous for maximum production. When any value given is less than 60 lbs/Ac or stated as a deficit, mark practice 22 on the scansheet.

23. Apply Potash (K). Potassium is recommended to some extent on soils with as much as 300 lbs/Ac for certain crops. As such, when any value is given that is less than 300 lbs/Ac or stated as a deficit, mark practice 23 on the scansheet.

24. Apply Nitrogen (N). Nitrogen requirements are highly variable. As such, nitrogen will be given as “adequate” or “deficient” without a numerical value. Mark practice 24 on the scansheet if a deficiency is indicated.

25. Apply NPK

Use the fewest combinations of practices to meet deficiencies given. The amount of plant nutrients needed in a soil depends upon a number of factors. The soil test that indicates a deficiency of a given plant nutrient for one set of conditions would not necessarily indicate the deficiency for another set of conditions. However, it would be difficult to take all factors into account for the event, and deficiencies will be given on the additional information sheet.

**III. SCORING**

Field 1 .....	70
Field 2 .....	70
Field 3 .....	70
Field 4 .....	70

**Total Points Possible**

<b>Individual .....</b>	<b>280</b>
<b>Team .....</b>	<b>840</b>

**IV. TIEBREAKERS**

Ties will be broken by the high score (team or individual) on Field 1 Part 1, Field 1 Part 2, and Field 2 Part 1 and etc. In the event the ties are unbreakable, the advisors/individuals will match for the highest placing.

## V. RESOURCES

### EXAMPLES FOR COMPLETING THE SCANSHEET

#### Example 1:

(a) Assume that evaluation of the land class factors has indicated a loamy surface 10" thick, a very slow permeability, a moderately deep soil, a slope that is strongly sloping, moderate erosion, and rapid surface runoff. Major factors keeping the soil out of Class I would be permeability, slope, erosion, and runoff. The land capability class would be VI. Also, assume no brush and trees are observed.

(b) Assume that the additional information sheet is as follows:

#### Field 1

No soils test results are available.

1. Thickness of original topsoil was 20"
2. Size of field is 100 acres.
3. Consider most intensive use of land for treatment purposes.
4. Do not consider present mechanical practices on the field.
5. Other conditions: None.

(c) Check practices 7, 8, 9, 10 and 20.

#### Example 2:

(a) Assume that evaluation of the land class factors has indicated a loamy surface 8" thick, a moderate permeability, a deep soil, a slope that is gently sloping, none to slight erosion, and moderate surface runoff. The only major factor keeping the soil out of Class I would be slope and the land capability class would be II. Assume that the only mechanical treatment observed on the land is terracing and that no brush or trees are observed.

(b) Assume that the additional information sheet is as follows:

#### Field 2:

1. Soil test shows the soil to be low in nitrogen and phosphorous.
2. Thickness of original topsoil was 9".
3. Size of field is 40 acres.
4. Consider most intensive use of the land for treatment purposes.
5. Do not consider present mechanical practices on the field.
6. Other considerations: pH = 5.6.

(c) Check practices 2, 5, 6, 15, 16, 21, 22 and 24.