

**2007 California Envirothon
Soils Station Test
Total = 100 points
Suggested time is 35 minutes**

Introduction: Worldwide concerns with global warming and potential climate change coupled with rising energy costs from dwindling supplies of fossil fuels and political maneuvering by some suppliers has resulted in a public outcry to come up with viable alternative energy sources. Alternative and renewable energy sources may include using solar, geothermal or wind power, or they may include crops that can be utilized as-is or further converted into sources of fuel and power. Because of the demand for alternative and renewable energy many areas not previously thought of as “agricultural” are being considered for growing some of these non-traditional alternative energy crops. As a soils consultant you are tasked to evaluate the viability of the area for potential growth of several alternative bioenergy or biofuel crops. Your task is three-fold. First, collect soil properties of the area to obtain baseline data. Next, assess the site for potential crop use. Finally, evaluate the site for specific soil and management concerns in regards to its intended use.

Describe Soil Properties

Answer the following questions by making observations in the soil pit. **Write your answer in the box to the left of the question.**

1. What is the color of the surface layer? **(2 points)**

- A. Very dark
- B. Medium or bright
- C. Very light
- D. Drab or mottled

2. What is the texture of the surface layer? **(2 points)**

- A. Sand or loamy sand
- B. Loam, sandy loam, or silt loam
- C. Clay loam, sandy clay loam, or silty clay loam
- D. Clay, sandy clay, or silty clay

3. What is the permeability of the surface layer? **(3 points)**

- A. Rapid
- B. Moderate
- C. Slow

4. What is the thickness of the surface layer? **(3 points)**

- A. 20 inches or more
- B. 10 to 19 inches
- C. 4 to 9 inches
- D. Less than 4 inches

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5. What is the color of the subsoil? **(2 points)**

- A. Very dark
- B. Medium or bright
- C. Very light
- D. Drab or mottled

6. What is the texture of the subsoil? **(2 points)**

- A. Sand or loamy sand
- B. Loam, sandy loam, or silt loam
- C. Clay loam, sandy clay loam, or silty clay loam
- D. Clay, sandy clay, or silty clay

7. What is the permeability of the subsoil? **(3 points)**

- A. Rapid
- B. Moderate
- C. Slow

8. What is the depth of the soil to the parent material? **(3 points)**

- A. 20 to 29 inches
- B. 15 to 19 inches
- C. 10 to 14 inches
- D. Less than 10 inches
- E. 30 to 39 inches
- F. 40 or more inches

9. What is the parent material of the soil at the pit location? **(3 points)**

- A. Soft bedrock
- B. Organic materials
- C. Hard bedrock
- D. Loose or mixed materials
- E. Unable to determine –parent material not observable

10. Where did the parent material at this site come from? What mechanism brought it to this location (wind, water, fire, weathering, ice, dump trucks etc)? Write a brief explanation of your thoughts on this? **(4 points)**

Describe Site Properties

Answer the following questions by making observations of the area surrounding the soil pit. **Write your answer in the box** to the left of the question.

11. Using a **clinometer**, measure the percent slope of the land between the stakes. Percent slope is the vertical feet of rise or fall for every 100 feet of horizontal run divided by 100. **(4 points)**

- A. 0 to 2 percent
- B. 2 to 4 percent
- C. 4 to 8 percent
- D. 8 to 15 percent
- E. 15 to 25 percent
- F. 25 to 50 percent
- G. More than 50 percent

12. What is your assessment of the type of erosion that has occurred in the area surrounding the soil pit? (Look 100 feet in all directions around the soil pit to answer this question) **(3 points)**

- A. No erosion apparent
- B. Sheet and Rill erosion
- C. Gully erosion

13. If there is erosion occurring what evidence do you see that confirms this? **(3 points)**

- A. No erosion and therefore no evidence
- B. Rills are present
- C. Gullies are present
- D. Deposition is evident

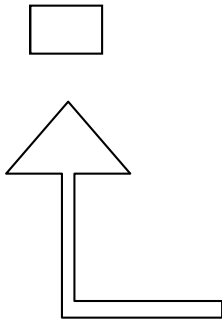
14. What is the severity of the erosion? **(3 points)**

- A. Cannot assess as there is no erosion apparent
- B. Slight: Mineral soil is exposed but less than 1 inch has been lost
- C. Moderate: More than 1 inch but less than 4 inches of mineral soil has been lost **OR** rills are present.

15. What is the depth to a water table? **(3 points)**

- A. More than 60 inches or not present
- B. 40 to 59 inches
- C. 20 to 39 inches
- D. Less than 20 inches

16. Rate the soil in the pit using the USDA Land Capability Classification System, the answers you obtained from your observations above, and the following information. Use the following table to assign a Land Capability Class to the soil. Choose the Land Capability Class for the single most limiting item. Limitations increase as you move from the top to the bottom of the table. Write your answer in the box to the left. (7 points)



Effective rooting depth: answer from Question 8
 Surface layer texture: answer from Question 2
 Permeability: answer from Question 3
 Depth to water table: answer from Question 15
 Available water capacity: **CHECK 2.5 inches CHECK**
 Slope: answer from question 11
 Erosion hazard: answer from question 14

Your answer here

Class	Effective soil depth ¹ (inches)	Surface layer texture ²	Permeability	Drainage Class ³	Available water capacity ⁴ (inches)	Slope (%)	Erosion Hazard
I	≥40	Sandy loam to clay loam (0 to 15%)	Moderate	Well or moderately well >60	≥7.5	< 2	None or slight
II	≥40	Loamy sand through clay (0 to 15%)	Rapid through slow	Somewhat poorly to somewhat excessively >36	≥5.0	< 5	None to moderate
III	≥20	Sandy loam to clay (0 to 35%)	Rapid through slow	Poorly to excessively >20	≥3.5	< 15	None to severe
IV	≥10	Loamy sand to clay (0 to 60%)	Any	Poorly to excessively >20	≥2.5	< 25	Any
V	≥20	Any	Any	Any	≥3.0	< 2	None or slight
VI	≥10	Any	Any	Any	≥2.0	< 50	Any
VII	Any	Any	Any	Any	1.0	< 75	Any
VIII	Any	Any	Any	Any	Any	Any	Any

1 Clay pans with slow permeability will be treated as limiting the effective depth.
 2 Percentage of gravel and rock fragments on the surface within 10,000 ft² area.
 3 Depth to water table during the growing season.
 4 Available moisture between field capacity and wilting point.

Interpreting Soil and Site Properties

Write your answer in the space provided or, for multiple choice questions, in the box to the left.

17. What gives the surface soil (the material underneath the leaf litter or duff layer) its characteristic color? **(3 points)**

18. The color of the subsoil is an indication of its: **(3 points)**

- A. Higher organic matter content than other layers
- B. Being saturated by water for extended periods
- C. Having lower organic matter content than other layers
- D. Coming from a different parent material than other layers

19. Removing the surface layer of the soil would most likely cause the greatest change in which of the following soil properties (if one considered the upper 40 inches of the soil)? **(3 points)**

- A. The soil pH (or soil reaction)
- B. The soil's water holding capacity
- C. The soil's fertility or nutrient level
- D. A and B
- E. B and C
- F. A and C

20. Explain or justify your answer to question 19. **(3 points)**

21. Based on your observation of the area adjacent to the soil pit (how it appears to have been used recently), what might be one potential problem with the soil in this high traffic area? What might this soil problem be contributing to? (Look around you for evidence). What is one solution to remedy this soil problem at this location? (Use your imagination to come up with some realistic solutions) **(5 points)**

22. The texture and permeability of the subsoil indicate that: **(3 points)**

- A. Water and air will penetrate slowly
- B. Water and air will penetrate rapidly
- C. New roots will find it difficult to exploit the subsoil
- D. New roots will find it easy to exploit the subsoil
- E. B and C
- F. B and D

Evaluate the site for potential use as an alternative/renewable energy source

Write your answer in the space provided or, for multiple choice questions, in the box to the left.

23. Could this area be used to produce, or serve as a source of alternative/renewable energy? What type or types of alternative or renewable energy would this site best be suited for (if any)? Defend your answer. **(5 points)**

24. Assuming you wished to utilize this site for ethanol or methanol production what general soil or site properties did you observe that might limit this area for that use? **(5 points)**

25. Which of the following energy sources would be least likely to be affected by the soil or site properties you observed? **(3 points)**

- A. Ethanol/Methanol Production
- B. Solar
- C. Geothermal
- D. Biomass
- E. A and B
- F. B and C
- G. C and D

26. Assuming you wished to utilize this site for biomass production (a term often equated with biofuels production) which of the following crops might you consider for this area? **(3 points)**

- A. Soybeans
- B. Switchgrass
- C. Corn
- D. Pines
- E. Poplars
- F. Redwoods

27. What is your rationale for choosing the crop you did? In other words, why did you choose the crop you did for this site? **(4 points)**

28. What site and/or soil factors might you have to consider or overcome (at this location) to successfully grow your chosen crop? (Think about what your growing crop needs to be healthy and think about how you want to maintain the site when addressing this question) **(4 points)**

29. Some crops produced for biomass or biofuel production are annuals (meaning they complete their growing cycle in one year), while others are perennials (meaning they live longer than a single year). Which of the following statements is most likely true regarding plants and soil properties? **(3 points)**

- A. Levels of soil carbon decreases under perennial plants
- B. Levels of soil carbon increase under annual plants
- C. Soil erosion increases under perennial plants
- D. Soil erosion decreases under perennial plants
- E. Compaction decreases under annual plants

30. There is one soil property in particular which allows you to predict the behavior of a soil under different management scenarios, and which also allows you to infer several other soil properties as well. What is this factor? **(3 points)**

- A. Soil available water capacity
- B. Soil texture
- C. Soil fertility
- D. Soil erodibility

REFERENCES (listed on <http://www.caenvirothon.com/soils.html>)

Questions 1-9, 11-20, 22, 30 California Land Judging Manual

Questions 23-29 Alternative and Renewable Energy Information from the links on this page:
<http://www.aresearchguide.com/energy.html>

Question 21 Observation

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