

# California Envirothon

## Soils and Land Use Learning Objectives

### I. Geology

Students should be able to:

1. Identify and describe the characteristics of the three major rock types (igneous, sedimentary, and metamorphic) and classify examples of each.
2. Explain how parent rock material influences soil mineral composition, texture, and fertility.
3. Differentiate between mechanical and chemical weathering and explain how each contributes to soil formation in different environments..

### II. Soil Formation and General Soil Properties

Students should be able to:

4. Identify the five soil-forming factors (climate, organisms, relief, parent material, time) and analyze their influence on a given soil profile or landscape.
5. Identify and compare types of parent material (residual, eolian, alluvial, marine, colluvial, volcanic, glacial, and organic) and explain their origins.
6. Explain soil-forming processes (additions, losses, translocations, transformations) and predict their effects on soil horizons and properties.
7. Explain the role of pore space, including macropores, micropores, and pore connectivity, and relate these features to water movement, aeration, and root growth.
8. Describe the role of organic matter (humus, litter, etc.) and explain its influence on soil structure, nutrient availability, and water retention.
9. Identify soil particle sizes (sand, silt, clay) and analyze how their proportions affect texture, permeability, and fertility.
10. Describe factors that influence soil structure and evaluate the impact of soil structure on soil function and plant productivity.
11. Define cation exchange capacity (CEC) and base saturation and explain their significance for nutrient availability and soil health.

### III. Soil Ecology and Soil Health

Students should be able to:

12. Describe and evaluate ecosystem services provided by soils, including water filtration, carbon sequestration, nutrient cycling, and plant growth support.
13. Explain soil-water interactions, including infiltration, percolation, runoff, and groundwater recharge.
14. Describe the roles of soil organisms (microorganisms, fungi, invertebrates, fossorial animals) and explain how biological activity supports soil structure and nutrient cycling.

### IV. California Soils and Land Use

Students should be able to:

15. Explain causes of soil compaction and recommend management practices to prevent or mitigate compaction.
16. Describe how pollution impacts soil properties and soil ecosystems, including chemical, physical, and biological effects.
17. Identify and describe the major California soil orders (Alfisols, Mollisols, Inceptisols, Aridisols, Ultisols, Andisols, Entisols, Histosols, and Vertisols).
18. Describe common California agricultural practices (conventional tillage, no-till, cover cropping, compost application, irrigation, etc.) and evaluate their effects on soil health.
19. Analyze soil suitability for different land uses, including agriculture, forestry, mining, septic systems, and urban development.

## **V. Field Skills**

Students should be able to:

20. Identify and describe soil profile characteristics, including horizons, color, structure, texture, and special features, using field observations or soil samples.
21. Determine soil texture using a soil texture triangle.
22. Read and interpret topographic maps and soil surveys to make land-use or management decisions.
23. Explain how GPS and GIS technologies are used in soil science for mapping, analysis, and monitoring.
24. Use common field tools to conduct on-site soil analysis, including:
  - a. Soil auger
  - b. Munsell soil color chart
  - c. Particle sieve
  - d. pH test kit
  - e. Clinometer or equivalent tool to measure slope
25. Given a soil profile, landscape position, and land-use scenario, how could you evaluate soil health and recommend appropriate management practices?