

# The Zones of a Watershed

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Santa Barbara Coastal Long Term Ecological Research Project



The National Science Foundation



## California Department of Education Science Standards

### 6<sup>th</sup> Grade

- Shaping Earth's Surface
  2. Topography is reshaped by the weathering of rock and soil and by the transportation and deposition of sediment.
    - a. Students know water running downhill is the dominant process in shaping the landscape, including California's landscape.
    - b. Students know rivers and streams are dynamic systems that erode, transport sediment, change course, and flood their banks in natural and recurring patterns.
    - c. Students know beaches are dynamic systems in which the sand is supplied by rivers and moved along the coast by the action of waves.
    - d. Students know earthquakes, volcanic eruptions, landslides, and floods change human and wildlife habitats.
- Investigation and Experimentation
  7. Scientific progress is made by asking meaningful questions and conducting careful investigations.
    - b. Select and use appropriate tools and technology (including calculators, computers, balances, spring scales, microscopes, and binoculars) to perform tests, collect data, and display data.
    - c. Construct appropriate graphs from data and develop qualitative statements about the relationships between variables.
    - f. Read a topographic map and a geologic map for evidence provided on the maps and construct and interpret a simple scale map.

### 7<sup>th</sup> Grade

- Investigation and Experimentation
  7. Scientific progress is made by asking meaningful questions and conducting careful investigations.
    - a. Select and use appropriate tools and technology (including calculators, computers, balances, spring scales, microscopes, and binoculars) to perform tests, collect data, and display data.
    - b. Use a variety of print and electronic resources (including the World Wide Web) to collect information and evidence as part of a research project.
    - c. Communicate the logical connection among hypotheses, science concepts, tests conducted, data collected, and conclusions drawn from the scientific evidence.
    - e. Communicate the steps and results from an investigation in written reports and oral presentations.

## Watershed Ecosystem Lessons

In this lesson students will be reintroduced to the six zones of the coastal watershed (ocean, beach, estuary, coastal plains, foothills and mountains) that they first traveled through in the Watershed Mystery Game. Topographic maps of Santa Barbara will help the students visualize and identify the different zones before they dive into a research project and become “experts” on one of the six zones. Using the LTER CD-ROM and guiding questions as the basis for their research, students will prepare a group presentation on their zone and will share what they have learned with the rest of the class.

### C. The Zones of a Watershed

#### Objectives:

- \* The students will become familiar with the different zones found in the coastal watershed: mountains, foothills, coastal plains, estuaries, sandy beaches and the ocean.
- \* Students will learn the characteristics and geographical locations of each zone.
- \* Students will understand that each zone blends into the next, there are not definite boundaries.

Specification: At the end of this lesson, the students should be able to:

- a. List all 6 watershed zones.
- b. Describe 2-3 of the main characteristics of each zone.
- c. Roughly sketch the position of each zone in relation to the others.
- d. Describe the boundaries between each zone and communicate that the boundaries are gradual rather than definite.

#### Introduction:

#### The Zones of a Coastal Watershed are....

Mountains\_ Foothills\_ Coastal Plains\_ Estuaries\_ Sandy Beaches\_ Ocean  
(See the LTER zone handout/CD-ROM for detailed information about each zone)

#### Zone Boundaries: Are they gradual or sudden?

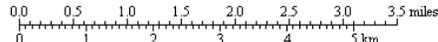
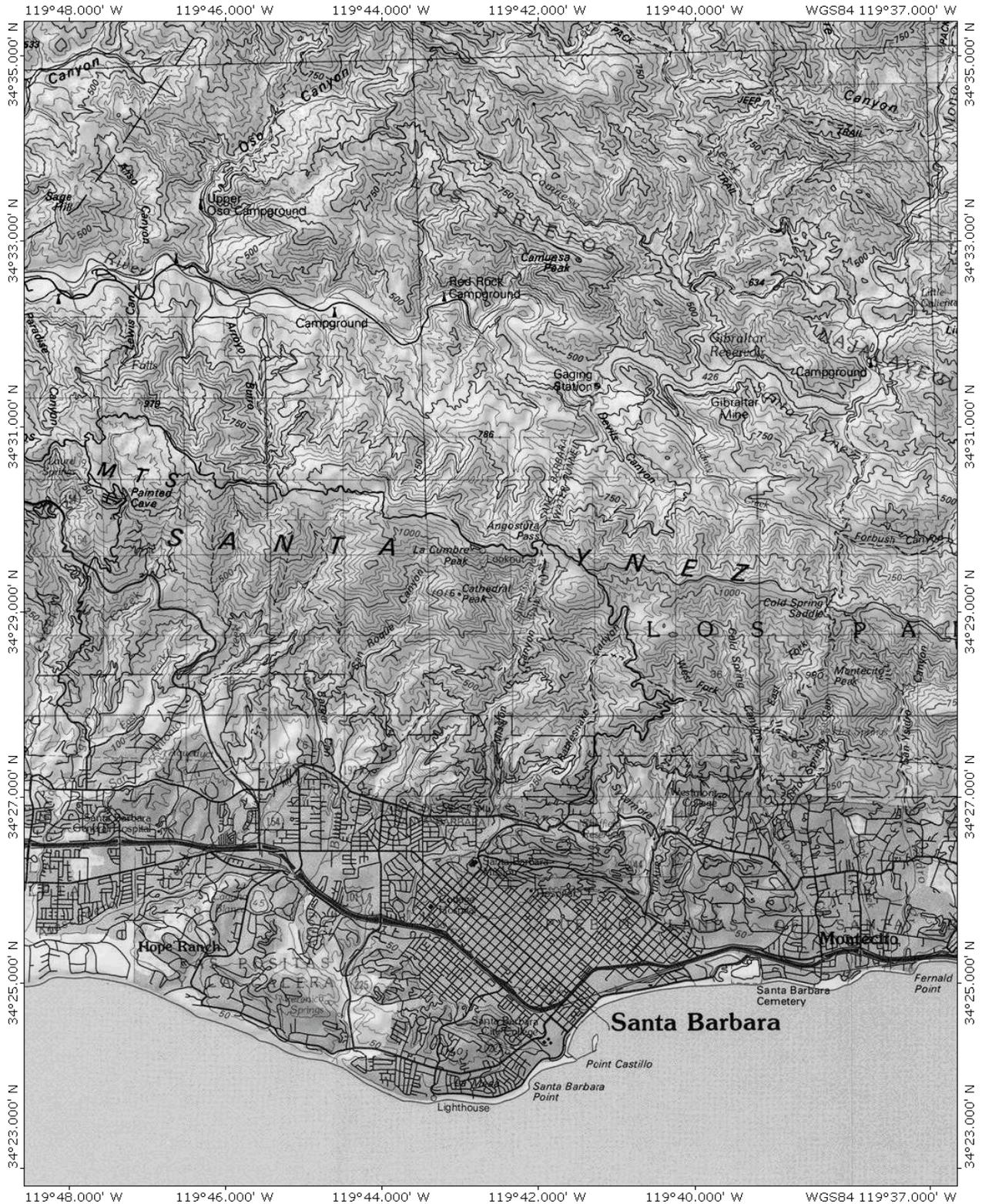
While there are definite zones, the boundaries are a little fuzzier. In the transition areas between zones you will find characteristics of both zones in a unique combination. Therefore, zones gradually blend into each, rather than having a definite boundary like a wall. These boundaries may have even more plant and animal species than the zones themselves. Since there are characteristics of both zones, the animals and plants from both zones may be able to do well there so you may see more species than you would find in just one zone.

**Activity:** (approximate time: 90 minutes)

*Materials:* LTER zone handout or CD-ROM, Student Presentation Notes Handout, Watershed Zones Worksheet, and topographic maps of Santa Barbara for each student (2 copies- 1 blank and 1 with fill in spaces).

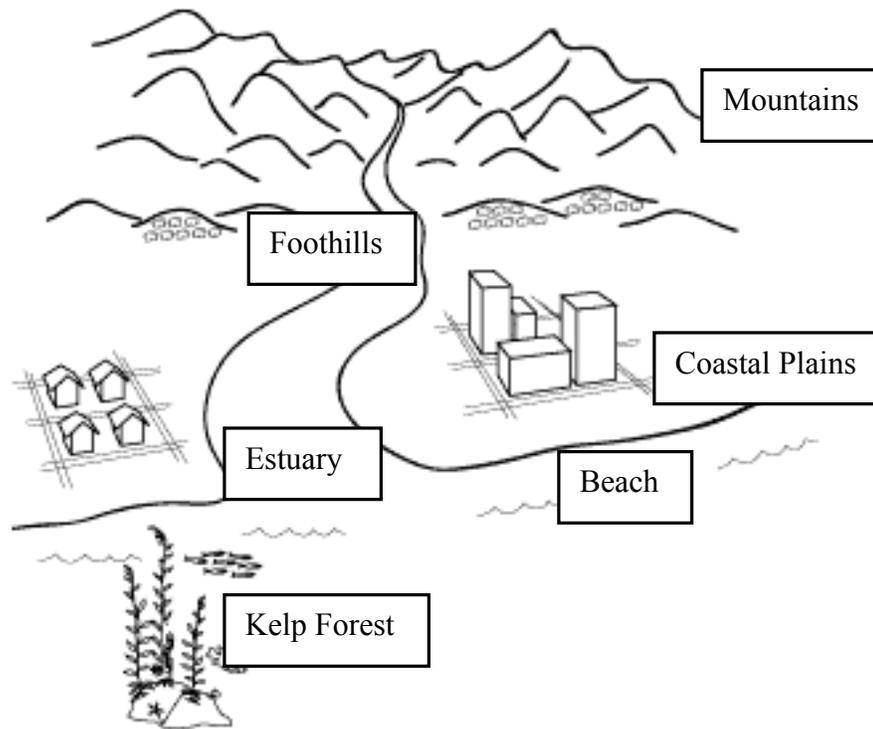
- Start by giving each student an unlabeled topographic map of Santa Barbara. Many students probably won't be familiar with topographic maps and a simple introduction to topographic maps will be necessary for this activity. Explain that topographic maps show the physical features of land (not just boundaries between cities, states, and countries); they include features like mountains, valleys and plains. A simple way to demonstrate this is with a demo on your (and/or their) knuckles. Show the students how a knuckle resembles a mountain, draw evenly spaced circles around your knuckles while making a fist. Then, flatten your hand and show the students what they circles look like. They will see that the circles are closer together where the knuckle or "mountain" was steeper and that the circles are further apart where the knuckle was flatter.
- Have them look at their maps and tell them to think about what they already know about watersheds and ecosystems. Based on what they know, ask them how they think we might split the watershed into zones. Have them brainstorm ideas of what the zones might be called and guide the discussion as needed. This can also be done as a journal activity. (*Remind them to think back to the watershed mystery game where they did hear the names of all 6 zones in the coastal watershed*).
- Have the students try to label all 6 zones of the coastal watershed on the blank topographic map. After they have made an attempt, give them a copy of the topographic map with fill-in spots at each of the zones and have them label these.
- After the students have identified the 6 zones, split the class into 6 groups and assign each group a zone. Either pass out copies of the LTER zone handout or help the students get to the LTER Natural History section of the CD-ROM on the computer, and have each group read about their zone to become "experts".
- Have them read the information on their zone and decide as a group which characteristics are the most important/defining for their zone. You may choose to use the Watershed Zones Worksheet to guide their presentations if you wish.
- Have each group prepare a short presentation for the rest of their class in which they report their findings and tell the rest of the class what they need to know about their zone. Have the students take notes on the presentations of the other students on the "Student Presentation Notes Handout" so that they end up with information about all of the zones.
- You can have the students answer the questions on the Watershed Zones Worksheet after the presentations to evaluate their understanding. This could also be an optional extra credit assignment.
- After the students have presented, ask the students what they think the boundaries between the zones are like? Are they obvious like walking from inside your house to outdoors? Are they subtle, like how the light fades away at sunset? Have the students discuss and explain their reasoning. This can also be done as a journal activity. Help guide the discussion so that students realize that the transitions are usually subtle or gradual and that all of the zones affect one another and blend into one another.

TOPO! map printed on 10/24/04 from "sb1.tpo"



Map created with TOPO! © 2003 National Geographic (www.nationalgeographic.com/topo)

Name \_\_\_\_\_ Student Answers \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_



Label the zones of the watershed pictured above. After reviewing the Natural History section of the UCSB LTER CD-ROM, please answer these questions.

\*\*\*Questions are bonus questions!

### ***Mountains:***

1. What is the zone that is the beginning of most watersheds here in Santa Barbara?

*Mountains*

2. A *divide* is the highest part of a mountain ridge where rain drains to either side of the mountain marking the dividing line of a watershed.

3. What are watersheds usually named after?

*Largest creek, stream or river they drain into*

4. Do you think more or less rain falls in the mountain zone as compared to the sandy beach?

*It falls more on the mountain zone because of the high elevation of the mountains, weather, like rain and fog behaves differently.*

5. How do the slope, bare rocks, and amount of plants affect the rainfall once rain reaches the mountains?

*It does not absorb the water, instead rain water runs downhill very rapidly in the narrow stream channels.*

6. Why are the mountains in Santa Barbara usually dry most of the year? Where does the water go?
7. \*\*\*Can you name three watersheds in Santa Barbara?

### ***Foothills***

8. Where are the foothills?

*The place where the landscape becomes flatter and gentler.*

9. Describe the slope of the foothills. How does that affect the flow of water in this zone?

*The soil is flatter and gentler, thus water flow more slowly as the slope decreases.*

10. How would you characterize the soil in this zone?

*The soil is thick and full of nutrients and rich organic matter. It is good for planting and farming.*

11. In Santa Barbara the foothill zone has some agricultural production. What fruits are typically but not exclusively grown in this area?

*Avocados and lemons*

12. \*\*\*Surrounding avocado trees there is often bare soil. How does runoff from agricultural land affect the rest of the watershed?

*The water clarity decreases and has a higher chance of becoming damaged. It can also give birth to algae blooms.*

### ***Coastal Plain***

13. How would you characterize the slope and flow of water in the coastal plain zone?

*The slopes are flatter, thus the water slows down.*

14. Why do the streams in the coastal plain meander? Explain the process of how this occurs.

*The stream channel has lots of bends and the ends erode the bank. They drop off sands, rocks, and other materials on inside of bends.*

15. How have humans affected this zone?

*Humans has channelized concrete streambeds, culverts, and narrow bridges.*

16. \*\*\*How do concrete channels affect the flow of water during a storm? How do concrete channels affect the ability of wildlife to live in the stream?

*Rainwater cannot meander so it rushes though channel. Animals can no longer live there.*

## ***Estuary***

17. What is an estuary?

*Wetlands where the freshwater from streams and salty water from the ocean meet and mix.*

18. What kind of water would you expect to find at the bottom of an estuary? At the top?

*The salt water is at the bottom because it is denser, while fresh water is at the top.*

19. What do plants and animals that live in the estuary have to be tolerant of?

*They need to tolerate water with varying amounts of salt.*

20. How is the mouth of the estuary (part of the creek closer to the ocean) different from parts of the estuary more inland?

*The mouth has freshwater, while inland is salty.*

21. \*\*\* What time of year do you expect the water to be freshest in the estuary?

*Summer*

## ***Sandy Beach***

22. Why is the sand in the sandy beach zone constantly changing?

*It is due to waves and longshore currents.*

23. Where does the sand come from?

*Large waves move sand to surf where it forms sandbars, then sand migrates back. The sand comes from the mountains.*

24. What are the main sources of food for sandy beach animals?

*The food comes from the ocean: phytoplankton, drift kelp, and seaweeds.*

25. \*\*\*Why do we have to dredge the harbor but bring sand to Goleta Beach?

*They dredge the harbor because sand piles up. They use the sand to rebuild Goleta Beach because El Nino eroded it, which lead to continuous erosion.*

## ***Kelp Forest***

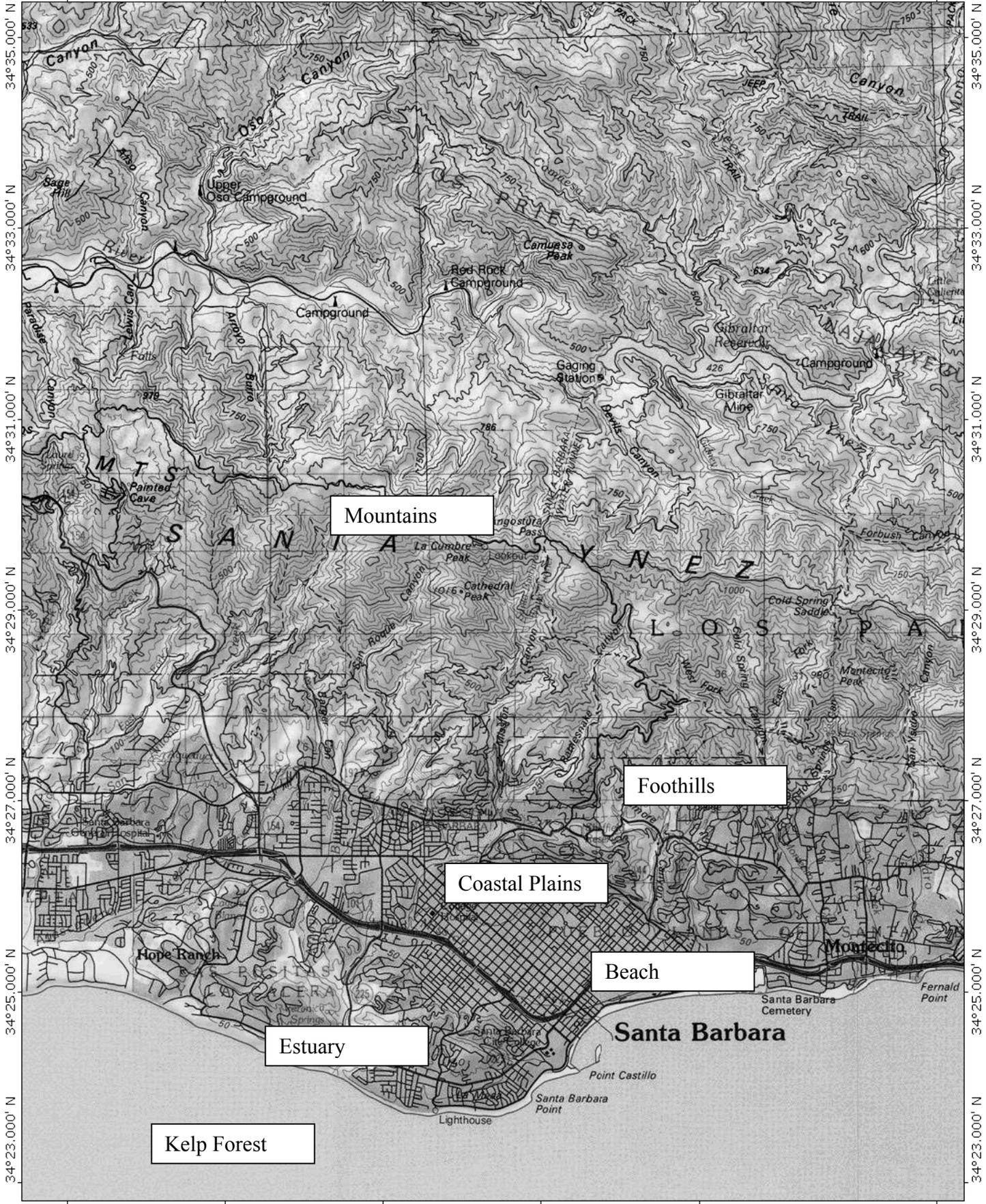
26. What is the largest marine plant that exists in the kelp forest?

*Giant Kelp (macrocystis)*

27. After a large rainstorm, muddy water is pushed into the kelp forest zone from local creeks, rivers, and streams. How does this muddy water affect the kelp and other marine organisms in the kelp forest zone?

*It makes it harder for the kelp to go through their process of photosynthesis because it needs sunlight. The kelp could die, which kills urchin and the that eat it.*

28. \*\*\*How is the kelp forest zone affected by actions that take place in different zones of the watershed? Pick a specific example in a specific zone.



Mountains

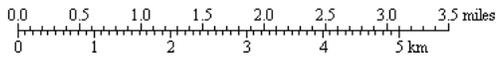
Foothills

Coastal Plains

Beach

Estuary

Kelp Forest



## **Zones of a watershed References**

### **Images:**

**All images without a reference are from Microsoft Clipart.**

Santa Barbara Coastal Long Term Ecological Research Project (SBC-LTER) Web Tools:

<http://www.msi.ucsb.edu/SBCLTER>

Funded by NSF OCE-9982105

Topographic maps created using: National Geographic TOPO! California Software.

2003. National Geographic Holdings, Inc.

### **Information:**

Santa Barbara Coastal Long Term Ecological Research Project (SBC-LTER): Natural

History Web Tool: <http://www.msi.ucsb.edu/SBCLTER/index.html>

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