

How Fast Can a Shoreline Change?

Shoreline and bluff erosion has been identified by shoreline residents as a critical problem along some parts of the Great Lakes. Land losses of up to 10 feet per year have been estimated for some areas. Property damage totals millions of dollars. Land loss and property damage are caused by the conflict between natural forces and human activity along the shoreline.

Ohio's Lake Erie shoreline consists of wetlands, low bluffs, and gently sloping shore in the western one-third of the state and glacial till and soft shale bluffs in the eastern two-thirds of the state. The rate of shore erosion is affected by the kind of land and rock materials and the use of protective structures.

Objectives

When you have completed this investigation, you will be able to:

- Recognize some shoreline features on aerial photos.
- Observe changes in a shoreline over time.
- Observe the effects of shoreline devices on rates of erosion.

Materials

- Ruler.
- Tracing paper.
- Pencil and colored pencils.
- Paper clips.
- Aerial photos of Painesville Township Park.

Procedure

You will be studying a portion of the Lake Erie shoreline in Lake County, Ohio. You will determine how fast erosion has occurred in the area and how much sand and clay has been removed by the waves and currents of the lake.

You will be using photographs taken from an airplane flying over the area at three different times, one in 1954, one in 1973, and again in 1981. The photos represent the same area of the shoreline. When using the photos, be sure that the large area of water (Lake Erie) is at the top of each photo. Then it will be oriented just like a map. The top will be north; the left side of the photo, west; and the right side, east.

1. Examine the 1954 photo. Describe the shoreline.
2. Now examine the 1973 photo. How has the shoreline changed? What features have been destroyed?
3. View the third photo from 1981. What changes do you see?

You should have noticed some straight objects jutting out into the water in the west central part of the photos. These are **groins**. They are structures designed to protect the shoreline by trapping sand.

4. How many groins are there in the 1954 photo? In the 1973 and 1981 photos?

5. Cover the 1954 photo with a sheet of tracing paper and secure it with paper clips.

6. Starting 1 inch in from the left border of the photo, draw 8 parallel N-S lines at one-inch intervals. Label the lines A through H starting at the left line.

7. Using a pencil, trace the base of the bluff on the paper. Label this line “1954.”

8. Now draw in and label the groins.

9. Outline two or three major road intersections. These will help you to position the paper on the other photo.

10. Now place the tracing paper on the 1973 photo. Match the road intersections.

11. Using a different colored pencil, trace in the base of the bluff. Label this line “1973.” Draw in and label the groins.

12. Notice that you have two different shorelines. Lightly shade in the area between the two shorelines.

13. Why are there two different shorelines?

14. What does the shaded area between the two shorelines represent?

15. What differences do you note between the area of shoreline east of the groins and that to the west of the groins?

16. What caused these differences?

17. Repeat the same procedure with the 1981 photo, comparing it to the 1973 photo. Note that the time elapsed between the 1954 and 1973 photos is more than twice that between 1973-1981. Observe the rates of erosion to see if there is a related relationship to time, i.e., did twice as much erosion take place between the first two photos as between the latter two? How can you tell?

Between 1954 and 1973, a portion of the shoreline eroded away. Between 1973 and 1981, an additional amount was removed. Shore erosion occurs through the combined effects of waves and currents. Waves, especially during storms, will attack the bluffs along the shore, causing them to collapse. Currents moving along the shore will pick up the sediments and carry them away. These currents flow in a predominant direction. Any obstruction will trap the sediment carried by the currents on its upcurrent side (the side from which the current is coming). On the downcurrent side of the obstruction, the currents will pick up a new load of sediment. Because of these processes, the groins slow down erosion upstream and cause additional erosion downstream.

18. In what direction do the currents along this section of the shore move?