



SHORELINE RESTORATION INDOOR LAB TEACHER'S GUIDE

Learning Goal: Learners will be able to understand the importance of buffer zones to maintaining the water quality and functioning of lake ecosystems. They will explore the various elements that are critical to a stable shoreline and methods to prevent erosion.

Objectives:

- Understand key terms and concepts essential to assess the stability of shorelines.
 - Determine factors that may contribute to runoff and erosion on shoreline habitat and the impact on water quality and lake ecosystems.
 - Develop a shoreline restoration project plan.
 - Discuss how land use can impact erosion and alter water resources.
1. Introduce the guests in the room.
 2. Tell students that today they will be learning about shoreline restoration. Ask students to define “shoreline” and “restoration” to begin the lesson.
 3. Review lake zone terms: littoral zone (where rooted plants may grow), limnetic zone (deeper area of lake). Where do you find most of life when near a lake? “90% of all lake life is born, raised, and fed where land meets water.” You can mention how this is dependent on how the sun is able to reach the bottom at shallower depths, allowing more plants to root and create habitat.
 4. Discuss how shoreline erosion influences water quality (through shade, water temperatures, critical habitat availability). The trees and surrounding vegetation on the shoreline have major impacts on water quality. Compare pictures of manicured vs. natural shoreline. Making the connections to previous LEEP topics when able.
 5. Explain the importance of native plants. Why should we plant native species compared to others that may be popular? Native plants help protect water quality by providing services such as filtering sediment, keeping the shoreline intact, reducing erosion and runoff, increasing infiltration and absorbing nutrients. They also provide habitat for animals and give people privacy. Show diagram of root lengths of native plants and compare them to lawn grass.
 6. Review terrestrial plant types, such as woody (hard, round, usually with stem, leaves, and flowers), forbs/wildflowers, grasses and sedges (plants with blade-like leaves). Introduce the different levels of vegetation, such as tree canopy (upper story), shrub canopy (middle story), grasses (lower story). Discuss the importance of having diverse levels to improve soil retention and to maintain a sustainable waterfront.

7. Introduce the importance of shoreline restoration. One way to restore habitat along shoreline is to plant native species. Restoration experts take many factors into consideration.
 - **Soil:** sand, loam, clay, etc. How would these different soil types affect erosion? Which plants do well in well drained vs. wet soils? Hand out soil samples so students can see differences in clay, sand, and loam.
 - **Sunlight:** full, partial, or shade. Plants often have a preferred amount of sunlight and should be matched up to that environment. If they get too much or too little light for what they are used to, they will not survive.
 - **Slope:** gently, moderate, steep. Some plants will not be able to develop roots to anchor themselves into steep slopes. Is there active erosion on the slope? Will plants be enough to stabilize the slope or are other practices needed?
 - **Existing vegetation:** What other plants already grow there? Planting similar plants could be successful. Some species are known to outcompete each other, so might not work to plant together.
 - **Human activity:** Some sites might not be suitable for planting if there is excess human activity. Look for building placement, stairways, paths, docks, firepits, roads leading to the lake (private boat landing), driveways, etc. How can you plant around these areas? Can some of these things be consolidated so the restoration area can be expanded?
8. Show examples of houses with varying factors showing erosion, runoff, or damage due to shoreline factors. Compare beaches with rain gardens and natural vegetation. Describe buffer zones. Biodiversity helps by increasing the types of plants that can retain soil and filter nutrients.
9. After the presentation, hand out lab packets so that students can fill in definitions. Make sure you direct students to the page they should be on and point to where they should write. Review the key terms and ask students to define the words in the packet.
10. Introduce the map activity, explain how to use topographical maps to understand changes in elevation and where land features are (hills, flat areas, steep areas). Show areas where lines are close together and far apart. Ask students to interpret the difference in steepness and what the effect would be on water runoff and erosion in these areas.
11. Hand out materials, including the markers (blue, yellow, red, black for each group).
12. As a class, ask students to find the deepest part of the lake. Have them use the black marker to write a "D" on their map and record the depth on their lab manual. Similarly, guide students to find three steep drop-offs in the lake bottom and write "DO" in these areas.
13. With a blue marker, have students color the lake area with blue and be sure that they include areas of the shoreline that might be wet. When students have completed the lake

coloring, have them use the yellow marker to color the land area around the water, extending into the water where plants may grow. This will create a green area where water and land overlap. As students are still coloring and finishing up, explain that these areas are the littoral zone and why they are important areas to consider for shoreline restoration.

14. Next, have students use the red marker to color the areas on the map that would be most susceptible to erosion. Have them consider the steepness of the land and any signs of human development that could cause shoreline to be damaged.
15. The final task is for the students to select a location on the lake for a house, road, and path to the lake as if they were developing a home on the lake. Before they select their locations, have a discussion on how we can minimize our impact on the land by considering the damage that development could create (roads, houses, paths).
 - Ask students what factors they should consider when building on shoreline. Make sure to mention slope, buffer zones, and how distance between houses and the shoreline helps reduce pollutants and other contaminants from getting in the water.
 - Ask students why they think the county requires a 75 foot setback from the shoreline. Is it a good idea or bad idea? Why? What would be the consequences if everyone built their cabins on the shoreline? How would this affect water quality and the organisms in the lake?
 - Have students consider the shape and placement of a path from the house down to the lake and a driveway from the nearest road to the house.
16. As students are working on selecting their home and drawing their paths/roads, go around the tables and ask them why they chose to develop the area as seen on their maps. If they drew a house on a steep area, ask them how this might affect the runoff and stability of the land. Similarly, if their path is straight, ask them how a curvy path may help reduce erosion from water runoff.
17. If time permits, have class discussion where students share the placement of their house, road, and path. Ask them why they think their choices might minimize erosion. Allow other students to provide constructive input or share their alternative placements. Make sure the students are not too critical of each other's work but can discuss different strategies to minimize erosion.
18. Students may compare this lesson to their experience on their own properties. You can explain the history of development, where we have learned over time some of these critical factors to reduce erosion. You can point to some of the lakes in Southern Wisconsin, which have had increased problems with nutrient pollution and overdevelopment. It is an ethical consideration between what humans want versus taking care of the land for current and future generations. With increasing population, it is even more important that we consider the damage that could be done to lakes with increased manmade activity around shorelines.