



Grade Level: 5th

Site: Classroom

Summary

During this lesson, students will aim to answer the question, “Why are animal populations (specifically deer and various bird species) declining in the Carson River Ecosystem?” They will review the connections in an ecosystem that allow it to function as a whole and brainstorm ideas as to why those connections are being lost around the Carson River. Students will experience hands-on activities to explain the functions of the Riparian zone and the issues causing animal populations to decline.

Materials

- Deer Population Graph
- Blank Ecosystem Picture
- Ecosystem Part Cards
- Coffee Filters
- Plastic or Paper Cups
- Coffee Grounds
- Black Paper
- Light Source
- Plastic Bin
- Sand (or similar substrate)
- Thermometer
- **Optional:** Rocks (or similar materials)
- **Optional:** Printable Science Notebook Pages

Essential Questions

- Why are key animals in the ecosystem (specifically deer and various bird species) leaving Northern Nevada?
- What disturbances occurred around Carson River?
- What ecosystem services do riparian zones provide?

Objectives (Integrated Content and Practice)

1. Students will be able to explain the connections of all the parts in a riparian ecosystem.
2. Students will be able to identify and describe the disturbances in the Carson River ecosystem and why they are affecting the animal populations.

NGSS

5-ESS3-1 Obtain and combine information about ways individual communities use science ideas to protect Earth’s resources and environment.

Common Core

- CCSS.ELA-Literacy.W.5.8 – Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work and provide a list of sources.
- CCSS.ELA-Literacy.W.5.9 – Draw evidence from literary or informational texts to support analysis, reflection, and research

Key Vocabulary:

- Riparian Zone
- Disturbances
- Coverage
- Sediment Pollution (& Sediment)
- River Curve

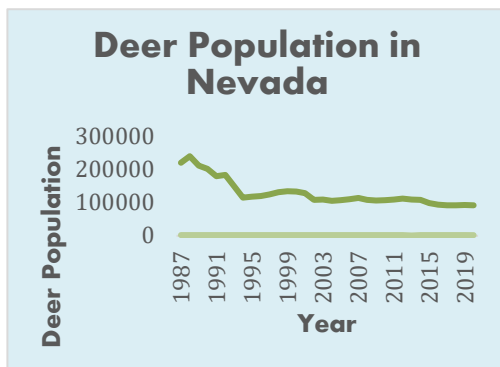
Invitation (5 minutes)

Summary:

Students will be shown a graph of deer population decline and brainstorm reasons why the population is declining in Nevada.

Tips and Tools:

The students will be revisiting their list of observations and ideas, make sure they keep their paper.



1. Show students the graph of declining deer population in Nevada and ask them what they notice about this graph. The observations do not have to be strictly mathematical or scientific. Have students write down any observations they see on a piece of paper or in their notebooks.
2. Have students focus on the trend of the graph, is it negative or positive? Is the population increasing or decreasing? They should conclude that the population is declining.
3. Ask students to think about *why* the population is declining. Have them write down all the reasons they can think of in their notebook. **TPS:** Students should share their ideas with a neighbor and discuss what ideas they have in common or what ideas are different. Why did they come up with these ideas?
4. Bring the class back together and have a few students share what ideas they discussed with their partner. Write them down on the board or a piece of paper for the whole class to look at. Keep this information up for the class to see throughout the lesson, you will be going back to this list.

Exploration (20 minutes)

Summary:

Students will first identify the parts of a working ecosystem and then build a working ecosystem using cards. They will get to hear about or look at other examples that their peers created and discuss why these ecosystems are working.

Tips and Tools:

If you have extra time, you can ask the students to identify more pieces of the habitat in the blank habitat picture (e.g., the log can be a shelter for bugs or macroinvertebrates) and/or discuss the cycles at play in the ecosystem (e.g., the water cycle).

Ecosystem Activity:

For this activity the cards should be sorted into groups including at least 4-5 cards each. Each group should include the river, a plant, one or two prey species, and a predator.

1. Explain that the key to answering this question begins with first discussing what a healthy ecosystem needs and what animals in that ecosystem need to survive.
2. Look at the full ecosystem picture and ask students to help you identify all the parts of the ecosystem, living and nonliving. How do these parts connect? Why are these connections important to the function of the ecosystem?
3. Split the class into groups and give each group a copy of the blank ecosystem drawing, and their ecosystem part cards. Each group should then work together to determine where each part of the ecosystem should go to make it function properly and be healthy. Have them discuss how these parts connect and why these connections are important to the function of the ecosystem. You can have them draw arrows on their paper between the parts to illustrate how they connect.
4. When the groups finish you may either have a few groups share what their ecosystem looked like and the connections they found, or have the class walk around and look at the different built ecosystems around the room.
5. Tell students that the ecosystem they just built is called a **riparian** zone/ecosystem. Define riparian as “an ecosystem located next to bodies of water that transition the aquatic (water) ecosystem and the terrestrial (land) ecosystem.”
6. On a sheet of paper or in a science notebook, have students draw a T-chart with one side labeled “Working Ecosystem” and the other side labeled “Not Working Ecosystem”. They should then write down all the things they’ve discussed and seen about what parts and connections an ecosystem needs in the column titled “Working Ecosystem.”

Concept Invention (20 minutes)

Summary:

Students will discover that the Carson River riparian ecosystem is not functional and discuss potential reasons why.

Tips and Tools:

Extra Question for **TPS**: Talk about how each part of the ecosystem will affect the entire ecosystem (i.e., What happens to the ecosystem when the fish population decreases?).

If you choose to write down the Claim-Evidence-Reasoning chart, there is an extra notebook page offered for students to write the chart down on their own. They can also draw the chart on their own piece of paper or in their notebook.

Alternatively, students can make their own Claim-Evidence-Reasoning chart and pick only one of those three reasons to argue for.

1. Tell students that, at the Carson River, this ecosystem no longer functions. Slowly flip over each card to reveal what parts are missing.
2. Ask students to think about why these things are missing in the ecosystem (e.g., why the fish are lacking freshwater). **TPS**: Give students some time to think about this question and then have them share their ideas with a partner.
3. As a class have a few students share what they talked about. Focus on why these potential explanations matter, what else they could affect, etc.
4. Tell students that these reasons are called **disturbances**. You can define disturbances as, “a temporary change in the parts or state of an environment that causes a negative change in an ecosystem.”
5. Revisit the question of why the deer (and other species) population(s) are declining. Look back at the list you made during the invitation and ask students if they would like to add anything else to the list.
6. When the students are satisfied with the list, ask them to think about what they think are the top three reasons out of all those. As a whole class, decide on only three reasons.
7. As a class, create a Claim-Evidence-Reasoning chart, or simply go through the steps out loud. The chart should support the claim that those three reasons are the most impactful.
 - a. **Claim**: Specific statement that declares a focused argument and can be supported with evidence.
 - b. **Evidence**: Data which can support that something exists or is true.
 - c. **Reasoning**: A written statement explaining *why* and *how* you reached your conclusion.
8. Introduce the 3 main reasons that the Carson River ecosystem is failing and present the terms **sediment pollution**, **river curve**, and **coverage**.
 - a. **Sediment**: Loose sand, clay, silt, and other soil particles that settle at the bottom of a body of water. **Sediment pollution** occurs when there is too much sediment.
 - b. **River Curve**: Describing the presence or lack of curves in a river.
 - c. **Coverage**: A measurement of the area of every plant/leaf covering an area of the ground.

Application (20 minutes)

Summary: Students will be going around to three different short activity stations that illustrate the terms sediment pollution, river curve, and coverage and experimenting to discover what these do to the riparian zone ecosystem.

Tips and Tools:

You can add a third part to the sediment pollution station by having students try the experiment with a semi-clean water sample.

Application Stations:

For the sediment pollution station, you will need 2-3 coffee filters and 1-3 cups per group, as well as coffee grounds, and water.

Prepare 2 cups of water samples per group, one cup filled with water and a small amount of coffee grounds. The other cup filled with a larger amount of coffee grounds and the same amount of water as the first cup. You can also prepare a third cup of water that is an intermediate between the two extremes.

For the coverage station you will need two cups of water, two black pieces of paper, and a lamp or flashlight that can be suspended above the paper and water. Put one cup of water and one piece of black paper directly underneath the light. Next, put the other cup underneath the light but underneath some sort of cover. If you cannot find cover, simply put the cup outside of direct light.

Lastly, put the other piece of black paper outside of direct light. For the river curve station, you will need a mid-sized plastic bin, sand or other kind of similar substrate, and water. You can also use rocks or other similar materials for when students are shaping their rivers.

1. Prior to the lesson you should have set up three stations to describe three of the main issues that can happen in an unhealthy riparian ecosystem, as described in the left column.
2. Split the students into at least three groups and assign the groups to a station. Have each group complete all three stations, writing their observations on a piece of paper or in their notebook.
3. **Sediment Pollution:** Placing one coffee filter over a cup, students will first pour the mostly clean water into the filter and observe how clean the water is inside the cup and how many coffee grounds are left in the coffee filter. Have them write down on a piece of paper or in their notebook what they see. Next, they will empty out their cup (or use a new cup), place a new coffee filter over the cup, and repeat the process with the mostly dirty water. This will simulate the buildup of sediment on the fish gills when there is too much sediment (in this case, coffee grounds) in the water.
4. **Coverage:** Students will take a thermometer and dip it into the water covered from the direct light. Have them record the temperature on a piece of paper or in their notebook. Then they will take the temperature from the water exposed to direct light and record that temperature on a piece of paper or in their notebook. They should notice that the temperature of the covered water is less than that of the exposed water. Next, students will put their hand on a black piece of paper not exposed to direct light and write down observations about the temperature they felt. Was it cold? Warm? Hot? Then they will put their hand on a black piece of paper exposed to direct light and write down observations about the temperature they felt to compare. They should notice again that the exposed paper is warmer than the unexposed paper.
5. **River Curve:** In the sand students will first dig out a straight line, representing their river. They should have it at a slight slant, so the water goes downward in one direction. They can use rocks or other similar items to line their river model. Then they will pour water into their river and observe how it flows. Have them write their observations on a piece of paper or in their notebook. Next they will add curves to their river and then repeat the process, pouring water into the river and writing down their observations.
6. Have students go back to their seats and ask them how the experiments went. What did they notice? Share these ideas as a class. Write down the shared observations and results and ask students what these observations and results could mean.

Check for Understanding (5 minutes)

1. Ask students to think about how these three concepts could negatively affect the riparian ecosystem. **TPS:** Students should share their ideas with a neighbor and discuss what ideas they have in common or what ideas are different. Ask them to explain their reasoning.

Reflection (5 minutes)

1. Tell students that environmental scientists work to identify and solve these disturbances. Ask them to be environmental scientists. They have already identified the disturbances, now you would like to solve the problems.
2. Revisit the Claim-Evidence-Reasoning chart and point out what reason(s) they determined were most impactful. Ask them what they would do to repair the damage done by these issues. If they wanted to restore the populations, what would they focus on? How might they do it?
3. Tell students that next time you will be discussing what scientists do to repair riparian ecosystem and then coming up with their own plan.

Background Information

- **Sediment Pollution:** Sediment pollution usually is caused by accelerated erosion or dams blocking the natural flow of sediment and causing a build-up. We are focusing on the way it clogs fish gills, but there are many more downsides to sediment pollution that lead to major ecosystem disruption. **In Carson River, sediment pollution is happening due to accelerated erosion caused by a straighter path of the river.**
- **Coverage:** The coverage is referring to a more complex environmental science concept: Leaf Area Index. It tells how much foliage there is and is a measurement of the photosynthetic active area (also telling of the area subjected to transpiration). The light received to an area also increases or decreases the temperature. **In Carson River, this temperature increase is disturbing the riparian zone, which is usually covered by shade that is no longer there in the same quantity. Plants are being dried out and animals therefore are discouraged from going to the area when the plants they would normally feed on are no longer available or available in lower quantities. Animals who stay have higher competition for food.**
- **River Curve:** The curve of a river determines many things, but in the riparian zone it is extremely important for erosion and flooding. The curve was straightened in Carson River to decrease flooding, but it is the floodplain created near the river that would give the water required to riparian flora. Many species that live right next to rivers require seasonal flooding to survive, and without it those species are drying out, disturbing the ecosystem.