MOSA MACK SCIENCE

Biodiversity Lesson 1: The Solve
Educator's Resource Guide

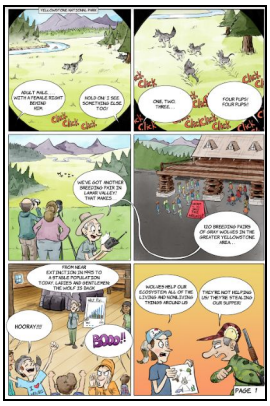
Objective
In *The Solve*, students will:

1. Solve a Comic Mystery that demonstrates how predators can affect an ecosystem and its biodiversity.
2. Create a Mind Map to explore relationships among complex Biodiversity vocabulary.
3. Communicate understanding that there can be multiple solutions to a problem.

Time Required: 40-75 minutes

Materials Required	Safety Considerations	Science & Engineering Practices
• Student Guide (*includes student agenda and Mind Map)* • Biodiversity Mosa Mack Comic Mystery • Scissors • Glue or tape	None	• Developing and Using Models • Constructing Explanations or Arguments From Evidence

Mosa Mack Comic Mystery Episode Description



It's close to all-out war in Yellowstone. And the animal at the center of the controversy? None other than the wolf. Some in the community have had it with the negative impacts of the wolves: in their view the wolves scare off the tourists and kill livestock. Some want them out for good! But others say the wolves must stay. In their view, wolves are essential to maintaining biodiversity in the area, and their presence has far-reaching impacts.
Mosa Mack is called to help the community figure out a solution to the canine problem. Mosa investigates both sides of the issues, weighs the pros and cons of each proposed solution, and at the end, tries to settle on a plan that protects the area's livestock while protecting the wolves and preserving the area's biodiversity.

Inquiry Scale: Leveling Information

The Solve can be completed in various settings, including presentation-style, small groups, or individually. In the case of a flipped or blended classroom, it can be completed entirely at home.

Level 1: Most teacher-driven (*recommended for grades 4–5)*

View the animated mystery twice: once in full, and a second time along with the discussion questions, pausing the video as needed to answer the episode questions as a group. Project and complete the Mind Map as a class-wide activity. This can be done digitally or on paper. Have students informally quiz each other on the vocabulary until you feel they're familiar with the terms. Use the discussion questions at the bottom of the Mind Map to have a group discussion. Finally, have students complete the quiz digitally or on paper as an exit ticket.

Level 2 (*recommended for grades 5–6)*

View the animated mystery in full. Afterwards, have students work through the episode questions to the best of their ability in small groups. Play the mystery a second time, pausing the video to discuss each question. Direct students to complete the Mind Map in small groups, either digitally or on paper. Come back as a class to review correct answers, as needed. Have students informally quiz each other on the vocabulary until you feel they're familiar with the terms. Use the discussion questions at the bottom of the Mind Map to have a group discussion. Finally, have students complete the quiz digitally or on paper as an exit ticket.

Level 3 (*recommended for grades 6–7)*

Provide students with their student URL and have students view the animated mystery in small groups. Have students play the animated mystery once in full and then answer episode questions in their table groups to the best of their ability. Then, as a class, project the mystery, pausing, as needed, to discuss episode questions in a think-pair-share format. Have students complete the Mind Map in table groups, either digitally or on paper. Have students quiz each other on the vocabulary until you feel they're familiar with the terms. In table groups, have students go through the discussion questions on their own, and review answers as a class. Finally, have students complete the quiz digitally or on paper as an exit ticket.

Level 4 *(recommended for grades 7–8)*

Provide students with their student URL and have students view the animated mystery and complete episode questions in pairs. Have students review their answers with a neighboring table group. Have students complete the Mind Map in pairs, either digitally or on paper. Have students quiz each other on the vocabulary until they feel they're familiar with the terms. Have these same pairs go through the discussion questions. Finally, have students complete the quiz digitally or on paper as an exit ticket.

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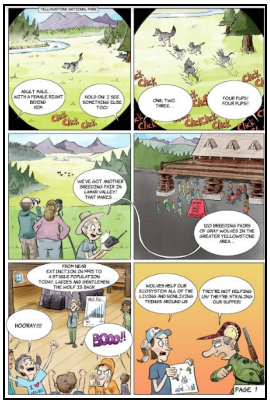
Agenda

I. Solve the Biodiversity Mosa Mack Mystery (20 minutes)

Differentiation Tip: The comic book and motion comic video can be read/watched as a class, in small groups, individually, or completed for homework. For additional support, students can read or watch the comic/episode twice: once before completing the questions, and once with teacher guidance, pausing to discuss each answer.

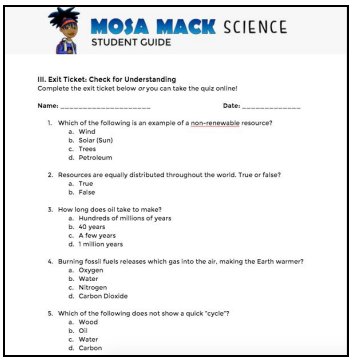


1. Read/watch the Mosa Mack Mystery on Biodiversity.

2. Students answer the questions in their Student Guide as they read/watch. Encourage students to cite the specific page numbers/time codes in the Comic Mystery to promote writing with supporting evidence. Answers can be found in the key below.

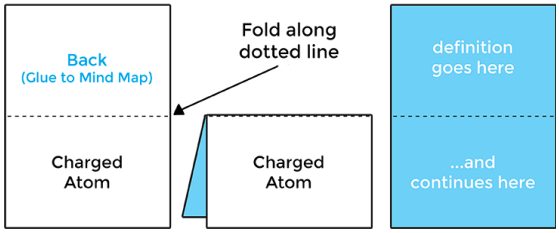
II. Vocabulary Mind Map Activity (15–45 minutes)

Differentiation Tip: The Mind Map can be done as a class, in small groups, individually, or completed for homework.



1. Students may complete the Mind Map **digitally**. Follow directions below. (15 minutes)
    a. Go to https://mosamack.com/home/biodiversity
    b. Select **Lesson 1: *The Solve***.
    c. Select **Vocabulary** and complete **Part 1:** matching terms with definitions.
    d. Complete **Part 2:** matching terms and definitions with images on a diagram.

2. To complete the Mind Map **on paper**, follow the directions below (45 minutes).
    a. Print and pass out the Student Guide: Biodiversity Lesson 1: *The Solve*.
    b. Introduce the warm up task: students will be making a Mind Map of the vocabulary for this Biodiversity unit.
    c. Model the directions carefully, emphasizing the following. Students should:
        - **cut** out the vocabulary cards on the solid lines only
        - **fold** the cards at the dotted lines
        - write the definition of the term on the inside of the card using definitions provided



d. Students use the clues from the Mind Map images, definitions, and terms to place the cards in the correct location in the Mind Map.
e. Check that the students have matched their cards correctly before moving on.
f. Students use glue or double-sided tape to connect the back of the vocabulary card to the correct place on the Mind Map.
g. Students discuss the questions with their group or as a class when they have completed the Mind Map.

Teacher Tips:

- Since this is the first time many of the students will have seen these vocabulary terms, have students work together to use the images, definitions, and collaborative thinking to figure out where the terms go.
- Check in on student groups through this process. When you see a student or group who has placed a card in the correct place, ask a facilitating question such as, "Why do you think that term goes there?" or "What evidence leads you to believe that term goes there?" When students explain their thinking, this is a great opportunity to provide positive reinforcement. Then, encourage students to share their reasoning to the class or to other groups who may have trouble identifying the location of that specific term.
- If you do not have access to a color printer, provide students with black and white copies and project the colored version of the Mind Map at the front of the room so that students can reference both images.

III. Exit Ticket: Check for Understanding (10–15 minutes)

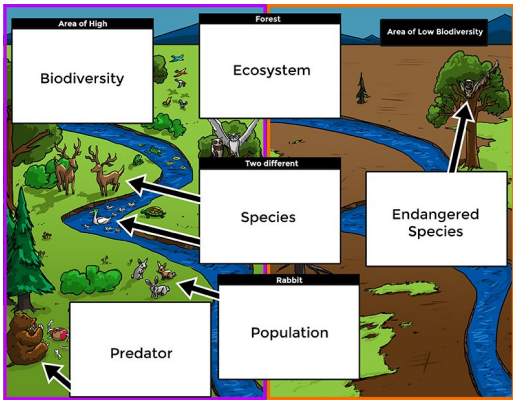
Differentiation Tip: This can be done in groups, pairs, individually, or more formally as a quiz online.

1. Students complete the exit ticket to check for understanding. This can be done online by selecting the **Quiz** button in Lesson 1 or on paper in the Student Guide. Answers are in the key below.

Answer Key

Mind Map Discussion Questions and Answers

1. How many organisms (living things) do you see in the area of high biodiversity compared to the area of low biodiversity?



Answers will vary but there are going to be more organisms in the area with high biodiversity compared to the area of low biodiversity. Organisms in the area of high biodiversity include: rabbit, tree, turtle, owl, bear, duck, mushrooms, bird, frog. Organisms in the area of low biodiversity include: owl, tree, grass.

2. How does the area of high biodiversity compare to the area of low biodiversity?

The area of high biodiversity has many types of animals and plants present, and it appears healthy. The area of low biodiversity has few plants and animals, and it looks unhealthy.

3. How do you think an ecosystem can be affected if you remove one of the species?

If you remove one of the species, it can disrupt the balance of the ecosystem. This disruption would affect the other organisms that rely on the missing species for food and cause other organism populations to increase or decrease.

Episode Questions

1. What was the initial problem that had the community divided?

The wolf population has increased and it's affecting the surrounding area. (page 1) (0:30-1:00)

2. What happened to the elk population when the wolf population decreased and why?

When the wolf population decreased, the elk population increased. This is because wolves ate elks and with no wolves around, more elks survived. (page 3) (2:05-2:20)

3. What happened to the environment when the wolf population was declining? What happened to the elk, leaves, grasses, and bark?

The elk population grew, and the elk ate all of the leaves, grasses, plants, and bark. (page 3) (2:30-2:35)

4. How did the gray wolf become endangered in the mid-twentieth century?

Hunters killed almost all of the wolves because they were eating their livestock: their cows, sheep, and horses. (page 3) (1:40-2:10)

5. Why did the government bring in new wolves from Canada?

The government brought in wolves from Canada to help grow the wolf population in Yellowstone. The idea was that the wolves in Yellowstone would mate with the wolves from Canada, thus growing the population.(pages 3-4)(2:40-3:10)

6. Now that the wolf population is back up, what are some of the problems the community faces?
Now that there are more wolves, campers fear attacks, hunters compete with the wolves for elk, and wolves eat ranchers' livestock. (pages 5-6)(3:45-5:00)

7. What are the benefits of having a larger wolf population?
A larger wolf population has many benefits including:

- *Ecotourism brings visitors to the park.*
- *Wolves are predators that help to balance the food web.*
- *Wolves cause the elk to move around more, which keeps the ecosystem healthy and improves biodiversity.* (pages 6-8) (5:05-7:30)

8. What is biodiversity?
Biodiversity is the variety of species in the environment. (page 8) (7:15-7:25)
9. Which solution should Mosa choose and why? Explain your reasoning behind your choice.

- Install a wall around the park.
    - Pro: The wolves stay inside the park and cannot attack livestock.
    - Con: A wall might be expensive and would separate the park from the rest of the natural ecosystem.
- Send the wolves to Canada.
    - Pro: There would be no more wolf-related problems.
    - Con: It might be difficult to catch all of the wolves to send away, and the ecosystem would suffer again.
- Allow more wolf hunting outside the park.
    - Pro: The hunters would protect their elk and livestock.
    - Con: The wolves could get over-hunted again.
- Ban wolf hunting.
    - Pro: The ecosystem remains balanced.
    - Con: The wolves continue to attack livestock and scare campers.
- Track wolves with collars or microchips and install better fences outside the park.
    - Pro: Wolves can be brought back into the park and the livestock can be better protected.
    - Con: It might take time and money to install trackers and fences.

(pages 9-10 and Answer Comic)

Quiz:

1. Which problem(s) are currently reported with gray wolves? Check all that apply.
    a. **Wolves could approach campers and could possibly attack campers in Yellowstone**
    b. **Wolves compete with hunters for the same prey: the elk**
    c. **Wolves kill cattle and sheep in local ranches**
    d. Wolves live in packs and howl at night, disrupting visitors at the park
2. Which of the following statements supports how wolves help the Yellowstone environment?
    a. Wolves attract tourists to the park and attendance at the park has gone up
    b. Wolves leave behind scraps of dead animals that they kill, helping to feed scavenger animals in the park
    c. Wolves keep elk on the move, allowing more trees to grow, which helps beavers to build their homes and lodges
    d. **All of the above**
3. Why were the wolves near extinction in the mid-twentieth century?
    a. Wolves help the living and nonliving parts of the ecosystem
    b. Humans turned wolf territory into towns and farms
    c. Wolves eat farmer's cows, sheep, and horses
    d. **Hunters killed them**
4. **True** or False: When the wolf population decreases, the elk population increases
5. Too many elk can disrupt an ecosystem because:
    a. **Elk eat grasses and plants, which destroys these resources for other animals in the ecosystem**
    b. Elk eat wolves, which disrupts the food chain
    c. Elk travel in herds and crush plants on the ground below them as they travel
    d. Elk feed on beavers in the river and can decrease the number of beavers in the environment
6. Which action was not put in place to protect the wolves?
    a. Wolves were brought into the region from Canada
    b. Hunting was banned in Yellowstone
    c. **Farmers raised wolves on their farms and later released the wolves into the environment**
    d. The government stepped in to help reintroduce the gray wolf back into Yellowstone.

7. True or **False**: Today, wolves can be hunted inside of Yellowstone Park