Exploring Ecosystem Dynamics

Companion Lesson to X-STEM All Access Episode "[Deep Sea Science](#)"

Grade/ Grade Band: 6-12	Topic: Prey-Predator Relationships in an Ecosystem	

Brief Lesson Description: In the video [Deep Sea Science](#), Dr. Mike Heithaus discusses the benefits of the apex predator to their ecosystems. In this lesson, students take a look at the predator-prey relationship through a simulator and describe how predators can be beneficial to their ecosystems.

Performance Expectation(s):
MS-LS2.4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.

Specific Learning Outcomes:
Students will be able to describe the relationship between predator and prey within an ecosystem.
Students will be able to explain the benefits of the predator-prey relationship.

Narrative / Background Information

Prior Student Knowledge:
Students should be able to explain the flow of energy through an ecosystem.
Students should be able to define ecosystem and describe various types of ecosystems.

Science & Engineering Practices:	Disciplinary Core Ideas:	Crosscutting Concepts:
Engaging in Argument from Evidence	**LS2.C: Ecosystem Dynamics, Functioning, and Resilience**	**Stability and Change**
Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s). ● Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. ([LS2-4](#))	● Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. ([LS2C](#))	Small changes in one part of a system might cause large changes in another part. ([LS2-4](#))

Possible Preconceptions/Misconceptions:
Students may think varying the population size of a species may not affect an ecosystem because some organisms are not important and have no role in the ecosystem. In this lesson, students will learn all organisms within an ecosystem are important. Students may also believe that the correlation between the predator and prey is equal. Varying a species' population size may not affect all other species equally, but it will affect the ecosystem as a whole.

LESSON PLAN – 5-E Model

ENGAGE: Opening Activity – Access Prior Learning / Stimulate Interest / Generate Questions:

Start the lesson with the video [Deep Sea Science featuring Dr. Mike Heithaus](#). As students watch the video, have them record 3 interesting facts Dr. Mike Heithaus discussed. With a partner, have students pair up to share their facts before sharing with the whole class.

Ask students the following question(s):
How might the ecosystem in Shark Bay be impacted if the fish population had less seagrass? How might humans be impacted if there was less seagrass in Shark Bay? How can we attract more sharks to Shark Bay and why would we want to?

With a partner, have students consider their possible responses and then discuss as a class to generate initial ideas.

EXPLORE: Lesson Description – Materials Needed / Probing or Clarifying Questions:
Ensure the student laptops can access the Rabbits and Wolves simulator.

Students are going to use a simulator to observe how changes in parameters (like birth rate) can affect predator prey interactions.

First have students go to the Rabbits and Wolves simulator at: http://www.shodor.org/interactivate/activities/RabbitsAndWolves/ and click "start simulator" and observe how the populations change over time.

Have students open the **population graph** to see the cycle. Then in pairs, students will answer the following questions:
- □ What happens to the grass over time?
- □ What happens to the rabbits?
- □ Why do you think the wolves did not survive?

View Startup Parameters for Prey and Predators. The parameters should read:
Initial Number of Rabbits: 20   Initial Rabbit Food Level: 10   Initial Grass Value: 20
Initial Number of Wolves: 5   Initial Wolf Food Level: 150
Point out to the students that at the bottom of the simulator are buttons that allow you to modify parameters. Tell students that their goal is to create an ecosystem where both the rabbits and the wolves can survive for at least 1000 iterations. They can change any parameters and run the simulation. If the wolves or rabbits die, they have not succeeded. Students should keep a record of the changes.
Parameters:

	Trial 1		Trial 2		Trial 3	
	Rabbits	**Wolves**	**Rabbits**	**Wolves**	**Rabbits**	**Wolves**
Maximum Food Level						
Metabolism Rate						
Reproduction Age						
Reproduction Probability						
Reproduction Food Level						
Maximum Age						
Number of iterations						

Note: It will take more than 3 trials to create an ecosystem where both rabbits and wolves can survive for 1000 iterations. Allow students to complete as many trials as time will allow (around 10 mins).

EXPLAIN: Concepts Explained and Vocabulary Defined:
In a stable ecosystem, the number of predators and the number of prey will cycle. As prey numbers go up, predator numbers also go up. When there are too many predators, the number of prey declines, causing a decline in the predator population.

Vocabulary:
Stable ecosystem- an ecosystem that recovers from a disturbance and maintains balance between the availability and the use of nutrients by recycling them through the natural processes
Predator- an organism that preys on other organisms, killing and eating them
Prey-an organism that is hunted or killed for food

ELABORATE: Applications and Extensions:
Prior to starting the elaboration section of this lesson, you will need to gather the following materials (per student): laptops and notebooks
Describe what parameters you changed to achieve a stable population of rabbits and wolves.
Change the size of the forest and determine if the same parameters resulted in a stable population. Suggest a reason why the size of the forest may have affected the outcome.
Write a report explaining what parameters are needed to create a stable ecosystem and suggest possible solutions for overpopulation and underpopulation of either predator or prey in this ecosystem.

EVALUATE:

Formative Monitoring (Questioning / Discussion): Questions found in the lesson: What happens to the grass over time? What happens to the rabbits? Why do you think the wolves did not survive?

Summative Assessment (Quiz / Project / Report): Students write down the parameters they used to achieve a stable population of rabbits and wolves in a report explaining why the ecosystem is now stable.

Elaborate Further / Reflect: Enrichment: Complete the Rocky Mountain Wolf Quest with Project Hero and weigh in on the decision to reintroduce grey wolves into Colorado's mountains. This is an online interactive activity that allows students to apply their knowledge and understanding of ecosystems to a controversial issue that was on the ballot in 2020. Students will help educate others about the potential impact wolves could have on the natural ecosystem and the humans that live in the area.

SOCIAL EMOTIONAL LEARNING ACTIVITY

CASEL Competency: **Responsible Decision-Making**

Decision-making is a skill that needs to be learned and strengthened. It's important to help students develop decision-making skills. Here are 8 steps to share with students as they face a dilemma:

1. *Identify the problem*. Write down the issue you are trying to resolve and why you must resolve it. The step gives you an idea of how important this decision is to you.
2. *Gather information and ask for advice*. Think about the facts of the situation and what might be holding you back. Ask others who have experienced a similar situation. This step gives you objective and subjective information to make a well-informed decision.
3. *What is important to you*? List your values, what's most important to you. This is where you think about the conditions of your choice and how the choice will impact and reflect on you.
4. *Brainstorm possible options*. Write down all the ideas you can come up with based on your research, your values, and the advice you received.
5. *Identify the consequences of each choice.* This is your pros and cons list. Write out the good things that could happen and the bad things that could happen for each of your options from the brainstorm.
6. *Decide on the best choice for you.* This is much easier now that you have the information gathered in the previous steps. Use the information you've gathered to make your decision, understanding the rewards and the consequences.
7. *Create a plan and carry it out*. Now that you've decided, put together a plan and put it into action.
8. *Reflect on the decision*. Did you make the right decision for yourself? If so, what helped you achieve this decision? If not, which of the steps could you have done a little more work on?

After reviewing the steps with students, give them the opportunity to practice with simple, non-threatening decisions: Should you get an after-school job? Or should you buy a new outfit for homecoming/prom? Or should you take the SAT, ACT, both, or neither?

INTERDISCIPLINARY CONNECTIONS/IDEAS

ELA: Students are writing a report based on evidence as the summative assessment; standard: **WHST. 6-8.1** *Write arguments to support claims with clear reasons and relevant evidence*

Materials Required for This Lesson/Activity	
Quantity	**Description**
Per student	Laptops

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