Tallgrass Prairie Storyline

Lesson 3: Comparing Ecosystems

Driving question: **How do prairie (and other ecosystems) maintain their health?**

Lesson 3 question: **How do different ecosystems compare?**

Terminology & Concepts

- *Biodiversity* = The number of different species (plants, animals, bacteria, fungi, protists) found within an ecosystem – may also include the genetic diversity within each of the species of these organisms.
- *Green World Hypothesis* = The idea that predators keep herbivore populations in check so that they don't consume all the plants.
- *Keystone Species* = Is a species upon which other species in an ecosystem large depend, so much so that if it were to be removed the ecosystem would change drastically. .
- *Resilience* = The ability of an ecological system to maintain its normal patterns of nutrient flow and energy cycling through the system despite disturbances (drought, flood, fire, climate change).
- *Trophic Cascades* = The concept that predators limit the density of their prey and therefore enhance the survival of the next lower trophic level. This can go backwards, too. If the top order predators are eliminated, then the numbers of the organisms in the trophic level that were their prey explodes in number, thus affecting the density of their prey/food species.

1. Compare Food Webs

Provide the students with a set of **Species Cards** from the **Rocky Intertidal System and the Kelp Forest** (in documents folder). You may want to laminate them for future re-use. Put butcher paper on the tables for students to construct food webs and to draw energy flow arrows.

ACTIVITY: You will receive a set of cards that depict some species of the Rocky Intertidal System. Use the cards to build models and answer the questions below:

TASK A: Using the Species Cards organize them each into their own food web. Draw arrows to indicate the flow of energy between organisms.

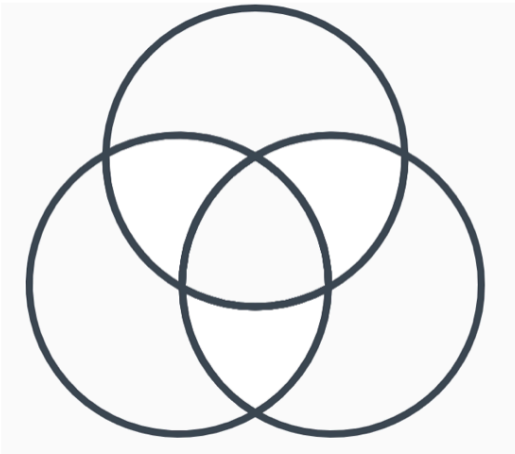
1. Which ecosystem do you think is the healthiest? Rank them (in your table's opinion) in 1,2,3 order.
2. Do you think the Tallgrass Prairie is a healthy environment?
3. How do you know/measure the health of an environment?

TASK B: In your notebook, draw a Venn diagram like the one below. (PowerPoint)

Label one ring: **Tallgrass Prairie**, another **Rocky Intertidal System**, and the last one **Kelp Forest**.

As we investigate these ecosystems further, we will find:

- Characteristics of each ecosystem that are found only within their systems (outside of any shared rings)
- Some overlapping characteristics that they share with 1 other system (overlapping 2 rings)
- Some characteristics that they all share (located in the middle)



2. Explore the Rocky Intertidal and Kelp Forest Ecosystems

Watch the video: Some Animals Are More Equal than Others: Keystone Species and Trophic Cascades (– from beginning to 8 minutes 45 seconds) (PowerPoint)

https://www.youtube.com/watch?v=hRGg5it5FMI

Terms – discuss in class - define in your notebook:

- What is a **Keystone Species**?
- What is the **Green World Hypothesis**?

3. Explore the Kelp Forest Ecosystem

Now let's explore a different ecosystem the occurs off the shore of the Pacific Coast – the Kelp Forest.

The Kelp Forest contains some species that are shared with the Pacific Coast, but it also has species unique to its system. The keystone species are also different.

Watch the video (from 8 minutes 45 seconds to the end) and then answer the questions as a group discussion: (PowerPoint)

Discussion – to be done in class:

1. What do you think the Kelp Forest ecosystem looks like without otters?
2. What do you think may be causing the sea otter population to decline in some areas?
3. Why would orcas begin eating sea otters?
4. How would you design an experiment to test the orca theory?
5. If the number of sea otters declines in an area where they are normally found, what effects would this have on the system as a whole?

Terms – discuss in class - define in your notebook:

- **Trophic Cascade**

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4. Limiting Factors

A Limiting Factor is a resource in an ecosystem that is needed for an organisms' life, and which may be in limited supply, thus keeping the numbers of individuals of a species to a limit.

Let's take another look at the biotic and abiotic limiting factors of both a Pacific Coast and Kelp Forest ecosystem. Copy the following tables in your notebook. Record all potential factors that would impact the species listed in the table.

Rocky Intertidal System (PowerPoint)

Species	Abiotic (non-living) Factors	Biotic (living) Factors
Sea Star		
California Mussel		
Zooplankton		
Phytoplankton		

Kelp Forest (PowerPoint)

Species	Abiotic (non-living) Factors	Biotic (living) Factors
Orca		
Sea Otter		
Sea Urchin		
Kelp		

Answer the following in your notebook:

1. How are the two systems different? Do they have different biotic and abiotic limiting factors?
2. How are the two systems similar? Do they have similar biotic and biotic limiting factors?
3. Which of the limiting factors are especially important in ensuring the health of the Kelp Forest? Put a star by it. Do the same for the factor that seems to especially affect the health of the Pacific Coast system.
4. Now, if you made one of these tables for the Tallgrass Prairie in the previous lesson, go back and add to a star to the limiting factors that you think are really important.

5. Biodiversity

Let's learn the term: **Biodiversity**, and explore the concept: (PowerPoint)

Now add the following term to your notebook... discuss and define.

- Biodiversity

After looking at the 3 ecosystems in the Pacific Coastline, Kelp Forest, and the Tallgrass Prairie, and using the information from the previous video, answer the following questions in your notebook:

1. Which one of these ecosystems (Rocky Intertidal System, Kelp Forest, or Tallgrass Prairie) seems to be the healthiest? The most stable? Why?
2. What does it mean for an ecosystem to be stable?
3. **Resilience** is the ability of ecological systems to maintain stable system properties. Which of the three systems we've been looking at, seem to be the most resilient?
4. Is the Tallgrass Prairie maintaining homeostasis?
5. Do you think there is a **Keystone Species** of the Tallgrass Prairie? If so, what is that species

6. Model Tracker

As we try to figure out more about healthy environments, it is going to be important to keep track of our discoveries and ideas.

Some things might be important in our models and others may be less important. To help us keep track of these ideas, we are going to use an **Incremental Modeling Tracker (IMT)**. The IMT will help us keep track of important discoveries and think through how we can prioritize our ideas and discoveries to revise or build on our model of healthy environments.

What did we figure out? Which parts of what we figured out (if any) can help us with our model? How can we add to or revise our models? *Record your current thinking about these questions on your IMT.*

LESSON QUESTION (What Question Are We Trying to Answer?) **&** **LESSON NICKNAME**	**WHAT DID WE FIGURE OUT?** Which parts of what we figured out (if any) can help us with our model? (Highlight them!)	**BASED ON OUR PROGRESS THIS LESSON, HOW CAN WE ADD TO OR REVISE OUR MODEL?** How should we represent our ideas in our model? (Use pictures, words, or symbols)
Lesson 3 - How do different ecosystems compare?		

Lesson 3 Exit Assignment – Comparing Ecosystems

Product submitted by student: A completed worksheet
Points: 4

Name:_____
Section:_____
Date:_____

TASK: Doing an internet search, find two distinct ecosystems – (other than the Tallgrass Prairie, Kelp Forest, or Pacific Rocky Intertidal System). **They must be in different continents – 1 may be aquatic, if desired**.

a. Find species in each of the systems that fit the following trophic levels:
   - Producer
   - Primary Consumer
   - Secondary Consumer
   - Top-level/Tertiary Consumer
b. Consider the abiotic limiting factors for each system. Are they similar or are they quite different? Explain.
c. What do you think is the Keystone Species for each system?
d. Compare and contrast how the two systems are different (this should be easy) and how they are alike (this should be more challenging).

System 1: _____

Producer:
Common name: _____

Scientific name: _____

Primary Consumer:
Common name: _____

Scientific name: _____

Secondary Consumer:
Common name: _____

Scientific name: _____

Top Level/Tertiary Consumer:

Common name: _____

Scientific name: _____

Keystone Species:

Who is it and why are they key to the system's operations?:

Abiotic limiting factors for this system:

System 2: _____

Producer:

Common name: _____

Scientific name: _____

Primary Consumer:

Common name: _____

Scientific name: _____

Secondary Consumer:

Common name: _____

Scientific name: _____

Top Level/Tertiary Consumer:

Common name: _____

Scientific name: _____

Keystone Species:

Who is it and why are they key to the system's operations?:

Abiotic limiting factors for this system:

Comparisons:

How are these two systems different?

How are these two systems alike? Do they have similar limiting factors?

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