MONARCH Lesson sequence

Lesson (time)	Lesson Focus	Learner Objectives	Activity/assessment
1 (~120 min)	Introduction to Modeling	Begin to understand models are learning and reasoning tools.	Introduction to Modeling; Drawing an initial Model to the question "How do animals interact in an ecosystem?"
2 (~120 min)	Introduction to the SSI	Take a position and construct an SSI argument about a local issue: *Should our school turn one soccer field into a garden to attract butterflies?*	Present the story of butterfly decline; Graph butterfly populations in Missouri over time; introduce SSI; Students write their initial stance on the issue and defend it
3 (~120 min)	Habitats	Determine how organisms survive within a habitat (food, water, shelter, and space).	Habitat thinking map; Build eco-columns; set up butterfly habitats; students diagram habitat observations; garden walk
4 (~120 min)	Habitats and Ecosystems	Understand Ecosystems are made up of habitats and that organisms are adapted to their specific habitat.	Read *At Home with the Gopher Tortoise;* Students research a habitat and present to the class; play habitat breakdown game; Evaluate and revise initial model
5 (~120 min)	Food Webs/Chains	Ecosystems are interdependent. The food of almost any kind of animal can be traced back to plants.	KLEW chart; sorting bag activity; class discussion; food web game; revisit KLEW chart; complete food web diagram independently
6 (~120 min)	Butterflies and food chains	Animals have predictable patterns in their life cycle and these stages are dependent on other organisms.	Read *A Butterfly is Patient;* Watch "Growing up Butterfly"; Cut and glue butterfly life cycle activity; Role Play activity; Read and discuss

			The Great Kapok Tree; Evaluate and revise initial model
7 (~120 min)	Final Modeling Lesson: What's important to the ecosystem? How do we know?	The purpose is to see how students' thinking about models and modeling has changed over time and to reinforce the new modeling concepts just introduced within this curriculum.	Revise initial consensus model and word storm chart; Elicit students' ideas about modeling; students pick an example and explain how it is a model; Draw a final model
8 (~120 min)	What can we do to protect our Earth? What can we do to fix our Earth? And whose responsibility is it?	Students will use scientific models to make and defend SSI arguments related to conservation and restoration of butterflies.	Poster activity of SSI questions; Revise initial stance on the issue; use their final model to write an evidence-based explanation about conservation in a different setting

Lesson 1: Introduction to an SSI: What's important to the environment? How do we know?

Materials:
Monarch Butterfly Movie - https://www.youtube.com/watch?v=Tq7G7nVCThc
Book: **Waiting for Wings *by Lois Ehlert.***

Background Information:
- Information about Monarch Butterfly Decline: https://www.learner.org/jnorth/tm/monarch/conservation_overview.html
- Information about why butterflies are important to our environment (http://butterfly-conservation.org/44/butterflies-and-moths.html)

We are connecting all science in the unit to this driving question:
What can we do to protect our Earth? What can we do to fix our Earth? And whose responsibility is it? ***By lesson 4 this should come up by the students. If not bring, it up during lesson 4.***

Overarching Question:
Take a position and construct an SSI argument about a local issue: *Should our school turn one soccer field into a garden to attract butterflies?*

Engage:
Present the story of butterfly decline to students.

https://www.youtube.com/watch?v=Tq7G7nVCThc (Start at 9:05 go until about 12:20)

The movie will show the migration path up from Mexico to Canada and then back from Canada to Mexico. The butterflies come up from Mexico, stop in the southern U.S., have kids, and die. The kids go to northern U.S., stop, have kids, and then die. The final generation flies into Canada, has kids, then die. These are the kids that fly all the way back to Mexico to start the whole cycle over again. No one knows why it happens this way or what triggers the butterflies to migrate.

Explore:
Build off of 2nd-grade what they've learned about the Monarch butterflies (at Shepard). Explore how they are important. Different resources as applicable.

**Teacher Note: Butterflies are important because they help flowers pollinate, eat plenty of weedy plants (that would not allow the "good" plants to grow), and provide a food source for other animals. In addition, their presence or absence tells us whether the environment is healthy. If we don't see butterflies, it may be because the temperature has*

changed or we aren't getting enough rain or we may have removed the things that they need to live.

Let's look at how many butterflies are making the trip each year that pass through Missouri. Give each table a year with a number. The number represents how many millions of butterflies made the trip that year through Missouri. You can chose whether to show on the graph the large number, or the small number in parenthesis. If you use the small number, talk about it being counts around the school yard. If using the large number, talk about it being counts all over Missouri. The goal is for the students to see that the downward trend over time. Fewer butterflies are making the trip each year. The data is from this website:
https://www.learner.org/jnorth/tm/monarch/conservation_overview.html

1996: 910 (9)
2003: 556 (6)
2006: 334 (3)
2010: 201 (2)
2015: 201 (2)

To Graph: Each small group will create a specific type of graph using the same data (pictograph, bar graph, line plot, etc.) using butterfly stickers if using Butcher Block paper, magnets on a white boar, or other way to make butterflies on the SmartBoard. Each table is to stick the number of butterflies on the graph. The important part of this activity is 1) to see the downward trend over time, and 2) to see how data can be represented in multiple ways or types of graphs to demonstrate this trend.

Does the decrease in the butterfly population matter?
Discuss the trend at the start and then help them question why there are fewer butterflies.

Explain:
Analyze the trend showing that butterflies are decreasing. Read *Waiting for Wings* by Lois Ehlert

**Teacher note: On page "They dip and sip", the book is showing milkweed.*

Introduce the terminology that is relevant to the lesson (in book). Some examples:

Milkweed: Butterfly food source
Migration: To move from one place to another during certain seasons
Pollination: Moving pollen from one plant to another

**Teacher note: Introduce to students that butterfly numbers are declining because plants they use as food and to grow on we think of as weeds, such as milkweed) and we mow large plant areas so we can play and run. We have also removed large of plants called prairies to build buildings, parking lots, and other structures.*

Extend/Elaborate:
Why are the numbers decreasing?
Research why butterfly (Monarch) numbers are decreasing

Evaluate
Ask students to write in Writing 1: *Should our school turn one soccer field into a garden to attract butterflies?*

After they write, they should share with a partner or at their tables what they have written. Once everyone has shared, have students discuss as a class what their ideas are.

Discussion questions:

1. Do you think we should do this? Why?
    a. Ask students who "benefits" from their decisions (Students? Butterflies? Ecosystem? Parents? Teachers?) and why does that group benefits?
    b. Return to the graph made at the beginning and use it to predict the trend – ask "If we were to put next year on this graph after restoring the soccer field, what would it look like? Would it be bigger than the line next to it? Or would it be smaller? Why do you think that?
    c. Ask what would be good about converting a soccer field to a butterfly habitat? What would be bad about doing this?

After students complete Lesson 2, they will write their answer a second time (in writing 2) to the question: *Should our school turn one soccer field into a garden to attract butterflies?*

Lesson 2: Introduction to Modeling

Instructional modeling sequence

1. Students develop an initial model that represents and explains phenomena
2. Students use their model to:
   a. make *predictions* about a phenomena
   b. *investigate* a phenomena
   c. *explain* a phenomena
   d. *communicate and justify* their explanations for phenomena
3. Students evaluate their models in light of empirical data and other model-based explanations
4. Students revise their model to better represent and explain phenomena

This general instructional cycle is grounded in past research and development work focused on scientific models and modeling in science classrooms (e.g., Abell & Roth, 1995; Forbes, Zangori, & Schwarz, 2015; Gilbert, 2004; Kahn, 2011; Lehrer & Schauble, 2006, 2010; Schwarz et al., 2009)

Key Concepts

- Models are representations, not exact copies, of real-world phenomena
- Models can include many different kinds of elements
- The ways in which scientists use models (to predict and explain) is what makes a model 'scientific'
- Something that takes an abstract idea and makes it concrete
- A way to display thinking, thought processes, sense-making of a scientific concept.
- Provide multiple ways to show a student's thinking
- Any time (drawing or writing) that you are making sense of something
- Provides opportunities for perspectives & scale.
- Very individual expression of a student's understanding.
- From a teacher's perspective, models are a method to probe further understandings, identify misconceptions, assess learning.
- Comparison of different models (different pictures)
- Teacher models and students models are still models

INTRODUCING MODELS

1. ***ENGAGE:***

   Do a word storm for the word "Model". Collect all words that the students say to the word model. Create categories about the words the students have provided. Guide the discussion to come up with how this could help us in science. Ask, "Would any of these words have anything to do with science? Or "Would any of these words not help me with science?"

   SAVE THIS FOR THE FINAL LESSON.

2. ***EXPLORE:***

ELICITING STUDENTS' IDEAS ABOUT MODELS

Tell students that one of the ways scientists represent and share their ideas is my making models. Ask students to consider which of the following are models.

Below are listed things that students might do in a science class. Might be a card sort or a list. Think about which of these are examples of a model.

- *A globe or map (model when used to make sense of something about Earth)*
- *A diagram of something like a life cycle (model when used to make sense of how animals grow and develop)*
- *A toy car or toy airplane (depends on a purpose, could be a model if it's used to make sense of something about the toy)*
- *Going on a field trip (for discussion, takes a while to come to this is a model. If it were a field trip to a science museum that uses a model to support making sense of something, it is a model. A field trip by itself is not typically a model)*

Could have small group discussion and then bring back to a larger group for a consensus. Ask them:

- How did you decide whether something was a model?
- How could they use their choice to understand something in science?

3. ***EXPLAIN:***

How do these scientific models help you understand?
Computer model
Diagrams
Cloud models (1st grade)
Human body t-shirt (2nd grade)
Animal diagram (2nd grade)
Mathematical model (cube model or other math manipulatives)
Plant life cycle diagram (2nd grade)
Writing

Set-up stations around the classroom for them to look through and write down how these things are models.

Discuss ideas emphasizing that:

- A model makes really complicated things in nature simpler so we can understand and study them
- Scientists construct, use, evaluate, and revise models to explain and make predictions about natural phenomena.

- People can create models with pictures, words, mathematical equations, and computer programs
- We can use models in the classroom to help us understand…..
- We can use our models to share ideas and to make those ideas better. We can get new or different ideas from other people, and we can think through our own ideas when people ask us about our models.

IF USING CONTENT/INQUIRY ENTRIES

Add new concepts to the content/inquiry chart.

- *What is a model?* [A model is a representation or something that has our ideas about, not an exact copy, of complicated things in nature]
- *What do models look like?* [Models can be lots of different things and have lots of different parts, like pictures, words, and numbers]
- *How do scientists use models?* [Scientists use models to explain and make predictions, that's what makes them 'scientific' models]

4. ***EXTEND:***

CONSTRUCTING A SCIENTIFIC MODEL TO ANSWER THE DRIVING QUESTION

Remind students that they are studying ecosystems in this unit. Introduce the science question. Ask,

- ***How do animals interact with their ecosystem?***

Tell students that scientists use models to study ecosystems and that they are going to begin to use scientific models to learn about ecosystems during the unit. Emphasize that certain things make a model a scientific model. Emphasize that that scientific models show,

- Important **parts** of something in real life
- **How** it works
- **Why** it works the way it does

Introduce and distribute the Student Modeling Packet. Ask students to be like a scientist and draw a model **in PENCIL ONLY** to illustrate and explain to answer the question above.

Ask them to consider thinking about the model first in their head, *how* things in the picture change, and *why* things are happening (a mechanism). Encourage to think about what's happening underground, not just above ground. Remind them to also write responses to all the questions that follow their model.

5. ***Evaluate*:**

A CONSENSUS MODEL TO ANSWER THE DRIVING QUESTION

A consensus model is one that all the students come to agreement on what is put on the model. It may be very sparse at the beginning. Guide the discussion towards what might be on the consensus model. Display a blank screen on a SMARTBoard or projector screen. Tell students scientists often have different ideas and models and have to work together to agree on things. Ask students to think like scientists and share the most important parts of their models with other members of their groups. Share these ideas with the whole class. As students share ideas, add these ideas to the SMARTBoard image. As students contribute ideas, highlight and reinforce important concepts about ecosystems, conservation, and restoration.

During the discussion ask students to tell you *what* they are suggesting should be put on the consensus model, and *how* and *why* these things are important to add to the consensus model. Some things to ask:

- Can you say more about that?
- Can you give an example?
- Why do you think that?
- What's your evidence for that?

Save the consensus model in the SMARTboard file. Return to it whenever you think appropriate to ask students if they still agree with what they have shown and why. In the final modeling lesson, have students draw a new consensus model, again asking them *what* they are suggesting, and *how* and *why* these things are important to add.

Lesson 3: Habitats (LC1)

Materials

Bottle Ecosystem
Butterfly Habitat
Portable USB Digital Microscope
Survivor Challenge Worksheet

Learning Goals

Students will identify the four components of a habitat (shelter, water, food, space)

**When habitat animals arrive, remember to have students make observations of the habitats at least twice a week.*

> *Reminder:* ***We are connecting all science in the unit to this driving question:***
> **What can we do to protect our Earth? What can we do to fix our Earth? And whose responsibility is it?** ***By lesson 4 this should come up by the students. If not bring, it up during lesson 4.***

Engage:

Create a thinking map with the word "Habitat" (background question: What is a habitat?). Students use background knowledge to chart ideas as teacher jots down their thinking. Guide the discussion to come up the four requirements of a habitat: shelter, food, water, space.

After the thinking map, teachers ask "Why are habitats important? And "Do people have an impact on habitats?"

Explore

Build bottle habitats
Set-up butterfly habitats

In the student packets, have students make their predictions for the following:
Look back at your model. What things are on your model do you think a butterfly, worm, and fish might need to survive? Let's find out more! Use your model to make a prediction about what you think the animals in the three habitats (worm, fish, and a butterfly) need to survive. Write your predictions below:

Explain*:* (Vocabulary)

Students will diagram their observations of the butterfly, grass, and water habitats in ecosystem bottle in the student packet.

As a class, fill out a 3-Box T to compare and contrast the three habitats. Use the same color. Return to this about a week later to fill in additional compare/contrast of the three habitats with a new color to show learning over time.

Watch video on Discovery Education called **Habitats: Homes for Living Things"** (Show intro 1:24 min.)

Habitat: A place that provides food, water, shelter, and space for a living thing to survive.

Have students individually or with partners read the Hop into Habitats article and answer the question at the end of the reading.

Extend:

(Teacher will introduce the activity by reminding students that habitats are providing the components for survival. Now it is time for you to survive in a habitat on a camping trip. Think about the four components of a habitat as you decide how to survive with your group.)

Have students complete the Survivor worksheet in groups. Guide students to understand they need food, water, shelter, and space.

Evaluate:

1. Take a walk to the **garden** for investigation of a habitat for butterflies. Students will sketch examples of things that fit into the four categories of food, water, shelter, space in their student packets.
2. Take a walk to the **playground** for investigation of a habitat for butterflies. Students will sketch examples of things that fit into the four categories of food, water, shelter, space in their student packet.

Lesson 4: Habitats and Ecosystems (LC2)

Materials
At Home with the Gopher Tortoise
Three of Earth's Habitats Readings
Ecosytems HD app for the iPad
Resources for multiple habitats such as those from Epic!, Pebble Go, ReadWorks.org, Science a-z, or other books that provide resources on individual habitats.
Strips of paper for game
below
20 red, 60 green,40 blue, 20 brown

Learning Goal
Understand Ecosystems are made up of habitats and that organisms are adapted to their specific habitat.

When habitat animals arrive, remember to have students make observations of the habitats at least twice a week.

> *Reminder:* ***We are connecting all science in the unit to this driving question:***
> **What can we do to protect our Earth? What can we do to fix our Earth? And whose responsibility is it?** ***By lesson 4 this should come up by the students. If not bring, it up during lesson 4.***

Engage:
Read *At Home with the Gopher Tortoise.* Discuss with students how different components interact or work together in an ecosystem. Talk about how smaller segments of these things are called habitats. Discuss how the butterfly habitat might fit into the bottle ecosystem if we could make the bottles big enough to hold them.

Talk about the four things the Gopher Tortoise had in his habitat. Discuss with students that habitats make up ecosystems.

Explore:
Students will work in partners and read available resources about multiple habitats and the Ecosystems HD.

Working together, have them choose a habit to research. They will be complete the habitat comparison study in their packet. Explain and chart the difference between habitats. Students will fill in the Habitat Comparison Study Conclusions.

Explain:
Have students share their information about the different habitats they have researched. Could be a presentation of some sort.

Guiding questions: Where can all of these habitats be found?

Define Ecosystem: Ecosystems are made up of many different habitats.

Extend

Play "Habitat Breakdown" game

1. Ask the students to imagine themselves as butterflies. In order to survive they must collect food, find water, find shelter and a place with enough space to live.
2. Distribute different colored strips of paper around the classroom. The codes are: Red - shelter, Green - food, Blue - water, Brown - space.
3. In order to survive the activity, each student must collect 1 red paper, 3 green strips of paper, 2 blue strips of paper, and 1 brown strip of paper in 30 seconds.
4. After all the strips have been collected. See which students have collected the correct number of each color. Those who haven't would be the first insects to die.
5. Discuss the game and the implications of not having the necessary elements for survival in a habitat.

Take a field trip to a prairie and/or butterfly garden.

Evaluate

Ask students what ideas they have for evaluating their models. Remind them that model evaluation is to see how their ideas have changed since they drew their initial model, not on how "correct" their model is or how "good" they think they did in drawing it.
Ask students to evaluate their models based on what they have learned in the past two lessons. Remind students that they have studied

- What organisms need to survive within an habitat (food, water, shelter, and space)
- That ecosystems are made up of habitats
- That organisms are adapted to their habitat

Ask students to evaluate their models for if they considered these things in their original model. Ask students to share their model evaluation with each other or as a class discussion. Students should then revise their models based on their evaluation using the color BLUE.

Have them complete their student packet. Their student packet says:

Look back at your original model that you drew at the beginning of the unit and decide how well it shows how organisms survive within a habitat, shows that ecosystems are made up of habitats, and that organisms live in habitats that have the things they need to survive. On the lines below write how well you think your model shows interactions among living things.

Go to your original model that you drew in Lesson 1. Use the color BLUE to make changes to your model to show interactions among living things.

Lesson 5, What is a Food Chain?

Materials:
Items for baggies: yellow ball or card to represent sun, leaves to represent plants, plastic examples of insects and plastic examples of animals, plastic worms, flies
For food web yarn activity (http://forces.si.edu/main/pdf/2-5-WeavingTheWeb.pdf)
Ball of yarn, Activity Sheets 1- 8 (pictures of prairie plants and animals), Tape to attach pictures to clothing, Space for the class to form a large circle
For engage activity: KLEW chart:
http://www.nsta.org/publications/news/story.aspx?id=51519

Learning Goal
Ecosystems are interdependent. The food of almost any kind of animal can be traced back to plants and the sun.

When habitat animals arrive, remember to have students make observations of the habitats at least twice a week.

Reminder: ***We are connecting all science in the unit to this driving question:***
What can we do to protect our Earth? What can we do to fix our Earth? And whose responsibility is it? ***By lesson 4 this should come up by the students. If not bring, it up during lesson 4.***

Engage:
What do we know about food chains?
Use KLEW chart to assess prior knowledge-see example below. *Teacher will complete the first section in the KLEW chart and then use this chart as a working document as the lesson progresses.*
Example from: http://www.nsta.org/publications/news/story.aspx?id=51519

Explore:
Sorting bag activity

Group students into groups of 3-4 and give each group a bag of items (see above). After, ask students to sort their items into groups that have something in common and create a label for each of their groups. Ask students to discuss and justify why they grouped their objects the way they did.

Next ask students to discuss how the groups are connected.

Explain:
Discuss findings as a class. Do all groups agree or disagree about how we sorted? Share and make changes as necessary. Have students identify what each group of items might represent in a food chain.Teacher now introduces the vocabulary for a food chain via a chart. Teacher will also show the transfer of energy from one source to another. (draw food chain with arrows to show this)

Sun: primary source of energy
Producers: plants that make their own food. Energy from the sun goes to the plant
Consumers: insects/animals that eat the plants. Energy from the plant goes to the consumer.
Consumers: animals that eat the animals. Energy from the animal eaten goes into the animal that eats it.
Decomposers: decomposers restore some materials back to the soil. Energy from the animal that died goes into the soil.

Extend:
Copy Activity Sheets pages 1 – 8 and cut apart from http://forces.si.edu/main/pdf/2-5-WeavingTheWeb.pdf.
Have students tape one picture each to their chests.
Tell the students that they will make a food web. Have them stand in a circle and introduce themselves as the plant or animal they represent. The student with the sun picture should stand in the center. They should look around and ask themselves:
Who in the circle could I give my energy to? (Who might eat me?)
Who in the circle could give me energy? (Whom could I eat?)
Explain that the ball of yarn represents sunbeams, or energy from the sun. Ask the student representing the sun to hold the end of the yarn tightly and toss the ball to someone who can use that energy (a green plant). When a student representing the green plant catches the ball of yarn, he or she should hold a piece of the yarn and throw the ball to someone else who could use the energy. For example, the sun might throw the yarn to the grass, the grass to the grasshopper, and the grasshopper to the meadowlark. After the yarn reaches a carnivore, break it off to represent one food chain. (Explain that humans, bears, raccoons, etc. are omnivores and can end a food chain, or they could be eaten by a carnivore.)

Return the yarn to the sun to start another chain. This time the sun might throw its energy to the grass, the grass to the field mouse, and the field mouse to a great horned owl. Again, break the yarn, throw it back to the sun, and have the sun start another chain. Continue making chains
until every student holds at least one strand of yarn.

At end of game: Revisit the KLEW chart in the engage phase to add on to the section "What are we learning? Evidence? Wonderings?

Evaluate:
Complete food chain diagram independently. See template in student packet.
If time permits, you could have them create a final copy on Kidspiration or by cutting out pictures from magazines and gluing them onto a poster to demonstrate a food chain or draw a diagram.
Important component:
Arrows to show flow of energy
Food chain components in correct order.
Labels: sun, producer, consumer, decomposer

Lesson 6, Butterflies and Food Chains

Materials
KLEW Chart: http://www.nsta.org/publications/news/story.aspx?id=51519

Materials
"Growing up Butterfly" From National Geographic TV (http://natgeotv.com/ca/great-migrations/videos/growing-up-butterfly) 3 minutes in length
A Butterfly is Patient by Dianna Hutts Aston and Sylvia Long
The Great Kapok Tree by Lynne Cherry

When habitat animals arrive, remember to have students make observations of the habitats at least twice a week.

> *Reminder:* ***We are connecting all science in the unit to this driving question:***
> **What can we do to protect our Earth? What can we do to fix our Earth? And whose responsibility is it?** ***By lesson 4 this should come up by the students. If not bring, it up during lesson 4.***

Learning Goal:
Animals have predictable patterns in their life cycle and these stages are dependent on other organisms

Engage:
Read *A Butterfly is Patient* by Dianna Hutts Aston and Sylvia Long

Ask students what they have noticed in the butterfly habitat since it started. Do they see the butterfly changing? How do these things interact with their habitat?

What about the grass growing in the top of the bottle and the worm? How do these things interact with their habitat?

What about the fish living in the bottom of the bottle? How do these things interact with their habitat?

Explore
"Growing up Butterfly" From National Geographic TV (http://natgeotv.com/ca/great-migrations/videos/growing-up-butterfly) 3 minutes in length

Explain
From their observations, have students put the butterfly life cycles in order in their packets (cut and.glue activity). Ask them to include what the butterfly needs at each stage of its life cycle to survive.

**Teacher notes: Identify the four elements of what a habitat provides for each stage of the butterfly's life cycle:*

Life cycle stage	**Water**	**Food**	**Shelter**	**Space**
egg	From leaves	Nutrients inside egg	Plant shelters egg	Room on leaf
caterpillar	From Leaves	Eats Leaves	Plant shelters caterpillar	Room on plant
chrysalis	Stores water inside chrysalis during metamorphosis	Stores food inside chrysalis during metamorphosis	Needs to hang vertically from plant or leaf	Room on plant to hang undisturbed for a week or two.
butterfly	From Nectar	Nectar	Grass & flowers	Many plants flowering

Then ask students about the plants within the habitat. Ask students to consider if the plants also need the butterflies. What does the butterfly do for the plants? (**Teacher note: Butterflies eat the nectar from the flowers. When they land, pollen from the flower gets on the butterfly. When the butterfly flies to a new flower, the pollen rubs off and the new flower is pollinated.*)

Introduce vocabulary term:
pollinator: An insect that carries pollen from one plant to another.

Extend: What happens to the butterflies if one of these parts of the habitat changes?
(*Teacher note: When something is removed or changed from the habitat the animals may migrate, adapt, or die.)*

Role play: Make up a scenario where part of a habitat changes. For example: Come back to have snack and the snack is gone! You have to travel to another classroom to get your snack. The focus is that students have to move to get either/or food, shelter, space, or water.

Are butterflies the only food for the plant? What else lives in that habitat?
Discuss other organisms that live in the same habitats as butterflies such as birds, snails, worms, etc

Read and discuss *The Great Kapok Tree* by Lynne Cherry

Evaluate

Ask students to look back at the predictions they made about the three habitats in Lesson 3. Have them fill out the following in their student packets:

Look back at the predicitions you made in Lesson 3 for what a butterfly, worm, and a fish needs to survive in their habitat. Write down what you now think of each of your predictions and what changes you would make to your original predictions.

Ask students what ideas they have for evaluating their models. Remind them that model evaluation is to see how their ideas have changed since they drew their initial model, not on how "correct" their model is or how "good" they think they did in drawing it.
Ask students to evaluate their models based on what they have learned in these past two lessons. Remind students that they have studied

- All things in habitats and ecosystems are interdependent. The food of almost any kind of animal can be traced back to plants.
- Animals, such as butterflies, have predictable patterns in their life cycle and all of these stages are dependent on other organisms

Ask students to evaluate their models for if they considered these things in their original model. Ask students to share their model evaluation with each other or as a class discussion. Students should then revise their models based on their evaluation using the color **RED**.

Their student packet says:
Look back at your original model that you drew at the beginning of the unit and decide how well it shows interactions among living things. What would you change on your model to show interactions in a habitat? Use RED to show the changes on your model.

Lesson 7: <u>Final Modeling Lesson: What's important to the ecosystem? How do we know?</u>

**Teacher note: The purpose to revisit this lesson from the beginning is to see how students' thinking about models and modeling has changed over time and to reinforce the new modeling concepts just introduced within this curriculum.*

<u>Key Concepts</u>

- Models are representations, not exact copies, of real-world phenomena
- Models can include many different kinds of elements
- The ways in which scientists use models (to predict and explain) is what makes a model 'scientific'
- Something that takes an abstract idea and makes it concrete
- A way to display thinking, thought processes, sense-making of a scientific concept.
- Provide multiple ways to show a student's thinking
- Any time (drawing or writing) that you are making sense of something
- Provides opportunities for perspectives & scale.
- Very individual expression of a student's understanding.
- From a teacher's perspective, models are a method to probe further understandings, identify misconceptions, assess learning.
- Comparison of different models (different pictures)
- Teacher models and students models are still models

INTRODUCING MODELS

ENGAGE:
REVIST THE INITIAL MODEL WORD STORM CHART.
Ask students what words they would now add. Guide discussion for if and how their thinking has changed.

EXPLORE
ELICITING STUDENTS' IDEAS ABOUT MODELS
Tell students that one of the ways scientists represent and share their ideas is my making models. Ask students to consider which of the following are models.

Below are listed things that students might do in a science class. Might be a card sort or a list. Think about which of these are examples of a model.

**Teacher Note: These choices have changed from the original lesson at the beginning of the unit.*

-Observing a bird's behavior (not a model)
-Building an ecocolumn (model)
-Watching a plant grow (not a model)
- Drawing a picture of the butterfly life cycle (model)

-Watching a bird eat a worm (not a model)

Could have small group discussion and then bring back to a larger group for a consensus. Ask them:

- How did you decide whether something was a model?
- How could they use their choice to understand something in science?

EXPLAIN:
How do these scientific models help you understand? Assign students to pick one and explain how it is a model:

Computer model of food chains/webs
Diagram of butterfly life cycle
Butterfly habitat
Worm habitat
Fish habitat

Discuss ideas emphasizing that:

- A model makes really complicated things in nature simpler so we can understand and study them
- Scientists construct, use, evaluate, and revise models to explain and make predictions about natural phenomena.
- People can create models with pictures, words, mathematical equations, and computer programs
- We can use models in the classroom to help us understand…..
- We can use our models to share ideas and to make those ideas better. We can get new or different ideas from other people, and we can think through our own ideas when people ask us about our models.

EXTEND
CONSTRUCTING A SCIENTIFIC MODEL TO ANSWER THE DRIVING QUESTION
Remind students that they are studying ecosystems in this unit. Introduce the science question. Ask,

- ***How do animals interact with their environment?***

Tell students that scientists use models to study ecosystems and that they are going to begin to use scientific models to learn about ecosystems during the unit. Emphasize that certain things make a model a scientific model. Emphasize that that scientific models show,

- Important **parts** of something in real life
- **How** it works
- **Why** it works the way it does

Introduce and distribute the Student Modeling Packet. Ask students to be like a scientist and draw a model to illustrate and explain to answer the question above.

Ask them to consider thinking about the model first in their head, *how* things in the picture change, and *why* things are happening (a mechanism). Encourage to think about what's happening underground, not just above ground. Remind them to also write responses to all the questions that follow their model.

Evaluate:

A CONSENSUS MODEL TO ANSWER THE DRIVING QUESTION - Evaluate the original consensus model completed at the beginning. Have students discuss revisions to the model. Either revise this model or create a new model.

A consensus model is one that all the students come to agreement on what is put on the model. It may be very sparse at the beginning. Guide the discussion towards what might be on the consensus model. Display a blank screen on a SMARTBoard or projector screen. Tell students scientists often have different ideas and models and have to work together to agree on things. Ask students to think like scientists and share the most important parts of their models with other members of their groups. Share these ideas with the whole class. As students share ideas, add these ideas to the SMARTBoard image. As students contribute ideas, highlight and reinforce important concepts about ecosystems, conservation, and restoration.

During the discussion ask students to tell you *what* they are suggesting should be put on the consensus model, and *how* and *why* these things are important to add to the consensus model. Some things to ask:

- Can you say more about that?
- Can you give an example?
- Why do you think that?
- What's your evidence for that?

Save the consensus model in the SMARTboard file. Return to it whenever you think appropriate to ask students if they still agree with what they have shown and why. In the final modeling lesson, have students draw a new consensus model, again asking them *what* they are suggesting, and *how* and *why* these things are important to add.

Lesson 8: What can we do to protect our Earth? What can we do to fix our Earth? And whose responsibility is it?

Background Information:

Information about Monarch Butterfly Decline:
https://www.learner.org/jnorth/tm/monarch/conservation_overview.html
Information about why butterflies are important to our environment (**Error! Hyperlink reference not valid.**)

Revisiting the driving question: **What can we do to protect our Earth? What can we do to fix our Earth? And whose responsibility is it?**

Engage:
Remind students that at the beginning of the unit we discussed this question: *Should our school turn one soccer field into a garden to attract butterflies?*

Explore:
Hand out questions to students to make a poster about the following:
Group 1: Habitat: What kinds of animals/plants would you put in the soccer field space that would survive?
Group 2: Food Chains: What kinds of things would this habitat need for the living things to survive?
Group 3: Protecting Habitat; How could we keep this habitat safe for butterflies?
Group 4: Protecting People: How do we keep this area safe for kids?

Each group will share their posters, ideas, thinking with class.

Evaluate
Have students revise/make changes to their original draft to the question *Should our school turn one soccer field into a garden to attract butterflies?*. Space is provided in the student packets for them to do this so they don't have to write over the original to the question.

After they write, they should share with a partner or at their tables what they have written. Once everyone has shared, have students discuss as a class what their ideas are.

Discussion questions:
Has your thinking changed about do you think we should do this? What things made your thinking changed?

1. Ask students who "benefits" from their decisions (Students? Butterflies? Ecosystem? Parents? Teachers?) and why does that group benefits?
2. Ask what would be good about converting a soccer field to a butterfly habitat? What would be bad about doing this?

Elaborate

Ask students to answer the following question in their packets (Susan has a template for opinion writing for students to use to answer this question):

An elementary school has a prairie habitat in their back yard next to a soccer field. But more students want to be able to play soccer and have asked for a second soccer field. The principal is thinking about turning the prairie habitat into the second soccer field. Write a persuasive letter to the school principal about whether or not the prairie should be turned into a second soccer field.