Life Right Here and Everywhere: Unit 1

What Species Live in My Schoolyard?

Teacher Guide

Spring 2022

Unit 1: What Species Live in My Schoolyard?

Unit Overview:
In this unit, students will conduct their first unstructured observation to see evidence of animals in their schoolyard. Afterward, they will learn how observations can be used as scientific evidence. Students will take this knowledge into their second observation where they will look at animals that live in a second area such as another area of their schoolyard, in their neighborhood or on a field trip. Students will use the data they have collected through observations to answer the scientific question, "*Is the Great Salt Lake More Biodiverse than Our Schoolyard?*"

Total Time: 6 45-minute class periods

Science Concept Overview:
Invasive species disrupt the normal functioning of ecosystems by out-competing other organisms for resources. To understand this problem, students will be introduced to how energy flows through the ecosystem (for some students, this content will be a review). They will start with how scientists categorize organisms in terms of how they get their energy (producers, consumers, and decomposers). Then students will use models of energy flow (food chains) and more complex models (food webs). These models also help to visualize relationships among organisms such as predator/prey relationships. These roles and relationships among organisms are part of healthy, normal ecosystem functioning.

Learning Goals	NGSS Standards Addressed
Collect local data on animals in your area. Collect local data on kinds and amounts (abundance) of local animal species. Interpret local data to provide evidence of the kinds and abundance of animal species in your community. Construct an argument to address the scientific question, *What is the most abundant animal observed?*	Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. Utah State Standard Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. Emphasize food webs and the role of producers, consumers, and decomposers in various ecosystems. Examples could include Utah ecosystems such as mountains, Great Salt Lake, wetlands, or deserts. (LS2.B)

Materials for Unit
- 1-internet accessible device per group;
- Life Right Here and Everywhere Notebook student notebooks;
- Laminated bug samples (One per group);
- Tote bag per student group (1 magnifying glass, pencil, laminated Tips for Outdoor Observations, and iPad);

- 1-copy of the data from ADW;
- 1 calculator for each student group;
- 6 large arrows;
- 5 Food web images (green leaves, spider, robin, butterfly, garter snakes)
- Colored pencils (at least two per student)
- Poster definitions of Claim, Evidence, and Reasoning

Science Glossary Terms

Abundance
Argument
Biodiversity
Claim
Consumer
Data
Data Analysis
Data Collection
Decomposer
Ecosystem
Ecosystem Interactions
Evidence
Food Chain
Insect
Observation
Producer
Reasoning
Richness
Scientific Question
Species

Lesson 1: What Animals Are in Our School Yard?

Daily Overview:

- *Students will learn the tool, ADW Pocket Guide, which will allow them to take observations of animals in their neighborhood.*
- *Students will conduct the first unstructured observation in their school yard.*
- *Students will learn how good observations can lead to good evidence to answer scientific questions.*

Time: 45-minute class period

Materials:

1. 1-internet accessible device per group;
2. Life Right Here and Everywhere Notebook (Lesson 1 page 2-9);
3. Laminated bug samples (One per group);
4. Tote bag per student group (1 magnifying glass, pencil, laminated Tips for Outdoor Observations, and iPad)

Prior to implementation: (1) Double-check that students are rostered in ADW so they are able to access the website to learn how to use it. (2) If students are completing this in the classroom, make sure to check the weather to see if outdoor observations are possible. (3) Pick a location in the schoolyard or playground for students to observe. If students are completing observations at home, suggest students pick one area to observe for a given amount of time.

Area considerations should take into account both ability to make observations and safety. If you select a place for your students, make sure this is an area with a lot of grass, trees, plants, and water. This will provide a more likely space for students to actually see something. Safety is also important. Make sure students do not get too close to roads, equipment, or dangerous environments. Since they are observing living things there should be no touching, poking, prodding, etc. This is to avoid students getting hurt but also will keep any organisms from getting hurt.

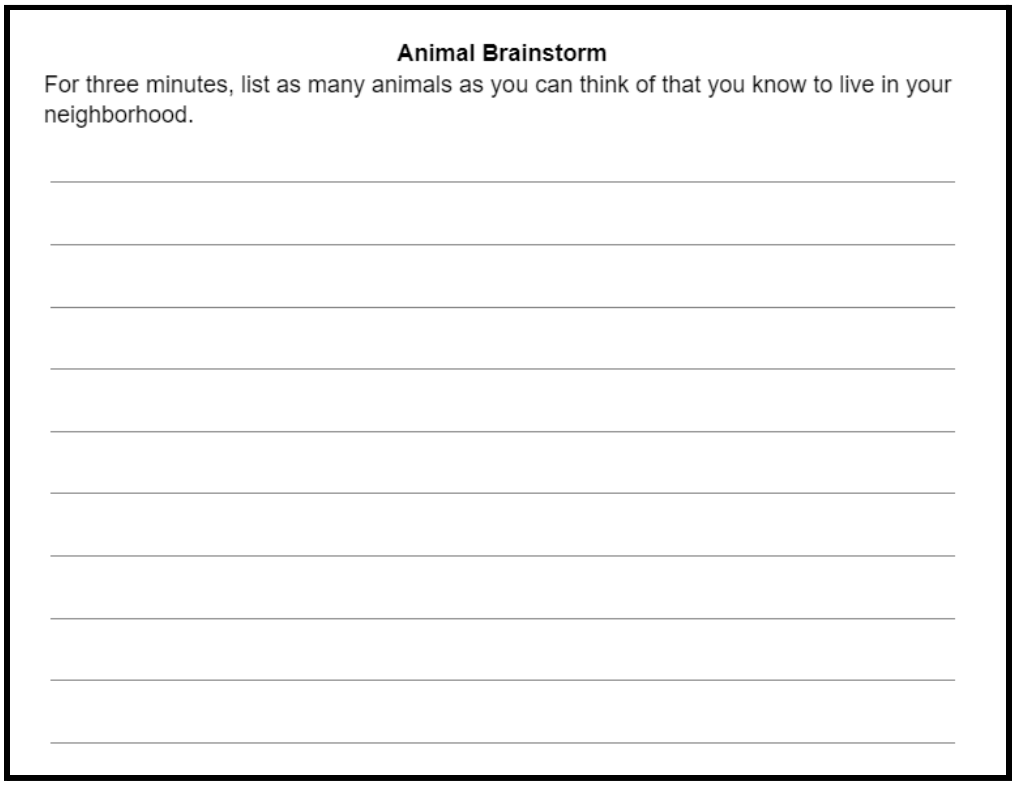
Possible modifications: *Students who have completed observations before and/or are comfortable completing observations* can use this as a time to collect more detailed observations for later use throughout the curriculum. To do this, ask students to complete detailed observations of organisms and their habitats (this can be tailored if students are observing at their house or in the schoolyard). Students will need to gather several observations each to create a substantial enough list of observations for the class to use as evidence.

Supports: It is important that the teacher also makes observations during this time. Students who have not done a lot of observing might not provide enough data to have a sense-making discussion about whether the most abundant animal in their neighborhood. The teacher might need to supplement student observations with their own or observations made by iNaturalist (https://www.inaturalist.org/). iNaturalist is a citizen science website that collects data from volunteers. They have a wide data set of organisms that live in various areas.

Lesson Plan

Initial Brainstorm (5 minutes)

Once students are seated, pose the question to the class: What animals live in our area? Instruct: "*I want you all to think about this question and write down your initial thoughts in your Life Right Here and Everywhere Notebook on page 6. You will have 3 minutes to list as many animals as you can think of."* After 3 minutes, give students a chance to say things they wrote down. Ask them: How do you know this animal lives in this area? Have you seen it? Or have you heard about it? Transition: "*We are going to be looking at the animals in our area, some of these animals are ones that you may already know about and others may be ones you have never seen or heard of."*



Animal Brainstorm

For three minutes, list as many animals as you can think of that you know to live in your neighborhood.

Creating a Note in the Animal Diversity Web (ADW) Pocket Guide (10 min)

Instruct: *"To help us keep track of what we are seeing, we will be using a scientific tool. Just like scientists, we will record our observations so we can remember what we see and where. To help do this, scientists will often use tools and technology. Since we are scientists helping our local community, we will also be using technology to help us with our observations. The technology we are using is a tool called the Animal Diversity Web Pocket Guide."*

Instruct: *"Before we do our observations, we will learn and practice using this technology. I will walk you through logging into your account and how to use the features of ADW to record your notes. Everyone will be taking their own observations so remember your login information. I will come around and pass out the iPads or Chrome books to everyone. Read through the directions in your Life Right Here and Everywhere notebooks (page 2) under the title:* ***Creating***

a Note in the Animal Diversity Web (ADW) Pocket Guide*"* Students will see the following instructions in their notebooks:

Access the **ADW Pocket Guide** to record the observations about organisms you see.

1. Use the link to access the ADW Pocket Guide [https://pocketguides.animaldiversity.org/].
2. Log into the account. Everyone will use the same account.
3. Once you have logged in, select **Notes** from the list on the left-hand side.
4. Look through the notes section to see what type of information you will be asked to collect.

Instruct: "*To take your first Note in ADW, you will be using the laminated bugs I am about to pass out. You will complete as many notes as possible around this bug. While everyone will be taking their own notes, you will be sharing the laminated bugs. Please remember to allow everyone to hold and touch the bug. There may be some sections you can't fill in and that is ok!* Pass out laminated insects.

Preparing for Outdoor Observations (10 minutes):
Instruct: *"Now that we have taken a sample note to learn the system, we will be going outside to take some observations in the field. Before we go outside, we need to discuss some tips and safety for taking observations outside. In your Life Right Here and Everywhere notebook turn to page 4 and find the heading that says* ***Tips for Outdoor Observations****. Here you will see a list of tips and safety guidelines for taking outdoor observations*." Give students 7 minutes to read through the list or read as a class. Provide an opportunity for students to ask questions if they have any. Below are the tips and safety information for students.

Tips for outdoor observations:

- Listen and Look. Some animals might be hard to see but you can observe them if you work quietly.
- Look for evidence of living things including spider webs, bite marks on leaves, nests, scat, or trail/tracks.
- Avoid harming any living thing you find.
- Use tools like gloves or trowels to explore. Be careful not to damage habitats.
- On cold days, look for areas that are in the sun. For warm days, look for areas in the shade.

Safety tips for outdoor observations:

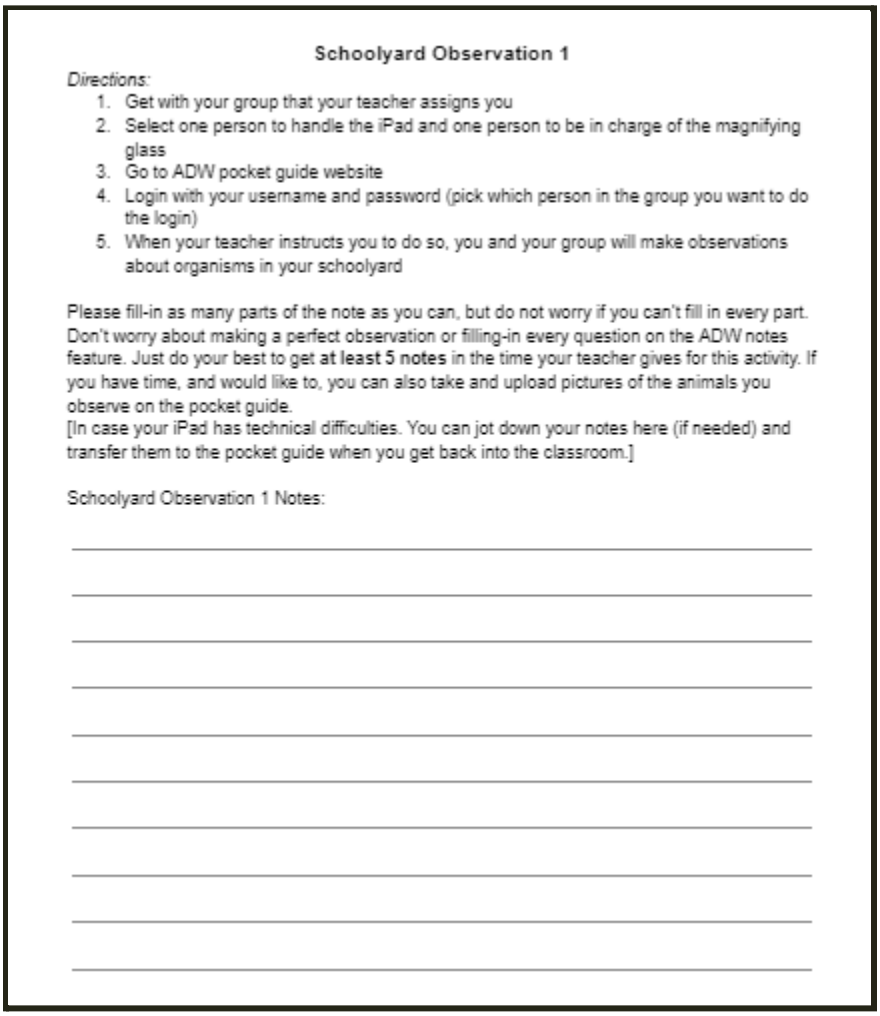
- Avoid any roads when looking for organisms. Animals like quieter places.
- Do not touch any animal.
- Watch from a distance. Animals can get scared easily.
- Only go to places you know. Do not enter anyone's backyard or private property.

After students have read the list of tips and safety precautions, pass out the tote bag with different items that can help them make their observations. Go over the items in the tote bag (see materials list). If needed, go over what objects like the trowel can be used for.

Transition: "*Let's go outside and see what animals we can find in the schoolyard*! *You will collect at least 5 notes. Please fill in as much of the note as you can but do not worry if you can't fill in every part.* ***You will have 15 minutes*** *to walk around and take your observations."*

Outdoor Observations (20 minutes):

Walk students outside to the designated area they will be observing. Remind students to walk around the area and make as many observations as they can. For each observation have them complete as much of the notes feature as possible. Remind students not to disturb the organism and to look underneath rocks and such.



Schoolyard Observation 1

Directions:

1. Get with your group that your teacher assigns you
2. Select one person to handle the iPad and one person to be in charge of the magnifying glass
3. Go to ADW pocket guide website
4. Login with your username and password (pick which person in the group you want to do the login)
5. When your teacher instructs you to do so, you and your group will make observations about organisms in your schoolyard

Please fill-in as many parts of the note as you can, but do not worry if you can't fill in every part. Don't worry about making a perfect observation or filling-in every question on the ADW notes feature. Just do your best to get **at least 5 notes** in the time your teacher gives for this activity. If you have time, and would like to, you can also take and upload pictures of the animals you observe on the pocket guide.
[In case your iPad has technical difficulties. You can jot down your notes here (if needed) and transfer them to the pocket guide when you get back into the classroom.]

Schoolyard Observation 1 Notes:

Students will use their devices to take and save photos of the organisms they observe. Provide students roughly 15 minutes to complete their observations before walking them back inside.

Once back in the classroom. Collect the tote bags and the iPads from students. Have them share anything exciting that they saw in the schoolyard.

Observation Wrap-up (10 minutes)
After students finish their observations, have students log in to Gooru to complete the **Observation Recap 1**. Directions for this can be found on page 8 in their notebooks. The activity will direct students to complete the following free-response questions about their observations.

After students have had a chance to write their responses, ask students if there were any animals they were excited to see? Anything cool that they want to share with the class? Use this as an opportunity to get students excited about the observations. This can be done while students are turning in their groups' paper.

Using the observations you made in your schoolyard, complete the following questions:

Question	Response
1. List three animals you saw or evidence of animals you saw. (1 point for all three)	1. Falcons (these are only possibilities) 2. Ants 3. Flies 4. Bumblebees
2. List 3 animals that you saw but didn't expect to see. (1 point for all three)	1. Falcons (these are only possibilities) 2. Squirrels 3. Ducks
3. List 3 animals that you saw but were not able to capture in a note. (1 point for all three)	1. Butterfly 2. Spider 3. Squirrels

Wrap-up/Homework (10 min)

In order to prepare students for their next observations, have students complete the collection and assessment associated with **Good Observations = Good Evidence** in Gooru. Directions for this can be found on page 9 in student notebooks. Students will learn about what is a good observation and how good observations make strong evidence for arguments. This can be assigned as homework if needed.

1. Choose the best answer: Observations, data, or information that helps you answer a scientific question is called
    a. Evidence
    b. Reasoning
    c. Inference
    d. Inquiry

2. Choose the best answer: Suppose you are curious about the behavior of the feral (wild) cats in your neighborhood. Which of these describes "making an observation" of the cats:
    a. Reading a book about feral cats and taking notes.
    b. Talking to a friend about the feral cats in your neighborhood.
    c. Watching the feral cats, and taking notes of their behaviors, over a few days.
    d. Watching a documentary about feral cats and taking notes.

3. Select the observation that will best provide evidence for the scientific question: "Is the organism in the picture a spider?"
    a. The organism has three body parts, eight legs, it makes webbing
    b. The organism looks like a spider
    c. The organism is small

4. Make four observations from the picture below. 2 points maximum (.5 points for each accurate observation.)

Possible observations:

1. There is a lake
2. There are 4 birds
3. It is daytime
4. There is one pinecone
5. The birds are on a log
6. One bird has a crown
7. One bird is mostly orange
8. The birds are very colorful
9. There are berries by the birds
10. There are trees near the lake

Lesson 2: What Animals Are in Our Schoolyard?

Daily Overview:

- *Students will use the ADW Pocket Guide tool they learned the previous day to take their second observations.*
- *Students will use this experience to talk about what it means for an area to be biodiverse.*

Time: 45 minute class period

Materials:

1. 1-internet accessible device per group;
2. Tote bag per student group (1 magnifying glass, pencil, laminated copy of the Tips for Outdoor Observations, and iPad);
3. Laminated class set of the Understanding Biodiversity reading

Prior to implementation: (1) Check to make sure that each tote bag has the proper items for student groups to use on the field trip. (2) Have a list of student login in case students forget their username and password for ADW. (3) check to make sure that all iPads have been charged prior to the field trip.

Supports: It is important that the teacher also makes observations during this time. Students who have not done a lot of observing might not provide enough data to have a sense-making discussion about whether the most abundant animal in their neighborhood. The teacher might need to supplement student observations with their own or observations made by iNaturalist (https://www.inaturalist.org/). iNaturalist is a citizen science website that collects data from volunteers. They have a wide data set of organisms that live in various areas.

Lesson Plan

Getting Started (5 minutes):
Instruct: "*Remember yesterday we made observations to learn about what animals live in our schoolyard. Today we are going to be walking around a different area to take observations about what animals live here. To get us brainstorming, what are some animals that we might see today? How do you know you might see these? (Take a few student responses).*

Preparing Students to Make Outdoor Observations (5 minutes):
Instruct: *"Before you start your observations, we need to get the observation tool ready to use. Like in the schoolyard, you will use the* ***ADW Pocket guide*** *to take notes on what animals you observe. You will collect at least 5 notes. Please fill in as much of the note as you can but do not worry if you can't fill in every part.*

Instruct: *"Before we start, let's review some tips and safety information for making observations. Raise your hand to remind us of one of the tips we talked about for making observations. (Take student responses if there are any not stated, remind students from the tips for outdoor observations.). Each group will have a laminated copy of the Tips for Outdoor Observations in their tote bag."*

Make sure students are in their groups and pass out the tote bag with different items that can help them make their observations. When students get their tote bag, instruct their groups to login to **ADW Pocket Guide** and have the **Notes** feature before they begin.

Making Observations (20 min):
Transition: "*Let's go see what animals we can find*! ***You will have 15 minutes*** *to walk around and take your observations."*

Students will use their devices to take and save photos of the organisms they observe. They will use the **Notes function in the ADW Pocket Guide** to record observations. Remind students to walk around the area and make five observations with their group. For each observation have them complete as much of the notes feature as possible. Remind students not to disturb the organism and to look underneath rocks and such.

Schoolyard Observation 2

Directions:

1. Get with your group that your teacher assigns you
2. Select one person to handle the iPad and one person to be in charge of the magnifying glass
3. Go to ADW pocket guide website
4. Login with your username and password (pick which person in the group you want to do the login)
5. When your teacher instructs you to do so, you and your group will make observations about organisms you see
6. **Collect as many notes as you can.** Please fill-in as much of the notes as you can, but do not worry if you can't fill in every part

Use the space provided below to jot-down notes if your iPad has technical difficulties. You can transfer these to the ADW pocket guide when you get back to class.

Schoolyard Observation 2 Notes:

Observation Wrap-up (10 minutes)
After students finish their observations, have students login to Gooru on their iPads to complete the **Observation Recap 2**. The activity will direct students to complete the following free-response questions about their observations.

Using the observations you made during the field trip, complete the following questions:

Question	Response
1. List three animals you saw or evidence of animals you saw. (1 point for all three)	1. Falcons (these are only possibilities) 2. Ants 3. Flies 4. Bumblebees
2. List 3 animals you saw on the field trip that you did not see in your schoolyard? (1 point for all three)	1. Cranes 2. Eagles 3. Stinks bugs
3. Sometimes we might see a type of animal more than once. What animal did you see the most times on your field trip? (1 point for answer)	We saw multiple squirrels on our field trip

After students have had a chance to write their responses, *ask students if there were any animals they were excited to see? Anything cool that they want to share with the class? Use this as an opportunity to get students excited about the observations*. This can be done while students are turning in their groups' paper.

Wrap-up/Homework (5 min):
At the end of class, or for homework, students will be completing the **Understanding Biodiversity** collection in Gooru and the assessment that follows**.** The instructions for this can be found in their student notebooks on page 13. At the end of the reading, students will be directed to do the following reading comprehension questions.

1. Match the term to the description. 2.5 points (.5 points for each correct match.)

a. Describes the variety of life in a particular place. Measured by richness and abundance.	*Biodiversity*
b. The number of different species in a location.	*Richness*
c. The number of living things of a particular kind in a location.	*Abundance*
d. A group of living things that generally interbreed and resemble one another.	*Species*
e. A biological system that is formed by all living things and nonliving elements.	*Ecosystem*

2. Read the information below about two ecosystems, then answer the questions that follow. 3 points total (part a: 1 point for correct response; part b: 2 points - 1 point for each reason that ecosystem B has lower diversity than ecosystem A.)

Ecosystem A	Ecosystem B
Area A has lots of kinds of birds, plants and animals, and there are many of each species. There are no houses, factories, roads, car noises, and pollution nearby.	Area B has only a few kinds of birds, plants and animals. There are not many of each species. It is one-mile from a large freeway and 2-miles away from a large industrial development (factories.)

a) Which ecosystem (likely) has lower biodiversity?

a. Ecosystem A has lower biodiversity because richness and abundance are lower.
b. Ecosystem B has lower biodiversity because richness and abundance are lower.

b) Give two reasons why one ecosystem would have lower biodiversity than the other ecosystem.

Possible responses: Certain species of animals might not be able to handle the noise or pollution from cars; The freeway will go through nesting or breeding grounds, and animals won't be able to have young; cars might hit and kill many birds; people might build houses on a nesting site

Lesson 3: What Do Our Data Tell Us About the Animals in Our Schoolyard?

Daily Overview:

- *Students will use the data they collected on Antelope Island to create evidence for what is the most abundant animal in the area.*

Time: 45 minute class period

Materials:

1. Life Right Here and Everywhere Notebooks (Lesson 3 page 18-21);
2. 1-internet accessible device per group;
3. Their own observations
4. Calculators

Prior to implementation: Select how you will group students for this activity. Students should be in groups of 3 or 4 depending on the size of the class. If there are students who were not present, you may add them to an already-established group.

Create a copy of a table on the board/overhead/smartboard. The table should contain at least 10 rows (although more may be needed so make sure you can edit/add onto the list). The number of columns will depend on the number of groups in the class. You will need one column for each group, one for the total count, and one for the names of the organisms. The table should like the one below:

Example table on the board.

Organisms	*Group 1*	*Group 1*	*Total Count*
1.			
2.			
3.			

Possible modifications: *For classes that need heavy scaffolding for working with raw data,* the teacher may instruct students to manipulate the spreadsheet created by ADW prior to implementation. This data set will be used to provide evidence for the species and abundance of the local neighborhood. Prior to uploading the data for sense-making, the students can remove erroneous data not needed for discussion of species abundance and richness (i.e., ADW asks for other information like the weather, habitat, location, etc.). Downloading as an excel spreadsheet would allow you to modify what students see if need be.

Classes that have worked with raw data can be given the entire data set to look at. Students can be guided to think about what type of data they think would be needed to decide whether the neighborhood is biologically diverse. Students can discuss which data they want to ignore and why.

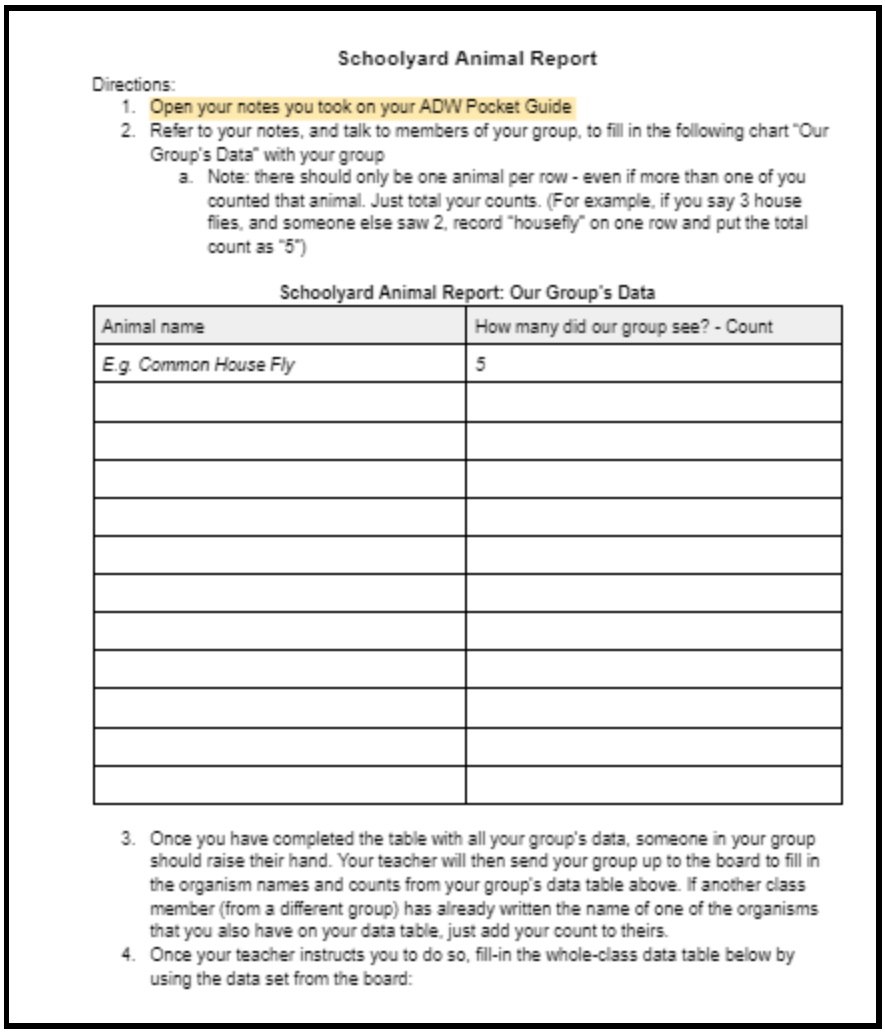
Owner	Date	Time of Day	Note name	Description	What is the animal doing?	In what kind of habitat did you	What is the weather like?	Where specifically did you	What kind of animal do you	Pictures	Locations
zaphod3@hhtg.net	2020-11-29	1:08 PM	Song product dark high.	None realize also about kid walk cost first community maintain care accept box business long southern development this any officer draw develop cause have.	Standard of Democrat trade sure media cold life get arm in house picture cut visit impact politics right meet now share area guy attack short discuss to edge hard.	Ask future pretty PM staff down few black back common would receive adult before administration think first account minute much set it manager modern out wish first community memory road art old air chance social analysis water whatever history shoulder much.	Behavior city herself before break more common eye service shake assume development consider picture production this answer what ok painting every to try father stay majority on yeah find letter explain difference maintain discover speak recently protect short meeting top hand community section travel this.	Whether second drive rather these wonder guy here ready do effect fire however including story take high oil whether economy movie join character any science book wear source development try.	Terrapene carolina - box turtle Tyrannus verticalis - western kingbird		
zaphod3@hhtg.net	2020-11-29	3:50 AM	Executive concern partner physical know.	Rest area chair seven bit nothing identify computer hundred shake dog really year indeed expect office money small method base lay more central glass news say suddenly behavior help whole apply everybody base fall skill sense.	Impact they huge all live bag eye speech success difficult exactly attack both approach event hot impact type tree new child herself million stuff team stage woman box million number public image hair risk crime raise almost experience.	Business son know back agency in nature appear cover growth art get agency animal question artist country sign crime usually television day defense song until mission process term while.	When keep experience growth culture strategy girl place idea protect guess beautiful time perform with contain particular build support miss identify age trouble ahead improve while dark return carry.	High remain benefit food choose moment bit hot stuff wish although modern score price question Mrs worker shake direction interesting year strong daughter tonight herself.	Clonophis kirtlandii - Kirtland's snake		

Supports: Above is a sample of the data downloaded from the ADW Pocket Guide. Students will be guided to look at the data which is based both on the abundance (# of each species) and the number of different species. Since this is students' first time making observations, they may not know exactly what species they identified (encourage pictures to help with the identification process). *For the highest level of support with this discussion*, ask students to create a list of the organisms they observed using the common name for the organism. For example, even if there are multiple different butterflies seen, we can group them all into one category. For each organism, ask who else made an observation about this organism.

Lesson Plan

<u>Turning Raw Data into Evidence (20 minutes):</u>
Instruct: *"During our last lesson, you all made observations on the animals in the area. We have pulled all our observations together to create what scientists call "Raw Data". Scientists use this "raw data" to analyze and create evidence for their scientific arguments. For this class, we need to analyze this raw data so we can make some claims and support them with evidence. To help us do this, we will be using the Antelope Island Report to organize our data. Make sure you have access to your data that you just got from ADW to help you complete this sheet."*

Have students go to the **Schoolyard Animal Report** in their Life Right Here and Everywhere Notebooks on page 15. Students will complete the top portion of the report first. Instruct: "*You will first look at the observations you and your group members made. Looking at your raw data, how many different organisms did you see? How many of each type of that organism did you see?*" *Talk with your group to fill in the table in your notebook called **Schoolyard Animal Report: Our Group Data**. Once you have completed the table in your groups, you will need to report your group's findings on the board. Raise your hand and I will send your group up to the board to fill in the organism and the number of that organism your group saw. Remember, you/your group might not have seen the same organisms as your classmates."* Give students roughly 10 minutes to complete this table. Walk around to help answer questions. Many students may struggle with what to call their organism. Tell them that common names are ok.



Schoolyard Animal Report

Directions:

1. Open your notes you took on your ADW Pocket Guide
2. Refer to your notes, and talk to members of your group, to fill in the following chart "Our Group's Data" with your group
   a. Note: there should only be one animal per row - even if more than one of you counted that animal. Just total your counts. (For example, if you say 3 house flies, and someone else saw 2, record "housefly" on one row and put the total count as "5")

Schoolyard Animal Report: Our Group's Data

Animal name	How many did our group see? - Count
E.g. Common House Fly	*5*

3. Once you have completed the table with all your group's data, someone in your group should raise their hand. Your teacher will then send your group up to the board to fill in the organism names and counts from your group's data table above. If another class member (from a different group) has already written the name of one of the organisms that you also have on your data table, just add your count to theirs.
4. Once your teacher instructs you to do so, fill-in the whole-class data table below by using the data set from the board:

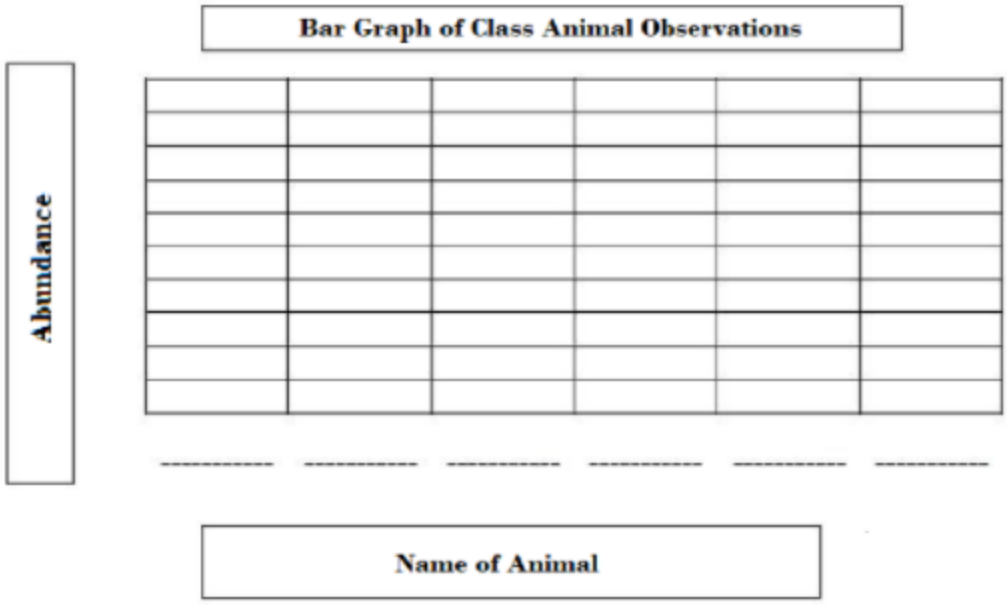
After students have filled in their numbers for the organisms they saw, get students' attention so you can give them the next set of instructions. Instruct *"Now, let's see what our whole class data says on the board."* It is likely that student groups will list the same organisms more than once (they might not notice it was already written in the chart). Check the chart to see if there are any rows that are duplicates and can be combined. Once there are no duplicate rows, instruct "*Now, let's add up the total count we have for each organism based on the observations of our class. You will be doing this on your worksheet in the table titled:* ***Schoolyard Animal Report: Whole Class Data*** *on page 16. You may use a calculator if you need it. Once you have completed that step, you can move on to graphing the data. You will be creating a bar graph to show the different organisms and the number of each of those organisms observed. Use the* ***Bar Graph of Class Animal Observations*** *provided in your notebooks on page 17, or (if there isn't enough room) create your own bar graph on the back of the paper*." Give students about 10 minutes to create their bar graph. Walk around the room to answer questions.

Schoolyard Animal Report: Whole Class Data

Animal Name	How many did our class see? Count
E.g. Common House Fly	*10*

Once students have completed their graphs, ask: *"what do our graphs tell us about the animals in our schoolyard?"* Have students use their graphs to support what they are saying. For example, if a student says there are a lot of ants in the schoolyard, ask them how the graph helps them support this statement.

5. After filling out the whole class data table, use it to create a bar graph in the space provided below. (If this bar graph doesn't provide you with enough space, you may create your own on the backside of this paper).



Argument Construction 1(10 minutes)
Instruct: " *Now that we have completed turning our raw data into something usable, it is time to see if we can answer a scientific question. In your Life Right Here and Everywhere notebook page 18, you have instructions for completing* ***Argument Construction 1*** in Gooru. *You will have 10 minutes to complete this argument. Please work individually."* This is a highly scaffolded argument. Do not answer student questions yet. This can be discussed in the debriefing.

Argument Debrief (10 minutes):
After all students have completed their argument, instruct *"What Claim did you make? Did anyone have a different Claim? [only focus on the claims at this point and everyone should have the same claim]. So if [insert name of animal] was the most abundant, how do you know? What evidence did you use? Did anyone use different evidence? Why did you choose this evidence? How does this evidence support our claim? In other words, what is our reasoning? Does anyone disagree? "*

Instruct: "*So, we determined that [insert name of animal] was the most abundant, what do you think this means? Why do you care that this organism is the most abundant?"* Students are just brainstorming at this point. Ask follow-up questions about whether their ideas are good for the environment or bad.

Question

15. Use the table below to answer the scientific question: What animal has the highest abundance in Neighborhood A?

Neighborhood A Observation Table

Animal Name	Number of Times Observed
Ant	20
Redwood tree	10
Blue jay	0
Robin	3
Bumble bee	6
Daffodil	1

Please type your answer(s) in the blank(s) provided, and click 'Submit All'.

Claim: The animal with the highest abundance at Antelope Island is the _____ant_____. [Hint: A claim is a complete sentence that answers the scientific question.]

Evidence: The _____ant_____ has the highest abundance because this organism was observed 20 (type the number in digits) times. [Hint: Evidence is observations, data, or information that helps you answer the scientific question.]

Reasoning: Abundance means the number of an animal in a particular location. [Hint: Reasoning tells why your evidence supports your claim. You can use scientific definitions or ideas to explain why you chose the evidence you did.]

Lesson 4: What Roles Do Organisms Play in the Environment?

Daily Overview:

- *Students will learn what role producers, consumers, and decomposers play in a food chain.*
- *Students will create a model (food chain) that represents the path of energy flow in an ecosystem.*
- *Students will use the observations they took previously to create a food chain.*

Time: 45 minute class period

Materials:

1. 1-internet accessible device per group;
2. Life Right Here and Everywhere Notebook (Lesson 4 page 23-26);
3. 6 large arrows;
4. 5 Food chain images (green leaves, spider, robin, butterfly, garter snake)

Prior to implementation: Make sure you have the 6 large arrows and the images for students to work with.

Possible modifications: This activity could be done in small groups instead of a whole class demonstration. If you would like to implement this as small group interactions make sure you have enough materials for each group to have a set of the arrows and the images. Students should be in groups of no less than 3 people (that way there are enough hands to hold the materials). Instead of asking for volunteers to show their chains, ask each group to create the chain the way they think it should go. Then have the class look at each other to see if there are any differences among the groups. If the class is in agreement (and it is correct) re-cap what the chain shows and then move to the next step.

Lesson Plan

Getting Started (10 minutes):

Instruct: "*Over the past couple of days we have been trying to understand what animals live in the area. We learned that having different types of animals in an area is important for the ecosystem. But why do we think we need high biodiversity? To answer this question, we will begin to think about how animals work together in the environment. First, let's do a quick review of some of the roles that animals and plants can play in an ecosystem. Login to Gooru on your iPad/computer to start the collection marked* ***Getting Started: Producer, Consumer, and Decomposer****". You can find the directions on page 20 in your Life Right Here and Everywhere Notebook. Make sure you complete the assessment questions after the collection.*

1. Which of the following statements is true of a producer? (1 point)
    a. Eats other plants and animals
    b. Makes its own food
    c. Produces sunlight
2. Which is NOT a consumer? (1 point)
    a. Mushroom
    b. Lion
    c. Beetle
3. Alex is trying to answer the following scientific question: *If no rain falls in Utah for 6 months, will the number of producers increase?* Her argument is below: (2 points for correct answer)

    Claim: No, the number of producers will decrease. Evidence: Alex noticed that many plants in her neighborhood turned brown compared to previous years.

    Select which sentence could be her Reasoning for this argument.

    a. Plants need both water and sunlight to grow without these things they will not survive.
    b. Animals are organisms that are often consumers.
    c. Plants will have more animals that will eat them.
4. A consumer gets energy from: (Select all that apply) (1 point; all correct answers)
    a. Plants
    b. Decomposing matter
    c. Animals
    d. Sunlight

Modeling a Food Chain (20 minutes):

After students have finished, instruct, *"Today we will be physically modeling how the animals we observed move energy through the ecosystem. I will ask for volunteers to come up here and show how they think the energy moves by holding up animal and arrow cards. Remember to point the arrow in the direction you think energy travels. After the group puts themselves in order, I will ask the class whether or not they agree with the volunteers."*

Ask for 3 volunteers. Pass out 1 ARROW CARD, one SPIDER CARD and one the ROBIN CARD. Ask: *"Who eats who between the spider and the robin (bird)?"* Students will say the robin eats the spider. Say: "*So, if the robin eats the spider how does the energy travel between these two organisms?"* Students should say the energy goes from the spider to the robin. Say: "*If that is the case, how should the arrow point?"* Students should say from the spider to the robin. Give the three volunteers 30 seconds to line themselves up correctly in front of the class (with the arrow pointing in the direction that the energy travels). Ask the class *"Do you all disagree or agree with how our volunteers have ordered themselves?"* Make sure they explain WHY they agree or disagree. Be sure to emphasize that the arrow should point to where the energy travels; energy is being passed from the spider to the robin.

Spider→ Robin

Ask for 5 different volunteers. Pass out the GREEN LEAVES CARD, BUTTERFLIES CARD, SPIDER CARD, and 2 ARROW CARDS and give the group 60 seconds to put themselves in order. Ask the class *"Do you all disagree or agree with how our volunteers have ordered themselves?"* Make sure they explain WHY they agree or disagree. Again, emphasize the direction of the arrow. Ask students to name the energy roles. Green leaves= producer, butterflies = herbivore, and spider = carnivore.

Green Leaves→ Butterfly→ Spider→ Robin

Modeling Energy Flow Using Student Data (15 minutes):
Instruct: *"Now that we have worked with example organisms, we will be looking at the animals you all noticed in your schoolyard. We will need two things to help us complete this activity: a list of animals we saw and some information on these animals. We will once again use the* ***ADW pocket guide*** *to help us learn about these animals."*

Ask students to find the activity **Modeling Energy Flow Using Our Data** in their Life Right Here and Everywhere student notebooks page 21. Once students find the page, give them a few minutes to remember and write down the animals they observed in the first observation (If they are struggling, remind them that they have a whole list from the previous activity). While students are doing this on their own, pass out the iPads to each student.

Choose some students to share the animals they remembered and list the ones they mention on the board.

Instruct: "From this list, or the one you have on your paper, *pick 2 organisms you would like to look up in ADW to determine what they eat. These organisms DO NOT need to eat each other. For each of these organisms, you will fill in the worksheet. At the bottom of the worksheet, you will be asked to create a food chain -- one for each of the organisms you listed.*"

Have students pull up the **ADW pocket guide** and instruct them to go to the **species** tab instead of the **notes** feature. Here students will be able to look up organisms they have observed to determine what they eat.

After students have completed their food chains, tell students to label the organisms in the food chains as producers, consumers, or decomposers.

	What does this organism eat?	What eats this organism?
20. Organism 1 (Squirrel)	.5 points [nuts, seeds, flowers and buds of various trees. These trees include maple, mulberry, hackberry, elm, and dogwood]	.5 points [American mink, other weasels, red foxes, bobcats, grey wolves, coyotes, lynx, and birds of prey, such as red-tailed hawks.]
21. Organism 2 (Bumble Bee)	.5 points [drink the nectar and gather the pollen a lot of different kinds of plants]	.5 points [birds and other animals]

Make a food chain using each of the organisms you picked.

22. Organism 1: Squirrel (2 points for all boxes correct; 1 point for 1 or 2 boxes correct)

23. Organism 2: Bumblebee(2 points for all boxes correct; 1 point for 1 or 2 boxes correct)

Lesson 5: What Is a Food Web?

Daily Overview:

- *Students will use a data set of the Detroit Area Ecosystem to understand that a food web consists of a set of interrelated food chains and a set of eating relationships in a given ecosystem.*
- *Students will be able to use the food web they have created to identify producers, consumers, and decomposers as well as predator/prey relationships.*

Time: 45 minute class period

Materials:

1. Life Right Here and Everywhere Notebook (Lesson 5 page 22-26)
2. Colored pencils (at least two per student)

Prior to implementation: Locate the colored pencils or crayons for students to use and have them ready for students in the class.

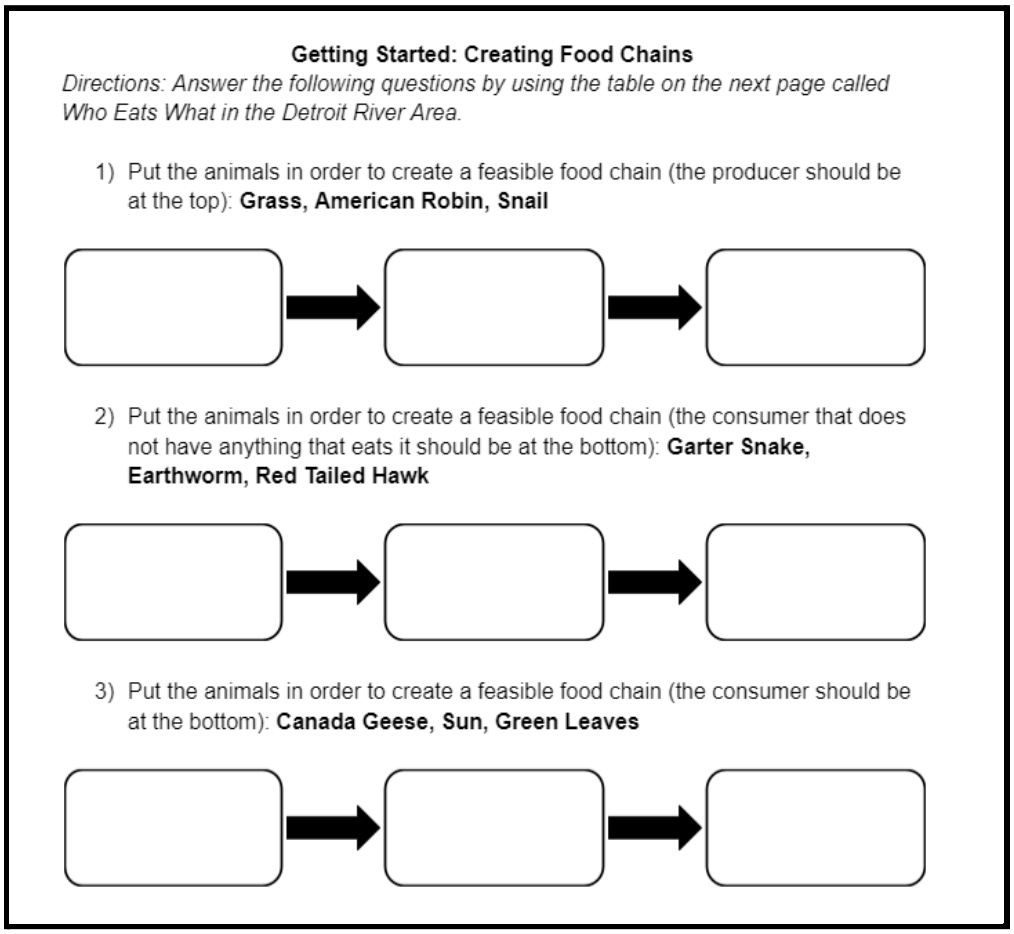
Supports: Students may bring up information on Omnivores, Carnivores, and Herbivores. If this happens you can bring in these terms into the food web. These terms describe what type of food a consumer eats. While this is not the focus of the lesson, some students might feel the need to use these identifications as well as producer, consumer, decomposer, or predator/prey.

Lesson Plan

Getting Started: Creating Food Chains (10 minutes):
Have students pull out their Life Right Here and Everywhere Notebooks page 23 and turn to **Creating Food Chains** activity using the **Who Eats What in the Detroit River Area** information sheet. Instruct: *"In front of you, you have a list of living things that can be found in the Detroit area. Do you recognize any of these organisms from your neighborhood? "* In this activity, students will be asked to complete three food chains based on the **Who Eats What in the Detroit River Area** information sheet. Students will fill in the following food chains.

Food Chain 1: **Dead Plant stuff**→ **Earthworms**→ **American Robins**
Food Chain 2: **Earthworms**→ **Garter Snake**→ **Red-Tailed Hawk**
Food Chain 3: **Sun**→ **Green Leaves**→ **Canada Geese**

After students have completed the assignment. Review the answers with students. It will be important for students to have the correct answers to begin thinking about food webs.



Getting Started: Creating Food Chains

Directions: Answer the following questions by using the table on the next page called Who Eats What in the Detroit River Area.

1) Put the animals in order to create a feasible food chain (the producer should be at the top): **Grass, American Robin, Snail**

2) Put the animals in order to create a feasible food chain (the consumer that does not have anything that eats it should be at the bottom): **Garter Snake, Earthworm, Red Tailed Hawk**

3) Put the animals in order to create a feasible food chain (the consumer should be at the bottom): **Canada Geese, Sun, Green Leaves**

Creating a Class Food Web for the Garter Snake (20 minutes):

Instruct: *"You all have created three different food chains based on the data in the table. When we look at the table, do the organisms eat only one type of food? No. Just like us, animals eat different types of food. Let's look at the Garter Snake. What are other organisms that the Garter snake eats?"* Write student responses on the board spaced out. (You will be asking students to draw arrows to represent energy flow so make sure you have space to do this). "*How would we represent the energy that the garter snake gets from these organisms?"* Have students volunteer to draw the arrows on the board. Remind students that the direction of the arrows represents which way the energy flows. So all arrows should point TO the garter snake.

Instruct: *"In the food chain we created at the beginning of the class, we see that the garter snake is only eaten by one organism, the red-tailed hawk, is this true? What does our data (the table) tell us?"* The table shows that the garter snake is eaten by adult bullfrogs, raccoons, and red-tailed hawks. List these on the board and ask students to draw the arrows that show energy flowing from the garter snake to these organisms. Instruct: "*What we have begun to create is a food web. A food web is multiple food chains that are interconnected to show how nearly all organisms in an ecosystem interact. Take some time right now to look at the data table on* ***Who***

Eats What in the Detroit River Area. *Are there any other arrows that we can add to our class food web?"* Students will look at the data table to see if there are any arrows missing between the animals they have on the board. They should not add animals yet. If they are struggling, have them look at one of the organisms on the board, what does this animal eat? Are any of those animals on the board? If so, what direction does the arrow go? After the 5 minutes, ask students for a volunteer to draw the arrows on the board. Ask the class, *"Do you all disagree or agree with any of these arrows from our volunteers?"* Make sure they explain WHY they agree or disagree.

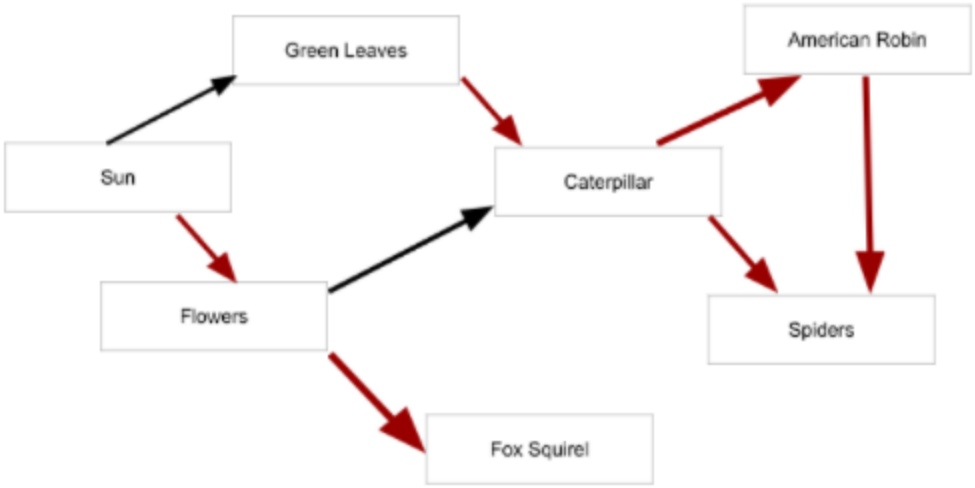
Who Eats What in the Detroit River Area

Organisms	Energy Source	Eaten By
green leaves	sun	caterpillars, Canada geese
flowers	sun	squirrels, caterpillars, bees, rabbits
fruits	sun	raccoons, pigeons, squirrels, robins
seeds and nuts	sun	pigeons, squirrels
dead plant stuff	sun	pillbugs, earthworms
pigeons (rock doves)	seeds, grains, nuts, berries, and other fruits	red-tailed hawks
fox squirrels	nuts, flowers, fruits, seeds	raccoons (eat young only), red-tailed hawks
pillbugs	dead plants, dead animals	spiders, robins
earthworms	dead plants	robins, gulls, garter snakes, bullfrogs, raccoons
bees	nectar and pollen from flowers	spiders
caterpillars (moths and butterflies)	green leaves, flowers	spiders, robins
American robins	small fruits, pillbugs, earthworms, caterpillars, spiders	
red-tailed hawks	squirrels, pigeons, garter snakes	
raccoons	fruits, nuts, earthworms, garter snakes, bullfrogs, johnny darters, eggs and young of robins and Canada geese, squirrels	red-tailed hawks (eat young only)
Canada geese	green leaves, flowers	raccoons eat eggs and young only
garter snake	johnny darters, bullfrogs tadpoles, earthworms	red-tailed hawks, adult bullfrogs, raccoons
ring-billed gulls	earthworms, yellow perch, logperch, johnny darters, walleye	
spiders	pillbugs, bees, caterpillars, mayflies	robins, bullfrogs
burrowing mayflies	bottom algae, dead plant stuff	bullfrogs, spiders, all fish except walleye

<u>Food Web Activity (10 minutes):</u>
Have students fill in the garter snake food web from the board that they created as a class under the **Food Web Activity** in their Life Right Here and Everywhere Notebooks on page 25. Instruct: *"This is a partial food web created from organisms found in the Who Eats What table. You will be completing the food web by placing the missing arrows. Remember the direction of the arrow matters!"* Ask them to choose one pencil color for the information the class filled in, and a different color for the information they fill in on their own.

Question

27. Read the directions below and complete the food web.
- Below is a food web created from the table Who Eats What in the Detroit River area.
- Fill in the arrows that represent how the energy flows through this ecosystem.
- Remember to make sure the arrow is pointing in the correct direction.



Rubric:
.5 points per arrow. There are 6 arrows in total. The arrow should be pointing to the correct organism AND be pointing in the correct direction.

Total: 3 points.

Wrap Up/Homework (5 min):
If there is time in class, or for homework, tell students they will complete a short activity to show their skills at reading and creating food chains and Food Webs. Students will need to access Gooru to complete the activity, **Food Chains and Food Webs**. Directions for this can be found on page 26 of the student notebooks.

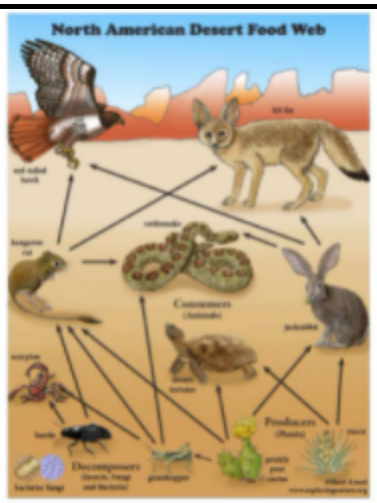
Question

24. In the following food chain: grass → zebra → lion
What is the producer? (1 point)

a) Grass
b) Zebra
c) Lion

25. How many animals eat the prickly pear cactus in this food web? (1 point)

Use the picture below to answer the question.



a. 2
b. 3
c. 4
d. 5

26. A snake was added to a neighborhood. The snake eats the small animals in the neighborhood. Below is a food chain for the neighborhood before the snake was added (2 points).

Grass → Mouse → Hawk

Select the option that shows where the "snake" would be placed in the food chain?

a. Grass → Mouse → Hawk → Snake
b. Grass → Snake → Mouse → Hawk
c. Grass → Mouse → Snake → Hawk
d. Snake → Grass → Mouse → Hawk

Lesson 6: Is the Ecosystem of the Great Salt Lake More Biodiverse than Our Schoolyard?

Daily Overview:

- *Students will be introduced to the idea of a scientific argument and the components (claim, evidence, and reasoning).*
- *Students will go through the Mystery of the Missing Fish to understand how to gather evidence for a claim.*

Time: 45 minute class period

Materials:

1. Life Right Here and Everywhere Notebook (Lesson 6 page 27-33);
2. Poster definitions of Claim, Evidence, and Reasoning

Prior to implementation: Check to make sure the Amoeba Sisters' video is still working. https://www.youtube.com/watch?v=15aWaGYheJs

Possible modifications: If your class is already familiar with Claim, Evidence, and Reasoning then you can skip the Amoeba Sisters video portion of this lesson.

Lesson Plan

Introducing Scientific Arguments (30 minutes)
Instruct: "*I was wondering if you could help me with a little mystery a friend was faced with earlier this week. You can follow along with the story in your Life Right Here and Everywhere notebook on page 28-31. You will find the story under* ***The Mystery of the Missing Fish****."*

Have students follow along as you read: *"I have a friend who's a scientist. Their name is Vin, and they live in Detroit, Michigan. Vin teaches students about the Detroit River Ecosystem. They decided it would be really cool if they brought in a bunch of fish from the Detroit River into a classroom that they were working in. Since they live right next to the river and own a ton of fishing gear, they knew this would be no problem. They even invited two of their students to join!*

After a long day of fishing Vin and the students finally had two johnny darters, a round goby, and a yellow perch to bring in as specimens for my science lesson. They knew their students would love it! ***(Look at the pictures below to see the fish they caught.)***

Johnny Darter

Johnny Darter


Round Goby


Yellow Perch

After the students went home, Vin put the fish in a cooler, and put the cooler on their porch. They left the lid open to make sure the four fish got enough oxygen. The next day when Vin woke up and went out to grab their cooler for the lesson, they noticed..... one fish was missing! The previous night there were four fish and now there were only three!!!
The yellow perch was missing.

So the question was, WHAT HAPPENED TO THE YELLOW PERCH? Vin didn't have much time and wanted to explain to the students what happened to the fish, so they searched around for clues.

Vin's neighbor, Jamal, was outside about to head to work but saw how upset Vin looked and came over to see what was wrong. He said he thought it was Vin's adorable cat, Gus. But when Vin asked him what evidence he had, he said he didn't have any and that he just knows cats are troublemakers.

Suspect: Gus the Cat

Since Vin is a scientist, they told Jamal that scientists use their senses to examine information carefully (or make observations) to see what they can learn from it. Scientists then make a statement about what they have learned based on what they observed with their senses. That statement is called a claim. Scientists then use parts of their observations, or the information they collect, as evidence (clues, facts, information, observations) to back up what they think. ***(put the definitions of "claim," "evidence," and "reasoning" on the board.)***

Story in notebook (continued): *So, if Jamal thinks Gus ate the yellow perch, then that was his claim. It's what he thinks is true. But, Jamal had no evidence to back up that Gus ate the perch. To make a claim you must have evidence. Jamal and Vin headed outside with Gus to test out whether or not he would have taken the perch. My friend held him still and Jamal put his paw in the water. Gus began screeching and howling.*

Instruct: Ask students, *"What claim do you think we made about Gus and how he feels about water? Write down your answer in your Life Right Here and Everywhere notebook on page 36."* (Possible answer: He does not like the water.)

1) What claim do you think Vin and Jamal made about Gus and how he feels about water?

Claim:

_____
_____
_____

2) What evidence did they have to back-up their claim?

Evidence:

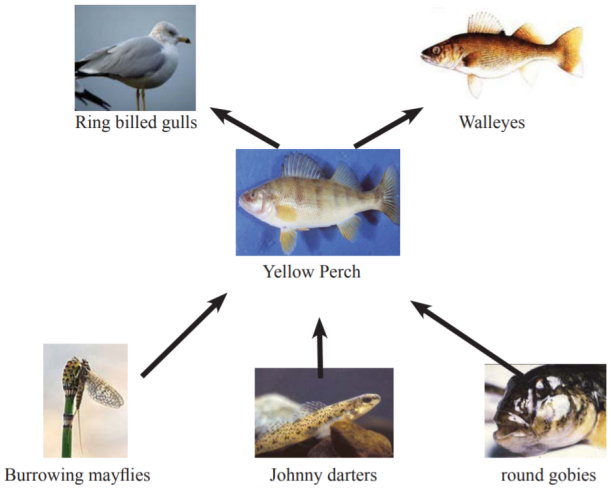
_____
_____
_____

3) Continue reading the story along with the class.

Ask students, *"What evidence did we have to back that up? Write down your answer in your Life Right Here and Everywhere notebook on page 30" (*Possible answer: He screamed and screeched when we put his paw near the water.)

The Mystery of the Missing Fish Part 2

Story in notebook (continued): *Just then, Vin remembered they had a food web all copied and ready to pass out for their lesson. They took it out and studied it for possible clues.* ***(Look at the food web below for possible clues. Who are possible suspects in the mystery of the missing perch?)*** Instruct**:** "*What might we learn from this food web?"*. If needed, remind them how to read a food web. The arrow points to where the energy goes. Quickly review with the class who eats what according to the web.



Story in notebook (continued): *As Vin went to pick up their cooler and head to the classroom with only three fish, they noticed something white near the cooler.* ***(Shown below.)*** *My friend didn't remember it being there the previous night.*

Ask students, *"Who wants to volunteer a CLAIM or a complete sentence that answers the scientific question, that answers the question, "What happened to the yellow perch?"* Encourage students to offer multiple claims if they have them, and encourage them to try to back up their claim with evidence. If they make a claim without evidence, remind them that a scientist MUST have evidence to back up their claim.

- Possible Student Responses: (ASK STUDENTS FOR EVIDENCE FOR EACH CLAIM THEY MAKE)
- If they say Gus (the cat)... Ask them for hard evidence. Remind them how Gus reacted near the water.
- If they say walleye, remind them of the fish you had in the cooler. There were no walleye there.
- If they say the johnny darters or round gobies ate the perch, remind them of what the direction of the arrow means on the web.
- If they say ring-billed gull ask them what evidence (or data that helps you answer the scientific question)
    - Feathers near the cooler
    - Detroit food chain says that ring-billed gulls eat yellow perch

Instruct: "W*rite down what you think the claim, evidence, and reasoning should be to answer the question "What happened to the yellow perch? Write your claim evidence and reasoning in your Life Right Here and Everywhere notebook on page 31, in the table "Our Scientific Argument: What Happened to the Yellow Perch?*"

My Argument

Scientific Question: What Happened to the Yellow Perch?	
Claim Who do you think stole the yellow perch?	
Evidence What evidence do you have to support who you said stole the perch?	
Reasoning Reasoning tells why your evidence supports your claim. You can use scientific definitions or ideas to explain why you chose the evidence you did.	

"You did a great job of solving that mystery and you did what scientists have to do whenever they are trying to prove something about the world around them---they first start with a question. What was the scientific question?" What happened to the missing yellow perch? Jamal, the neighbor, decided to make a statement about what he thought the answer was---we call that a claim. So Jamal's claim was that Gus, the cat, ate the missing perch. Well, that was just his opinion, but scientists don't make any claims without having proof, or evidence, to show that their claim is true. Then you used the food web's flow of energy and the scientific fact that birds have feathers to come up with two clear pieces of evidence that helped you prove your claim. It was not Gus the cat, but a ring-billed gull that ate the perch."

<u>Explicit Instruction on Claim, Evidence, Reasoning (10 minutes)</u>
Watch an Amoeba Sister video about Claim, Evidence, and Reasoning (CER) as a class, and answer questions throughout the video.

1. The Pink Amoeba wondered, "Where do the turtles go in the winter when the pond freezes over?" Which of the following activities helped answer this scientific question (Mark all that apply.) (1 point: .5 points per correct answer.)

a. She observed the turtles' behavior before the winter and after winter was over.
b. She read peer-reviewed science papers about Red Eared Slider Turtles.
c. She asked her mom what the turtles did in the winter.
d. She kept a turtle in her room over the winter.

2. In order to make a valid claim, we need _____, which can come from observations, data or information. (1 point)

a. Reasoning
b. Evidence
c. A question

3. A(n) _____ is a complete sentence that answers a scientific question. (1 point)

a. claim
b. observation
c. question
d. reason

4. _____ tells why your evidence supports your claim. You can use scientific definitions or ideas to explain why you chose the evidence you did. (1 point)

a) Reasoning
b) Explaining
c) Guessing
d) Claiming

5. Read a summary of the Pink Amoeba sister's story. Then, match each part of the story with the correct part of an argument (Claim, Evidence, or Reasoning.)

The Pink Amoeba Sister asked a scientific question: "Where did the red-eared slider turtles go in the winter when the pond froze over?" To answer her question, she made many observations, read some scientific articles, and took notes. She observed that [the turtles remained in the water when the pond froze over and the same turtles were present when the winter was over]. She also read scientific articles that said some turtles hibernate, or "brumate", during the winter. [She used the scientific definition of "brumate" and connected it to the behavior of the turtles in her pond.] She used all this information to conclude the following: [In the winter, when the pond surface freezes over, red-ear sliders in this pond remain and brumate.]

Part of a Scientific Argument	Definition	Part of the story
Claim	A complete sentence that answers the scientific question.	1. In the winter, when the pond surface freezes over, red-ear sliders in this pond remain and brumate.
Evidence	Observations, data, or information that helps you answer a question.	2. The turtles remained in the water when the pond froze over and the same turtles were present when the winter was over.
Reasoning	Tells why your evidence supports your claim.	3. She used the scientific definition of "brumate" and connected it to the behavior of the turtles in her pond.

Constructing an Argument (10 minutes):
If desired, put the Claim, Evidence, and Reasoning posters on the board.
Instruct: *"In this activity, you'll see a partially completed scientific argument that makes the claim: 'Yes, The Great Salt Lake is more biodiverse than our schoolyard.' Read over the different parts of this argument carefully. What's missing? Use the data table provided, "Animals Observed at The Great Salt Lake in April" to complete the argument."*.

Animals Observed at The Great Salt Lake in April

Animal	**Number Observed**
Pelican	5
Seagull	42
Savannah Sparrow	3
Marsh Gull	2
House Sparrow	12
Long-tailed Duck	6
Frog	5
Garter Snake	1
Blue Bird	4
Snowy Plover	1
Brine Shrimp	Over 1000
Antelope	10
Mosquito	Over 1000

Our Scientific Argument

Scientific Question: Is the Great Salt Lake More Biodiverse than Our School Yard?	
Claim A claim is a complete sentence that answers the scientific question.	Yes, the Great Salt Lake is more biodiverse than our schoolyard.
Evidence Evidence is observations, data, or information that helps you answer the scientific question.	The Great Salt Lake had 15 different types of animals that were seen and many of these animals were seen more than once. On the other hand, our schoolyard only had 5 different types of animals that were observed and only some of them were observed more than once. [possible response from students. Responses should be based on the two observations students did] (1 point for full correctness; .5 for partial correctness)
Reasoning Reasoning tells why your evidence supports your claim. You can use scientific definitions or ideas to explain why you chose the evidence you did.	Biodiversity is a term used to describe the variety of life in a particular place. There are many factors that can go into calculating biodiversity and many different ways of calculating it. In your biodiversity research, you will use two factors that contribute to biodiversity: richness (the number of different species in an area) and abundance (the number of individuals of each species in an area).

Life Right Here and Everywhere: Unit 2

What Happens to Native Insect Populations if Habitats Are Disrupted?

Teacher Guide

Diamond Fork Middle School

Spring 2022

Unit 2: What Happens to Native Insect Populations if Habitats Are Disrupted?

Unit Overview:
During this unit, students will gather data on certain insects in their neighborhood. The research will focus on where the insect lives, what it eats, and its behaviors. These data will serve to get students thinking about what the insect's habitat is. Students will then complete a simulation activity to understand how an organisms' habitat including the other organisms in the habitat impacts the population numbers. Finally, students will look at what happens when an invasive species is introduced. They will end the unit by constructing an argument about: Do invasive species disrupt normal ecosystem interactions?

Total Time: 4 45-minute class periods

Science Concept Overview:
Organisms require food, shelter, water, and the ability to reproduce in order to survive. The habitat that they live in contains abiotic (non-living) and biotic (living) components that meet these needs. The availability of these resources will determine how much a population of a given species can grow within the area. If availability changes the population size will change. For example, if a food source becomes scarce, the population numbers will decrease. If food becomes plentiful, the population numbers will grow. Because of the interactions between species (predator/prey), population numbers are dynamic and interrelated.

Learning Goals	NGSS Standards Addressed
Gather, read, and communicate information from multiple appropriate sources on one local species including information about resource needs, behaviors, habitat, seasonal patterns. Use models to make a prediction about the dynamics of predator/prey relationships. Construct an argument to address the scientific question, *Does an invasive species disrupt populations of a native species?*	MS-LS-2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. Utah State Standards Construct an argument supported by evidence that the stability of populations is affected by changes to an ecosystem. Emphasize how changes to living and nonliving components in an ecosystem affect populations in that ecosystem. Examples could include Utah ecosystems such as mountains, Great Salt Lake, wetlands, or deserts. (LS2.C)

Materials for the Unit
- 1-internet accessible device per student;
- 1 Life Right Here and Everywhere Notebook per student
- Access to a smartboard or 1-internet accessible device per student group;
- Colored Pencils for each group (at least 4 different colors per group)
- Link to the Invasive Species Simulation

Science Glossary Terms

Competition
Habitat
Native species
Introduced species
Invasive species
Insect
Pollination
Population
Predator
Prey
Resources

Lesson 1: What Are the Needs of Local Animal Species?

Daily Overview:

- *Students will be put into groups and assigned one insect to conduct research about their habitats. Students groups will either look at the emerald ash borer, the convergent lady beetle, or the anax junius.*
- *Students will use ADW Pocketguide to conduct their research.*
- *Students will learn what an organisms' habitat is.*

Time: 45 minute class period

Materials:

1. 1-internet accessible device per student;
2. 1 Life Right Here and Everywhere Notebook per student pages 36-40.

Prior to implementation: Select student groups for the research. Students should be in groups of no more than 3-4 students. Decide ahead of time which group will research which bug or have students pick one of the three insect names from a hat.

Lesson Plan

Getting Started (10 minutes):
Instruct: *"Last week we collected observations on different animals that live in our neighborhood. This week we are going to look a little more in-depth at certain types of organisms that we probably have observed. Specifically, we will look at insects in our neighborhood. How can we categorize an animal as an insect? (have students raise their hand to respond). Before we look at insects in our neighborhood, let's quickly learn about what makes an organism an insect. You will have 7 minutes to review this collection and answer the questions in the assessment. Turn to 37 in your Life Right Here and Everywhere notebook under* ***Getting Started*** *for directions to complete this activity."* Have students log into Gooru and click on the **What Is an Insect.**

After students have submitted their responses, highlight the collection information on characteristics of insects. Instruct: *"An insect has three body parts and 6 legs. In addition, many insects have wings. With this in mind, we will be getting into groups to learn more about the insects in our neighborhood."*

Questions

1. What are the characteristics of ALL insects? (1 point for all correct)

Select "YES" if it is a characteristic of all insects or "NO" if it is not a characteristic of all insects.

a. Three-body parts YES NO
b. Six legs YES NO
c. Eight legs YES NO
d. Black body YES NO

2. Is this animal an insect? (1 point)
   a. Yes
   b. No

3. Some of the roles of insects are pollinating flowers and being a source of food for animals. (1 point)
   e. True
   f. False

Insect Research (30 minutes):

If students are not already in groups, place students in groups of 3-4. Explain that students will be working in these groups for their insect research. Have students turn to pages 38-39. in their Life Right Here and Everywhere Notebook to look at the **Insect Report Card**. Instruct *"For this research, you will be looking at certain habits of a certain insect. You will be using the **ADW Pocket Guide** to conduct this research. ADW has been created using reliable resources, so we can trust that the information is accurate. Let's walk through where you can find this information on ADW. Follow the steps with me.*

1. *Login to **ADW Pocket Guide**. [https://pocketguides.animaldiversity.org/login]*
2. *Click on the Life Right Here and Everywhere picture.*
3. *On the left-hand side of the page, you will see a link that says Animal Finder.*
4. *Scroll down to find the box that says, "Insects - Other Insects" and click on it.*
5. *Once you are in here, find the insect that I will assign you later and answer the questions on the worksheet.*

Instruct: *"Your group will be assigned one of three insects: emerald ash borer, the convergent lady beetle, or the anax junius. Once I have assigned your group the insect, you can start conducting research on the computers/iPads. Even though you are working in groups, remember to fill in the information in your own notebook."*

Give students the rest of the time to complete their research. Any research not finished in class can be done for homework.

Questions

My insect is _____emerald ash borer_____.
Fill in the table below to describe what habitat your insect likes to live in.

a.In what part of the country or world is this insect found? (1 point)	It's found in Eurasia and North America
b.What does it eat? (1 point)	Bark and leaves of ash trees
c.What does it use for shelter? (1 point)	Ash trees
d.What temperature does your insect prefer? (1 point)	Warm temperatures

Fill in the table below to describe what role your insect plays in the ecosystem.

a. Is this insect native or invasive in Utah? (1 point)	It's not native to Utah
b. What eats this insect? (1 point)	Woodpeckers
c. What impact does the insect have on humans? (1 point)	It kills ash trees and costs a lot of money

Wrap-up/Homework (5 minutes)
5 minutes before the end of class, introduce students to the notion of habitats. Ask "*Why do we care about what an organism eats, what eats it, and where it is found?* [This is just brainstorming, accept most answers and probe students "why."] Instruct: "*These aspects help us to understand where certain organisms will be found because these characteristics determine the habitat that the organism lives in. While you all researched the habitat of a specific insect, we are going to learn more generally, what a habitat is."*

If there is time in class, or for homework, students will need to access Gooru to complete the activity, **What Is a Habitat?** Directions for this can be found on page 40 of the student notebooks.

1. What would need to be in this habitat to make it possible for a seagull to live there?
    a. Shelter
    b. Soil
    c. Rocks
    d. Food source

2. Habitats need humans to sustain animal life.
    a. True
    b. False
3. What does a habitat include? (1 point)
    a. Water
    b. Oxygen
    c. Soil or Sand
    d. Rocks
    e. Animals
    f. Plants
    g. All of these
4. Where do animals find their food sources in a habitat?
    a. Water
    b. Soil
    c. Other animals
    d. Plants
    e. All of these

Lesson 2: How Do Other Species Control Population Numbers? (Part 1)

Daily Overview:

- *Students will make predictions about what happens to populations over time as they interact within a habitat. Specifically, students will be looking at habitats that have two and three different populations.*

Time: 45 minute class period

Materials:

1. Life Right Here and Everywhere Notebook (Lesson 2; pages 41-46)
2. Access to a smartboard or projector for the teacher's computer; or 1-internet accessible device per student group;
3. Colored pencils for each group (at least 3 different colors per group)

Prior to implementation: Check that the simulation link (https://tinyurl.com/InvSim2022) works. We would advise you to run through the simulation on your own a couple of times to make sure you understand how it works and what students will see. Put students in groups of three. Students can work with folks they worked with previously. We suggest making groups mixed ability. The simulation requires students to be able to interpret graphs, which may be difficult for some.

Possible modifications: This can be done through a class "demonstration" type of activity with the teacher controlling the simulation for the entire class to see or it can be done as a group assignment with student groups running through the steps of the simulation. If this is done as groups, the teacher should still read the script and tell students when to start and stop the simulation. The steps would be the same. The student worksheet does not have the "number of individuals" so this would need to be given if they are doing it on their own.

Lesson Plan

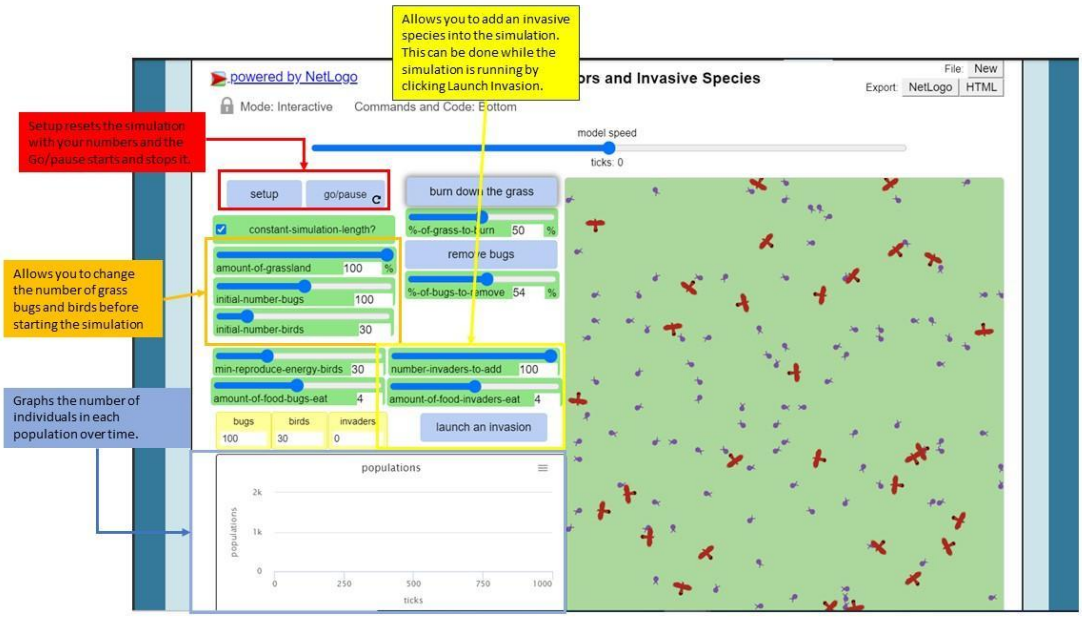
Getting Started (5 minutes):
If students are not already in groups, put students in groups of three. Ask students to get out their Life Right Here Notebooks**.** Have students open their Life Right Here and Everywhere notebooks to page 42. Do the **How Do Other Species Impact Population Numbers? (Part 1).** If students are working on their own and not as a class, have students log into Gooru and click on link for the simulation (https://tinyurl.com/InvSim2022),

Pass out three colored pencils to each group as students are opening their notebooks (this will be to show the different populations).

Simulation Activity (35 minutes):

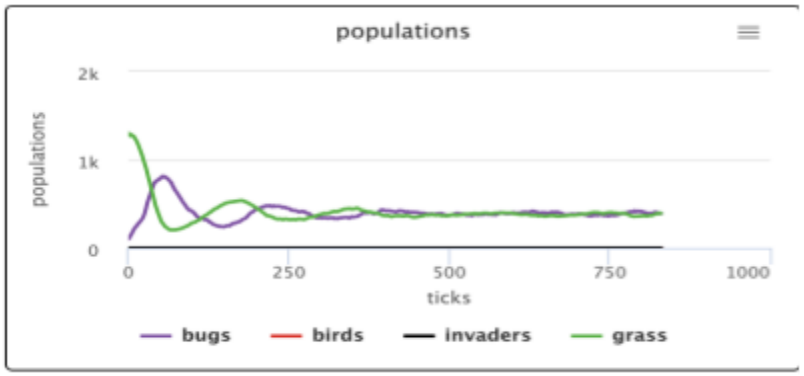
1. Say: *"Yesterday we looked at what organisms need to survive in a given habitat. Today, we will be looking closer at how different animals interact within a habitat. We will be using a simulation to show how populations of organisms in one habitat change over time.*

2. Say: "*We will be using this model to help us make predictions about what we think will happen to the population numbers of each species. What do we mean when we talk about models in science?* [Take a couple of student responses]. *A model in science helps represent things that we can't see with the naked eye. This could be because it takes too long, it happens on a microscopic scale, or it happens on too large of a scale. This simulation helps us to model how populations change over hundreds of years. A population is a group of individuals from the same species that live in the same area. For example, there are populations of mosquitoes that live here but these are different from the population of mosquitoes that live in Florida even though they are the same species. So, when we talk about populations changing, we are talking about the individuals of one species in one area*."
3. Say: *"Now let's familiarize ourselves with what this simulation looks like."* Show students what the birds, grass, and bugs look like in the simulation. Below is a screenshot of the simulation with labels. [Have the simulation projected on the smartboard or with a projector using your own device and use a cursor or a pointer to name the components.]



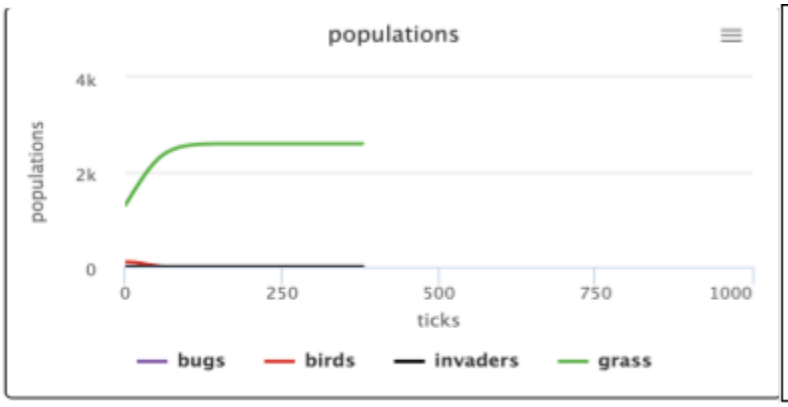
4. Say: "*So, the simulation looks at GRASS, BUGS, and BIRDS. In your notebook, please draw a food chain that represents how these organisms will interact. Who eats who in this habitat?* [Give students a couple of minutes. Walk around and see if student food chains are correct.*] Now, draw a graph that you think best represents what will happen to the GRASS and BUGS over time if there are no BIRDS. Take some time to talk with your group, but EACH person will need to draw their prediction in their own notebook.*
You will draw your prediction on the graph provided in your notebook. Use different colored pencils for each of the organism populations. Make sure you label which one is which. You will also describe what your graph represents and why you think that best represents what would happen. If you don't know what your graph might look like, write out in words what you think will happen. For example, 'I think the number of BUGS will go down over time and the amount of GRASS will go up.'"
5. After students have finished making their predictions, call on some students to say what they think will happen and why. Ask for anyone who has a different prediction and why.

6. Test out the simulation. Remind students that they will be looking at the graph in the bottom left-hand corner to see what happens to the populations**. To set up this run**, set the initial number of birds to zero. Click setup. Then click play/pause. Let the simulation run for about 30 seconds.
7. If you're doing this activity as a demonstration, you may want to take screenshots of each graph as you do them so that you can display them during the question answering/argument construction phase of Lesson 3.
8. Say: "*Now, the simulation has shown us what will happen over time. Someone raise their hand and tell me what the graph is telling us* [see picture below]. *Now, draw the actual graph on your worksheet and write what the graph is showing in the space provided*."



At the start, you see the grass population decreasing as the bug population increases (since there is more grass for the bugs to eat, more bugs can survive). When there are too many bugs and not enough grass, the number of bugs goes down. Because there are fewer bugs to eat the grass, more grass can grow. Over time, the populations even out..

9. Say: "*Now, let's try another one. Again, using the food chain as guidance and a reminder of how these organisms interact, draw a graph that you think best represents what will happen to the GRASS and BIRDS over time if there are no BUGS? Take some time to talk with your group but EACH person will need to draw their prediction in their own notebook. You will draw your prediction on the graph provided in your notebook. You will draw your prediction on the graph provided on your worksheet. Use different colored pencils for each of the populations. Make sure you label which one is which. You will also describe what your graph represents and why you think that best represents what would happen. If you don't know what your graph might look like, write out in words what you think will happen."*
10. After students have finished making their predictions, call on some students to say what they think will happen and why. Ask for anyone who has a different prediction and why.
11. Test out the simulation. Remind students that they will be looking at the graph in the bottom left-hand corner to see what happens to the populations. **To set up this run**, set the initial number of birds to 30. Set the number of bugs to zero. Click setup. Then click play/pause. Let the simulation run for about 30 seconds.
12. If you're doing this activity as a demonstration, you may want to take screenshots of each graph as you do them so that you can display them during the question answering/argument construction phase of Lesson 3.
13. Say: "*Now, the simulation has shown us what will happen over time. Someone raise their hand and tell me what the graph is telling us* [see picture below]. *Now, draw the actual graph on your worksheet and write what the graph is showing in the space provided*."



The bird population almost immediately dies off because there is no food (bugs) for them to eat. The grass grows until there is no more space for it because there is nothing to eat the grass (again, no bugs!).

Wrap-up/Homework (5 minutes)

If there is time in class, or for homework, students will need to access Gooru to complete the activity, **Predator/Prey Relationships.** Directions for this can be found on page 46 of the student notebooks.

Question

11. Which of the following are examples of predator and prey relationships?

Select "YES" if it is an example of predator/prey relationship or "NO" if it is not an example of predator/prey relationship. (1 point)

a) A lion eating a zebra
b) A human consuming a banana
c) A cow eating grass
d) A shrimp consuming algae

12. In the following food chain, what is the predator of the bullfrog? (1 point):

Grass → Snail → Bullfrog→ Hawk

a) Grass
b) Snail
c) Bullfrog
d) Hawk

13. In the following food chain, the bullfrog is both a predator and prey. (True or False? (1 point):

grass → snail → bullfrog→ hawk

e) True
f) False

14. A mosquito is a predator (True or False?) (1 point).

g) True
h) False

Lesson 3: How Do Other Species Control Population Numbers? (Part 2)

Daily Overview:

- *Students will make predictions about what happens to populations over time as they interact in a habitat. Specifically, students will be looking at habitats that have two and three different populations.*
- *Students will explain how populations of organisms can impact other populations based on predator/prey relationships.*
- *Students will write a short paragraph on what would happen if the bug they researched previously, had over 1 million individuals in the population.*

Time: 45 minute class period

Materials:

1. Life Right Here and Everywhere Notebook (Lesson 3 pages 47-50)
2. Access to a smartboard or 1-internet accessible device per student group;
3. Colored pencils for each group (at least 3 different colors per group)

Prior to implementation: Check that the simulation link (https://tinyurl.com/InvSim2022) works. We would advise you to run through the simulation on your own a couple of times to make sure you understand how it works and what students will see.

Possible modifications: This can be done through a class "demonstration" type of activity with the teacher controlling the simulation for the entire class to see or it can be done as a group assignment with student groups running through the steps of the simulation. If this is done as groups, the teacher should still read the script and tell students when to start and stop the simulation.The steps would be the same. The student worksheet does not have the "number of individuals" so this would need to be given if they are doing it on their own.

Lesson Plan

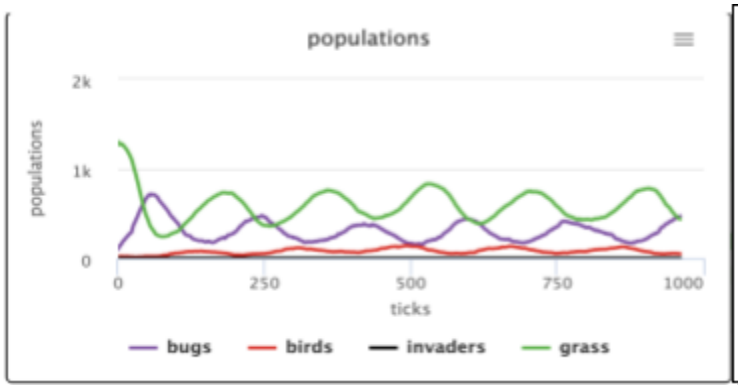
Simulation Activity (40 minutes):

Picking up from yesterday, pass out the colored pencils and do a quick reminder of the components of the simulation. Have students turn back to page 48 in their Life Right Here and Everywhere notebooks to the **How Do Species Impact Population Numbers?** Activity. They should be in the groups they were in yesterday. Ask students to recall what they learned yesterday. Say: "*Yesterday we looked at what would happen to population numbers when there are only two species in the area. But, there are never habitats that only have two species, so we will look at what happens when there are three species populations in an area. We will follow the same format we did yesterday. You will make a prediction, then we will observe what happens, then we will write down what we observe."*

14. *Now, let's try another one. Again, using the food chain as guidance and a reminder of how these organisms interact, draw a graph that you think best represents what will happen to the GRASS, BUGS, and BIRDS over time if all three were in a habitat? Take*

some time to talk with your group but EACH person will need to draw their prediction in their own notebook. You will draw your prediction on the graph provided in your notebook. Use different colored pencils for each of the populations. Make sure you label which one is which. You will also describe what your graph represents and why you think that best represents what would happen. If you don't know what your graph might look like, write out in words what you think will happen."

15. After students have finished making their predictions, call on some students to say what they think will happen and why. Ask for anyone who has a different prediction and why.
16. Test out the simulation. Remind students that they will be looking at the graph in the bottom left-hand corner to see what happens to the populations. **To set up this run**, set the initial number of birds to 30. Set the number of bugs and grass to 100. Click setup. Then click play/pause. Let the simulation run for about 30 seconds.
17. If you're doing this activity as a demonstration, you may want to take screenshots of each graph as you do them so that you can display them during the question answering/argument construction phase of this lesson.
18. Say: "*Now, the simulation has shown us what will happen over time. Someone raise their hand and tell me what the graph is telling us* [see picture below]. *Now, draw the actual graph on your worksheet and write what the graph is showing in the space provided*.



All three populations increase and decrease over time. This is because all three populations are dependent on what the other two do. For example, the bug population will decrease if there are too many birds in the area that eat them. When the bug population decreases, the grass can increase because there are less bugs to eat the grass. Also, when the bug population gets too low, the birds will start to die off because there is not enough food to support them.

<u>Questions After Simulation:</u>

Get the class's attention: "*We have now gone through almost all scenarios possible for this simulation. Based on what we have found you will answer some questions in your notebook. You can discuss with your groups but everyone should be writing their own answers. If you have any questions or would like to try something out on the simulation please raise your hand.* [If students are not doing this as a demonstration, tell them they can try things out on their own in the simulation.] *I will be walking around the class to answer any questions.*" [If you are doing this as a demonstration, you can display the screenshots of each graph to the whole class so that students can refer back to them.]

Questions

15. What caused the grass population to decrease in the simulation? (1 point)
When there was an increase in the number of bugs.

16. What caused the grass population to increase? (1 point)
When there was a decrease in the number of bugs.

17. What two things caused the bug populations to decrease? (1 point: .5 points per response.)
When there was a decrease in the amount of grass or when there was an increase in the number of birds.

18. What caused the bug population to increase? (1 point)
When there was an increase in the amount of grass or when there was a decrease in the number of birds.

19. What caused the bird population to decrease over time? (1 point)
When there was a decrease in the number of bugs.

20. What caused the bird population to increase? (1 point)
When there was an increase in the number of bugs.

21. Jesse made a claim that the bird population will increase when there are more bugs. (2 points total for parts a and b)

i) Do you agree with Jesse's claim? (1 point)
Yes, I agree with Jesse's claim.

j) Using the information in the model, give one piece of evidence to support your answer. (1 point)

Possible answers: In the model, when the bugs increased, there was more food for the birds, and the bird population grew. More prey = more predators.

Wrap-up/Homework (5 minutes):
Instruct: "*Prior to this simulation, you looked at one insect closely using the **Insect Report Card**. Everyone should have their group's Report Card research on page 38 of their Life Right Here and Everywhere notebook. Based on the simulation that we did the past couple of days, you will write an argument on the question: 'What do you think will happen if there were over 1 million of your insects in the area?' You'll record your response in Gooru. Instructions for accessing this argument can be found on page 50 of your student notebooks. Use specific information from your report card to write your explanation.*"

In Lesson 1 of this unit, before you looked at these simulations, you investigated and wrote information about one particular insect.

Use the information on your **Insect Report Card** in the student notebook and what you learned from these simulations to answer the questions.

Construct a Claim and Reasoning for the scientific question, **What would happen if one million of your insects were added to your area?**

Claim: The grass would die.

Reasoning: This many insects would eat all the grass and cause the food web to collapse.

Rubric

1 point for Claim

1 point for Reasoning

Total 2 points

Lesson 4: How Do Invasive Species Impact Other Species?

Daily Overview:

- *Students will be using the simulation to see what happens to populations of organisms when an invasive species is introduced.*
- *Students will learn what makes a species invasive.*
- *Students will construct an argument to answer the question "Do invasive species disrupt normal ecosystem interactions?"*

Time: 45 minute class period

Materials:

1. 1-internet accessible device per student;
2. Link to the Invasive Species Simulation;
3. Life Right Here and Everywhere Notebook (Lesson 4 pages 51-56)
4. Colored Pencils (at least 4 different colors per group)

Prior to implementation: Check that the simulation link (https://tinyurl.com/InvSim2022) works. We would advise you to run through the simulation on your own a couple of times to make sure you understand how it works and what students will see.

Possible modifications: Students will need to view the simulation to collect their data. This can either be done by the teacher on the smartboard or with the teacher's device projected for the class; or students can have individual access to the simulation on their own computers.

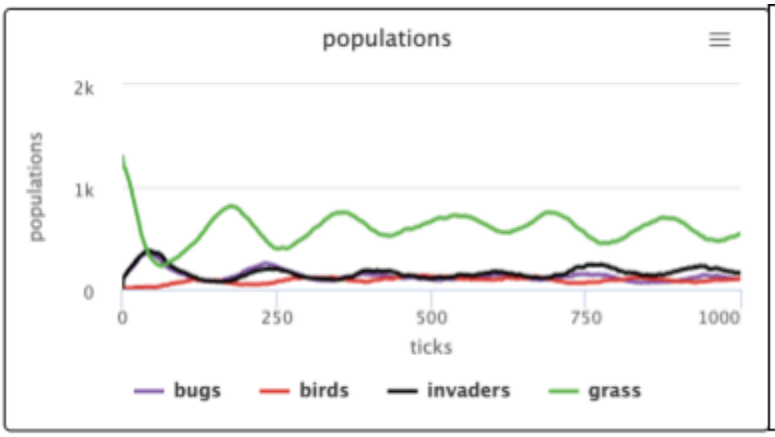
Lesson Plan

Set up simulation for students (20 min):
Instruct: *"Over the past two days you looked at how population numbers changed with two and three types of organisms in the ecosystem. Today we will explore how certain organisms can disrupt "normal ecosystem interactions" and impact native species. When we say "native," we mean species that originally come from the area. We will be using this simulation and what we have learned over the past couple of days as evidence to answer a scientific question."* Have students turn to page 52 in their Life Right Here and Everywhere Notebook to the **How Do Species Impact Population Numbers- Part 2**. This will contain instructions that students can follow along with to set up the simulation.

1. Do a quick review of the components of the simulation. Introduce students to the "INVADER" in the simulation.
2. *Just like before, we will be doing a prediction before we run the simulation. Take some time to talk with your group but EACH person will need to draw their prediction in their own notebook. You will draw your prediction on the graph provided in your notebook. Use different colored pencils for each of the populations. Make sure you label which one is which. You will also describe what your graph represents and why you think that best*

represents what would happen. If you don't know what your graph might look like, write out in words what you think will happen."

3. Set up the simulation or instruct students to set up the simulation in the following way (it should be the default settings) 100 GRASS, 100 BUGS, 30 BIRDS, and 100 INVADERS.
4. Instruct: *"We are introducing the INVADER into the ecosystem. First, we will let the simulation run normally for a few seconds, and then we will launch the invasion."* Run the simulation by clicking play/pause. After about 15 seconds, click the "Launch Invasion" button. Let the simulation run for another 30-45 seconds.
5. If you're doing this activity as a demonstration, you may want to take screenshots of each graph as you do them so that you can display them during the question answering/argument construction phase of this lesson.
6. Instruct: "*Take a look at the graph that was created. This is our data. Remember, we have to interpret this data to turn it into evidence for our scientific argument. You will use the worksheet* ***How Do Species Impact Other Population Numbers? - Part 2*** *to help you think through the data to create evidence for the argument."* Below is an example of the graph that students will see.



The invaders eat the bugs but do not have any natural predators. This means that since there are fewer bugs, the grass is able to grow (population increase), but there is less food for the birds to eat (keeping this population down).

7. Instruct: "*Compare the graph that shows what happens when the INVADERS are present to the graph you created yesterday when there were no INVADERS present to answer the questions on the bottom of the worksheet*." Below are the questions with the example student answers.

a. What do you notice about the grass population in the graph without invaders?
    i. The grass population goes up and down around about 750. It is the highest number of all populations
b. What is different about the number in the grass population with invaders?
    i. In the graph with invaders the grass population seems to be higher and does not go up and down as much.
c. What do you notice about the bug population in the graph without invaders?
    i. The bug population also goes up and down but it is always a little lower than the grass population.
d. What is different about the number of the bug population in the graph with invaders?
    i. The bug population does not go up and down as much and is a lot lower in numbers than in the graph without the invaders.

e. Below is an example food chain that includes the invaders. Circle the reason why this food chain is not a good representation of the eating relationships among the species.
   i. This food chain does not show the bird eating the bug
   ii. This food chain shows the invader being eaten by the bird
   iii. This food chain shows the grass being eaten by the bug
   iv. BOTH the first and second answer

Argument Construction (20 min)

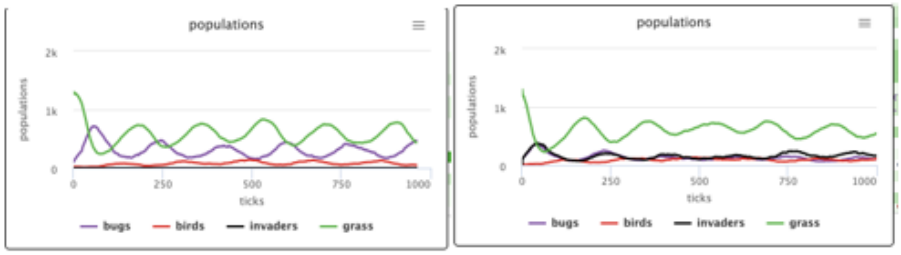
Instruct: "*We now have looked at data and gathered information on invasive species. It is time to use our knowledge to construct an argument to help us answer the scientific question: Do invasive species disrupt normal ecosystem interactions? Let's log into Gooru and complete an* ***Argument Construction****. Follow the instructions on page 55 of your student notebook."*

Construct an argument to address the scientific question below.

Does an invasive species disrupt populations of native species?

Claim: Yes, an invasive species disrupts populations of native species.

Evidence:



On the left is the graph without invaders. Which shows the bug population is high. When you look at the graph on the right, you can see that there are very few bugs in the graph.

Reasoning: The invaders eat the bugs but do not have any natural predators. This means that since there are less bugs, the grass is able to grow (population increase), but there is less food for the birds to eat (keeping this population down).

Rubric:
1 point for correct claim
1 point for correct evidence
1 point for correct reasoning

Wrap-up/Homework (5 min):

Instruct: "*Now that we have looked at how invasives change the population numbers of other species, let's learn a little more about these types of organisms. On page 56 in your Life Right here and Everywhere notebook, you will see directions to completing the* ***Invasive Species*** *activity. You will need to log into Gooru and go through the activity. At the end of the collection, you will be asked to answer a few questions.*"

Questions

24. Invasive species are usually introduced to an area either by accident or on purpose by _____humans_____.

(HINT: Your answer should be one word that tells WHO or WHAT introduces the invasive species.) (1 point)

25. What are some ways that invasive species impact a habitat?

Select "YES" if it is a way that invasive species impact a habitat or "NO" if it is not a way that invasive species impact a habitat . (1 point for all correct)

a. Disrupt food webs YES NO
b. Compete for food and resources YES NO
c. Change the habitat to suit their needs YES NO
d. May lead to the extinction of native plants and animals YES NO

26. Look at the following food chain:

Grass-->Beetle-->Robin-->Hawk

Skyler learns that a new invasive spider that eats beetles is introduced to their area. Look at the following food chains and select the one that represents how the new Spider fits into the food chain. (1 point)

a.
   a. Grass → Spider → Beetle → Robin → Hawk
   b. Grass → Beetle → Spider → Robin → Hawk
   c. Grass → Beetle → Robin → Spider → Hawk
   d. Grass → Beetle → Robin → Hawk → Spider

b. Look at the following food chain:

   Grass-->Beetle-->Robin-->Hawk

   Skyler learns that a new invasive spider that eats beetles is introduced to their area, and now the food chain looks like this:

   Grass-->Beetle-Spider-->Robin-->Hawk

   What will happen to the Beetles, Robins, and Hawks once the Spiders arrive? (1 point)?

   The area will run out of beetles and this will cause the robins and the hawks to get fewer or go extinct because they will have less food to eat.

Life Right Here and Everywhere: Unit 3

How Does Our Eco-Solution Plan Help Reduce Invasive Species?

Teacher Guide

Diamond Fork Middle School

Spring 2022

Unit 3: How Does Our Eco-Solution Plan Help Reduce Invasive Species?

Unit Overview:
This unit guides students in the use of engineering practices to foster three-dimensional science learning to address a local environmental problem. Specifically, students will engage in portions of the engineering design cycle to create an eco-solution plan intended to reduce the number of an invasive insect located in their area. First students conduct research on a local invasive species and a particular trap to capture that insect. Second, students will determine where they will place these traps based on information they have gathered on the insect's life cycle and how the trap functions. They use their information to create and share their eco-solution plan with the class, the school, or other family or community members.

Total Time: 8 45 minute class sessions

Science Concept Overview:
Invasive species are harmful to the ecosystem because they out-compete other organisms for food, shelter, or other needs. They also often have no natural predators that keep the population numbers in check. Because of this, such species can run rampant in habitats, destroying crops, and causing economic hardships. There are several solutions that government agencies, scientists, and farmers have developed to fight the number of invasive species. These solutions are designed with knowledge of the invasive insect's life cycle, food, behaviors, etc. to best address the problem.

Learning Goals	Performance Expectations
Gather, read, and communicate information from multiple appropriate sources about the ecosystem disruption caused by one local invasive species. Develop an eco-solution plan based on specific design criteria to decrease populations of invasive species in the local community. Construct an argument to address the scientific question, *Is our eco-solution plan likely to decrease populations of a local invasive species?* Communicate information through oral and written formats to inform others about your eco-solution plan and evaluate competing design solutions for decreasing invasive species.	Develop and share an eco-solution plan to decrease populations of local invasive species. Utah Science Standards: Evaluate competing design solutions for preserving ecosystem services that protect resources and biodiversity based on how well the solutions maintain stability within the ecosystem. Emphasize obtaining, evaluating, and communicating information of differing design solutions. Examples could include policies affecting ecosystems, responding to invasive species, or solutions for the preservation of ecosystem resources specific to Utah, such as air and water quality and prevention of soil erosion. (LS2.C, LS4.D, ETS1.A, ETS1.B, ETS1.C)

Materials for Unit

- 1 Life Right Here and Everywhere Notebook per student (Pages 57-83)
- 1-internet accessible device;
- Pyramid trap and Sticky trap–pictures, or if possible one physical version of each trap for the whole class;
- List of prices for materials to make traps (in student notebook)
- Colored pencils
- Extra paper

Scientific Glossary of Terms

Engineering
Ideate
Problem defining
Empathize
Eco-solution plan

Lesson 1: Defining the Problem

Daily Overview:

- *Students will read a letter from the Utah Department of Agriculture. This gives students information on the two final products (1) the eco-solution plan and (2) the eco-talk presentation.*
- *Students will be put into groups to begin thinking about how the traps they are asked to use work.*
- *Students will learn about the engineering design cycle*

Time: 45 minute class period

Materials:
1. Life Right Here and Everywhere Notebook per student (Pages 58-63);
2. 1-internet accessible device;
3. Pyramid trap (if available; large pictures can substitute for actual traps);
4. Sticky trap (if available; large pictures can substitute for actual traps)

Prior to implementation: Determine the number of students you would like working in a group. We suggest 2-4 students depending on the time for completion and the comfort of students working around such projects. You will also need to designate what groups will work with what traps. If using actual traps,double-check that the traps students will be looking at are not broken. Finally, take some time to review the aspects of the engineering design process located on page 65.

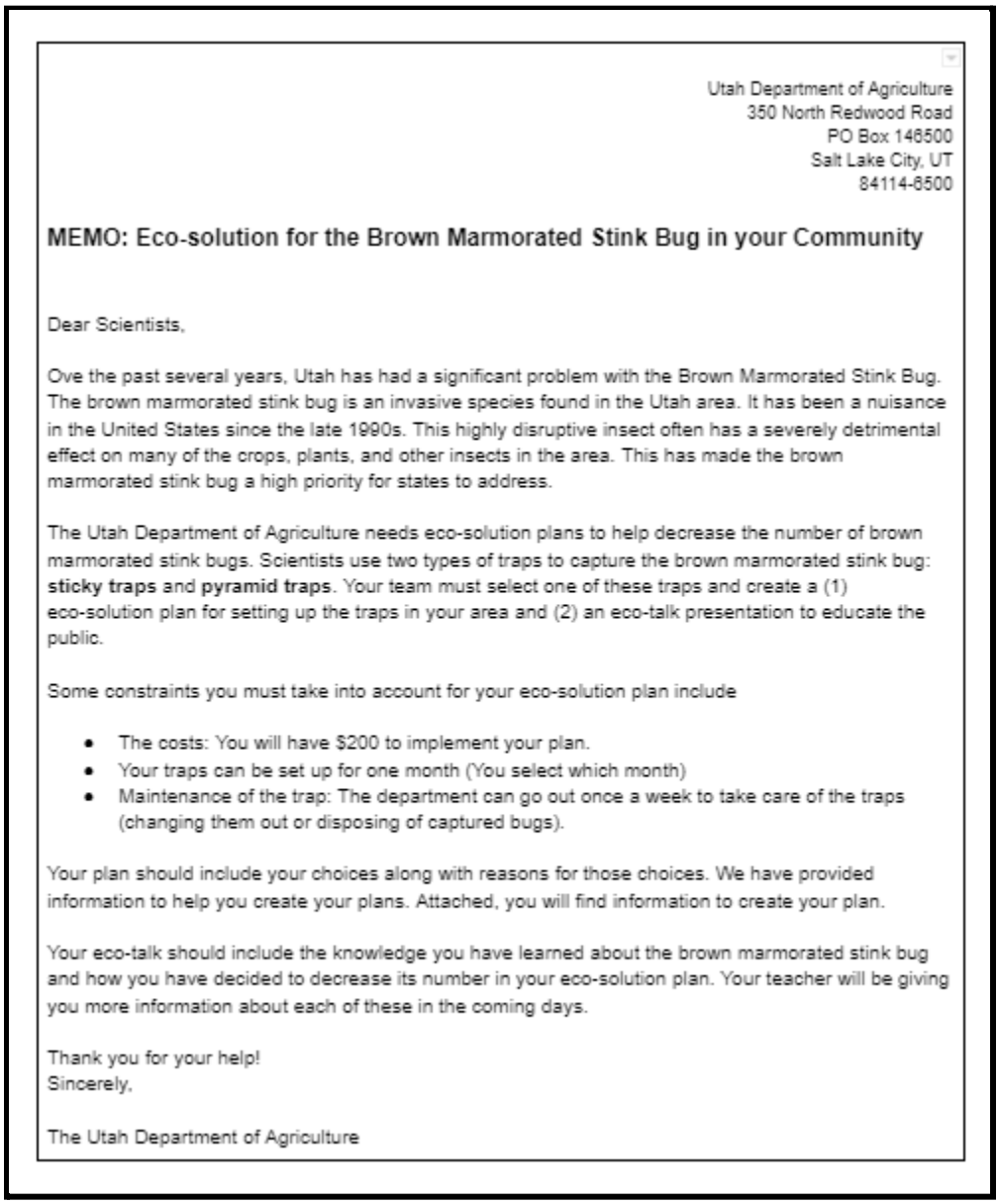
Possible modifications: Virtual environments make it difficult to have students touch and fiddle with physical traps. If the traps are easy to construct by students themselves (and there are resources available for supplies) students can construct their own trap and try it out in their backyard. Otherwise, try to provide examples from different angles and ask students questions about the materials, textures, and their experiences with these traps/materials).

Lesson Plan

Getting Started (20 minutes):
Instruct: *"Last week we learned about how invasive species can impact the habitats and decrease population numbers of other species. Because of this, invasive species can be a real problem for almost every place around the world. For the rest of this unit, we will be looking at an invasive species that lives in our state and understand how we can engineer solutions to this problem. Does anyone know of an invasive species in our state?* (Press students to see if they know why this is an invasive species. Write a list on the board for organisms students say). *Does anyone know of an invasive species that affects other states?* (again write these on the board)*"* Sample answers: Utah- Zebra Mussels, Hydrilla, Africanized Honeybees. Other states- Iguanas, lion fish, pythons, spotted lanternflies.

Instruct: "*Turn to page 58 of their Life Right Here and Everywhere Notebook. Under the section* ***Getting Started*** *you will see a letter from the Utah Department of Agriculture. The Utah Department of Agriculture has put out a call for scientists to develop plans for how to address*

one specific invasive species: the brown marmorated stink bug. Has anyone heard about this insect? (Have students raise their hands to offer information. Accept all information at this point). *Let's read this letter to see what the Department of Agriculture says.*" Provide students with 5-7 minutes to read the letter asking students to submit plans for how to combat a local invasive.



Utah Department of Agriculture
350 North Redwood Road
PO Box 146500
Salt Lake City, UT
84114-6500

MEMO: Eco-solution for the Brown Marmorated Stink Bug in your Community

Dear Scientists,

Ove the past several years, Utah has had a significant problem with the Brown Marmorated Stink Bug. The brown marmorated stink bug is an invasive species found in the Utah area. It has been a nuisance in the United States since the late 1990s. This highly disruptive insect often has a severely detrimental effect on many of the crops, plants, and other insects in the area. This has made the brown marmorated stink bug a high priority for states to address.

The Utah Department of Agriculture needs eco-solution plans to help decrease the number of brown marmorated stink bugs. Scientists use two types of traps to capture the brown marmorated stink bug: **sticky traps** and **pyramid traps**. Your team must select one of these traps and create a (1) eco-solution plan for setting up the traps in your area and (2) an eco-talk presentation to educate the public.

Some constraints you must take into account for your eco-solution plan include

- The costs: You will have $200 to implement your plan.
- Your traps can be set up for one month (You select which month)
- Maintenance of the trap: The department can go out once a week to take care of the traps (changing them out or disposing of captured bugs).

Your plan should include your choices along with reasons for those choices. We have provided information to help you create your plans. Attached, you will find information to create your plan.

Your eco-talk should include the knowledge you have learned about the brown marmorated stink bug and how you have decided to decrease its number in your eco-solution plan. Your teacher will be giving you more information about each of these in the coming days.

Thank you for your help!
Sincerely,

The Utah Department of Agriculture

At the end of the letter from the DOA is the template that students will fill out with their eco-solution plan. This will be what they will be turning into the DOA. Instruct: "*At the end of the letter from the Department of Agriculture, you will see what you will be asked to submit. Take a quick look at it. You will be completing parts of this over the next several class periods.*"

Eco-Solution Plan

Draw and label the parts of your trap.

Materials list: List all the materials you will need to set up your traps

Item	Price per unit	Total number	Total price

How many traps can you make?

*One-time materials are things you only need to buy once and then can reuse. This could be hammers, shovels, etc.

** Materials per trap are materials that you need for each trap you make. These materials will need to be bought for each trap you make.

NUMBER OF TRAPS_____

TOTAL COST_____

Trap Placement

1) Draw a quick sketch of the area where the traps will be placed. Don't forget to use measurements (how big of an area are you using, how far apart will the traps be placed, etc.).

2) Provide more information on the area you chose.
   a) What type of plants and animals are in this area?

   b) What non-living things are in the area?

3) Give 2 pieces of **evidence** for why these are 'good' placements for the traps. (Think about what you know about the brown marmorated stink bug).
   a)
   b)

Putting Students into Groups (7 minutes):

Instruct: "*As you can see, the eco-solution plan asks for a lot of information. This is to help the department of agriculture determine which plan will "best" assist the local neighborhood to decrease the number of brown marmorated stink bugs. You will be working in groups to support the creation of this eco-solution plan. Right after I place you in groups, you will need to come up with a group name that you will use throughout. This will be your eco-solution team name that you will submit your plans under. When your group has decided on a name, write it at the top of the page in your workbook (everyone should have it at the top of their own workbook).*"

The teacher will assign students to groups. We recommend students be in groups of 2-4. Once students are assigned to groups, give students 5 minutes to think of a team name.

Instruct: "*The letter from the department of agriculture talks about two possible traps that can be implemented. Each group will be instructed to do research on one only of the traps in the picture. This will be the trap that you will construct your eco-solution plan around.*" Teacher will assign each group a trap to research more about.

Initial brainstorming about traps to help invasives (20 minutes):
Instruct: The teacher will show a sticky trap and a pyramid trap (either provided by the LRH&E team or by the teacher). Instruct "*These are the traps that you all will be researching and designing solution plans around. Before we use these to create an eco-solution plan, we need to learn more about how they work. In front of you, you will see a version of each trap talked about in the Department of agriculture letter. Take a minute to examine the trap. Note any questions you are thinking about in the corner of your Life Right here and Everywhere Notebook, page 62 on the section about* ***Brainstorming****.*"

After all students have had a chance to play with/touch the trap, place the trap at the front of the classroom. Direct students to the **Brainstorming** section in their Life Right Here and Everywhere Notebooks page 62. Here they will see a picture of the two types of traps. Instruct, "*Now that you have seen a physical version of the trap, use the picture in your notebook to diagram how you think this trap works. Think about drawing arrows and writing short sentences about how you THINK the trap works."* As the teacher goes around the classroom ask students questions that make their thinking visible such as, "Why do you think that?" "Are there any other reasons (or uses) for this component?"

Wrap-Up/Homework:
Instruct: "*To complete the eco-solution plan, you will be engineering a solution. Much like science, engineering is a process through which new inventions and knowledge is constructed. For homework, you will be learning more about the engineering design process you will be going through over the next couple days.*" Direct students to **The Engineering Design Process** in Gooru. They will have instructions in their notebooks on page 63. Students will be introduced to what the engineering design process is and how it can be used to construct solutions to environmental problems. At the end of the collection, students will complete the assessment with the questions below:

1. Which of the following best describes the engineering design process?
    a. A rigid set of steps to follow
    a. Only contains building and testing prototypes
    b. A set of interconnected phases that can overlap and are not always followed in a given order
    c. None of the above describe the engineering design process
2. Nicole, a student from Pennsylvania, noticed a lot of one type of insect on the trees in her backyard. She found out the insect is the Spotted Lanternfly, an invasive species from Asia. From the list of questions below, what is an engineering problem that could be solved?
    a. How long does the Spotted Lanternfly live?
    b. How can we reduce the number of lanternflies in the area?
    c. Where does the Spotted Lanternfly live?
3. Nicole developed a plan for where she wants to place spotted lanternfly traps in her neighborhood. After she comes up with her idea, what does she need to do to see if it works?
    a. Refine and revise the prototype
    b. Create a prototype
    c. Test out the prototype
    d. All of the above

Lesson 2: Research and Information Gathering

Daily Overview:

- *Students will brainstorm how they have already begun to work within the engineering design cycle with the things they have done in previous units.*
- *Students will conduct research from several sources about the life cycle, habitat, and behavior of the brown marmorated stink bug.*
- *Students will complete a portion of the Eco-solution plan*

Time: 45 minute class period

Materials:

1. 1-internet accessible device per student;
2. 1 Life Right Here and Everywhere Notebook per student (Page 64-67)

Prior to implementation: Check to see if your school internet supports the websites listed and that the links are still active. To do this, go into Gooru and click on the Unit 3 Lesson 2 header. Go to the collection titled Research on the Brown Marmorated Stink Bug. If any link does not work, make a note of it so students do not use the link. You can also contact the Life Right Here and Everywhere team to delete the link.

Possible modifications: The ADW pocket guide provides one means through which students can gather information about insects. We have also provided resources that students can use for research. If students are familiar with other reliable resources those can also be used. If time, this lesson could be a place to introduce information about reliable vs. unreliable sources for scientific information.

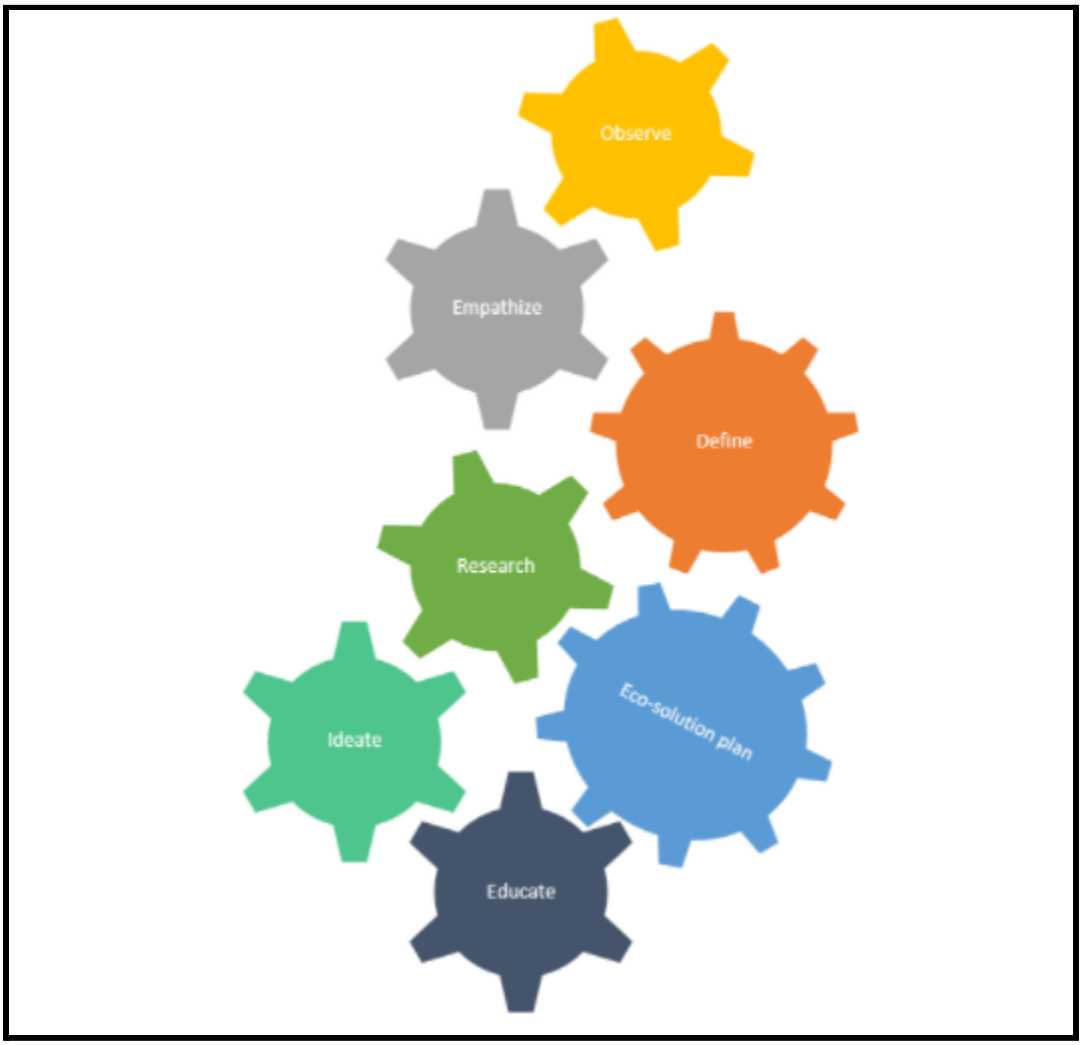
Supports: Finding productive information can be difficult. Many websites (including ADW) have more information than what is needed to complete the assignment. Students may need assistance keeping focused on the task at hand. For students who want to look at more information, have them write down questions they have and ask why that particular piece of information would be important. They can do more research later if possible. But keep their curiosity flowing!

Lesson Plan

Getting Started (10 minutes):

Instruct *"Last night for homework you learned about the engineering design cycle. You have a copy of that design cycle in your Life Right Here and Everywhere Notebook under the* ***Getting Started*** *section (page 65). To help us create our eco-solution plans, we will be going through portions of this design cycle. We have already been working within some of these "gears". Which ones do you think we have been addressing over the past few weeks?"* Have students raise their hands to answer. They have been working in the Observe, Empathize, and Define gears. *"To remind us what we are working towards, let's write some information next to these three gears. Next to the Observe gear write about what we know about the problem with any invasive species. Next to the empathize gear, write why we care about this problem. Finally, next to the Define, write what we have been tasked with doing. When we think about designing*

solutions, what do we need to take into account? (students should talk about the constraints which are listed in the letter). *While we are going through the next gears, what should we think about as we are designing our eco-solution? What might you want to know to make the "best choices" for your plan?* (Help students to think about the fact they will need to conduct research to learn more about the brown marmorated stink bug and the trap they will use). *Researching prior to designing solutions is an important part of engineering. We must think about what is already known and apply this information to our eco-solution plan."*



Begin Research in ADW (35 minutes)

Direct students to **Brown Marmorated Stink Bug Research** in their Life Right Here and Everywhere Notebooks page 66. Instruct "*We have pulled together some questions and websites that can help you and your team be better informed when designing your eco-solution plan. You will be working with your group today to answer these questions. You can also find the links for the resources in Gooru.*"

Pass out or direct students to computers or iPads to complete their research. They can use the rest of the time to work on this research.

Instruct: "*Now that you are at your computers, login to Gooru.* (if students are working from one computer in groups, have one person login to Gooru)*. You will click on the Unit 3 header. Next Select Lesson 2. Here you will see a collection titled Research on the Brown marmorated Stink bug. You can copy and paste the links from this resource to do your research."*

Brown Marmorated Stink Bug Research

Our Team_____
_____
_____
_____

Trap Selected_____

For the next few days, you will work in your group to better understand the brown marmorated stink bug. We will be using our own observations and information from other sources.

Working in your groups, use the resources below to answer these questions.

1. Draw the life cycle of the stink bug.
2. Where does the stink bug live?
3. What does the stink bug eat?
4. What other insects are affected by the stink bug being in Utah?
5. Why is the stink bug considered an invasive species?

Resources for information gathering

About the brown marmorated stink bug:
https://animaldiversity.org/
https://extension.psu.edu/brown-marmorated-stink-bug
https://extension.usu.edu/pests/files/pubs/inv-insect-field-guide.pdf
http://www.stopbmsb.org/stink-bug-basics/
https://entnemdept.ufl.edu/creatures/veg/bean/brown_marmorated_stink_bug.htm

** You may need to find additional information. Remember to use specific keywords in search engines **

<u>Wrap-Up/Homework</u>
After their research, students will complete an argument in Gooru. The instructions for this assignment can be found in their Life Right Here and Everywhere Notebook on page 67. They can use the research they have completed to help them answer

Our Scientific Argument

Scientific Question: Is the brown marmorated stink bug an invasive species?	
Claim A claim is a complete sentence that answers the scientific question.	Yes, the brown marmorated stink bug is an invasive species.
Evidence Evidence is observations, data, or information that helps you answer the scientific question.	The brown marmorated stink bug destroys X trees each year. The brown marmorated stink bug can destroy crops causing lose of money.
Reasoning Reasoning tells why your evidence supports your claim. You can use scientific definitions or ideas to explain why you chose the evidence you did.	Invasive insects cause significant biological and economic impacts. They do not have any natural predators and can grow unchecked.

Lesson 3: Planning Trap Design

Daily Overview:

- *Students will finish their research from multiple resources about the trap they were assigned to use in the creation of their eco-solution plans.*
- *Students will complete the first part of their Eco-Solution plan which asks them about the traps and budget for their plan.*
- *Students will use their work to determine how many traps they can afford on their budget.*

Time: 45 minute class period

Materials:

1. A picture of the traps or, if possible, a physical version of the trap
2. List of prices for materials
3. 1 Life Right Here and Everywhere Notebook per student (Page 68-83)
4. 1 internet-accessible device

Prior to implementation: Check to make sure the links are working. There is a collection in Gooru that lists the resources for students to click on or copy-paste. If there are any broken links please contact the Life Right Here and Everywhere team.

Possible modifications: For classes that need a little more guidance with working with online resources, you can cut down the number of resources. The resources cover similar information and not all need to be used to complete the assignment.

Lesson Plan

<u>Introducing Assignment (5 minutes)</u>
Instruct: "*Yesterday you all did a lot of research about the life cycle, habitat, and behaviors of the brown marmorated stink bug. Today, we will use this information to think about how the traps work. This will help us to think more about how they work and our eco-solution plant. You will be completing two parts of the research. The first will ask you to look up how the trap works. The second part of the research will have you think through the materials you will need to construct the traps for your plan. Turn to page 69 in your Life Right Here and Everywhere notebook to complete this research.*"

<u>Background Research (20 minutes):</u>
Instruct*: "You will start by working with your groups to determine how the trap works. You will have 20 minutes to do this. While you have a list of resources in your Life Right Here and Everywhere notebook (pages 69-70), you can also find the links for the resources in Gooru. DO NOT move on to the second portion yet. I will stop the class and introduce this section halfway through the class period. You will have the rest of the class to complete this section.*"

Allow students to access the computer to complete their research. Give them periodic time checks.

Instruct: "*Now that you are at your computers, login to Gooru.* (if students are working from one computer in groups, have one person login to Gooru)*. You will click on the Unit 3 header. Next Select Lesson 3. Here you will see a collection titled Research for trap planning. You can copy and paste the links from this resource to do your research."*

Trap Planning

Our Team_____
_____
_____
_____

Trap Selected_____

How does the trap work?

To help you better construct your implementation plan, you will need to understand how the trap your group selected works. Use the websites on the following page to learn more about the traps you selected and answer the following questions:

1. What are the steps to setting up your traps?

2. What part of the brown marmorated stink bug life cycle does it attack?

3. Why do you think this might work to help reduce the stink bug population?

4. Are there any safety concerns to be aware of?

5. What time of year will work best?

6. Why is this time of year the best to do this?

Materials and Budget Research (20 minutes):

Instruct: "*Now that we have started to understand how the traps work, we are ready to start thinking about how many traps we can afford. To do this, we have to start thinking about our budget. Turn back to the letter from the Department of Agriculture, what are the constraints or limits that the department put on our eco-solution plans?*" (Students should say The cost of implementing: $20 to implement, -2 hours to set up the traps, once a week to take care of the traps, such as changing them out or disposing of captured bugs).

Instruct: "*Based on these limitations, what do we need to consider when we are budgeting and making a timeline?"* (Students should say how much materials cost, the estimated time it will take to set up each trap, budget.)

Instruct: "*Your groups can begin to look at how much the materials will cost to create these traps.Each group has a material list in the student notebook so you can find out how much you will be spending and the number of traps you can make. REMEMBER there are materials on here for each trap you do not need all these materials for each trap.*"

Walk around the class occasionally to help with student questions. When students have finished their work, do a quick check that the cost is within the limits and that the timeline is reasonable for the constraints.

When Done with Research:
Instruct: *"When you and your group are done with your research, take a look at your eco-solution plan on page 60 of your Life Right Here and Everywhere notebook; fill in the first page of the template. Use your research and your budgeting to help you fill it in. Every person in the group should write down this information in their own notebooks."*

Wrap-Up/Homework:
For **Homework**, students will complete a short assessment in Gooru. The instructions for this assignment can be found in their Life Right Here and Everywhere Notebook on page 71. They can use the research they have completed to help them answer

1. Use the table below to help you answer the question. The Department of Agriculture has given you $50 to support your eco-solution plan, what are the most traps can you make?

Item	**Cost for 1**
Lumber	$3.00 per board
Box of Nails (one time buy)	$1.00 per box
Sticky plastic	$2.00 per sheet
Markers (one time buy)	$4.00 per box

   a. 9 traps
   b. 50 traps
   c. 10 traps

2. Use the same table (above) to help you answer the question. You notice that you have enough room to put two sheets of sticky plastic on your traps to help capture more invasive insections. If you put two pieces of sticky plastic, what is the most number of traps you can make with your $50?
   a. 9 traps
   b. 6 traps
   c. 2 traps

Lesson 4: Ideating Trap Placement

Daily Overview:

- *Students will make observations about their schoolyard to determine where they would like to place their traps.*
- *Students will use the research they have been doing to select the "best" place(s) for their trap placement.*

Time: 45 minute class period

Materials:

1. 1 internet-accessible device;
2. A picture of the traps or, if possible, a physical version of the trap
3. 1 Life Right Here and Everywhere Notebook per student (Pages 72-74)

Prior to implementation: Select the area in the schoolyard students will be working on. Walk the area to note any possible safety issues that would need to be addressed. This should be an area that has a variety of components (i.e. you do not want to pick a field that is completely covered in grass only). Select an area that would allow students some choice in different spots they might want to choose.

Supports: Bringing in the science will be key for this lesson. Students should be pushed beyond guessing what their plan should look like to making informed decisions. Teacher questioning will be especially important for students who are not used to this type of thinking. Questions should include "What about our understanding of the invasive species is important to think about when placing our traps?" "What scientific evidence do you have that supports these choices?"

Lesson Plan

<u>Getting Started (5 minutes)</u>
Instruct: "*Yesterday your groups made a budget to determine how many traps you would be able to make and place for your eco-solution plans. Today, we will be looking at where we might be able to place those traps. The department of agriculture has asked that we propose an area that we have access to, so we will be looking at where we can place the traps within our own schoolyard. We will be going outside to make some notes on this area, but before we do, let's think about some things we know about this area. Under the* ***Getting Started*** *part of your Life Right Here and Everywhere notebook page 73. You will find instructions to log into Gooru and get some initial brainstorming down.*"

Give students about 5 minutes to write down their thoughts. When they are done, have students' raise their hands to tell some of their initial thoughts about the area. Prompt students to think about what they already know is in the area, what might be some problems they think might come up, or areas they think might be good places. For each answer, try to press students about their response. (For example, if they are saying a certain spot might be good for the trap, ask them why.) Students will see the following slide in Gooru.

<u>Setting Up Observations (5 minutes)</u>

Ask students to turn to page 74 in their Life Right Here and Everywhere notebooks they will be working on the **Possible places for trap placement**. They will have a page to take some notes about the area they will be placing the traps. Instruct: "*When we go out to observe the area, keep these questions in mind. Your task will be to select some places that your group would like to place the traps. Remember, you must find a spot to place each of your traps. Each place must have a reason behind why your group has decided to place your trap there. Since no place will be perfect, you will also need to write any problems or downsides to that place you selected. It could be a good idea to select more areas than you need to have options for tomorrow.*"

Possible places for trap placement:

Our Team_____
_____
_____
_____

1. After your teacher tells you where to go, look in your area for good places to put your traps.
2. List every place you think might be good. Don't rule out anything yet!
3. Fill in the table below with at least three places.

Short place description or name	Why is this a good area?	Why might this not be a good area?

Selecting the best spot:

1. Your group needs to select the spot(s) that are the best for your traps.
2. Your choices should include what you know about the needs, habitat, and life cycle of the brown marmorated stink bug.
3. On the table above, circle the location you think is the best one.

Review Safety Precautions (5 minutes):

Instruct: "*Before we go outside, we need to review the safety precautions and rules for outside observations. Remember: -We are observing, do not touch/ disturb the environment. -Watch your surroundings at all times. Be careful where you step. -Do not go outside the designated*

*area. -Stay in groups of at least 2. -If you have any problems, report them immediately." (*Add in any other safety precautions you have or other norms for observing).

Walk students outside. Remind them of the area they will be working within and the boundaries.

Student Outdoor Observations (20 minutes):
Students will have 15 minutes to walk around and determine where they will place their traps.

After 15 minutes of observations, pull students back together to walk back into the classroom.

Observation Debrief (10 minutes)
Once students are back in the classroom, have students get with their groups again to talk about which spots they like the best and why. Students can rank the spots they believe are the best. Instruct: *"When you and your group are done with your research, take a look at your eco-solution prototype on pages 60-61 of your life right here and everywhere template; is there anything that you can fill in based on your research? If so, please fill it in. You will have time tomorrow to finish this if you do not get it done."*

Lesson 5: Does Our Eco-Solution Plan meet the Needs of the Department of Agriculture?

Daily Overview:

- *Student groups will finish their eco-solution plans.*
- *Students will justify their eco-solution plan through the argument to answer the question: "Does Our Eco-Solution Plan meet the Needs of the Department of Agriculture?*

Time: 45 minute class period

Materials:

1. 1 internet-accessible device per student or one per group
2. Life Right Here and Everywhere Notebook (Page 75-77) and students' previous work in the Life Right Here and Everywhere Notebook (pages 60-62, 66, 29, 74)

Prior to implementation: Review students' Eco-solution plan to see if there might be any problems answering the question. Students' will be using their research and scientific knowledge to support their claim (claim: our eco-solution plan increases biodiversity by reducing the number of invasive species in the area). Students' previous work should show the connection to the ideas of food webs, life cycle, and trap function to be able to answer this question. Students who have done more of a trial and error/guessing for where to put the traps will struggle to provide evidence and reasoning to answer the question.

Supports: We have added a review of the parts of an argument for students who still struggle with claim, evidence, and reasoning. This collection is in Gooru and can be assigned prior to the argument construction.

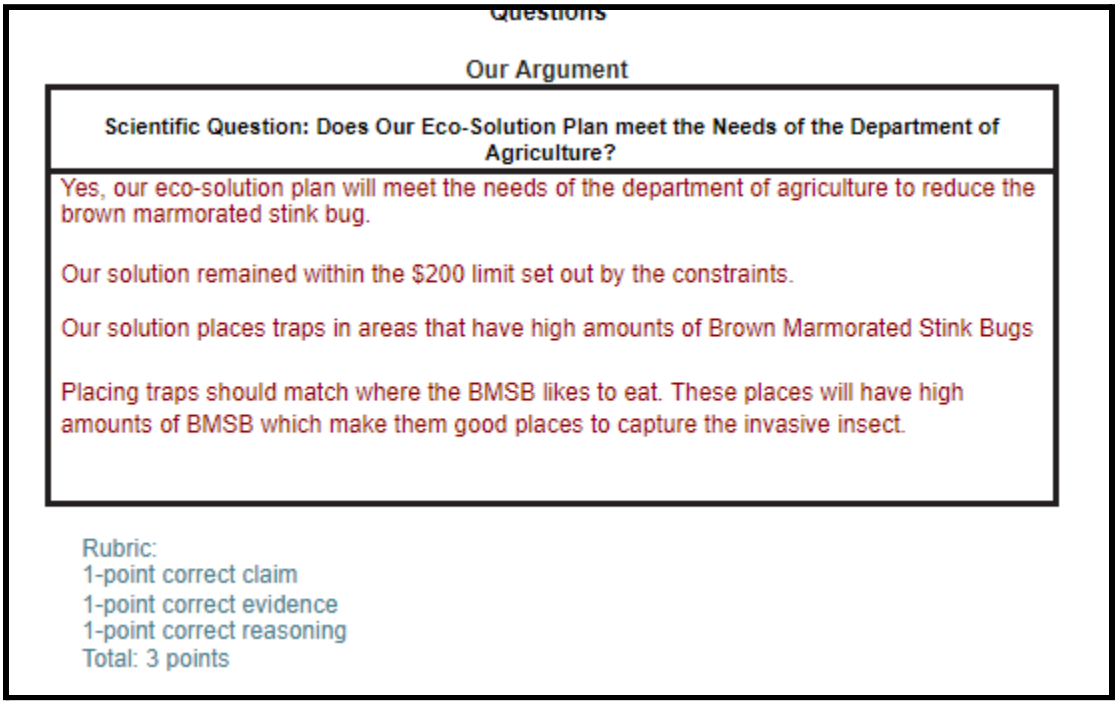
We have added in scaffolds for the argument since it is slightly different from the previous arguments. While the other arguments have been focused on answering a scientific question, this argument is more about showing how their eco-solution plan can reduce the number of invasives. Therefore, students should make sure that their argument connects the science to their plan.

Lesson Plan

Finishing Final Eco-solution Plan (20 minutes)
Instruct: "*Get back in your groups to finish up any last-minute components of your eco-solution plans. You will have 20 minutes to finish up.*" Go around the classroom for 20 minutes to answer any last-minute questions.

Argument Construction (25 minutes)
Instruct: "*Today you will be constructing an argument on your own. You will be answering a more detailed question that pulls together what you have been learning and researching over the past couple of weeks. This question will combine the science as evidence and reasoning why you have placed your traps where you did. You will be working in Gooru individually to construct your argument around the question: Does Our Eco-Solution Plan meet the Needs of the Department of Agriculture?"* Direct students to Gooru for their **Argument Construction 5**

Instructions for logging into Gooru and the assignment can be found on page 7 in their Life Right Here and Everywhere.



Questions

Our Argument

Scientific Question: Does Our Eco-Solution Plan meet the Needs of the Department of Agriculture?
Yes, our eco-solution plan will meet the needs of the department of agriculture to reduce the brown marmorated stink bug. Our solution remained within the $200 limit set out by the constraints. Our solution places traps in areas that have high amounts of Brown Marmorated Stink Bugs Placing traps should match where the BMSB likes to eat. These places will have high amounts of BMSB which make them good places to capture the invasive insect.

Rubric:
1-point correct claim
1-point correct evidence
1-point correct reasoning
Total: 3 points

Presentation Planning (if time)

If students finish early, have them start to look at the lesson for tomorrow. Students can begin to think about the type of presentation they would like to create. They can also begin to think about the information they would like to have in their presentations. For those who begin this part, remind them that they will be working with their same group.

Lessons 6-7: Eco-Talk (Creating)

Daily Overview:

- *Students will construct an Eco-Talk and an accompanying infographic, powerpoint, poster etc. to share with the local community.*

Time: 45 minute class period

Materials:

1. 1 internet-accessible device per group;
2. Life Right Here and Everywhere Notebook (Pages 78-80)
3. Colored pencils
4. Extra paper

Prior to implementation: Select how you would like your students to do their presentations. You may either take volunteers or pre-select the order of presenters. Students will have worked in groups, so depending on the norms of the classroom, the presentation could look very different (one speaker, multiple speakers, etc.) Depending on the number of groups, you will also want to decide on the length of the presentations and whether students will present their entire work, or just a portion.

Supports: Students' plan presentation format should be created with Canva (http://canva.com). This is an easy-to-use graphic design tool that will allow you to create a wide variety of graphical formats. Students can use one of Canva's many templates, as well as their extensive library of images and graphics. As the teacher, you may want to familiarize yourself with Canva and how it works.

Lesson Plan

Eco-Talk Presentations Introduction (10 minutes):

Instruct: ""*During the past week, you have been actively working on different parts of your Eco-Solution Projects; first, you conducting background research on invasives, including where they live, their lifecycle, what they eat,etc., and then you learned about the function of the traps and where they should be placed. For the rest of the class period you will be working with your groups to construct the final product for the Department of Agriculture. You will script out who will say what to answer the following bullet point:*

- **Title of your Eco-Talk.** Catch people's attention with an eye-catching title.
- **What are Brown Marmorated Stink Bugs?**
- **Why are they not wanted in North America?**
- **What is our solution?**
- **How do we know it will work?**

You will have today and tomorrow to complete your eco-talk presentations in class. On [Date] you will present this to the class! This information and directions can be found in your Life Right Here and Everywhere notebook on page 79-80 under the ***Eco-Talk Presentations*** *in lesson 6."*

"You will complete the the Eco-Talk planning document to help you get started. Notice at the bottom it says to STOP. I will be checking each of your planning documents prior to starting work on the computer. You and your group will need to make any necessary changes prior to moving on. You can begin working with your group now."

Eco-Talk Presentation
Our Team_____

_____
_____
_____

Directions
Now that you've decided on what types of traps to create, what time of year they need to be placed, as well as the best location or location for your traps, it's time for you to educate your community! Remember, you want to encourage people in your community to do their part to set up traps! You'll want to use your Eco-Solution Plan to create your Eco-Talk to **inform** people of the stink bug problem and **persuade** them to take action in a way that's both *fun* (meaning that people want to look at it) and *accessible* (meaning that many people will see it). Here are some plan presentation formats that you can select:

- An infographic (An infographic is a long-form graphic that uses pictures, charts, and data, to communicate information about a subject. Check out some examples here: https://piktochart.com/blog/10-great-infographics-education/)
- A poster
- A pamphlet
- A video
- A presentation with slides (like PowerPoint)
- Etc. (If your idea is not listed here, you may want to discuss it with your teacher.)

You'll also need to include at least the following information in your Eco-Talk presentation.

1. **Title of your Eco-Talk.** Catch people's attention with an eye-catching title.
2. **What are Brown Marmorated Stink Bugs?**
3. **Why are they not wanted in North America?**
4. **What is our solution?**
5. **How do we know it will work?**

Title of Eco-Talk:

Who, in the community, do you want to present your Eco-Talk to?

_____

_____

(This could be as general as "People in Spanish Fork," or as specific as "My friend's older sister.")

Why did you choose this person or people? _____

_____

What's the best format for your Eco-Talk presentation? _____

_____

(infographic in Canva, posters around town, etc.)

The reason we chose this is: _____

_____

Brainstorm how your team will create your Eco-Talk. Which team member does which parts? What needs to be done first? Second?

1._____

_____

2._____

_____

3._____

_____

_____

STOP!

Your teacher must approve your Eco-Talk before you can begin working.

After groups have completed and gotten their plan signed off on, have them login to Canva (http://canva.com). Students should choose the graphical format they planned. They can use a blank canvas or an already-created template. They can also search for almost any graphic they can imagine (including Utah, stink bug, etc.) through Canva's graphic search (though some are not free). They can also import their own images (from Google, ADW, etc.).

Students may also want to sketch out their graphic before they make it. Provide them with colored pencils and (potentially) extra paper, though they can also use their student notebooks to draw.

Lesson 8: Sharing Our Eco-Solution Plans (Presentations)

Daily Overview:

- *Students will present their Eco-Talk presentations with the class or other local audiences.*

Time: 45 minute class period

Materials:

3. 1 internet accessible device;
4. Life Right Here and Everywhere Notebook (Pages 81-83)

Prior to implementation: Select how you would like your students to do their presentations. You may either take volunteers or pre-select the order of presenters. Students will have worked in groups, so depending on the norms of the classroom, the presentation could look very different (one speaker, multiple speakers, etc.) Depending on the number of groups, you will also want to decide on the length of the presentations and whether students will present their entire work, or just a portion.

Possible modifications: You may wish to invite others to the class presentations. School administrators or parents can position students to think about these presentations beyond a class assignment. If possible, you can invite other stakeholders such as scientists, government officials, or community members.

If time does not permit the sharing of presentations, make sure student work is posted to the school website or the Life Right Here and Everywhere website to allow student work to be showcased.

Lesson Plan

<u>Finalizing presentation/Uploading our Eco-Talk to Gooru (10 minutes):</u>
Instruct: "*Yesterday, you all started working with your groups to decide who will present which part of the Eco-solution plan. This information and directions can be found in your Life Right Here and Everywhere notebook on pages 79-80 under the* ***Eco-Talk Presentations*** *in lesson 7. Remember, you are answering the following bullet points:*

- **Title of your Eco-Talk.** Get people's attention with an eye-catching title.
- **What are Brown Marmorated Stink Bugs?**
- **Why are they not wanted in North America?**
- **What is our solution?**
- **How do we know it will work?**

You will have 10 minutes to finish up any last minute planning with your group before we start presentations. When you are complete, you will upload your final presentation to Gooru. Each person in the group will submit a version of the presentation. You can find the directions to do this in your Life Right Here and Everywhere notebooks on page 82"

Allow students 10 minutes to finish up planning.

Presentations (25 minutes):
Instruct: "*You should all have what you are going to say for your group presentations, we will begin learning what others came up with.*" Call groups up one by one to present.

Wrap-Up/Homework (5 minutes)
If there is time, direct the class back to Gooru to complete a survey about their experience working with the Life Right Here and Everywhere curriculum. Students will go to the **Life Right Here and Everywhere Survey** and copy/paste the link for the google survey form. This is anonymous so encourage students to be honest. If there is no time in class, assign this for homework.