

5E Arts Integrated STEM Lesson Plan – Template

Lesson Title: Ecology Near and Far

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Topic: Ecosystems, species interactions, biotic and abiotic factors, biodiversity, human impact, urban ecology

Targeted Grade Level: 9th grade biology

Time Needed: 5-7 50-minute periods.

Subject Integration: Science, Art, Technology

Justification: In this lesson, I want to bring in this historical work of scientists who shared understanding of the world through sketching. I also want students to appreciate that today, we can easily capture phenomena at any given moment with a photograph. By using both art and technology, I want students to be aware that the ecological concepts we discuss in class are present and observable all around us- even in our urban environment of New York City. Students will create an ecological portfolio, observing and capturing concepts in our local ecosystem through both sketches and photography.

Standards:

NGSS Performance Expectations

HS-LS2-1. Use mathematical and/or computational representations to support explanations of biotic and abiotic factors that affect carrying capacity of ecosystems at different scales. [Clarification Statement: Emphasis is on quantitative analysis and comparison of the relationships among interdependent factors including boundaries, resources, climate and competition. Examples of mathematical comparisons could include graphs, charts, histograms, and population changes gathered from simulations or historical data sets.]

[Assessment Boundary: Assessment does not include deriving mathematical equations to make comparisons.]

HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.* [Clarification Statement: Examples of human activities could include urbanization, building dams, and dissemination of invasive species. Examples of solutions could include simulations, product development, technological innovations, and/or legislation.]

HS-LS2-8. Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.

[Clarification Statement: Emphasis is on: (1) distinguishing between group and individual behavior, (2) identifying evidence supporting the outcomes of group behavior, and (3) developing logical and reasonable arguments based on evidence. Examples of group behaviors could include flocking, schooling, herding, and cooperative behaviors such as hunting, migrating, and swarming.]

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts:
<p>Asking Questions and Defining Problems Asking questions and defining problems in 9-12 builds on K-8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations. ■ Ask questions that arise from examining models or a theory to clarify relationships. (HS-LS3-1)</p> <p>Obtaining, Evaluating, and Communicating Information Obtaining, evaluating, and communicating information in 9– 12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs. ■ Communicate scientific information (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically).</p>	<p>LS2.A: Interdependent Relationships in Ecosystems ■ Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem. (HSL2-1),(HS-LS2-2) ■ (NYSED) Carrying capacity results from the availability of biotic and abiotic factors and from challenges such as predation, competition, and disease. (HS-LS2-1),(HSL2-2)</p> <p>LS2.C: Ecosystem Dynamics, Functioning, and Resilience ■ (HS-LS2-2),(HS-LS2-6) ■ Moreover, anthropogenic changes (induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species,</p>	<p>Patterns ■ Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HSL4-1),(HS-LS4-3)</p> <p>Science is a Human Endeavor ■ Technological advances have influenced the progress of science and science has influenced advances in technology. (HS-LS3-2),(HS-LS3- 3),(New NYSED PE)</p> <p>■ Science and engineering are influenced by society and society is influenced by science and engineering. (HS-LS3-2), (HS-LS3-3),(HS-LS1-8)</p> <p>Scale, Proportion, and Quantity ■ The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. (HSL2-1) ■ Using the concept of orders of magnitude allows one to understand how a model at one scale relates to a model at another scale. (HS-LS2-2)</p>

overexploitation, and climate change — can disrupt an ecosystem and threaten the survival of some species. (HS-LS2-7)

LS2.D: Social Interactions and Group Behavior

- Group behavior has evolved because membership can increase the chances of survival for individuals and their genetic relatives. (HS-LS2-8)

New York State Next Generation Learning Standards:

ELA/Literacy – 11-12.RST. 1 Cite specific evidence to support analysis of scientific and technical texts, charts, diagrams, etc., attending to the precise details of the source, and attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

11-12.SL.5 Make strategic use of digital media and/or visual displays in presentations to enhance understanding of findings, reasoning, and evidence, and to add elements of interest to engage the audience.

11-12.WST.7 Draw evidence from informational texts to support analysis, reflection and research.

NYS Regents Standards:

Standard 1:

1.1a Scientific explanations are built by combining evidence that can be observed with what people already know about the world.

1.1b Learning about the historical development of scientific concepts or about individuals who have contributed to scientific knowledge provides a better understanding of scientific inquiry and the relationship between science and society.

Standard 4:

- 1.1a Populations can be categorized by the function they serve. Food webs identify the relationships among producers, consumers, and decomposers carrying out either autotrophic or heterotrophic nutrition.
- 1.1b An ecosystem is shaped by the nonliving environment as well as its interacting species. The world contains a wide diversity of physical conditions, which creates a variety of environments.
- 1.1c In all environments, organisms compete for vital resources. The linked and changing interactions of populations and the environment compose the total ecosystem.

National Art Standards

Philosophical Foundation: The Arts as Communication: Visual Arts

In today's multimedia society, the arts are the media, and therefore provide powerful and essential means of communication. The arts provide unique symbol systems and metaphors that convey and inform life experience (i.e., the arts are ways of knowing).

Anchor Standard 1: Generate and conceptualize artistic ideas and work

Enduring Understanding: Creativity and innovative thinking are essential life skills that can be developed

HS Proficient: VA: Cr1.2.1a Shape an artistic investigation of an aspect of present day life using a contemporary practice of art or design.

Anchor Standard 2: Organize and develop artistic ideas and work. Enduring Understanding: Artists and designers experiment with forms, structures, materials, concepts, media, and art-making approaches

HS Advanced: VA:Cr2.1IIIa Experiment, plan, and make multiple works of art and design that explore a personally meaningful theme, idea, or concept.

Measurable Student Learning Objectives: Students will be able to define and identify the components of an ecosystem and the relationships between components through both textual resources and novel encounters. Components include biotic factors, abiotic factors, producers, consumers, herbivores, carnivores, predators, prey, as well as signs of human impact. Interactions include symbiosis, competition, photosynthesis, and predation.

Nature of STEM: I would like students to understand that scientific knowledge is a result of human endeavor, imagination, and creativity. In this course, I came across the sketches of Robert Hooke, and I spent a great deal of time looking at the sketches from his book, *Micrographia*. It was awe-inspiring. It is fascinating to think that scientific observation was first recorded through sketching, and that all scientific findings were because of curious, persistent individuals that observed the world around them. Ecology is so very relatable to every-day life. Every concept covered in class can be observed in a student's commute home from school. I want to inspire my students to observe the natural world around them and to understand that understanding science, in fact, is a human endeavor.

Engaging Context/Phenomena: I plan to show students the sketches of Robert Hooke in parallel to some amazing images and footage of species and ecosystems that we have today. I want students to think about the nature of science, and the importance of recording observations in our development of scientific understanding.

Data Integration: Human Impact is really the focus of our next unit, but it is something that I would like to touch on during these lessons because I want students to make observations and record images of human impact as they are completing their image portfolio. I found a fantastic resource through NASA called *Biological Diversity and Ecological Forecasting*-<https://earthdata.nasa.gov/learn/toolkits/biological-diversity>. While I am not necessarily going to ask my students to draw any conclusions from the data during this unit, students will use the site to explore the plethora of data that NASA is in fact collecting regarding our human impact. There are some nice descriptions about how NASA uses the various data sources, and I would like my students to explore the use of data in ecosystem forecasting.

Differentiation of Instruction: Scaffolded sheets for taking notes, recording observations, and answering questions will be provided to all students. Students will be provided with a glossary of vocabulary. Students will be working in heterogeneous group, and I will give students the option to work with a partner. Both textual and visual resources will be provided for students to explore concepts.

Real-life Connection: Often, living in the city, students feel disconnected from many ecological concepts and the way that they are taught / covered (i.e foreign environments), when really, all of these concepts are observable in our local park. A major purpose of this lesson is that I want students to feel connected to nature. Students will observe and document ecological phenomena in our local park.

Possible Misconceptions: Once again, living in New York City, students often feel disconnected with nature and fail to see that our urban environment IS an ecosystem. They might not understand that the small and large green spaces in our city represent islands of biodiversity. Because ecology is often taught using examples from raw or rural environments, students might not realize that ecological interactions are observable every time they step outside.

Lesson Procedure:

5E Model	5E Objectives
<p><u>Engage</u></p> <p>How did our understanding of the natural world come to be? How were species and environments documented?</p>	<p>Procedure: Students will observe the sketches of Robert Hooke. Students will look at scientific photographs ranging from satellite shots from space to images from an electron scanning microscope. Students will watch a short, engaging clip of species from the documentary <i>The Hunt</i>. Students will complete a <i>See, Think, Wonder</i> as they browse through the images.</p> <p>We will discuss the significance of technology in our modern understanding of science, but we will also discuss the qualities of a good scientist that lead to scientific discovery before technology existed. We will discuss what might have been most difficult for scientists to understand in the past (things that are microscopic, not observable with the naked eye), versus what might have been easier (species, stars, weather, etc.). <i>Why? What was the challenge?</i> Using four quadrants on their group white boards, students will record group thoughts during table-level discussion. Students will also share out for class-level discussion.</p> <p>As our unit sequence progresses from micro to macro, students are used to trying to understand things that are not necessarily observable in our classroom. We are now at the macro level and students will appreciate that ecological concepts are all around us.</p> <p>Modifications: N/A</p>

Standards Addressed Science is a Human Endeavor ■ Technological advances have influenced the progress of science and science has influenced advances in technology. (HS-LS3-2),(HS-LS3- 3),(New NYSED PE) ■ Science and engineering are influenced by society and society is influenced by science and engineering. (HS-LS3-2), (HS-LS3-3),(HS-LS1-8)

1.1a Scientific explanations are built by combining evidence that can be observed with what people already know about the world.

1.1b Learning about the historical development of scientific concepts or about individuals who have contributed to scientific knowledge provides a better understanding of scientific inquiry and the relationship between science and society.

Formative/Summative Assessments Students will complete See, Think, Wonder.

Resources Images of sketches, images of photographs, video clip, group white boards

- 1) 10 Scientific Images that changed how we looked at the world: <https://www.popularmechanics.com/space/telescopes/g1589/10-scientific-images-that-changed-how-we-looked-at-the-world/>
- 2) Microscope/Microphotography: <https://www.businessinsider.com.au/best-microscope-pictures-year-nikon-small-world-2017-10>
- 3) Fish Shoal Feeding Frenzy: The Hunt: <https://www.youtube.com/watch?v=6zOarcL1BSc>

Discussion Questions:

- 1) *How has our ability to convey scientific knowledge changed over time?*
- 2) *Without technology, what might have been most difficult for scientists to understand and why?*
- 3) *Without technology, what might have been easier for scientists to understand and why?*
- 4) *In the past, what were some of the most important qualities of a scientist? Are those qualities still important today?*

<p style="text-align: center;"><u>Explore</u></p> <p>How do species interact with each other and their environment? Are these interactions positive or negative?</p>	<p>Procedure: Students will explore series of images and video clips and identify/explain the observed interactions in their own words</p> <p>Series of images will address specific interactions and/or vocabulary related to the DCIs and NYS Regents standards (competition, group behavior, biotic and abiotic factors, etc.) Students will analyze images of organisms benefiting from group behavior, competing for finite resources, abiotic and biotic factors, organisms struggling to survive in their environment, etc.</p> <p>Students will record observations about living things, nonliving things, and any observable interactions for at least 5 images.</p> <p>Modifications: Students, as long as fully engaged, may complete less than 5 images if class time runs out. Students will be working in heterogenous groups.</p> <p>Standards Addressed</p> <p>1.1b An ecosystem is shaped by the nonliving environment as well as its interacting species. The world contains a wide diversity of physical conditions, which creates a variety of environments.</p> <p>1.1c In all environments, organisms compete for vital resources. The linked and changing interactions of populations and the environment compose the total ecosystem.</p> <p>Formative/Summative Assessments: During the explore phase, students are recording their initial observations and making initial inferences about species interactions and ecosystem components (“Initial Thoughts”). Students will re-visit their observations in the “<i>Explain</i>” lesson to build upon, add to, or correct their initial assumptions (“Second Thoughts”). After the “<i>Explain</i>” lesson, I will collect the sheets to see initial misconceptions and growth.</p> <p>Resources Images and student record sheet.</p>
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Explain

How can we further explain and classify the components of and interactions in an ecosystem using specific content vocabulary?

Procedure: Students in groups will explore a series of resources (mainly short video clips) explaining ecological concepts and introducing content vocabulary. The role of the teacher is simply to circulate and answer any questions. Ecosystems generally are quite easy for students to understand. The trick is getting them to apply the vocabulary. As students explore each resource, they will write down key vocabulary, and then return to yesterday's images. Browsing through, they will identify if the concepts are present in each picture. If so, they will ADD the new information to their "**Second Thoughts.**" In this lesson, students will also explore authentic data that is tracked by NASA to make forecasts about ecosystems.

This activity should take two class periods. Tasks 1 and 2 will be completed in class in the first lesson, 3 and 4 will be completed for homework, and 5 and 6 will be completed in the second lesson.

In the second lesson, there will be time for share out. Posting the images on the screen one at a time, teacher will ask for student volunteers to share out and identify/explain observable ecological concepts. Teacher will address any misconceptions and will clarify each concept to the class.

At the conclusion of the lesson, students will be provided with an Ecology Glossary resource sheet that they can use for future lessons.

Modifications: I anticipate that each concept will take about 15 minutes to complete. This leaves time to move on to additional concepts and to eliminate / reduce homework. In the second session, the additional time in the period for share out gives students an opportunity to write down any concepts that they might've missed. All students will use clearly scaffolded guiding sheets to record their observations. Students should be working in heterogeneous groups to control class pacing. If teacher feels that students have not grasped understand of ecological concepts through independent exploration, the sequence may be modified to include a teacher-centered mini-lesson. We will not move on to the "Elaborate" stage until teacher feels that the classroom is ready. A homework assessment will help to gauge understanding.

Standards Addressed:

ELA/Literacy – 11-12.RST. 1 Cite specific evidence to support analysis of scientific and technical texts, charts, diagrams, etc., attending to the precise details of the source, and attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

11-12.WST.7 Draw evidence from informational texts to support analysis, reflection and research.

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Patterns ■ Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HLS4-1),(HS-LS4-3)

1.1a Populations can be categorized by the function they serve. Food webs identify the relationships among producers, consumers, and decomposers carrying out either autotrophic or heterotrophic nutrition.

1.1b An ecosystem is shaped by the nonliving environment as well as its interacting species. The world contains a wide diversity of physical conditions, which creates a variety of environments.

1.1c In all environments, organisms compete for vital resources. The linked and changing interactions of populations and the environment compose the total ecosystem.

Formative/Summative Assessments: I will assess general classroom understand through the class share out. Collectively, are we able to identify all of the ecological concepts in the images? If a concept was missed, can students figure it out with prompting? At this point, I will also collect the assignments to view individual thoughts. This is also an appropriate time to give a graded online homework (Jupiter Ed, Google Form, etc.) on some of the key vocabulary.

Resources Short YouTube clips, guided notetaking sheet, prior lesson. At this point, I will also provide my students with a glossary of ecological terms that they can refer back to.

Elaborate

Is ecology only found in suburban, rural, and natural environment? Where can we see ecological concepts and species interactions in New York City?

Procedure: During this lesson, students will be asked to brainstorm examples of species interactions and ecological concepts that could be observed right in our local neighborhood in NYC. Often, students only think of suburban and rural environments when it comes to ecology and completely miss the connections to our urban ecosystem. In this lesson, we will also begin our Integrated Arts Project- 2 days of outdoor exploration. Students will be given a “Scavenger List” of ecological concepts. Students will take photographs and/or sketches to document their findings. Students will be required to make at least 1 sketch (more if they choose). Photographs must have written captions to describe the concepts captured by the artist. To encourage creativity and appreciation of art and photography, students will be asked to focus on the aesthetics of their images. For creativity, students will be asked to show contrast, focus, filtering, etc.

Students will upload their images to Padlet, where they will also be required to communicate the creative elements and scientific content shown in their images (photographs or sketches).

When explaining the purpose of this assessment, we will circle back to the importance of the image in communicating scientific phenomena, and ways that technological has influenced our ability to communicate.

Modifications It might be a good idea to allow students to work in pairs / partners. If using the technique, it will be required that each student makes their own sketch. But, they can collaborating on taking photos, as it might be possible that some students do not have cell phones, or that some students have phones with “better cameras.”

Standards Addressed

1.1a Scientific explanations are built by combining evidence that can be observed with what people already know about the world.

1.1b Learning about the historical development of scientific concepts or about individuals who have contributed to scientific knowledge provides a better understanding of scientific inquiry and the relationship between science and society.

Standard 4:

	<p>1.1a Populations can be categorized by the function they serve. Food webs identify the relationships among producers, consumers, and decomposers carrying out either autotrophic or heterotrophic nutrition.</p> <p>1.1b An ecosystem is shaped by the nonliving environment as well as its interacting species. The world contains a wide diversity of physical conditions, which creates a variety of environments.</p> <p>1.1c In all environments, organisms compete for vital resources. The linked and changing interactions of populations and the environment compose the total ecosystem.</p> <p>Formative/Summative Assessments: In terms of the rubric for this project, at this point I will be assessing the “Effort” component of the rubric. I do not anticipate taking off points for students, but this portion of the rubric is the motivating factor for staying engaged outdoors and for commitment to completing the tasks in a timely manner.</p> <p>Resources Students will use group whiteboard to brainstorm ecological concepts in our local neighborhood. Students will receive the project description and the project rubric.</p>
<p><u>Evaluate</u> How can we both capture and communicate images of ecological concepts right here in our</p>	<p>Procedure: Students understanding of ecological concepts will be based on their successful completion of the art portfolio. Students will complete a virtual gallery walk and comment on each other’s submissions. As a motivation factor to gain student investment in the creative component, I would consider a contest for the “best photos.” Students can comment / vote on Padlet by using the “like” function.</p> <p>Modifications Students who are particularly interested in drawing make request to do more drawings that photographs. I might even tell students that I would except video footage upon personal request. I really want the students to choose how they are best able to represent and capture the concepts.</p> <p>Standards Addressed ELA/Literacy – 11-12.RST. 1 Cite specific evidence to support analysis of scientific and technical texts, charts, diagrams, etc., attending to the precise details of the source, and attending to important distinctions the author makes and to any gaps or inconsistencies in the account.</p>

<p>local ecosystem?</p>	<p>11-12.SL.5 Make strategic use of digital media and/or visual displays in presentations to enhance understanding of findings, reasoning, and evidence, and to add elements of interest to engage the audience.1.1a Scientific explanations are built by combining evidence that can be observed with what people already know about the world.</p> <p>1.1b Learning about the historical development of scientific concepts or about individuals who have contributed to scientific knowledge provides a better understanding of scientific inquiry and the relationship between science and society.</p> <p>Standard 4:</p> <p>1.1a Populations can be categorized by the function they serve. Food webs identify the relationships among producers, consumers, and decomposers carrying out either autotrophic or heterotrophic nutrition.</p> <p>1.1b An ecosystem is shaped by the nonliving environment as well as its interacting species. The world contains a wide diversity of physical conditions, which creates a variety of environments.</p> <p>1.1c In all environments, organisms compete for vital resources. The linked and changing interactions of populations and the environment compose the total ecosystem.</p> <p>Formative/Summative Assessments Final student submissions will be graded according to the rubric. Full ‘<i>Effort</i>’ credit will be awarded so long as students behaved appropriately and were focused in the outdoor working periods. Students will be awarded points for creative elements in their submissions. “<i>Creative elements</i>” are outlined as shading, focus, contrast, filters, etc. Students will be assessed on whether or not their images correctly portray the ecological concepts from the Scavenger List. Students are given the opportunity and will be assessed on their communication and explanation of said concepts in each post in their portfolio. Students will provide peer feedback through <i>Padlet</i>, and there is the possibility of a contest for the “Best Photos.”</p> <p>Resources Project task sheet, Padlet page, STEAM Rubric.</p>
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Teacher Background:

I was inspired to create this lesson because I am working to teach ecology outdoors as much as possible- even in the City, the best classroom for ecology is outside of school. I was further inspired by the Endeavor course Culturally Responsive Teaching and NGSS

biology for all. This unit is centered around exploring and explaining local phenomena that the students can feel connected to. These lessons could be adapted for any school in both rural and suburban settings. Prior to this lesson, teacher should pre-determine an appropriate place where ecological phenomena will be easy to observe. For example, a school yard or manicured sports field might not be the best place. For this unit, I plan on taking students to Battery Park, which is along the water and where many different species of plants, birds, insects, and small herbivores can be spotted. Furthermore, there is clear evidence of human impact. Student-facing resources and found on the next few pages (i.e. tables and charts for recording observations, content resources, glossary, rubric, etc.). This mini-unit is entirely student-centered. There should be no need for teacher content delivery- only facilitation of student understanding. This unit is best taught after evolution. Students should have prior knowledge of photosynthesis, biogeochemical cycles, and some species interactions.

Lesson 1: Engage

Fill out the chart below for each of the 5 images displayed. What do you see and how was the image captured? What do you think about it and what's something else you'd like to know?

Images- What do you See and how was the image captured	Think - Why do you think this image was taken?	Wonder - What is something that you would like to know about the image?

Lesson 2: EXPLORE (“Second thoughts” are for lesson 3- EXPLAIN)

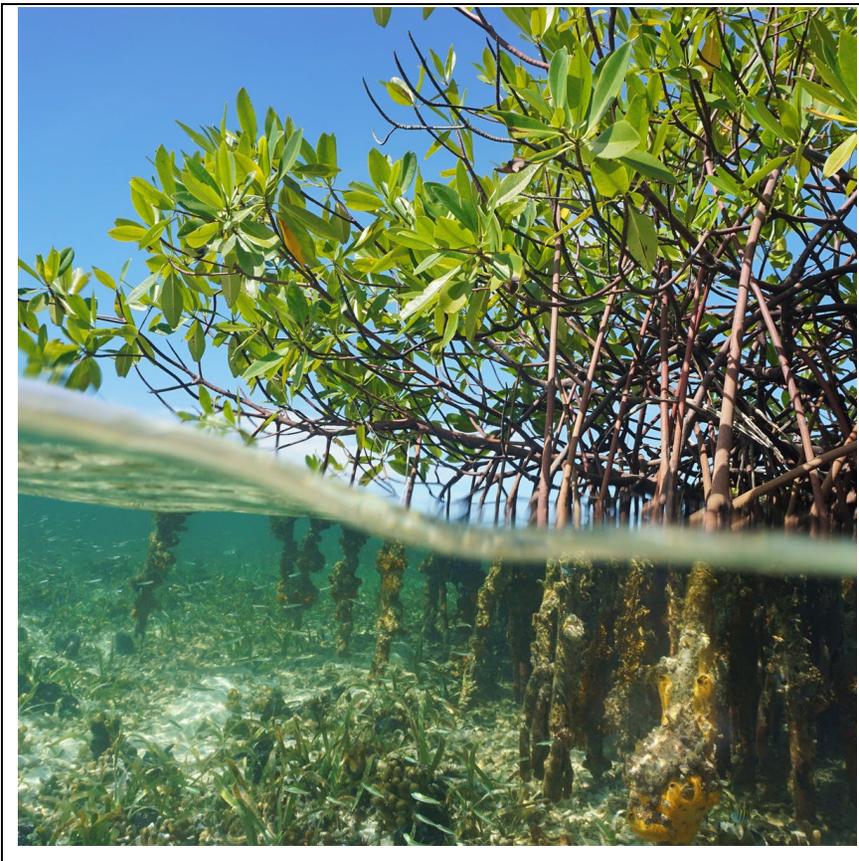
Image 1:	
Living:	Nonliving:
Initial Thoughts: Describe any interactions that you observe (species interacting with other species, or species interacting with their environment):	
*Second Thoughts:	

Image 2:	
Living:	Nonliving:
Initial Thoughts: Describe any interactions that you observe (species interacting with other species, or species interacting with their environment):	
*Second Thoughts:	

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Image 3:	
Living:	Nonliving:
Initial Thoughts: Describe any interactions that you observe (species interacting with other species, or species interacting with their environment):	
*Second Thoughts:	

Image 4:	
Living:	Nonliving:
Initial Thoughts: Describe any interactions that you observe (species interacting with other species, or species interacting with their environment):	
*Second Thoughts:	







LESSON 3 EXPLAIN:

Directions: Ecological concepts will be explained to you in brief videos. As you and your partner explore the resources, record any new vocabulary. Then, return to yesterday’s activity. Browse through all of the images again. If you think that the ecological concept is shown in the image, add it to the “**Second Thoughts**” box!

Biotic and Abiotic Factors:	What is an Ecosystem?	Roles in an Ecosystem:
https://www.youtube.com/watch?v=E1pp_7-yTN4&t=30s (2 min 40 seconds)	https://www.youtube.com/watch?v=-IJKm_Te8wk&t=6s	https://www.youtube.com/watch?v=Gntqsg_za78&t=8s
New Vocabulary:	New Vocabulary:	New Vocabulary:
Group Behavior:	Species Interactions:	Human Impact:
https://www.youtube.com/watch?v=r2_npLI4Cyc	https://www.youtube.com/watch?v=zSmL2F1t81Q	https://earthdata.nasa.gov/learn/toolkits/biological-diversity
New Vocabulary:	New Vocabulary:	Read the INTRODUCTION and record important new vocabulary:
		NASA records A LOT of data about ecological factors that humans are influencing/ changing. Write down 10 of these factors that NASA is monitoring.

Human Impact cont.: <https://earthdata.nasa.gov/learn/toolkits/biological-diversity>

What is “ecosystem forecasting?” Give 1 example of how NASA is using a data source to make predictions about ecosystems.

Lesson 3 resource after classroom discussion:

ECOLOGY GLOSSARY:

Abiotic- The NONliving parts of an ecosystem- water, sunlight, CO₂, soil, O₂, pH level, temperature, weather, etc.

Autotroph- An organism that can make its own organic molecules for chemical energy. (they can make their own food!)
Examples- plants, algae, phytoplankton

Biotic- The LIVING components of an ecosystem- plants, animals, bacteria, fungi- food and mates

Biodiversity- The number of *different* species living in an ecosystem. The more biodiversity is, the more genetic diversity there is and the more stable the ecosystem is.

Consumer- An organism that eats other organisms for chemical energy.

Decomposer- Fungi and bacteria- breakdown DEAD organisms to get chemical energy. Decomposers recycle inorganic compounds back into the soil!

Dynamic Equilibrium- Stability; staying within a certain range; a population at its carrying capacity stays in dynamic equilibrium

Ecosystem- A place where both living and nonliving things depend on and interact with each other

Ecology- The study of how biotic and abiotic factors interact

Food Web- Shows the interdependence of all biotic factors in an ecosystem. Shows all of the feeding relationships.

Group Behavior- Some species live in groups, which can increase an organisms chance of survival. Some group behavior increases chances of getting good, protects from predators, maintains warmth, increases chance of finding a mate, etc.

Heterotroph- Organism that cannot make its own chemical energy. They rely on others for food.

Photosynthesis- The process by which autotrophs/producers make their own food using abiotic/inorganic compounds from the environment.

Water + Carbon Dioxide -----> Glucose + Oxygen

Predator- Hunter; carnivore

Producer- Organism that can make its own food (chemical energy)

Lesson 4: ELABORATE:

Ecosystem and Species Interaction Portfolio:

BACKGROUND: The combination of images and words are some of the most important tools in scientific communication. In our local urban ecosystem, your task is to identify and capture the concepts we've learned in class and to communicate your findings to others. You have 2 days in class to work on the project. Your task is to capture all of the concepts from the Scavenger List. Take as many photos as possible. For your final portfolio, choose the images that best represent each concept. To capture images, you can use your camera phone. Additionally, at least ONE SKETCH is required.

Your *Ecosystem and Species Interaction Portfolio* can be a combination of photography and sketches. **At least 1 sketch is required.**

Your portfolio of images will be shared to **Padlet**. For each photo that you post you will be required to

- *Accurately capture an ecological concept from the scavenger list*
- *Provide a caption to clearly explain the ecological concept in your image*
- *Incorporate some type of creative element. In your drawing, include shading, labels, or colors. In your photographs, consider the lighting, contrast, focus, color, adding filters, or editing the photo.*

Scavenger List:		
A biotic factor	An abiotic factor	A biotic factor relying on an abiotic factor
Two biotic factors interacting (positive or negative)	A producer/autotroph	An herbivore
A biotic factor being affected by human impact	An abiotic factor being affected by human impact	Two biotic factors competing.
A population	A community	An ecosystem

Lesson 5: EVALUATE

Ecological Concept Image Portfolio Rubric:

	Does not meet standards (1 points)	Approaching standards (3 points)	Meets standards (5 points)
<p>Concept Portrayal - Photos or sketches that accurately depict a concept from the scavenger list.</p>	Does not accurately portray concepts of ecosystems and species interactions. Most portrayals are inaccurate or irrelevant.	Accurately portrays some concepts of ecosystems and species interactions. Portrayal may be inaccurate for some entries.	Accurately portrays all concepts of ecosystems and species interactions
<p>Concept Explanations - Each photo or sketch should include a brief, written explanation of a concept from the scavenger list. How does your image represent the concept? What is the viewer looking at?</p>	Does not accurately explain concepts of ecosystems and species interactions. Most explanations are inaccurate.	Accurately explains some concepts of ecosystems and species interactions. Explanations may be inaccurate for some entries.	Accurately explains all concepts of ecosystems and species interactions
<p>Effort - Make consistent progress during class time. Ask if you need help, avoid unproductive distractions.</p>	Student was not actively working on portfolio during most of the allotted class time.	Student actively works on portfolio during most class time, but lost focus and required redirection.	Student actively works on portfolio during all allotted class time.

<p>Creative Elements.</p> <p>- Put creative effort into your portfolio. For at least TWO portfolio entries, provide an explanation of the effort you put into capturing the concept.</p>	<p>Student does not demonstrate creative effort into their sketches or photographs</p>	<p>Student demonstrates and explain some creative effort in their sketches or photographs (focus, lighting, colors, filters, shading, etc.)</p>	<p>Student demonstrates and explain creative effort in their sketches or photographs (focus, lighting, colors, filters, shading, etc.)</p>
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