The Eastern Coyote (Coywolf): How Environmental Changes Can Cause the Emergence of a New Species

Unit: BIO 4.4	**Utah SEEd Standard / NGSS Performance Expectation:** Engage in argument from evidence that changes in environmental conditions may cause increases in the number of individuals of some species, the emergence of new species over time, and/or the extinction of other species. Emphasize the cause and effect relationships for how changes and the rate of change to the environment affect distribution or disappearance of traits in a species. Examples of changes in environmental conditions could include deforestation, application of fertilizers, drought, or flood. (LS4.C)	**Time: 1 Class Period**

Link to all material in this lesson: https://byu.box.com/s/ebgk67t6tw8rsoj9r2k3gn9ue2dx0vz0

Anchor Phenomenon	How did the Eastern Coyote emerge?
Driving Question(s)	How do environmental changes impact species' decline and emergence? How do environmental changes affect the traits of a species?
Performance Task	Students will engage in reasoning and argument to determine how changes in an environment can cause the emergence of a new species and what criteria are used to determine when a new species is created.

Lesson Summary: In this lesson, students use the Eastern Coyote as a case study to show how changes in an environment can cause the emergence of a new species and how the rate of change in the environment can affect the traits of a species.

	Time	**Guiding Question / Learning Objective**	**How are students answering the guiding question or meeting the learning objective?**
Engage	20 min	- Read Objectives. - Determine traits that make an animal best suited to a food source.	Here students are introduced to the idea that species are adapted to their environment.

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 **Explore**	15 min	- Discuss the distribution and traits of the Eastern Wolf. - Discuss the distribution and traits of the Western Coyote. - Think-Pair-Share for the development of an explanation as to why the distribution of coyote and wolf have changed.	- Students will recognize that the distribution of the Eastern Wolf and Western Coyote has changed over time and begin to understand that the distribution change is the result of a changing environment. - Use The Eastern Wolf and The Western Coyote in the Compilation of Evidence file.
 **Explain**	15 min	- Discuss how environmental changes have affected the distribution of the Eastern Wolf and the Western Coyote. - Discuss how deforestation and urbanization have changed the environment of the wolf and coyote.	- Use the Deforestation and Urbanization files in the Rise of the Coywolf PowerPoint. - Students should be able to make the connection between the distribution of the wolf and coyote and deforestation and urbanization.
 **Elaborate**	5 min	- Begin to explain the emergence of the Eastern Coyote. - Discuss traits that make the Eastern Coyote successful.	- Use The Eastern Coyote in the Compilation of Evidence file. - Here students will understand that the change in the distribution of the wolf and coyote allowed them to interbreed and give rise to the eastern coyote.
 **Evaluate**	15 min	- Assessment: The focus of the assessment is for students to consider if the Eastern Coyote is a new species	- Use the Assessment Piece file for students. There is reading and questions to prompt students to consider the eastern coyote and have them form an opinion if the eastern coyote is a new species.

Three Dimensions Focused on in This Lesson		
Disciplinary Core Idea: **NGSS Appendix E** Evolution results primarily from genetic variation of individuals in a species, competition for resources, and proliferation of organisms better able to survive and reproduce. Adaptation means that the	**Science and Engineering Practices:** **NGSS Appendix F** **Engaging in argument from evidence**: in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the	**Crosscutting Concept:** **NGSS Appendix G** **Cause and Effect:** Students understand that empirical evidence is required to differentiate between cause and correlation and to make claims about specific causes and effects. They suggest

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distribution of traits in a population, as well as species expansion, emergence or extinction, can change when conditions change.	natural and designed world(s). Arguments may also come from current scientific or historical episodes in science. ● Evaluate the claims, evidence, and/or reasoning behind currently accepted explanations or solutions to determine the merits of arguments.	cause and effect relationships to explain and predict behaviors in complex natural and designed systems. They also propose causal relationships by examining what is known about smaller scale mechanisms within the system. They recognize changes in systems may have various causes that may not have equal effects.
Learning Objectives In science, reasoning and argument are essential for identifying the strengths and weaknesses of a line of reasoning and finding the best explanation for a natural phenomenon. The emergence of the Eastern Coyote phenomenon will be used as a case study for how environmental changes can cause the emergence of a new species and what changes will determine the creation of a new species.		
Related Knowledge and Skills from Prior Grades		
Disciplinary Core Idea: NGSS Appendix E Species can change over time in response to changes in environmental conditions through adaptation by natural selection acting over generations. Traits that support successful survival and reproduction in the new environment become more common.	**Science and Engineering Practices:** NGSS Appendix F **Engaging in argument:** From evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).	**Crosscutting Concept:** NGSS Appendix G **Cause and Effect:** Students classify relationships as causal or correlational and recognize that correlation does not necessarily imply causation. They use cause and effect relationships to predict phenomena in natural or designed systems. They also understand that phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability
Connections to Mathematics and ELA/Literacy Standards		
ELA/Literacy Standards:		**Mathematics Standards:**

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● **RST-11.12.8:** Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. ● **WHST.9-12.9**: Draw evidence from informational texts to support analysis, reflection, and research.	● **MP.2**: Reason abstractly and quantitatively.

Materials

Handouts	Lab Supplies	Other Resources
Successful Animal Traits Folder with evidence documents - Compilation of Evidence Coywolf Assessment Piece	N/A	Teacher PowerPoint Slides Video: What makes a species a species? Coywolf information Wolf information How do you save a wolf that's not really a wolf? article

ENGAGE

How do environmental changes impact species' decline and emergence?
How do environmental changes affect the traits of a species?

Slide 1: Lesson objectives Slide 2: Organize students into groups. - Give groups a "Successful Animal Traits" handout. Slide 3: Assign a food source to groups. - Using the handout, students will select one trait from each category to create an organism best adapted to their assigned food source. - Students will provide written reasons and justifications on they selected those traits. - REMEMBER, YOU'RE CREATING AN ANIMAL TO BE SUCCESSFUL!	**Teacher Tips**

EXPLORE

How do environmental changes impact species' decline and emergence?
How do environmental changes affect the traits of a species?

Teacher: "First, we will explore the North American Food Web."
Slide 4:
Teacher: "From this photo, pick what 2 predators are going to be the biggest competitors for food."

- Allow 2-3 minutes for students to make a conclusion.
- Have students answer: "What traits do these competitors have that make them successful?"(remind students to use the "Successful Animal Traits" to help them compare traits and habits that may make wolves and coyotes top competitors of each other)
- "Now turn to your neighbor and justify why you picked your 2 biggest competitors."

Teacher: Take this time to express that even though the food web shows all these predators could be considered competitors, we will focus on two: the wolf and coyote. Explain how similarities of apex predators will also make them top competitors i.e. habitat, reproductions periods, specialized traits, and prey ect.

(10 minutes) After talking about the food web have the students read and highlight things that stood out to them form the following sections from the Compilation of Evidence file, and conduct a Think-Pair-Share for the following:

- Eastern Wolf- looking for Distribution, habitat, traits.
- Western Coyote- looking for Distribution, habitat, traits.

Go over slides 5-10:

Have students focus on "Why has the distribution of coyote and wolf changed since the early 1900s to now?"

Students should start to develop an argument from evidence as to why these things are happening.

Teacher Tips

While students are sharing, make sure you walk around and interact with their conversations. You can then use this information to call on students to share.

EXPLAIN

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Ask a few students or groups to share their conclusions on why the eastern wolf population has diminished and why the western coyote population has increased and spread. Slides 11-13: Share slides on the detailed changes in habitat (deforestation) and urbanization (census population map) over the last 200 years. Have students discuss how those things fit into their models. Slide 14: Introduce students to the eastern coyote. Explain what the driving force behind this example of hybridization has been. Have the students use the Eastern Coyote portion of the Compilation of Evidence file to determine 3-4 things that make the eastern coyote different from either eastern wolves or western coyotes. Slide 15: Use this slide to show the genetic makeup of the eastern coyote and as a lead in to the discussion if the eastern coyote is to be considered a new species.	**Teacher Tips** When using the compilation of evidence, you can use the information on Eastern Wolf, Western Coyote, and Eastern Coyote only (first three pages). There is enough information here for a student to gain a basic understanding. You may choose to read and discuss the information together as a class.

ELABORATE

How do environmental changes impact species' decline and emergence?
How do environmental changes affect the traits of a species?

What is a species? - Ask Students: "Define what a species is." - Allow 2-3 minutes for students to contemplate their answers and then have them share. Slide 16: Show the slide that defines a species. You may want to give the example of breeding a horse and a donkey to create a mule. Pose the question: "Is the mule considered a species knowing that it cannot reproduce.?" Students will now take the opportunity to look at the evidence we have explored and determine if the environmental changes caused an emergence of a new species – the eastern coyote (coywolf).	While students are defining a species, talk to a few students to gauge their understanding.

EVALUATE

How do environmental changes impact species' decline and emergence?
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Students will fill out Assessment Piece by answering the following questions 1. Create a Venn Diagram that shows the differences and similarities between the Eastern Wolf and Eastern Coyote. What traits make them both successful predators? 2. According to what we talked about in class, what are the major causes behind the declining numbers of the Eastern Wolf? Please answer with a complete paragraph. 3. Refer to question #2. How were these changes advantageous to the Western Coyote? Please answer with a complete paragraph. 4. How has the ecosystem of the northeastern U.S. changed over the last 300 years? What traits have helped make the Eastern Coyote a successful organism in the current ecosystem? Please answer in a complete paragraph. 5. In your opinion, is the Eastern Coyote a "True Species"? Please cite specific evidence from the lesson and reference material to support your answer. Please answer with a complete paragraph. 6. Using outside sources to help you research, identify an additional example of how changes to an environment led to changes within a population of organisms. Your response should be 1-2 solid paragraphs. Students may either turn in a written version of this assessment or do a video/audio recording of themselves explaining each answer.	**Teacher tips** If students choose to do a recording, they may need to be provided an alternate space to record

POSSIBLE EXTENSION / ALTERNATIVE ADAPTATIONS

- If possible, incorporate physical models or analogs of the differences between coyotes and wolves (e.g., paw castings, scat models, or skull replicas).
- Another example that students could use is the Polar Bear and Grizzly Bear. Here is a website with information on the Prizzly, a hybrid polar-grizzly bear.
- Share what the "biological species concept" concludes and share the video clip in the slideshow (the beginning to 3:08 of the video) (Video is imbedded on slide 16, you can show this in class if you feel they need more understanding of Speciation)

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