

GRC: Lesson Idea Template

Instructional Alignment to Three Dimensions

3D-Student Science Performance

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Grade - Middle School Life Science

Lesson Title

Squirrels and Where They Live

Lesson Topic - Interdependent Relationships in Ecosystems

Performance Expectations (Standard) from State Standards or NGSS:

MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. *[Clarification Statement: Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems. Examples of types of interactions could include competitive, predatory, and mutually beneficial.]*

Lesson Performance Expectations:

- **Develop an argument** to support the **explanation** that different types of squirrels live in different habitats, but have similar roles in their own ecosystem.

Powerful Practices

*Engage Students
In Making Sense of
Phenomena*

*Developing questions to
plan and carry out
investigations, design
solutions, and/or obtain*

*Gathering data and
information to use in
developing evidence*

*Reasoning about how the
evidence supports an
explanation for the cause
of the phenomenon*

*Engaging in Academic
Discourse*

Student Science Performances

Phenomenon: Utah Prairie Dogs and Uinta Ground Squirrels live in the desert areas of Utah, and the Red Squirrels live in trees in the mountains of Utah.

(Teaching Suggestion: Show pictures of each of the squirrels in their native habitat.)

Gather

1. Students **explore** the schoolyard or nearby natural areas to observe and photograph the various species of organisms in their natural habitats.
2. Students **observe** pictures of squirrels in different natural environments. (See Appendix B-1 for photos)
3. Students **develop questions to obtain** information about how different squirrel species have adapted to live in various **ecosystems**.

Class Discussion - about good questions to investigate

4. Students **obtain information** by reading about various types of squirrels and how different species have **changed** over time (evolved) to adapt to the environment.
5. Students **obtain information** about **patterns** of how organisms serve similar roles across multiple **ecosystems**.

Reason

6. Students **construct an explanation** supported by evidence for how some squirrels in Utah (or other states) are better adapted to live in the mountain **ecosystems**, and other squirrels are better adapted to live in the sagebrush desert **ecosystem**.

7. Students **use a model** to show the **patterns** of animals that serve similar roles across multiple ecosystems. *(Example of Model in Appendix C)*

Class Discussion:

Questions to initiate Discussion:

Q: Why do some types of squirrels live in trees and others underground or between rocks?

Q: What purpose does the tree cavity or underground burrow have for the squirrels?

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<p><i>Presenting Evidence of Learning</i></p> <p><i>Communicating Reasoning Through Individual 3D Performance</i></p> <p><i>Applying Science Learning Beyond the Classroom</i></p>	<p><i>Q: Which adaptations do both types of squirrels have but use for different purposes?</i></p> <p><i>Q: Why do Utah squirrels need to hibernate/winter sleep in the winter?</i></p> <p><i>Q: What are the interactions of the Uinta ground squirrel in desert ecosystems similar to the interactions of red squirrels within the mountain ecosystem, and how are they different?</i></p> <p><i>Q: How do organisms in different ecosystems serve similar roles to an organism you observed in our walk?</i></p> <p><i>(Teaching Suggestions: Focus questions on the difference in the adaptation as they relate to the area where the squirrels live. The squirrels fill the same niche, but the environment causes differences.)</i></p> <p>8. Students construct an explanation for how a different species in a different ecosystem has the same role as the squirrel in the forest ecosystem. (This can be done in class discussion or small groups.)</p> <p><i>(Teaching Suggestion: Students work in groups. They describe the adaptations of squirrels that help them survive in their environment. This is how they may build dens, act as predators or prey, or collect food.)</i></p> <p>Communicate Reasoning</p> <p>9. Students construct an explanation for how one of the species observed near their home has a role that is similar to that of a different species in a different ecosystem in other places.</p> <p>Beyond the Classroom</p> <p>Invite students to develop electronic posters describing the roles of all the organisms in a specific ecosystem (e.g., oceans, forests, alpine, prairie). You can have a 15-minute show-and-tell discussion, during which students can share their posters. The posters should focus on the roles of the animals and how these roles are similar to other ecosystems.)</p>				
Formative Assessment for Student Learning					
Elicit Evidence of Learning: Construct an explanation for how one of the species observed near their home has a role that is similar to that of a different species in a different ecosystem in other places.					
<p>Evidence of Student Proficiency</p> <p><i>Student arguments should describe how the evidence from the reading and models supports the explanation that squirrels have different structures to help them live in specific environments. (e.g., claws for climbing, claws for digging, color to match the environment for camouflage, teeth to gnaw through hard nuts, cheek pouches to hold more seeds to bring back from ground gathering trips)</i></p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%; text-align: center;">Range of Typical Student Responses</th> <th style="width: 50%; text-align: center;">Acting on Evidence of Learning</th> </tr> </thead> <tbody> <tr> <td style="vertical-align: top;"> <p>Full understanding - We observed a robin eating worms out of the lawn. The animal that is like this in the desert ecosystem is the hawk. The robin eats worms, so it is a predator. The hawk eats snakes, so it is a predator too. These two animals have the same role in different ecosystems.</p> <p>Partial understanding - Plants and animals have similar roles across multiple ecosystems. The roles relate to how they interact within their ecosystem.</p> <p>Emerging understanding - We learned that the red squirrels had sharp, hooked claws, while the ground squirrels had thicker, stronger claws for digging. We read that Uinta ground squirrels mostly eat seeds and plants, and therefore have smaller, less powerful teeth. Foxes eat ground squirrels, and hawks eat red squirrels.</p> </td> <td style="vertical-align: top;"> <p><i>Action for students with limited understanding. Use a pair of similar species and focus on one aspect of those organisms (e.g., Polar Bears and Alaskan Brown Bears, lions and tigers, Mule Deer and Whitetail Deer). Gather information, evaluate the information, construct an explanation, and develop an argument. Focus on the role of the organism in the environment in which they lives throughout the investigation. Be sure to have a good class discussion.</i></p> </td> </tr> </tbody> </table>	Range of Typical Student Responses	Acting on Evidence of Learning	<p>Full understanding - We observed a robin eating worms out of the lawn. The animal that is like this in the desert ecosystem is the hawk. The robin eats worms, so it is a predator. The hawk eats snakes, so it is a predator too. These two animals have the same role in different ecosystems.</p> <p>Partial understanding - Plants and animals have similar roles across multiple ecosystems. The roles relate to how they interact within their ecosystem.</p> <p>Emerging understanding - We learned that the red squirrels had sharp, hooked claws, while the ground squirrels had thicker, stronger claws for digging. We read that Uinta ground squirrels mostly eat seeds and plants, and therefore have smaller, less powerful teeth. Foxes eat ground squirrels, and hawks eat red squirrels.</p>	<p><i>Action for students with limited understanding. Use a pair of similar species and focus on one aspect of those organisms (e.g., Polar Bears and Alaskan Brown Bears, lions and tigers, Mule Deer and Whitetail Deer). Gather information, evaluate the information, construct an explanation, and develop an argument. Focus on the role of the organism in the environment in which they lives throughout the investigation. Be sure to have a good class discussion.</i></p>
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<i>Featured SEP, CCC, and DCI</i>	Science Essentials
Science Practices	Ask questions to obtain information about relationships in systems. Construct an explanation for the relationship between structure and function.
Asking questions to obtain information Constructing explanations	
Crosscutting Concepts	Explain how the structure of an organism affects how it functions in its environment. Determine how components of systems interact.
Structure and Function Systems and Systems Models	
Disciplinary Core Ideas	Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms and their environments, both living and nonliving, are shared. (MS-LS2-2)
Interdependent Relationships in Ecosystems	

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Appendix A: Student Prompts for the Lesson

Phenomenon: *Utah Prairie Dogs live in the desert areas of Utah, and Red Squirrels live in the trees in the mountains of Utah.*

Group Performance:

1. **Explore** the schoolyard or nearby natural areas to observe and photograph the various species of organisms in their natural habitats.

Class Discussion about the environments where plants and animals were observed

2. **Observe** pictures of squirrels in different natural environments.
3. **Develop questions to investigate** how different squirrel species have adapted to live in various **ecosystems**.

Class Discussion - about good questions to investigate

4. **Obtain information** by reading about various types of squirrels and how different species have **changed** over time (evolved) to adapt to their environment.
5. **Obtain information** about **patterns** of how organisms serve similar roles across multiple **ecosystems**.
6. **Construct an explanation** supported by evidence for how some squirrels in **Utah** (or other states) are better adapted to live in the mountain **ecosystems**, and other squirrels are better adapted to live in the sagebrush desert **ecosystem**.
7. **Use a model** (chart) to show the **patterns** of animals that serve similar roles across multiple **ecosystems**. *(See Appendix for Examples)*

Class Discussion about the models and explanations

8. **Construct an explanation** for how a different species in a different **ecosystem** has the same role as the squirrel in the forest **ecosystem**. *(This can be done in class discussion or small groups.)*

Individual Performance:

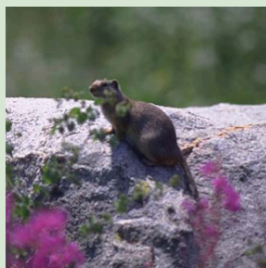
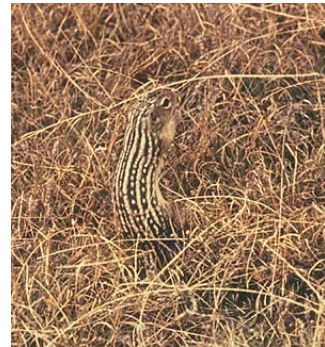
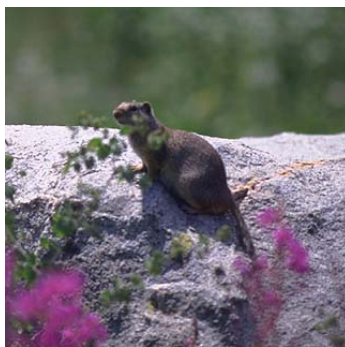
9. **Construct an explanation** for how one of the species observed near your home has a role that is similar to that of a different species in a different **ecosystem** in another place.

(Teaching Suggestions: Exploring natural areas is important. If you do not have suitable areas near your school, assign students to complete this task in the community as a homework assignment the day before the investigation. Use your state as an example for #6. The information on red squirrels applies to most states. The other squirrels' readings may need to be switched for your local squirrels.)

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Appendix B-1. Pictures of Squirrels for the exploration part of the lesson.

Use these pictures to discuss the habitats of the tree squirrels and ground squirrels.



[Link to Utah Squirrel Species](https://fieldguide.wildlife.utah.gov/?family=sciuridae)

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Appendix B-2 Information and Readings about Squirrels

Squirrels of Utah - Adapt this for the state where you are teaching. This information is available on your State Division of Wildlife Resources.

Red Squirrels

The red squirrel is a small tree squirrel common to the forests of the United States, including Utah. The overall range of the red squirrel includes much of Canada, Alaska, the northeastern United States, and the Rocky Mountain states. Red squirrels are typically quite loud, and they are often heard (and seen) by hikers, campers, and others in Utah's forested areas.



Red squirrels usually nest in trees, most often in tree cavities, but leaf nests are sometimes constructed on tree branches. The species eats nuts, seeds, fruits, fungi, and occasionally even small animals. When food items are plentiful, large amounts of food are cached (or hidden) for later use. The red squirrel mates in early Spring and litters of approximately five young are born about one month later. The species is active throughout the year, primarily during daylight hours.

The American Red Squirrel is a small rodent that is approximately 28-35 cm in length (approx. 9-15 cm in length). Their fur coat varies depending on the time of year and the area in which they live. They are usually red with a lighter color underneath. The tail is very distinctive, with red at the base of the fur and black and white at the tips. Their nests are in tree cavities or in burrows in the leaves. They eat a variety of things, including nuts, seeds, fruit, bark, small birds, eggs, and mushrooms. The tail is usually smaller in comparison to other squirrels in North America. The red squirrel is usually easily identified by its very vocal bark at any intruder that might be around. The red squirrel is usually found at higher elevations in forest habitats. They can be found in Iron County and most mountainous counties in Utah. The scat from the red squirrel is similar to that of a rat. It is small, dark, and roughly the shape of a grain of rice (slightly larger, of course).

Prairie Dogs

The Utah prairie dog is one of three prairie dog species found in Utah, occurring in the southwestern part of the state. Interestingly, the species is not found anywhere else in the world, making it the only non-fish vertebrate endemic to the state of Utah. The Utah prairie dog is so rare that it has been federally listed as a



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threatened species.

Similar to other prairie dogs, Utah prairie dogs form colonies and spend most of their time in underground burrows, often hibernating during the winter months. The species breeds in the spring, and young can be seen above ground in late May or early June. The Utah prairie dog's diet is composed of flowers, seeds, grasses, leaves, and even insects.

Rock Squirrels



Rock squirrels are one of the largest members of the Sciuridae family, growing to nearly a foot in length, not including their long, bushy tails, which are nearly as long as their bodies. In front and on top, their coat is a speckled grayish-brown; in the back, and on the bottom, the gray becomes a more mottled brownish-black tone. They have a marked light-colored ring around their eyes and pointy ears that project well above their heads. When alarmed, they whistle a short, sharp, oscillating call.

Uintah Ground Squirrels



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Appendix B-3 - *This is an essential component of the lesson to ensure it aligns with the standard.*
Patterns of organisms across multiple ecosystems

Role of Organisms Across Multiple Ecosystems

An ecosystem is a geographic area where plants, animals, and other organisms live together. The nonliving parts of the system, such as water, soil, rocks, and air, are part of the system. The living or bio together to form a bubble of life. Ecosystems have organisms that have specific roles. Plants are producers, changing water and carbon dioxide into plant matter. Primary consumers are those that eat plants, and secondary consumers are those that eat other animals.

Ecosystems exist in various environments, including wetlands, mountain forests, prairies, and oceans. Patterns in the interactions among organisms across multiple ecosystems can be observed and described. In the prairie ecosystem, grasses are the primary producers, rabbits are the primary consumers, and coyotes are the secondary consumers. In the forest ecosystem, small fish like anchovies and sardines are producers, trees and bushes are producers, deer are the primary consumers, and mountain lions are the secondary consumers. An ocean ecosystem exhibits similar patterns, with plankton serving as the primary producers, small fish, such as anchovies and sardines, as the primary consumers, and larger fish and dolphins as secondary consumers.

When you explore the areas where you live, you can observe the organisms that inhabit ecosystems. The interactions among plants, animals, decomposers, and the environment make life possible. Matter is cycling, and energy is flowing among the organisms and the environment. Producers use energy from the sun to rearrange matter from air and water, creating sugars that store energy. Animals are using the matter from plants to get energy and matter to live and grow. The animals are recycling carbon dioxide and water from the plants and animals they eat into the environment. Decomposers change dead plants and animals back into carbon dioxide and water.

Think about the organisms you see when you take a walk. What is their role in the ecosystem where they live? Do you know other ecosystems where the interactions among plants, animals, decomposers, and the environment are similar to those in the ecosystem where you live?

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Appendix B-2 Table

Animal Name	Habitat	Food	Physical Characteristics	Prey	Predators