

NATIONAL 4-H CURRICULUM



**AT THE INTERFACE BETWEEN
LIVESTOCK AND PREDATORS:
REDUCING DEPREDATION
THROUGH LIVESTOCK HUSBANDRY**



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Agriculture and Natural Resources

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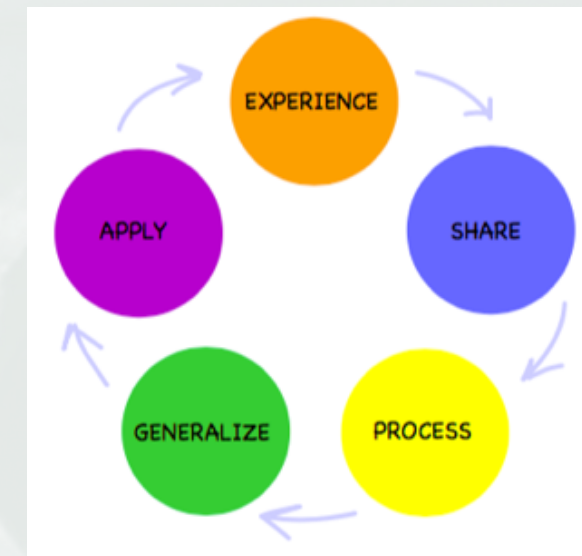
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FACILITATOR TIPS

Teaching and Learning Strategies

This 4-H curriculum entitled *At the Interface Between Livestock and Predators: Reducing Depredation Through Livestock Husbandry* uses experiential learning and inquiry-based strategies that assist in emphasizing the importance of learning-by-doing. Learners interact with other learners and their environments to help foster the development and acquisition of new knowledge and skills. The curriculum is structured such that learners participate in activities focused on specific concepts; reflect on their learning through sharing, processing, and generalizing; and, finally, apply new knowledge and skills in authentic settings.

Experimental Design



Pfeiffer & Jones (1983)

Inquiry-based learning strategies utilize guided investigations and open-ended questioning to help youth think critically to solve problems. Such approaches help engage learners in a creative learning environment that is grounded in experience and focuses on the learning and application of specific content knowledge. By using critical thinking skills, youth delve deeper into the content and are able to craft more creative observations and comparisons.

Organization of Learning Environment

The activities in this curriculum emphasize teamwork and communication skills, important elements of high quality 4-H experiences. To this end, each activity provides suggested groupings that help organize the learning environment and optimize the potential for learning. Thus, to achieve the desired outcomes, it is recommended that these groupings be followed as closely as possible.

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Module 1:

Biomes and Habitats

Background

Earth is home to several million species of plants and animals distributed across a wide variety of **terrestrial** and aquatic habitats. Earth's unique, terrestrial habitats, which cover approximately 29% of its surface, are categorized into biomes based on physical and biological features. Specifically, a **biome** is an ecological community that is defined primarily by its **climate** and main form of vegetation. These include **desert, grassland, tundra**, and a variety of forest biomes.

The resources available within each biome vary, and thus the plants and animals that inhabit them differ, too. For example, tundra biomes, found on both poles of the earth and at very high altitudes, are characterized by cold climates with short growth and reproduction seasons and, accordingly, low plant and animal diversity. Grasslands are found on most continents and are distinguished mainly by small shrubs and thin grasses. This biome can be further differentiated into savannas and temperate grasslands which differ by precipitation and temperature. Forest biomes – **deciduous forests, coniferous forests**, and **tropical rainforests** – are scattered across the Earth and are distinguished through varied climates, tree types, and animal inhabitants. Furthermore, desert biomes are characterized by the amount of annual precipitation (generally less than 50 centimeters/20 inches). Some deserts are hot and dry; others are cold and dry. Animals that inhabit deserts must be adapted for such extreme conditions.

Within any given biome, there are thousands of different **habitats**. For example, within the forest, the canopy may serve as a habitat for tree-nesting birds or mammals, while the forest floor may provide a habitat for ground-nesting birds and mammals. The trees and the forest floor may also provide habitats for other animals such as insects, amphibians, or reptiles. Plants and animals that live in specific habitats have **adaptations** that help them grow and reproduce. For example, a polar bear that lives in the tundra has thick fur to help insulate from the cold, in contrast, the fennec fox, a desert mammal, has large ears that help dissipate excess heat.

Key Terms

Adaptation:	A modification in the structure or function of an organism over time that results in it becoming better suited for survival within its environment.
Biome:	An ecological community primarily defined by its climate and vegetation.
Climate:	The prevailing weather conditions of a specific region. A region's climate comprises conditions such as temperature, air pressure, wind, humidity, sunshine, cloud cover, and precipitation averaged over a long period of time.
Coniferous Forest:	A type of forest with needle-bearing trees that generates seeds with cones.
Deciduous Forest:	A type of forest with shrubs and trees that shed their leaves at the completion of each growing season.
Desert:	A biome with low and unpredictable precipitation (less than 50 centimeters/20 inches of rainfall annually). Very few plant and animal species can survive its extreme conditions. Temperatures across deserts vary, from hot and dry, to cold and dry.
Grassland:	A large, open, biome found on nearly every continent. Its vegetation predominantly consists of thin grasses and small shrubs.
Habitat:	A species' home. It includes all the resources a species needs to survive (e.g., food, water, and shelter).
Terrestrial:	Of or relating to dry land or the Earth.
Tropical Rainforest:	A type of forest with bountiful rainfall (more than 200 centimeters/80 inches annually). The temperature is warm all year.
Tundra:	A vast, mostly treeless, biome. The topsoil remains frozen all year, which hinders tree growth in the region.

Activity 1: Biomes of the Earth

Objectives:

- To characterize the six terrestrial biomes across the globe.
- To describe features of different types of plants and animals specific to the six terrestrial biomes.

Life Skills:

- Contribution to Group Effort
- Critical Thinking
- Teamwork
- Creativity

Next Generation Science Standards:

Crosscutting Concepts:

- 1 - Patterns

Practices of Science:

- 1 - Asking questions,
- 4 - Analyzing and interpreting data,
- 7 - Engaging in argument from evidence,
- 8 - Obtaining, evaluating, and communicating information

Disciplinary Core Concepts:

- Ecosystems: Interactions, Energy, and Dynamics;
- Earth's Systems

Suggested Groupings:

Small groups of 2-4 youth

Time Required:

1-1.5 hours

Materials Needed:

One copy of Appendices 1, 2, 3, and 4 per group

One copy of "Biome Pictures" handout (Appendix 1) per group

1-2 pieces of flip chart paper per group

Writing utensils (e.g., pens, pencils, or markers; shared materials) for each group

Getting Ready:

1. Print one set of Biome Pictures (Appendix 1), Biome Fact Sheets (Appendix 2), Animal Behavior Fact Sheets (Appendix 3), and Appendix 4 (Answer Key) as handouts for each group.

2. Cut the Biome Pictures, Biome Fact Sheets, and Animal Behavior Fact Sheets so all of the photos and fact sheets are separated

Note: The answer key is not provided to the youth until after the activity has been completed.

3. Copy Appendices 5 and 6. Make one copy of each document for each youth.

Opening Questions/Prompts:

For each prompt, ask the youth to draw or write down their response on the piece of flip chart paper, or to share it verbally. Discussion is encouraged.

1. Describe the area and environment where you live.
2. Describe the area and environment where your favorite wild animal lives.
3. Explain what you know about the different places animals live in different parts of the world.

Activity

Part 1: About the Biomes

1. Divide youth into pairs or small groups of 2-4.
2. Provide each group with Appendices 1 and 2.
3. Working together, have youth match the fact sheets and pictures. They should come up with six different groups, one for each biome.
4. Once they have finished, ask them to present their matches. Ask the groups to describe how they reached their decisions. What information from the fact sheet did they use to make their matches?

Part 2: To Which Biome do these Animals Belong?

1. After the first part has been completed, pass out a set of Animal Behavior Fact Sheets (Appendix 3) to each group of youth.
2. Ask the youth to match the animals with one or more biomes using the animal behavior fact sheet. (Facilitator Tip: Several of the animals could live in different biomes). Encourage the youth to develop lines of reasoning as to why they think the animal is able to live in one or more of the biomes.

3. Once they have finished, ask them to present their thoughts and ask the groups to describe how they reached their decisions.
4. Pass out a copy of Appendix 4 (Answer Key) after they have finished presenting their findings.

Sharing, Processing, and Generalizing

In a large group discussion, follow the lines of thinking of the youth after they have shared their thoughts. Some prompts to help guide their thinking may include:

1. Compare some of the similarities and differences you observed between biomes.
2. Describe your understanding of how a single biome can have multiple habitats for different animals.
3. If there are plants and animals that you believe can inhabit multiple biomes, explain why you think it is or is not possible. Give a few examples.

Concept and Term Discovery/Introduction

At this point, make sure the terms Adaptation, Biome, Climate, Coniferous, Deciduous Forest, Desert, Forest Habitat, Grassland, Terrestrial, Tropical Rain Forest, and Tundra have all been utilized and discussed.

Note: The goal is to have the youth develop an understanding of these concepts through their own exploration and to define the terms using their own words.

Exploring Your Biome Activity

Time Required: 45-60 minutes

Materials Needed:

One copy of “Field Notes” handout (Appendix 5) for every youth
One copy of “Exploring Your Biomes Guide” handout (Appendix 6) for every youth
Writing utensils
Optional:
Binoculars
Magnifying Glass
Camera/cell phone to document pictures

Getting Ready:

1. Print one copy of the “Field Notes” handout (Appendix 5) and “Exploring your Biomes Guide” handout (Appendix 6) for each youth
2. Give every youth a writing utensil
3. Select any area in your community to make observations (e.g., park, city block, school grounds, nature reserve, vacant lot, backyard)

Activity

1. As a group, walk to a local area in your community or around your neighborhood.
2. Youth will explore the area and search for plants and animals. They will record (draw/write) their findings in the “Field Notes” handout. If more space is needed, they may ask for extra paper to make additional observations. The goal of the activity is for youth to record information about their environment and the plants and animals that live there in order to figure out the biome in which they live.
3. Youth can use cell phones and other technology to look up current weather or to take pictures of their findings.

4. After making observations, the youth will share their findings with one another.
5. Next, each youth will receive a copy of “Exploring Your Biome Guide”. They are encouraged to record more observations and discuss the questions with their peers.
6. In groups, youth will identify their home biome.

Sharing, Processing, and Generalizing

Give youth some time to share their findings in their groups (3-5 minutes) before holding a large group discussion. In the large group discussion, follow the lines of thinking of the youth as they share their observations. Some prompts to help guide their thinking may include:

1. Using your observation notes, explain what biome you believe you inhabit.
2. Explain how natural disasters or events might change a habitat and affect the organisms that live there.
3. Describe how human intervention (e.g., new housing developments; roads) might affect the type of biome in which you live.

Optional Extension Activities

Option 1: Create a pen pal relationship with a youth that lives in a different biome. In this pen pal relationship youth can tell each other about their biomes and habitats to find similarities and differences.

Option 2: Youth can select an animal of their choice and create a diorama depicting the habitat of that animal. They may cut out the pictures from this activity to include in their diorama. The youth will then explain their diorama to a family member or friend, describing both the type of biome the animal lives in and the adaptations the animals developed to live there.

Module 2:

Food Web

Background

Ecosystems sustain a variety of plants and animals that must be well suited to the habitat in which they live. All living organisms have to establish a delicate balance with all other **species** that share the same space. The **food web** connects these diverse species to one another and maintains order and health within each given habitat to create a balanced **eco-system**. As a result of these interconnections, taking one animal out of these systems can lead to significant consequences for the whole ecosystem.

Animals and plants play a role in the series of interconnecting **food chains** that make up the food web. At the top of the food web is the **apex predator** and following are various groups of **prey**, some of which could also be **predators** themselves. The multitude of species found in the food web can be organized into four broad categories that are based on their diets: **carnivores**, **omnivores**, **herbivores**, and **autotrophs**. Every habitat has its own unique relationships among the species that fall under one of these four categories, thus creating the food web for that particular area. The food web is built on relationships of food energy flowing from one source to another: plant to herbivore and herbivore to carnivore, and so on. Therefore, if a single animal species is removed, or populations decline, the food web could be missing a link. For example, if a predator is removed from an ecosystem due to depredation, the entire food web is thrown off balance, furthermore impacting the rest of the ecosystem's ability to thrive. The relationship between predators and prey helps ensure that neither population exceeds the **carrying capacity** of that specific location.

Key Terms

Apex predator:	A predator at the top of the food chain because it has no predators.
Autotroph:	An organism that produces its own food through light, carbon dioxide and water. They are also referred to as “producer” organisms.
Carnivore:	An animal that eats mostly other animals as its food source.
Carrying Capacity:	The size of the population no longer has the resources to reproduce and sustain itself. The population is at its maximum.
Ecosystem:	A particular biological community and its physical environment that exchange matter and energy.
Food chain:	A hierarchal feeding sequence that begins with a producer organism and ends with an apex predator. It represents how energy and materials are shared between organisms

Note: This term is used less often compared to food webs because it does not explain the interconnectedness between all plants and animals in an ecosystem.

Food web:	Connections between individual food chains that describe feeding relationships amongst organisms in an ecosystem.
Herbivore:	An animal that eats mainly plants as its food source.
Omnivore:	An organism that eats both animals and plants as food sources.
Predator:	An animal that consumes other animals.
Prey:	An animal that is hunted and consumed for food.
Species:	Connections between individual food chains that describe feeding relationships amongst organisms in an ecosystem.

Activity 1: Who is in the Food Web?

Objectives:

To learn and be able to understand the different categories within the food web and how they interrelate.

Life Skills:

Heart

- Communication
- Cooperation

Hands

- Teamwork

Head

- Decision Making
- Critical Thinking
- Planning/Organizing

Next Generation Science Standards:

<https://www.nextgenscience.org/search-standards>)

Crosscutting Concepts:

- Patterns
- Cause and Effect
- System and System Models
- Stability and Change

Science and Engineering Practices:

- Developing and using models
- Constructing explanations

Disciplinary Core Ideas:

- Interdependent relationships in ecosystems
- Organization for matter and energy flow in organisms
- Ecosystems dynamics,
- Functioning and resilience

Suggested Groupings:

3-4 youth per group

Time Required:

30-45 minutes

Materials Needed:

A copy of “What’s on the Menu?” hand-outs (Appendix 1) for each group

A copy of “What’s on the Menu?” Answer Key (Appendix 2) for each group.

A copy of “Who is in the Food Web?” Answer Key (Appendix 3) for each group.

Markers or other writing utensils

Scissors, Yarn, & Tape

Getting Ready:

1. Print a copy of the “What’s on the Menu?” handouts (Appendix 1) for each group.

2. Print a copy of “What’s on the Menu? Answer Key” (Appendix 2) for each group.”

3. Print a copy of “Who is in the Food Web? Answer Key” (Appendix 3) for each group.

4. Cut yarn into 3-foot pieces and give each group one piece.

5. Each group should have writing utensils, a pair of scissors, and tape.

Opening Questions/Prompts:

For each prompt, ask the youth to draw or write down their response on the piece of flip chart paper, or to share it verbally

1. Discuss how what you eat gets on your table.
2. Describe what you know about the different types of food animals can eat and what characteristics allow them to consume that food. Provide an example.
3. In respect to their diet, explain the interactions between plants and animals in their environment

Activity

1. Divide youth into groups of 3-4 and give each group a handout titled “What’s on the Menu?” (Appendix 1) and have the youth cut out the photos with scissors.
2. As a group, the youth will review each case and match the picture of the animal jaw with the picture of the different type of food they think it eats and be able to explain their reasoning. They will also discuss their thoughts and answer the questions together on the handout.

Note: Encourage the youth to make a chart of characteristics of the skulls, and how that may support their claim as to the diet of the skulls.

Facilitator tip: Make certain students complete steps 1-2 prior to providing the answer key, “What’s on the Menu? Answer key” (Appendix 3).

3. Once a group has finished going through all the cases, hand them yarn and tape. Working as a group, have the youth create a large food web with all of the photos from all the cases and connect them with the yarn. This may be done in a large open space on the floor, on a large table, or on a large bulletin board. The youth may refer to the first handout for reference.
4. Provide youth with “Who is in the Food Web? Answer Key (Appendix 3) for the answer key and photos. Ask the youth to revise their food web if necessary.

Facilitator Tip: Make certain students complete steps 3 prior to providing “Who is in the Food Web? Answer Key (Appendix 3).

Sharing, Processing, and Generalizing

Give the youth some time, 3-5 minutes, to share their findings in their small groups before holding a large group discussion. In the large group discussion, follow the lines of thinking of the youth as they share their observations. Some prompts to help guide their thinking may include:

1. Compare what different characteristics you observed in the jaws of animals observed in the photographs.
2. Describe why you think it is possible for some animals to eat multiple types of foods and why others can only eat one type.
3. Explain what you think may happen if you remove any one of the animals from the food web.

Concept and Term Discovery/Introduction

At this point, make sure the terms **Food Web, Food Chain, Predator, Apex Predator, Prey, Carnivore, Omnivore, Herbivore, Autotroph,** and **Species** have all been utilized and discussed.

Note: The goal is to have the youth develop an understanding of these concepts through their own exploration and to define the terms using their own words.

Activity 2: Food Web Balance

Objectives:

To learn about the connections between the predator and prey in a food web can affect the balance in an ecosystem.

Life Skills:

Heart

- Communication
- Cooperation

Hands

- Teamwork

Head

- Decision Making
- Critical Thinking

Next Generation Science Standards:

(See <https://www.nextgenscience.org/search-standards>)

Crosscutting Concepts:

- Patterns, cause and effect,
- System and system models,
- Stability and change

Science and Engineering Practices:

- Developing and using models
- Constructing explanations

Disciplinary Core Ideas:

- Interdependent Relationships in Ecosystems
- Organization for Matter and Energy flow in organisms.
- Ecosystems Dynamics,
- Functioning and Resilience

Suggested Groupings:

All youth. This activity is written for five youth participants but can be adjusted according to group size.

Time Required:

30-40 min

Materials Needed:

Paper dots from a hole punch (or another shape may be cut using scissors or a paper cutter)

Envelope/container to put dots in

Getting Ready:

1. Cut out 200 paper dots (or any shape that is easy to pick up will work). A hole punch may be a useful tool for this process. Facilitator Tip: Dots “consumed” by the “predators” should be reused for each cycle described.

2. Identify an open space where the dots can be spread out on the floor.

3. **Note:** The activity as written is for five youth participants but all youth should be invited to participate. The number of dots can be adjusted depending on the number of youth. For example, if four youth are participating then the activity would start with 80 instead of 100 dots: if three youth are participating there will be 60 instead of 100 dots.

Activity

1. Spread 100 paper dots evenly on the ground covering an area of approximately 3' x 3'.
2. Explain to the youth that in this activity they will represent predators and the dots will represent prey.
3. During each cycle the youth will need to pick up 10 dots each, one by one, and place them in a given container. Emphasize that youth need to stand up each time they pick up a dot and place it in the envelope/container provided.

- **Cycle 1:** Each of the five youth need to remove 10 dots in approximately 45 seconds. **Note:** Remind the youth that, as predators, these dots are prey and represent the amount of food they need to survive.

The facilitator will then replace the 50 dots removed with 50 new dots. **Note:** Explain that the replacement of dots represents the prey population reproducing; populations typically double, and now the resulting prey population is back to its original of 100. After the dots are replaced the first cycle of the activity has been completed and the following cycles will be patterned similarly.

- **Cycle 2:** This cycle is a repeat of cycle one to help youth understand the pattern and relations between predators and prey. Cycle 2 begins after the facilitator has replaced the 50 dots that were removed in Cycle 1. As in Cycle 1, each of the five youth will remove 10 dots in approximately 45 seconds.

The facilitator will then replace the 50 dots removed with 50 new dots. **Note:** Remind the youth that the replacement of dots represents the prey population reproducing; populations typically double, and now the resulting prey population is back to its original of 100. After the dots are replaced the second cycle of the activity has been completed.

- **Cycle 3:** Before Cycle 3 begins the facilitator will remove one youth participant, which means four youth will participate as predators in this cycle. This will represent the removal of a predator from the ecosystem such as a raccoon being removed because it was killed by a car.

Each of the four youth remaining need to remove 10 dots in approximately 45 seconds. **Note:** Again, remind the youth that, as predators, these dots are prey and represent the amount of food they need to survive.

Activity

At this point, the facilitator will explain that 60 dots remain, and these “prey” will reproduce. (Note: facilitator adds 60 dots so the population is at 120). Populations typically double, and now the resulting prey population is 120. After the dots are replaced the third cycle of the activity has been completed.

- **Cycle 4:** Before Cycle 4 begins the facilitator will remove another youth participant, which means only three youth will participate as predators in this cycle. A reason for this removal could be that a raccoon was killed by a farmer because of a recent poultry loss.

Each of the three youth remaining need to remove 10 dots in approximately 45 seconds. Note: Again, remind the youth that, as predators, these dots are prey and represent the amount of food they need.

At this point, the facilitator will explain that 90 dots remain, and these “prey” will reproduce. (Note: facilitator adds 90 dots so the population is at 180). Populations typically double, and now the resulting prey population is 180. After the dots are replaced the third cycle of the activity has been completed.

- **Cycle 5:** Before Cycle 5 begins the facilitator will remove another youth participant, which means only two youth will participate as predators in this cycle. A reason for this removal could be that a raccoon died due to habitat loss from the development of a housing project.

Both youth remaining need to remove 10 dots in approximately 45 seconds. Note: Again, remind the youth that, as predators, these dots are prey and represent the amount of food they need.

At this point, the facilitator will explain that 160 dots remain, and these “prey” will reproduce. Populations typically double; ask the youth what the resulting prey population size will be when it doubles.

Note: As a point of further discussion, the youth are encouraged to discuss other reasons that predators might be lost from an ecosystem. They also might discuss what would happen in the situation above if all predators were removed.

Sharing, Processing, and Generalizing

Give the youth some time to share what they observed with smaller groups, 3-5 minutes, before holding a large group discussion. In the large group discussion, follow the lines of thinking of the youth as they share their observations. Some prompts to help guide their thinking may include:

1. Explain how in cycles 1 and 2 the predator and prey populations were balanced. What changed during each cycle (e.g. number of dots)?
2. Discuss how removing a predator in this scenario affected Cycles 3, 4, and 5 the prey population size. Explain how you think this could affect the prey population.
3. Discuss how a larger-than-normal predator population might affect the ecosystem.

Concept and Term Discovery/Introduction

At this point, make sure the terms **Food Web, Food Chain, Predator, Apex Predator, Prey, Carrying Capacity, Carnivore, Omnivore, Herbivore, Autotroph, Ecosystem** and **Species** have all been utilized and discussed.

Note: The goal is to have the youth develop an understanding of these concepts through their own exploration and to define the terms using their own words.

Concept Application:

Youth will identify five animals in their local biome and then complete the following steps:

- Develop a list of what these animals eat and determine if they are autotrophs, herbivores, omnivores or carnivores.
- Create a poster of a food web or food chain with the five animals they identified.
- Share and discuss their findings.

Optional Extension Activity:

Youth may write a short story about animals that are interconnected in a food web. They should describe what would happen to animals if one was taken out of the food web. Think about the habitat these animals live in and how that affects their food web if it was destroyed.

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Appendix 1: What's On The Menu?



Directions:

For each skull, analyze the teeth of the animal. Discuss with your group what you see and predict what type of food the animal might possibly eat. Based on your observations, select three photos of food items for each skull that you think the animal may eat. Some food items may work with more than one skull. Additionally, for each skull, discuss the following questions below. After you finish one skull, your group can move onto the next skull.

Questions for Each Skull Observed

Write down your answers on a separate piece of paper.

1. Using explanatory terms describe the different types of teeth this animal has and how these teeth affect the type of food the animal eats.
2. For the food items you chose, discuss how you think an animal with this type of the skull can eat it.

Appendix 1: What's On The Menu?



Module 3:

Predator Identification

Background

Predators are animals that hunt and feed on other animals for survival. They play an important role in the environment by maintaining the natural balance between the population of predators and prey, which contributes to the well-being of the ecosystem. This ensures that neither population exceeds the **carrying capacity** of that specific location. Due to the key role the predators play in the environment, it is necessary for wildlife biologists to monitor species' populations in order to determine the best course of action to protect the plants and animals of the area.

In order to track wildlife – predators or **prey** – researchers utilize different methods to track, tag, and keep records. Researchers may use **field guides** which contain information about different species of animals, such as photographs, as well as measurements of animals' **tracks**, and **scat** to help them identify different species in the wild. Field guides will also include additional information about the species like biology, reproduction, or behavior. This information is then utilized in the field to identify an animal that may have left behind clues about its presence.

Animal foot prints represent one valuable tool when tracking and identifying an animal in the field. For example, the size of a foot print will help reveal the relative size of the animal. One set of foot prints, or many sets of foot prints, can indicate whether the animal is solitary or pack/herd oriented. The number of toes in a foot print show whether or not claw marks are evident. In addition, observing whether the footprint is a paw or a hoof can provide further details about the animal.

Another tool to help identify an animal is the recognition of the differences in an animal's vocalizations. Vocalization is an effective way to know animal types, locations, and emotions, since animals have different vocalizations for different purposes. Additionally, researchers may opt to set up cameras to capture images or videos of wildlife in their natural conditions; allowing researches to observe their natural behaviors. They may even attach tracking collars on individual animals to observe their movements without human interference. Through the use of radio, satellite, and GPS trackings, researchers are able to track and continue to keep records of animals.

Background continuation

Major predators residing in Northern America include: **cougars, bobcats, gray wolves, coyotes, red foxes, bears, raccoons, and raptors**. Cougars, also known as mountain lions and pumas, are large predatory felines that typically prey on large **ungulates** (e.g., deer), as well as smaller animals. They occupy a variety of habitats such as forests, prairies, deserts, and swamps. Bobcats, characterized by their short 'bobbed' tail, are also predatory felines, although they are smaller than cougars. They typically hunt smaller prey, such as rodents, but are also capable of hunting small ungulates. Similar to the cougar, bobcats occupy an array of habitats such as forests, swamps, scrublands, and deserts.

Gray wolves are large predatory canines that typically hunt in packs to take down large ungulates. They will also eat smaller prey, carcasses, and garbage to supplement their diet when larger prey animals are unattainable. Since gray wolves have become extinct throughout a majority of the United States region, wolves typically reside in the wilderness and remote areas. Coyotes are medium-sized opportunistic canines that hunt individually, and rarely in packs, with diets ranging from fruits and insects, to large ungulates and livestock. Coyotes can exist in almost all habitats, including grasslands, deserts, forests, mountains, and even human altered landscapes (urban areas). Red foxes are small, omnivorous members of the canine family with diets consisting of rodents, other small animals, insects, fruits, and berries. Typically solitary animals, red foxes are found in a variety of habitats including forests, mountains, grasslands, deserts, and even urban areas.

American black bears are large, omnivorous mammals that live primarily in grasslands and forests. Usually solitary, bears prey on smaller mammals and consume a lot of plant material, such as berries and leaves. Raccoons are small, nocturnal animals that have adapted to a wide variety of habitats, from living in forests to living among humans in urban areas. They are omnivores that consume anything from trash to fish to fruit. Lastly, raptors are birds of prey, meaning they are carnivorous, with hooked beaks and sharp talons that help them consume the small mammals, birds, and fish they hunt. Raptors are a large class of birds which allow them to be found in a variety of habitats including coasts, forests, grasslands, deserts, and urban areas.

Key Terms

Black Bear:	A large, omnivorous mammal located throughout the most northern parts of North America, especially in Canada.
Bobcat:	A medium-sized, wild, predatory cat ranging from Canada, through the United States, and into Mexico.
Carrying Capacity:	The size of the population no longer has the resources to reproduce and sustain itself; the population is at its maximum.
Cougar:	Large, wild, predatory cat with ranges throughout the Western Hemisphere.
Coyote:	A medium-sized, wild, predatory dog located throughout the Americas.
Field guide:	A book that contains general information about the species and methods of identification particular to the animal.
Gray Wolf:	Large, wild, predatory dog with ranges throughout the Northern Hemisphere.
Predator:	An animal that consumes other animals.
Prey:	An animal that is hunted and consumed for food.
Raccoon:	Small, masked, omnivorous mammal located throughout the United States and Mexico.
Raptor:	Birds of prey that live in many biomes and are carnivorous. They have curved claws and sharp beaks to capture and eat prey.
Red Fox:	A small, red, predatory dog located throughout the northern and eastern parts of North America.
Scat:	Animal droppings that signify the habitat and the diet of the species.
Tracks:	Marks that are left behind by the animal's foot identifying their direction and species, occasionally indicating age, sex, and/or unique features.
Ungulates:	Hooved mammals. Examples include: deer, horses, cows and pigs.

Activity 1: Seeking Wildlife

Objectives:

Youth will gain an understanding of how to identify some predators and prey. They will be able to apply their understanding to help identify animals in the area where they live.

Life Skills:

Heart

- Communication
- Cooperation

Hands

- Teamwork

Head

- Decision Making
- Critical Thinking
- Keeping Records

Next Generation Science Standards:

<https://www.nextgenscience.org/search-standards>

Crosscutting Concepts:

- Patterns, cause and effect, scale proportion and quantity, structure and function

Science and Engineering Practices:

- Planning and carrying out investigations, analyzing and interpreting data, engaging in argument from evidence and obtaining, evaluating, and communicating information

Disciplinary Core Ideas:

- Ecosystems: interactions, energy, and dynamics; earth and human activities; heredity: inheritance and variation of traits; biological evolution: unity and diversity

Suggested Groupings:

Small groups or pairs of youth.

Time Required:

60 - 90 minutes

Materials Needed:

One copy of "Footprints" for each pair or group (Appendix 1)

One copy of "Field Notes" for each youth (Appendix 2)

One copy of "Field Guide" for each youth (Appendix 3)

One copy of the "Footprint Answer Key" for each pair or group (Appendix 4)

One ruler for each group (at least 6 inches long)

Blank sheets of paper

Flip chart

OPTIONAL: Camera/phone for youth to take pictures/record evidence.

Getting Ready:

1. Print out one copy of "Footprints" (Appendix 1).
2. Print out one copy of "Field Notes" (Appendix 2) for each youth.
3. Print out one copy of "Field Guide" (Appendix 3) for each youth.
4. Print out one copy of the "Footprint Answer Key" (Appendix 4) for each pair or group.
5. Scatter the handouts of "Footprints" around the room so they are distinctly separate from one another. They can be put on the floor or tables.
Note: This activity can be also be done outside.
6. Give one ruler (at least 6 inches) to each pair or group.

Opening Questions/Prompts:

For each prompt, ask the youth to draw or write down their response on the piece of flip chart paper, or to share it verbally.

1. Describe what clues you think you can observe that may indicate there is wildlife in the area.
2. Explain methods you think someone who studies wildlife would use to find animals in an area.
3. Explain how you believe you can differentiate tracks left by one species from another species.

Activity Part 1: Identification Methods

1. Working in pairs or small groups, provide each youth the "Field Notes" (Appendix 2) handout and a writing utensil for collecting information. Provide youth additional sheets of blank paper if more space is needed.

Note: Do not distribute the "Field Guide" (Appendix 3) yet.

- Youth will walk around the room to collect as much information about the tracks as possible. Each group should have the chance to go to each station at least once; encourage the youth to take their time and record specific observations. As the youth move around the room from one station to another, encourage them to discuss their observations and make inferences on the size, habitat, and other characteristics of the animals.

Note: The youth should focus on gathering observations on specific identification markers, measurements, or significant differences rather than trying to identify what the animal is. Youth are encouraged to sketch and write out their observations on the “Field Notes” (Appendix 2)

- After all of the youth have gone around the room at least once, a larger discussion should take place where the youth discuss and organize the information they collected. The youth should note any disagreements or misperceptions they had during the activity.

Activity Part 2: Using a Field Guide

- Working in the same pairs or small groups, facilitators may now provide each youth a “Field Guide” (Appendix 3) handout.
- Have the youth groups revisit the stations with their Field Guides (Appendix 3) and Field Notes (Appendix 2) from Activity Part 1.
- The youth will then construct an explanation of whether or not they believe their animal is represented at each station using what they learned from their discussion of observations of the station and using the information on their Field Guide (Appendix 3). They will discuss their findings within their groups and note additional observations on their Field Notes (Appendix 2).

Facilitator Tip: Make certain students complete steps 1-3 prior to providing the “Footprint Answer Key” (Appendix 4).

Sharing, Processing, and Generalizing

Give the youth some time, 3-5 minutes, to share their findings in their small groups before holding a large group discussion. In the large group discussion, follow the lines of thinking of the youth as they share their observations. Some prompts to help guide their thinking may include:

- Describe what methods you used to determine which track belonged to which species of animals.
- Describe some different characteristics of the footprints you observed that gave you specific information about the animal.

Notes: such as size, number of toes, or shape of foot

- During your observations, explain what difficulties you may have had trying to discern one animal from another. If you did not, explain why.
- If you were in the wild tracking animals, describe some difficulties you may experience.

Examples could include:

- Soil was too hard to leave prints.
- Soil was too moist; track shape/size was difficult to discern.
- Why might you not be able to observe raptor tracks on the ground?

Concept and Term Discovery/Introduction

At this point, make sure the terms **Black Bear, Bobcat, Cougar, Coyote, Field Guide, Gray Wolf, Prey, Predator, Scat, Tracks, Raccoon, Raptor, Red Fox, Ungulates** have all been utilized and discussed.

Note: The goal is to have the youth develop an understanding of these concepts through their own exploration and to define the terms using their own words.

Concept Application

Field Guide Exploration Activity

Time Required:

45 - 60 minutes

Materials Needed:

One copy of "Field Notes" for each youth (Appendix 2)

One copy of "Field Guide" for each youth (Appendix 3)

Blank sheets of paper

OPTIONAL:

Rulers

Magnifying glass

Binoculars

Camera/phone for youth to take pictures/record evidence

Getting Ready:

1. Print a copy of the "Field Guide" (Appendix 3) handout for each youth OR have youth reuse the field guides from Activity 1: Seeking Wildlife.
2. Print a copy of the "Field Note" (Appendix 2) handout for each youth.

Activity:

1. Ask the youth to explore and gather evidence of possible wildlife in an area near their home, farm, or ranch.
2. As they explore the area, youth should be encouraged to use their Field Guides (Appendix 2) for reference as they make observations about the environment. If they find any scat, tracks, or other markings left behind by animals, youth are encouraged to take measurements and make drawings on their field notes or take photographs to document the evidence.
3. Ask the youth to use the evidence they collect to compare it to the information in their Field Guide (Appendix 2). Remind them to make inferences from the evidence they have collected (e.g., size of animal, number of animals, predator, prey).
4. Share findings with other youth.

Sharing, Processing, and Generalizing

Give youth some time to share their findings in their groups, 3-5 minutes, before holding a large group discussion. In the large group discussion, follow the lines of thinking of the youth as they share their observations. Some prompts to help guide their thinking may include:

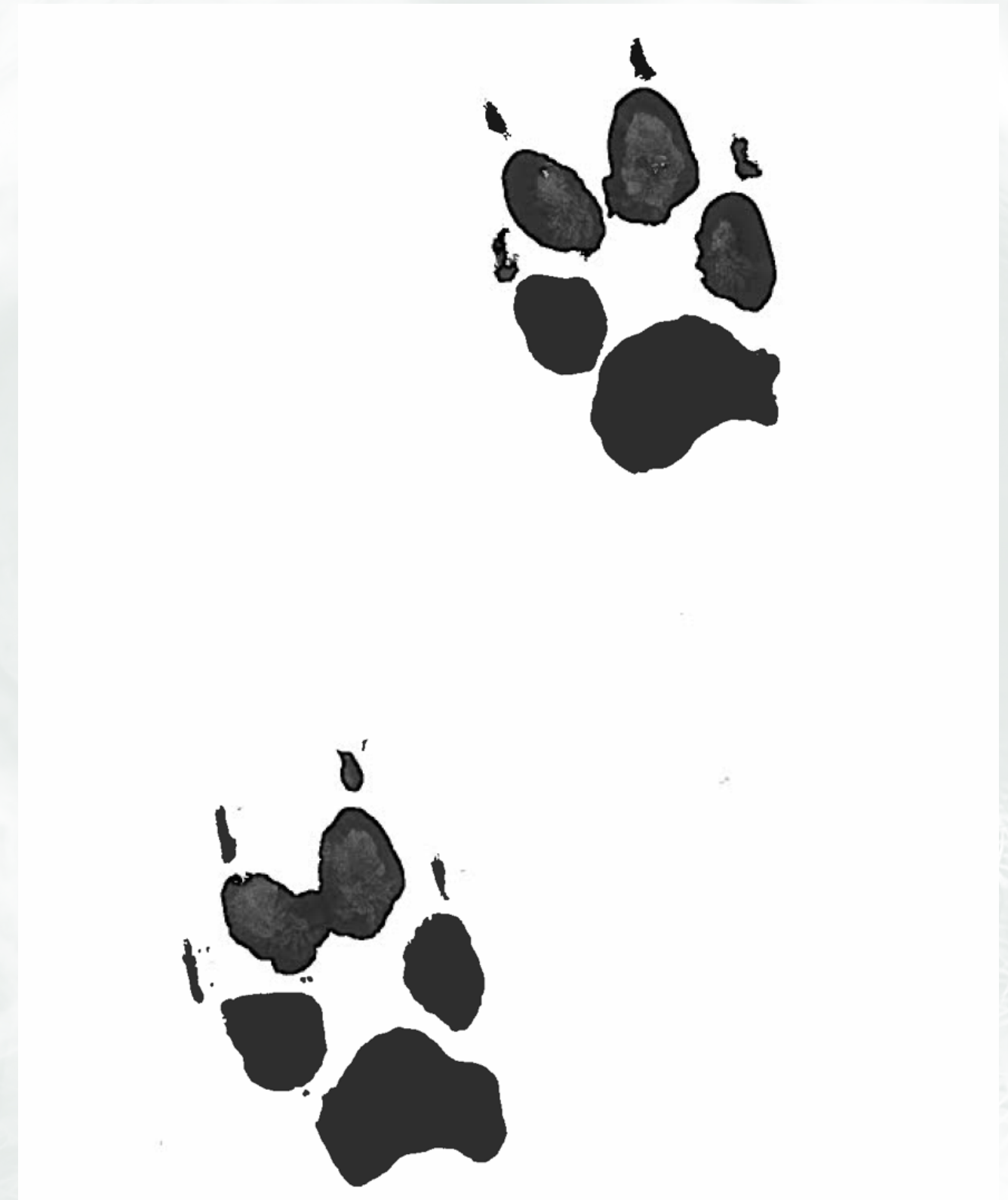
1. Describe ways that one may be able to distinguish between predators and prey in the wild.
2. Discuss one or more reasons why it might be important to understand the type of wildlife that are present around a home, farm, or ranch.

Concept and Term Discovery/Introduction

At this point, make sure the terms **Carrying Capacity**, **Prey**, **Predator**, **Scat** and **Tracks**, and have all been utilized and discussed.

Note: The goal is to have the youth develop an understanding of these concepts through their own exploration and to define the terms using their own words.

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Module 4:

Risk Assessment and Mitigation

Background

Various **predators**, such as coyotes, bobcats, cougars, raptors, red foxes, black bears, raccoons, and gray wolves may pose a threat to livestock and poultry. When a predator preys upon livestock or poultry, they may be targeted for removal from the area. **Predator depredation**, meaning the removal of predators that pose a threat to agricultural products or resources, is one strategy to help decrease the interactions between wildlife and food animals; however, depredation also has the potential to lead to ecosystem imbalances that can disrupt the natural food web.

Another strategy that can help reduce interactions between predators and livestock/poultry, and in turn reduce the incidences of predator depredation, is to encourage livestock and poultry growers to perform a risk assessment. A **risk assessment** is a systematic, intentional approach to analyzing possible threats from natural predators as they pertain to practices used in the raising of livestock or poultry, including feeding, housing, waste management, transport, etc.

Because different predators represent different risks, it is necessary to identify the predators in the geographic area first. Once this has been accomplished, a systematic risk assessment – risk identification and analysis – of the given livestock or poultry production system related to the specific predators identified is undertaken. After risks have been identified, individuals are then urged to develop a **risk mitigation plan**, which provides a framework to guide changes in the production system that will help reduce the potential risks.

Key Terms

Predator:	An animal that consumes other animals.
Predator Depredation:	When a person intentionally kills a predator. Often occurs after a predator attacks or kills livestock, poultry, or a pet. A depredation permit is needed.
Risk Assessment:	The process of analyzing possible dangers in a situation with a recognized threat(s).
Risk Mitigation Plan:	A framework to minimize and avoid depredation effects. It can include areas such as livestock and poultry fencing, housing, and management.

Activity 1: Assessing Risks and Developing a Mitigation Plan

Objectives:

Youth will be able to identify factors that may put a 4-H livestock project at risk for predation and develop a mitigation plan.

Life Skills:

Heart

- Communication
- Cooperation
- Conflict Resolution

Hands

- Teamwork

Head

- Decision Making
- Critical Thinking
- Keeping Records
- Problem solving
- Planning/Organizing

Health

- Personal Safety
- Disease Prevention

Next Generation Science Standards:

<https://www.nextgenscience.org/search-standards>)

Crosscutting Concepts:

- Patterns, cause and effect, systems and systems models, stability and change

Science and Engineering Practices:

- Asking questions and defining problems, developing and using models, analyzing and interpreting data, constructing explanations and designing solutions

Disciplinary Core Ideas:

- Earth and human activities

Suggested Groupings:

3-4 youth per group

Time Required:

50 - 60 minutes

Materials Needed:

One copy of the “Risk Assessment Scenario” handout per group (Appendix 1)

One copy of the “Risk Assessment Tool” handout for each youth (Appendix 2)

Writing utensils for each youth

One piece of flip chart paper for each group.

Getting Ready:

1. Print one copy of the “Risk Assessment Scenario” handout for each group (Appendix 1)

2. Print one copy of the “Risk Assessment Tool” handout for each youth (Appendix 2)

Opening Questions/Prompts:

For each prompt, ask the youth to draw or write down their responses on the piece of flip chart paper, or to share them verbally.

1. Explain what risk means to you.
2. Describe some ways a predator may represent a risk for your 4-H livestock project.
3. Explain what features of the environment you need to assess to evaluate risk.

Activity

1. Facilitators will provide each pair/small group of youth with one scenario from the Risk Assessment Scenario handouts (Appendix 1).

Facilitator Tip: Pairs/small groups can do more than one scenario if time permits

2. Instruct youth to read their scenario and identify potential risks to predation for the animals. Youth may also identify aspects of their scenario that will help protect their livestock from predation.
3. After the pairs/small groups have identified and discussed the risk and protection factors in their scenarios, facilitators will give each youth a copy of the Risk Assessment Tool (Appendix 2).
4. With the Risk Assessment Tool as a guide, youth will read their scenarios again. Ask the youth to identify risks and rate them as low, medium, or high.

Facilitator Tip: Not all of the categories listed in the risk assessment are present in each of the scenarios, but each of the main topics (housing, management, and fencing) are included.

5. After the pairs/small groups rank the risks using the Risk Assessment Tool, ask them to discuss strategies to reduce the risks they have identified.

6. At this point, ask the pairs/small groups to share their scenario, their risk assessment, and the strategies they developed to reduce the risks they identified with the other pairs/small groups. Encourage the youth to look for similarities and differences.

Sharing, Processing, and Generalizing

Give the youth some time, 3 - 5 minutes, to share their findings in their small groups before holding a large group discussion. In the large group discussion, follow the lines of thinking of the youth as they share their observations. Some prompts to help guide their thinking may include:

1. Explain why, if at all, you think performing a risk assessment could benefit 4-H animal science projects.
2. Explain barriers or challenges you might face in implementing strategies to reduce some of the risks you identified.
3. Would you design your enclosure for your animal differently if you were raising a small animal versus a large animal? Describe why or why not.

Concept and Term Discovery/Introduction

At this point, make sure the terms **predator**, **predator depredation**, **risk assessment**, and **risk mitigation** plan have been discovered by the youth or introduced.

Note: The goal is to have the youth develop an understanding of these concepts through their own exploration and to define the terms using their own words.

Concept Application

Have the youth assess predator risks on their own property using the Assessing Your Own Risks Handout (Appendix 3) and the Risk Assessment Tool (Appendix 2) as a guide. After assessing their own project, youth can develop a risk mitigation plan to help reduce predation risks and depredation for their project animals.

Module 5:

Service-Learning and Application

Background

Service-learning offers opportunities for youth to apply learned material to their community to solve authentic community needs, like predator and livestock depredation. The main purpose of service-learning is to help develop better communities and individuals. To help accomplish this it is important to utilize backwards planning design principles, thinking about the desired impact first, and then designing the project around it. There is not one right way to conduct service-learning projects. The community, resources, environment, time and many other factors help determine how a service-learning project should be shaped. In this module, you will find a flow chart, logic model and project plan handout to help determine what service-learning project would be the best fit.

Within service-learning there are four main types of service: **direct service**, **indirect service**, **research** and **advocacy**. None of these types of service are more effective or better than the others. In fact, it is possible to engage in more than one type of service at the same time. What type of service you conduct depends on your community's needs and resources. Together these types of services can help solve authentic community needs and create community. Furthermore, **impact** and **reflection** need to be considered at every step of the project. Often times, reflection is where the most learning occurs because it connects one's experience cognitively, socially and emotionally. A project's impact could include the reflection and transformation of individual participants.

There are steps that can be taken to ensure your service-learning project is as impactful as possible. The National Youth Leadership Council (NYLC) has identified the following standards to help implement high-quality service-learning for K-12 youth: meaningful service, link to curriculum, reflection, diversity, youth voice, partnerships, progress monitoring, duration and intensity. Consider these standards while creating service-learning projects with the youth. Some common steps for service-learning include: investigation, preparation and planning, action, reflection and demonstration.

Partnerships between youth, adults, community members and organizations are critical aspects in every service-learning project. In 4-H service-learning projects, **youth-adult partnerships** are important. This partnership brings together the experience and knowledge from both groups. In any partnership, it is essential to develop clear expectations and goals and to share decision-making power and participation. Often, the more youth-driven the service-learning project is, the larger impact and application it will have on the youth and the community.

Background continuation

Many use service-learning, community engagement, community service and civic engagement interchangeably. There are similarities among these terms, but each has its own unique purpose. Often community service is a one-time event, not necessarily connected to a curriculum or program. Service-learning is often a step further than community service and promotes civic engagement. Civic engagement is an individual and collective action centered around public concern. Community engagement is an umbrella term for all these types of engagement. Other ways youth can be engaged include: citizen science and Youth Participatory Action Research (YPAR), particularly in the field of STEM. All these types of community engagement are important and serve a purpose.

Key Terms

Advocacy:	Create awareness or promote action on an issue of public interest.
Direct Service:	Face-to-face contact with those who benefit from the service. Interacting with animals or the environment can be considered direct service.
Impact:	A way to measure the effect of your actions to see if you made a difference in the community. It can be measured quantitatively (with numbers) or qualitatively (non-numerical).
Indirect Service:	No direct contact through service, but the community benefits.
Reflection:	Process that brings meaning to an experience by connecting one's experience with knowledge, skills and empathy to the community. Can be done nonverbally or verbally and can be structured or unstructured. Should be a continuous and ongoing process.
Research:	With public interest in mind, identifying, collecting and sharing findings.
Service-Learning:	Type of experiential learning where learned material and critical thinking are used to address an authentic community need.
Youth-Adult Partnership:	Youth and adults actively collaborating with one another.

I PLEDGE:

my head to clearer
thinking, my heart to greater
loyalty, my hands to larger
service, and my health to better
living for my club, my community,
my country, and my world

