How do Wolves Impact an Ecosystem?

Grade Level:
Upper Elementary, Middle School

Time:
One hour

Guiding Question:
How can the presence of wolves in an ecosystem impact other species?

Objectives:
Students will be able to:

- Identify the trophic level for wolves and their prey.
- Build a food web based on an ecosystem in Colorado.
- Explain how a food web might change overtime with and without wolves.

Colorado Academic Standards:
Upper Elementary:

- SC.5.2.2: Matter cycles between air and soil, among plants, animals and microbes as the organisms live and die.

Middle School:

- SC.MS.2.5: Organisms and populations of organisms are dependent on their environmental interactions both with other living things and with non-living.
- SC.MS.2.6: Ecosystems are sustained by the continuous flow of energy, originating primarily from the sun, and then recycling of matter and nutrients within the system.
- SC.MS.2.7: Ecosystems are dynamic in nature.

Program Overview:
Wolves are considered an apex predator in an ecosystem, which can affect other species in an ecosystem. In this activity, students explore the wolf's place in a food web within a Colorado ecosystem to explain their potential impact on the system, including other species.

Background:
The gray wolf ranges across Eurasia, and in North America, from the Arctic to Mexico and from coast to coast. Historically, wolves inhabited most of Colorado feeding on herds of bison, elk and deer, while supplementing their diet with rabbits, rodents and carrion.

Once distributed statewide, the gray wolf has long been extirpated from the state, with wolves deemed to be off the landscape around 1940. When market hunters over-hunted the large mammals that constituted the main diet of wolves in the 1800s, they naturally turned to a new food source in the developing frontier – livestock. Because of their depredation of domestic animals, wolves in Colorado were systematically eradicated by shooting, trapping and poisoning. Over the past few decades, Colorado has confirmed wolves traveling in and out of the state, with the first known breeding pair to be confirmed by Colorado Parks and Wildlife biologists in June 2021.

On November 3, 2020, Colorado voters passed Proposition 114, a ballot initiative directing the Colorado Parks and Wildlife Commission to develop a plan to reintroduce gray wolves onto the western slope of Colorado by December 31, 2023. Through a collaborative process between stakeholders and experts in the field, a Technical Working Group and Stakeholder Advisory Group will provide recommendations to Colorado Parks and Wildlife staff for the plan to reintroduce and manage gray wolves.

Vocabulary:

Apex Predator

- A predator at the top of a food chain with little to no natural predators. They occupy the highest trophic level in a food web, with their presence leading to cascading effects throughout the ecosystem.

Ecosystem:

- An area where plants, animals and other organisms interact with one another and with the physical environment in which they live. These interactions lead to a transfer of energy and nutrients throughout the system.

Extirpation:

- The complete removal of a species from a specific area. While they no longer exist in the given area, they do exist elsewhere.

Food Web:

- All of the interconnected food chains in a single ecosystem that allows for the transfer of energy and nutrients throughout the system.

Keystone Species

- An organism that plays a major role in how an ecosystem looks and works, including the potential health and survival of other species.

Trophic Level:

- Categories in which organisms are grouped based on their location in a food web. These categories include producers (make their own food), multiple levels of consumers (organisms that eat producers including herbivores, omnivores, and carnivores), and decomposers (turn organic waste into nutrient-rich soil).

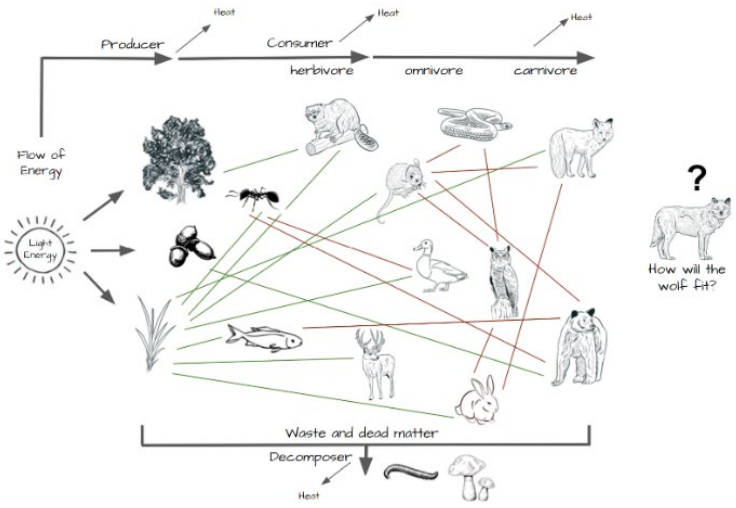
Enacting these plans will require close partnership with the US Fish and Wildlife Service (USFWS) and will be subject to their approval based on the February 10, 2022 ruling from the U.S. District Court for the Northern District of California. That ruling vacated the USFWS's 2020 rule delisting gray wolves across the lower 48 states, excluding the Northern Rocky Mountain population in Idaho, Montana, Wyoming and parts of Washington and Oregon. The ruling returns management authority of gray wolves in Colorado to the USFWS. While CPW will continue its planning efforts to meet the deadlines directed by statute, the permitting requirements and processes outlined by USFWS will need to be followed as they now have management control over wolves in Colorado.

Basic Biology:

Despite their name, gray wolves may be white, tawny gray, black, or any combination of those colors. Adult males weigh between 90 and 110 pounds, with females typically weighing between 80 and 90 pounds. Females are around 5 feet long, from nose to tail tip with males being slightly larger. Under natural conditions, wolves tend to live 5-6 years, but can live up to 14 years depending on the conditions.

Wolves are social creatures, living in packs that average around 10 individuals consisting of a breeding pair, their offspring, and other adults. Their territories can range from 50 to over 1,000 square miles depending on prey availability and human presence.

Wolves are considered habitat generalists and can occupy a wide range of habitats. As long as prey is available, and they are tolerated by people living in the area, wolves can live in a variety of locations. While their main source of diet is elk and deer, wolves are known to supplement their diet with a variety of food sources including moose, small mammals like rabbit, insects and berries. Wolves will also turn towards livestock or scavenge carrion as additional food sources. This wide range of diet, not only gives them the ability to live in many ecosystems across Colorado, but leads to them being at the top of the food chain as an apex predator.



Notes:

There are many questions regarding the type of impact wolves will have on Colorado's landscape as an apex predator being reintroduced to land it once occupied. There are no easy answers for these questions. While some research has suggested large ecological effects to prey species and the overall health of an ecosystem, other studies have shown this is not the case, with the reintroduction of wolves causing little impact on an established ecosystem over time. There are many biotic and abiotic factors that can affect an ecosystem and we should be cautious with over generalizing the potential impact from one species. Long-term studies using sound methodology will provide the necessary data to truly understand how wolves might affect an ecosystem and to what degree.

Discussion Questions:

- What impact do wolves have on other consumers in your ecosystem poster?
- What impact do wolves have on producers in your ecosystem poster?
- How do you think different ecosystems in Colorado have changed over the past 80-100 years? What living and non-living factors could have led to those changes?
- What potential impacts do you think wolves will have on Colorado's landscape when reintroduced? Why?

Assessments:

- Develop a food web for a given ecosystem in Colorado.
- Explain the potential impact to species in other trophic levels from the reintroduction of wolves.

Extensions:

- Compare and contrast the potential impact of wolves within the different ecosystems.

Online Resources:

- https://cpw.state.co.us/learn/Pages/SOC-Wolves.aspx

Procedure:

1. In groups of 3-4, or as a whole group, provide students with the I Notice, I Wonder handout (page 5). For 2-3 minutes, students will discuss and jot down what they notice in the pictures. Next, students will spend 2-3 minutes writing down all of the questions they have about the pictures. Help students go deeper with their thinking by asking them what they notice and wonder about wolves in relation to their habitat and prey.

2. Using the background information, share with students the history of wolves in Colorado and basic biology about wolves.

3. Ask students what a food web is and what relationships are represented in a food web. As you draw a simplified food web on the board highlighting the transfer of energy and nutrients, make sure students understand the following vocabulary and how to represent each on the web: food web, trophic level, producer, consumer, decomposer, apex predator.

4. Place students in groups of 3-4 students. Provide each group with an ecosystem poster from the Wild Colorado: Crossroads of Biodiversity poster set, and a corresponding ecosystem handout with labeled species (pages 6 - 11), drawing paper, and color pencils.

5. Students will study their poster and create a food web for the ecosystem. In their food web, they need to label the following using some of the species identified in the poster:
    - Trophic levels for the species identified in the poster, including which species are producers and consumers.
    - Arrows showing the transfer of energy and nutrients.

6. Each group will then discuss the impacts they think may happen to the different trophic levels within their ecosystem with the reintroduction of wolves. Walk around and discuss thoughts with individual groups to help guide these conversations.

7. Have groups share with the class their thinking about how wolves can affect each trophic level in their ecosystem, including non-prey species. Use the discussion questions provided to go deeper with the conversation.

8. Walk the Line Discussion: Hang a sign that says "Strongly Agree" on one side of the room, and "Strongly Disagree" on the other. Say each statement below and have them line up with their feelings from strongly agree to strongly disagree. Give students the option to share why they stood where they did.
    - Wolves have little impact on Colorado's ecosystems.
    - Wolves are beneficial to Colorado.
    - I am comfortable with wolves being reintroduced to Colorado.

9. Have students revisit their I Notice, I Wonder handout. What new "I Notice" statement could they add? Which "I Wonder" questions have been answered?

I Notice, I Wonder

What do you notice and wonder about wolves as you look at the pictures below?

I Notice:

I Wonder:

Subalpine

Birds
1. American Dipper
2. Western Tanager
3. Sandhill Crane
4. Clarke's Nutcracker
5. Blue Grouse
6. Green-winged Teal
7. Broad-tailed Hummingbird

Mammals
8. Yellow-bellied Marmot
9. American Elk
10. Bighorn Sheep
11. Least Chipmunk
12. Moose
13. Black Bear
14. Golden-mantled Ground Squirrel

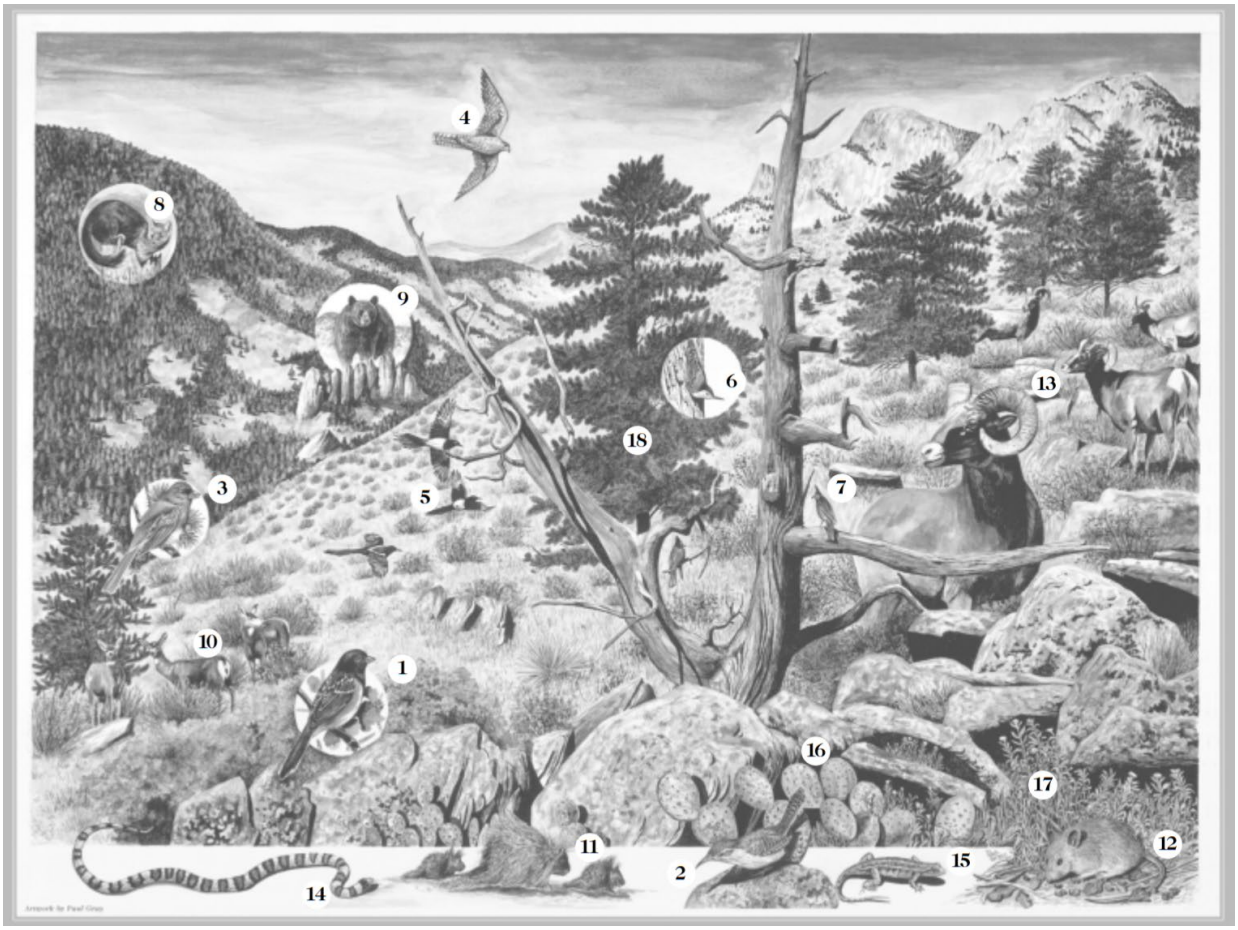
Amphibian and Reptile
15. Tiger Salamander
16. Western Terrestrial Garter Snake

Fish
17. Cutthroat Trout

Plants
18. Columbine
19. Paintbrush
20. Scarlet Gilia

Trees
21. Quaking Aspen
22. Englemann Spruce

Montane Forest



Birds

1. Spotted Towhee
2. Rock Wren
3. Dark-eyed Junco
4. Prairie Falcon
5. Black-billed Magpie
6. White-breasted Nuthatch
7. Steller's Jay

Mammals

8. American Marten
9. Black Bear
10. Mule Deer
11. Common Porcupine
12. Mexican Woodrat
13. Bighorn Sheep

Reptiles

14. Milk Snake
15. Sagebrush Lizard

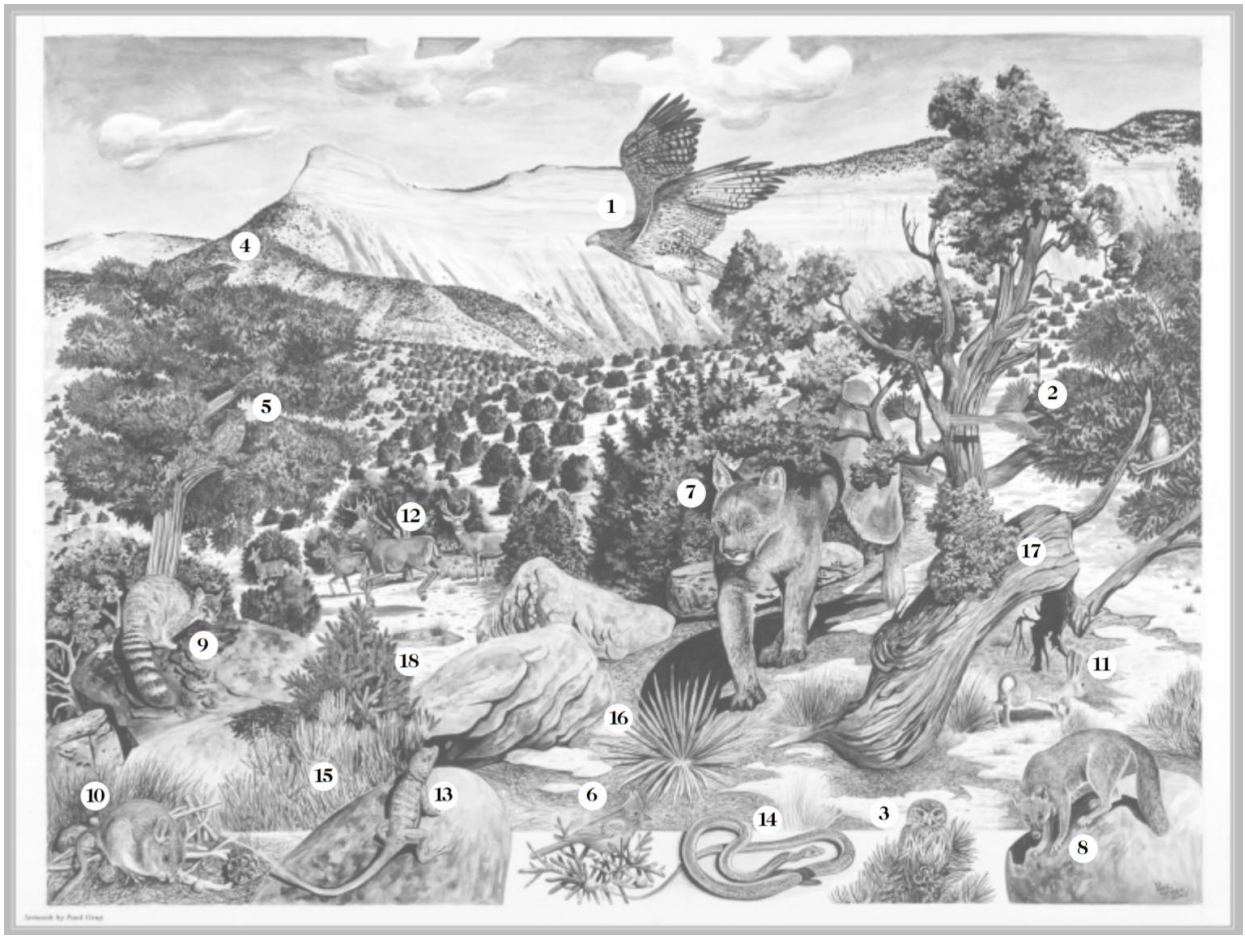
Plants

16. Prickly-pear
17. Skunkbrush

Tree

18. Ponderosa Pine

Pinon-Juniper Shrubland



Birds

1. Red-tailed Hawk
2. Western Scrub Jay
3. Northern Pigmy-Owl
4. Common Raven
5. Great Horned Owl
6. Juniper Titmouse

Mammals

7. Mountain Lion
8. Gray Fox
9. Ringtail
10. Mexican Woodrat
11. Desert Cottontail
12. Mule Deer

Reptiles

13. Collared Lizard
14. Striped Whipsnake

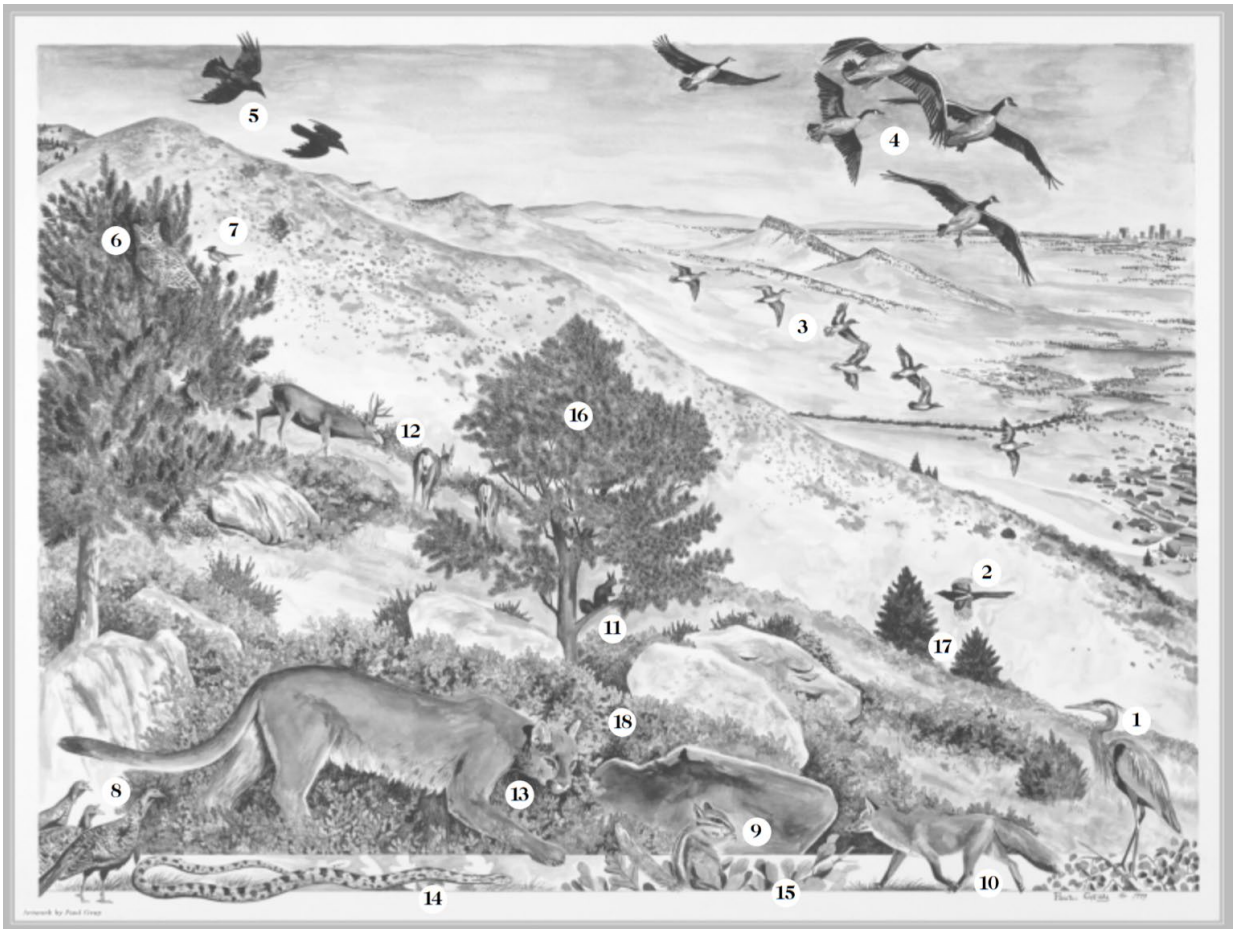
Plants

15. Mormon Tea
16. Yucca

Trees

17. Pinon Pine
18. Utah Juniper

Montane Shrubland



Birds

1. Great Blue Heron
2. Black-billed Magpie
3. Green-winged Teal
4. Canada Goose
5. Common Raven
6. Great Horned Owl
7. Steller's Jay
8. Wild Turkey

Mammals

9. Colorado Chipmunk
10. Red Fox
11. Abert's Squirrel
12. Mule Deer
13. Mountain Lion

Reptile

14. Bullsnake

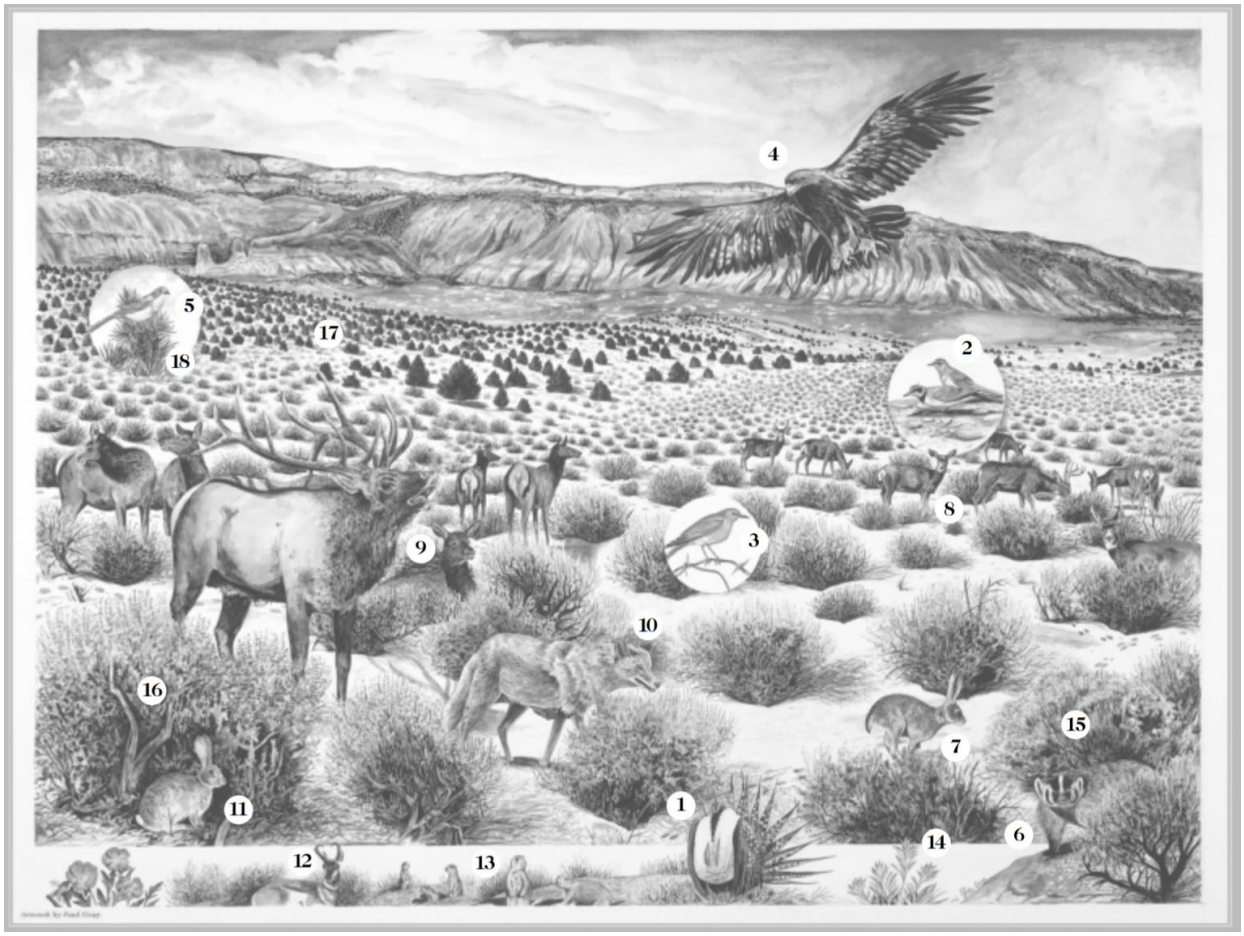
Shrub

15. Mountain Mahogany

Trees

16. Ponderosa Pine
17. Rocky Mountain Juniper
18. Gambel Oak

Sagebrush Shrubland



Birds

1. Sage Grouse
2. Horned Lark
3. Mountain Bluebird
4. Golden Eagle
5. Western Scrub Jay

Mammals

6. American Badger
7. Black-tailed Jackrabbit
8. Mule Deer
9. American Elk
10. Coyote
11. Desert Cottontail
12. Pronghorn
13. White-tailed Prairie Dog

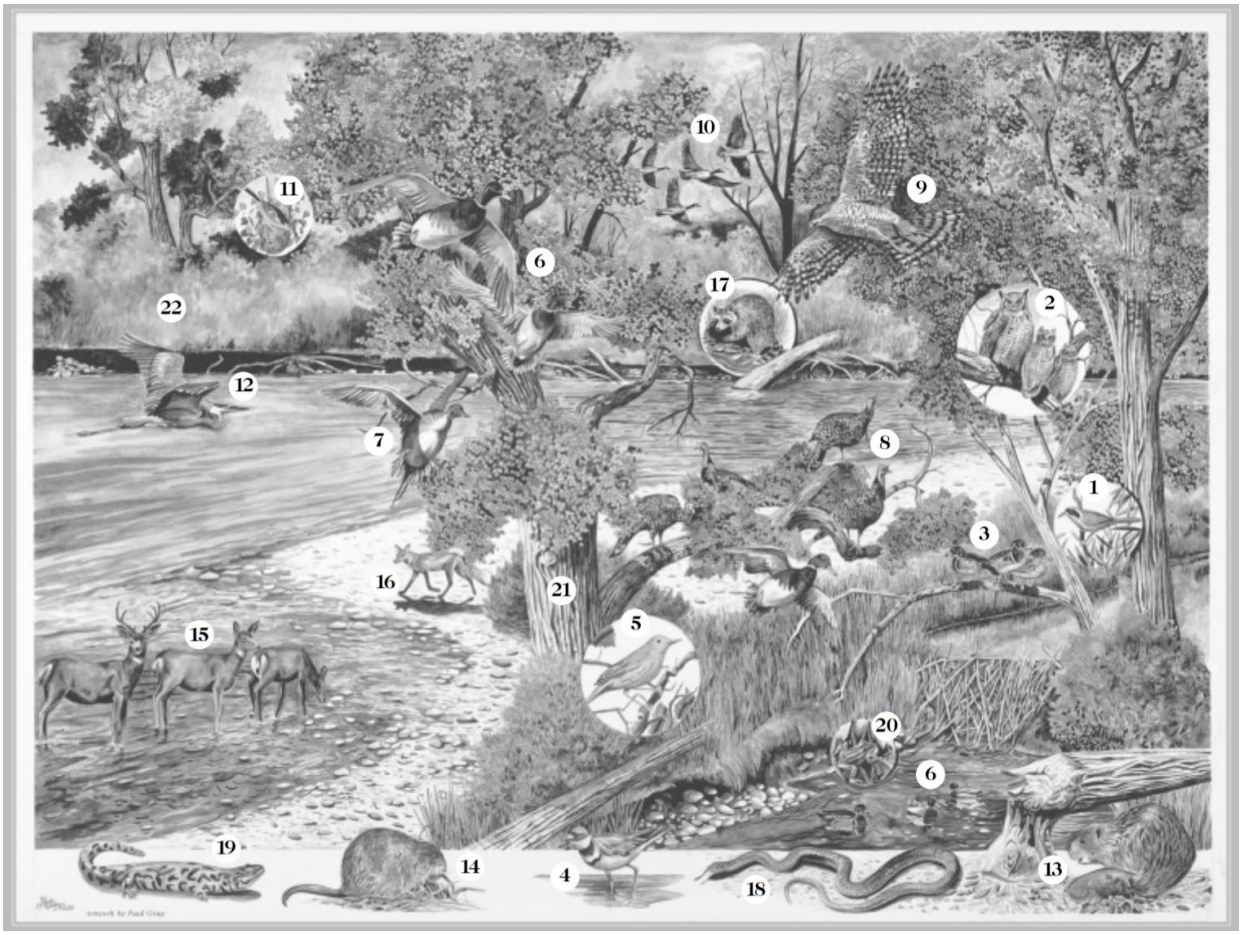
Plants

14. Paintbrush
15. Rabbitbrush
16. Sagebrush

Trees

17. Utah Juniper
18. Pinon Pine

Riparian



Birds

1. Common Yellowthroat
2. Great Horned Owl
3. Wood Duck
4. Killdeer
5. Yellow Warbler
6. Mallard
7. Northern Pintail
8. Wild Turkey
9. Sharp-shinned Hawk
10. Canada Goose
11. Bullock's Oriole
12. Great Blue Heron

Mammals

13. American Beaver
14. Common Muskrat
15. Mule Deer
16. Red Fox
17. Raccoon

Reptile and Amphibians

18. Smooth Green Snake
19. Tiger Salamander
20. Western Chorus Frog

Trees

21. Cottonwood
22. Sandbar Willow