

## RESOURCE LIBRARY | LESSON

# Making Sense of Migration

Students will engage with photographs, videos, handouts, and animations to learn why and how animals migrate, methods used to track and map migrations, and how humans are impacting animal migration. Students use a variety of resources to research a focal animal in order to create a map layer showing its migration pattern, which is part of their unit project. This lesson is part of the [Detours and Distractions: How Humans Impact Migration Patterns](#) unit.

**GRADES**

6, 7, 8

**SUBJECTS***Biology, Ecology, Conservation, Engineering, Geography, Geographic Information Systems (GIS)***CONTENTS**

4 Activities

## In collaboration with



### ACTIVITY 1: COLLISION! HUMAN IMPACTS ON ANIMAL MIGRATION | 50 MINS

## DIRECTIONS

This activity is part of the [Detours and Distractions: How Humans Impact Migration Patterns](#) unit.

## **I. Spark student interest in animal migration by teasing the *Human Impacts Photo Gallery*.**

- Place the images from the *Human Impacts Photo Gallery* around the perimeter of the classroom.
- Ask students to look at the images, then elicit their ideas about what they think the topic of discussion is, based on these photos.
- Establish that the topic is animal migration, and elicit students' background knowledge.

Ask:

- *What is animal migration?*
  - *Why do you think animals need to migrate?*
  - *What animals do you know that migrate?*
  - *What problems do you think migrating animals could encounter?*
- To confirm and extend students' prior knowledge, project and read aloud the *Migration* encyclopedic entry.

## **2. Highlight how wind turbines impact animal migration.**

- Project the photograph of the wind turbine from the *Human Impacts Photo Gallery* for students to see. Hide the image caption.
- Have students think-pair-share to discuss how wind turbines could be impacting animal migration and to discuss their responses to the image.
- Ask the class:
  - *Why are wind turbines important?* (Possible responses: They provide a cost-effective, clean, sustainable source of energy.)
  - *How can wind turbines be deadly?* (Possible responses: Turbines can kill migrating birds, bats, and insects, as well as animals on the ground).
- To build on students' responses, reveal the image caption for all students to see, and read aloud.

## **3. Allow students to explore the *Human Impacts Photo Gallery*.**

- Direct students' attention again to the *Human Impacts Photo Gallery* hanging around the classroom. Emphasize that students' perspectives about the photos will likely change or expand over the course of the unit.

- Distribute a supply of two different colors of sticky notes to each student. Mention to students that the completed sticky notes will be kept and reused later in the unit.
- Explain the activity:
  - Sticky note color number one: Students will examine each photograph in the gallery walk and answer the following question on their sticky note: *What is depicted in the photograph (e.g., highway) and how might it impact a migrating animal?* They should stick their note on the wall next to the photograph.
  - Sticky note color number two: Next, direct students to revisit the gallery walk and read the captions on the underside of the photographs. On this sticky note, students should record their responses to the images after reading the captions. Again, students should stick their notes on the wall next to the photograph.
- Bring students back together as a class and invite volunteers to share their ideas and feelings about each photograph.
- Keep the sticky notes associated with their respective image, as they will be reused later in the unit.

#### 4. Introduce the *Detours and Distractions: How Humans Impact Migration Patterns* unit project and complete a class *Know & Need to Know* chart.

- Drawing on the gallery walk and students' reactions to the images, elicit student responses to the unit driving question: *How can we help solve the problems faced by animals on the move?*
  - After a few volunteers have shared, introduce students to the unit project: Student groups will create a multilayered paper map that shows a particular animal's migration pattern, how its migration is impacted by humans, ecosystem effects of migration, and recommended solutions to mitigate human impacts on migration. Explain that students will also present an argument supported by empirical evidence to convince stakeholders to implement recommended solutions.
- Encourage students to pair up and explain to each other what they need to do to have a successful unit project.
- As a class, create a *Know & Need to Know* chart based on students' understanding and questions about the unit. This will develop a sense of ownership and help guide student work over the course of the unit.
- Use the process below to elicit students' ideas and questions related to the unit, which can be revisited over time. Record students' responses and display them in the classroom.

- Ask students to discuss the following questions with a partner and then share their responses with the class:
  - *What do we already know about animal migration and how humans impact it?*
  - *What do we need to know about animal migration in order to create a map that shows how humans impact animal migration?*

### 5. Discuss opportunities for further action.

- Consider ideas for students to take additional action after the unit concludes to continue momentum toward helping end negative human impacts on animal migration and extend the impacts of their project work into the local or global community. Ideas for further action include:
  - Identify local migratory organisms. Create a backyard “pit stop” for the most vulnerable organisms, such as a bat box or specific native flowering plants.
  - Author a class letter to Congress, local government, or a local business to encourage an animal migration solution (e.g., building a wildlife crossing bridge, installing a culvert). Students can submit copies of their maps and presentations as evidence.
  - Download the [Animal Tracker app](#) or [eBird app](#) and follow and add to scientific knowledge about migrating animals through student citizen science field work.

## Tip

**Step 1:** Hang the *Human Impacts Photo Gallery* photographs around the room a few days before you launch the activity to build interest in the unit.

## Tip

**Step 3:** Hang each photo from the *Human Impacts Photo Gallery* on a larger sheet of paper so that the sticky notes can be stuck on the larger paper for easier access later.

## Modification

**Step 3:** If space is limited, show the photos to the class as a slideshow and have students record and share their responses on paper or digital devices.

# Modification

**Step 3:** Instead of different colored sticky notes, students could also use colored pencils to respond to the different prompts.

## Tip

**Step 3:** You may also choose to keep the *Human Impacts Photo Gallery* hanging throughout the duration of the unit; students will revisit these images in Lesson 3 during the [Exploring Solutions to Human Impacts on Animal Migration](#) activity.

## Tip

**Step 4:** To learn more about facilitating a *Know & Need to Know* chart in project-based learning, this [PBL Works](#) blog provides explanations and examples.

## Tip

**Step 4:** You can also record the *Know & Need to Know* chart with interactive tools or on a place easily accessible online.

# Informal Assessment

Use students' answers from the various class and partner discussions, as well as their responses during the gallery walk and *Know & Need to Know* chart, to assess initial understanding of human impacts on animal migration.

# Extending the Learning

- Find a story or fact about a migratory animal in a newspaper, magazine, or on the news. Students can bring these into the next class or share them through a private class online discussion board.
- Visit a local zoo, aquarium, or conservation center. This provides opportunities for students to see animals they might study, as well as add to their knowledge about animal migration and the need for conservation.
- Have students free-write in response to one of the photographs or a new photograph.
- Have students find their own photographs that showcase animal migration at the intersection of human activity.

- Visit a local art museum. Prompt students to look for representations of animals, human interactions, or impacts on animal migrations.

## OBJECTIVES

# Subjects & Disciplines

### **Biology**

- Ecology
- Conservation
- Engineering

### **Geography**

# Learning Objectives

Students will:

- Explain their thinking about why human activity can harm animal migration.
- Explain to someone else what they need to do to create a successful unit project.
- Identify some things they know and some things they need to know about animal migration and how humans impact it.

# Teaching Approach

- Project-based learning

# Teaching Methods

- Brainstorming
- Discussions
- Multimedia instruction

# Skills Summary

This activity targets the following skills:

- 21st Century Student Outcomes
  - Learning and Innovation Skills
    - Critical Thinking and Problem Solving
- 21st Century Themes
  - Global Awareness
- Critical Thinking Skills
  - Understanding
- Science and Engineering Practices
  - Obtaining, evaluating, and communicating information

# National Standards, Principles, and Practices

## COMMON CORE STATE STANDARDS FOR ENGLISH LANGUAGE ARTS & LITERACY

- **CCSS.ELA-LITERACY.SL.7.1:**

Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on Grade 7 topics, texts, and issues, building on others' ideas and expressing their own clearly.

## NEXT GENERATION SCIENCE STANDARDS

- **Crosscutting Concept 1:**

Patterns

- **Crosscutting Concept 2:**

Cause and effect: Mechanism and prediction

- **Crosscutting Concept 7:**

Stability and change

- **MS. Ecosystems: Interactions, Energy, and Dynamics:**

MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

- **Performance Expectations: MS-LS2-2:**

MS-LS2-2: Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

- **Science and Engineering Practice 1:**

Asking questions and defining problems

- **Science and Engineering Practice 6:**

Constructing explanations and designing solutions

• **Science and Engineering Practice 8:**

Obtaining, evaluating, and communicating information

**Preparation**

## BACKGROUND & VOCABULARY

### Background Information

Animal migration is a pattern of behavior in which animals travel from one habitat to another in search of food, better conditions, or reproductive needs. Many different animal species migrate, and there are many different types of migration. Some are well-known like the monarch butterfly or the Arctic tern, which travel across countries, while others are lesser known, like plankton that migrate up the water column during the night, and down during the day.

Animal migration is an important component of many ecosystems, and migratory animals contribute to human economies, such as recreation, hunting, and tourism, in addition to having cultural and intrinsic value. Unfortunately, human infrastructure and behavior have altered animal migration patterns. From building roads that act as barriers to wildlife crossings, to constructing wind farms that create hazards for birds, bats, and insects, to causing climate change that renders ecosystems uninhabitable for many native organisms, humans are impacting animal migration.

### Prior Knowledge

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### Recommended Prior Activities

- None

### Vocabulary

| Term | Part of Speech | Definition |
|------|----------------|------------|
|------|----------------|------------|



| <b>Term</b>              | <b>Part of Speech</b> | <b>Definition</b>  |
|--------------------------|-----------------------|--|
| <b>animal migration</b>  | <i>noun</i>           | process where a community of animals leaves a habitat for part of the year or part of their lives, and moves to habitats that are more hospitable. |
| <b>argument</b>          | <i>noun</i>           | reason or set of reasons given with the aim of persuading others that an action or idea is right or wrong.   |
| <b>detour</b>            | <i>noun</i>           | unplanned or temporary path.   |
| <b>ecosystem</b>         | <i>noun</i>           | community and interactions of living and nonliving things in an area.  |
| <b>empirical</b>         | <i>adjective</i>      | able to be proved with evidence or experience.   |
| <b>evidence</b>          | <i>noun</i>           | data that can be measured, observed, examined, and analyzed to support a conclusion.   |
| <b>impact</b>            | <i>verb</i>           | to influence or have an effect on something.   |
| <b>key</b>               | <i>noun</i>           | an explanation of symbols and abbreviations used on a map, also known as a legend.   |
| <b>map</b>               | <i>noun</i>           | symbolic representation of selected characteristics of a place, usually drawn on a flat surface.   |
| <b>map layer</b>         | <i>noun</i>           | part of a map representing specific features of a place.   |
| <b>migration pattern</b> | <i>noun</i>           | predictable movements, in time and space, of a group of animals or people.   |
| <b>migration route</b>   | <i>noun</i>           | path followed by birds or other animals that migrate regularly.  |
| <b>solution</b>          | <i>noun</i>           | an answer to a problem.  |
| <b>species</b>           | <i>noun</i>           | group of similar organisms that can reproduce with each other.   |
| <b>stakeholder</b>       | <i>noun</i>           | person or organization that has an interest or investment in a place, situation, or company.   |
| <b>wind turbine</b>      | <i>noun</i>           | machine that produces power using the motion of wind to turn blades.   |

## ACTIVITY 2: WHY AND HOW ANIMALS MIGRATE | 50 MINS

### DIRECTIONS

This activity is part of the [Detours and Distractions: How Humans Impact Migration Patterns](#) unit.

**I. Build on students' existing knowledge of animal migration by watching six short video clips and completing an accompanying handout.**

- Distribute the Migration Cues handout to each student.
- Read the directions aloud and allow students time to read the handout and ask any questions.
- Encourage students to complete the handout as they watch these six short video clips from *Great Migrations*:
  - *Wildebeest Migration*
  - *Red Crab Mothers*
  - *Red Crab Eggs*
  - *Sperm Whale Migration*
  - *Monarch Migration*
  - *Plankton Light Show*
- Allow additional time to complete the handout.
- After the video clips, invite volunteers to share their answers with the class. Supplement their responses with the answers from the Migration Cues Answer Key and with additional questions to prompt student thinking, such as:
  - *Do the animals all use the same cues to trigger their migration? Explain.* (Possible responses: No. They use different combinations of internal and external cues, depending on their environments and what they have to do to meet their survival needs: air, water, food, and the ability to reproduce, as well as environmental conditions such as day length and temperature.)
  - *Why do you think more than one thing triggers migration?* (Possible responses: Animals that migrate are not able to get all their survival needs met by staying in one location, and may need to move to find suitable conditions for breeding or nesting. Animals are diverse and have evolved with varying capabilities to survive, have different senses and modes of locomotion, and different needs.)
- Collect the *Migration Cues* handout upon completion or at the end of the activity.

**2. Introduce different migration methods through the *What Do You Know About Migration Methods?* handout.**

- Distribute the What Do You Know About Migration Methods? handout to each student. This informal quiz introduces students to different migration methods and allows them to

choose if each method is used by humans, animals, or by both. Students may complete it individually or in groups.

- When individual students or small groups have completed the quiz, ask them to join with another student or group to share and discuss answers. Encourage students to ask for and provide reasoning to back up their answers.
- Regroup for a class discussion and invite students to share answers. Supplement students' answers with information from the resources provided in the *Background & Vocabulary* tab.
- Collect the *What Do You Know About Migration Methods?* handout upon completion or at the end of the activity.

### 3. Revisit the class *Know & Need to Know* chart to add students' ideas about animal migration.

- Revisit the class *Know & Need to Know* chart from the *Collision! Human Impacts on Animal Migration* activity. Ask students to add to the chart by asking the following questions:
  - *What do we already know about animal migration?* (Possible responses: animals move from place to place, animals live parts of their lives in different places, animals move during different seasons or when they need to find mates)
  - *What do we already know about which animals migrate?* (Possible responses: monarch butterfly, birds going south for the winter, whales)
  - *What do we already know about why animals migrate?* (Possible responses: to find food, to find mates, to stay warm)
  - *What do we already know about how animals migrate?* (Possible responses: using their senses (eyes, nose, ears), following others, remembering the way, magnetic field of the earth)
  - *What do we need to know?*

### 4. Invite students to complete the *Choose Your Migrating Animal* exit ticket.

- Project the *Migrating Animal Collage* to introduce the 12 animals students can study; this visual input will help students make their decisions on the exit ticket.
- Distribute the *Choose Your Migrating Animal* exit ticket, which includes a list of the animals students can choose from for their unit project.
  - Humpback whale (*Megaptera novaeangliae*)
  - Reindeer (caribou) (*Rangifer tarandus*)
  - Arctic tern (*Sterna paradisaea*)

- Adelie penguin (*Pygoscelis adeliae*)
  - Pronghorn (*Antilocapra americana*)
  - Leatherback sea turtle (*Dermochelys coriacea*)
  - Chinook salmon (*Oncorhynchus tshawytscha*)
  - White-throated sparrow (*Zonotrichia albicollis*)
  - Globe skimmer dragonfly (*Pantala flavescens*)
  - Sandhill crane (*Antigone canadensis*)
  - Canada goose (*Branta canadensis*)
  - Painted lady butterfly (*Vanessa cardui*)
- Ask each student to complete the exit ticket by listing the top three animals they would be interested in studying throughout the unit and why. Explain that students will be grouped together based on interest. Project groups should have three to four students; each group will study a different animal.

## Tip

**Step 1:** Before class discussions, scaffold students' sharing of their ideas by having them engage in a think-pair-share activity.

## Modification

**Step 4:** Alternatively, instead of assigning groups based on interest, students can be assigned an animal, or pre-assigned groups can randomly draw animals.

## Tip

**Step 4:** Animals on the list are recommended because there are many online resources to support students' research and they are not covered explicitly during the unit. Different or additional animals can be included.

## Informal Assessment

Use students' responses from the various discussions and their answers to the *Migration Cues* and *What Do You Know About Migration Methods?* handouts to assess their understanding of animal migration and how that thinking changed throughout the activity. Use students' exit tickets to gauge interest and to determine project groups.

# Extending the Learning

- Find a story or fact about a migratory animal in a newspaper, magazine, or on the news. Students can bring these into the next class or share them through an online class discussion board.
- Visit a local zoo, aquarium, or conservation center. This provides opportunities for students to see animals they might study, as well as add to their knowledge about animal migration and the need for conservation.

## OBJECTIVES

## Subjects & Disciplines

### **Biology**

- Ecology
- Conservation

### **Geography**

## Learning Objectives

Students will:

- Understand that animals migrate for different reasons and use different cues.
- Identify some things they know and some things they need to know about animal migration.
- Explain their interest in working with different animals for their unit project.

## Teaching Approach

- Project-based learning

## Teaching Methods

- Discussions
- Guided listening
- Multimedia instruction

# Skills Summary

This activity targets the following skills:

- 21st Century Student Outcomes
  - Learning and Innovation Skills
    - Communication and Collaboration
- Critical Thinking Skills
  - Remembering
  - Understanding
- Geographic Skills
  - Asking Geographic Questions
- Science and Engineering Practices
  - Constructing explanations (for science) and designing solutions (for engineering)
  - Obtaining, evaluating, and communicating information

## National Standards, Principles, and Practices

### COMMON CORE STATE STANDARDS FOR ENGLISH LANGUAGE ARTS & LITERACY

- **CCSS.ELA-LITERACY.SL.7.1:**

Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on Grade 7 topics, texts, and issues, building on others' ideas and expressing their own clearly.

### NEXT GENERATION SCIENCE STANDARDS

- **Crosscutting Concept 1:**

Patterns

- **Crosscutting Concept 2:**

Cause and effect: Mechanism and prediction

- **Crosscutting Concept 7:**

Stability and change

- **MS. Ecosystems: Interactions, Energy, and Dynamics:**

MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

• **Performance Expectations: MS-LS2-2:**

MS-LS2-2: Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

• **Science and Engineering Practice 1:**

Asking questions and defining problems

• **Science and Engineering Practice 6:**

Constructing explanations and designing solutions

• **Science and Engineering Practice 8:**

Obtaining, evaluating, and communicating information

## Preparation

# BACKGROUND & VOCABULARY

## Background Information

Animals use a variety of cues to determine when it is time to migrate. Some migrations are triggered by external cues, like changing daylight hours or temperature. Other animals rely on internal cues like fat reserves or instinct, while others respond to multiple cues occurring at the same time. During migration, different species use different methods to guide their journey. Some animals rely on the position of the sun, moon, or stars, some use smell, and still others use the magnetic field of the Earth to guide them.

## Prior Knowledge

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## Recommended Prior Activities

- [Collision! Human Impacts on Animal Migration](#)

## Vocabulary

| Term | Part of<br>Speech | Definition |
|------|-------------------|------------|
|------|-------------------|------------|

| Term              | Part of Speech | Definition   |
|-------------------|----------------|--|
| animal migration  | noun           | process where a community of animals leaves a habitat for part of the year or part of their lives, and moves to habitats that are more hospitable. |
| competition       | noun           | contest between organisms for resources, recognition, or group or social status.   |
| condition         | noun           | an environmental state that must be present or exist in order for something else to exist or function.   |
| curiosity         | noun           | desire to know more about a subject.   |
| detour            | noun           | unplanned or temporary path.   |
| distract          | verb           | to divert or draw attention away from something.   |
| environment       | noun           | conditions that surround and influence an organism or community.   |
| external          | adjective      | outside of something.  |
| internal          | adjective      | inside, or having to do with the inner part of something.  |
| method            | noun           | way of doing something.  |
| migration cue     | noun           | natural signal, such as a change in temperature, to which animals respond by migrating to more hospitable habitats.                                |
| migration pattern | noun           | predictable movements, in time and space, of a group of animals or people.   |
| overcrowd         | verb           | to fill an area with too many objects or organisms.  |
| predator          | noun           | animal that hunts other animals for food.  |
| reproduce         | verb           | to create offspring, by sexual or asexual means.   |
| survival          | noun           | ability to live.   |
| trigger           | verb           | to cause or begin a chain of events.   |

## ACTIVITY 3: TRACKING ANIMAL MIGRATION | 50 MINS

### DIRECTIONS

This activity is part of the *Detours and Distractions: How Humans Impact Migration Patterns* unit.

#### 1. Assign student groups to a focal animal for their unit project.

- Group students together based on their interest in one of the following animals, as recorded on their *Choose Your Migrating Animal* exit ticket completed during the *Why and*



## How Animals Migrate activity:

- Humpback whale (*Megaptera novaeangliae*)
  - Reindeer (caribou) (*Rangifer tarandus*)
  - Arctic tern (*Sterna paradisaea*)
  - Adélie penguin (*Pygoscelis adeliae*)
  - Pronghorn (*Antilocapra americana*)
  - Leatherback sea turtle (*Dermochelys coriacea*)
  - Chinook salmon (*Oncorhynchus tshawytscha*)
  - White-throated sparrow (*Zonotrichia albicollis*)
  - Globe skimmer dragonfly (*Pantala flavescens*)
  - Sandhill Crane (*Antigone canadensis*)
  - Canada goose (*Branta canadensis*)
  - Painted lady butterfly (*Vanessa cardui*)
- Explain that over the course of the remainder of the unit, each group will create a paper map highlighting their animal's migration route, research how its migration is impacted by humans, identify how its migration affects its ecosystem(s), and develop solutions to the human impacts.

## 2. Introduce animal tracking and explain the activity's objective.

- Elicit students' background understanding of animal tracking. Ask:
  - *How do you think we know where animals go during migration?* (Possible responses: we can follow them, we can track them, drones.) Emphasize that scientists and explorers use a wide variety of methods to track and study animals to understand their migrations.
- Direct project groups to read the [What is Animal Tracking?](#) page from Movebank, a free online database of animal tracking data, in order to identify three interesting facts about animal tracking. Then, in a class discussion, have groups share out interesting facts while recording them in a visible place for all to see.
- Explain the purpose of today's activity is to:
  - Introduce students to the Greater Yellowstone Ecosystem, which students will focus on more deeply in a later activity.
  - Explore a variety of resources and learn about how different animals are tracked.

- Get comfortable interacting with and interpreting animal migration maps, which students will be making for their unit project.

**3. Bring students back together to guide the class through the Follow the Elk's Perilous Journey animation to investigate how elk in Yellowstone National Park are tracked during their migration.**

- Create two lists on the board that are titled “Animal Migration Tracking Methods” and “Animal Migration Maps.” Encourage students to identify the different tracking methods and maps they encounter throughout the activity. As they are addressed during the discussion, record student contributions to the lists on the board.
- As you scroll through the animation, choose students to read text portions aloud as appropriate. As you engage with the content, emphasize the following:
  - North American Elk Range: Call attention to the difference between the historic and current elk ranges. Mention that students will be creating a similar multilayered map for their unit project showing the typical migration route and the human interrupted migration route for their project animal.
  - Greater Yellowstone Superherd: Ask students to paraphrase the elk’s migration pattern.
  - Winter: Click the arrow to start the animation. Explain that the movement of the dots represents average elk herd movement in March. Ask students:
    - *What tracking method is mentioned here?* (GPS collar)
    - *What does this map depict?* (Elk herd movements in their winter feeding grounds)
  - If needed, prompt students to add the tracking method, the map title, and description to the class list.
  - Spring Migration: Click the arrow to start the animation. Explain that the movement of the dots represents average elk herd movement between April and August. Ask students:
    - *What does this map depict?* (spring migration, herds moving into the park)
    - If needed, prompt students to add the map title and description to the class list.
  - Pulse of the Park: Click the arrow to start the animation. Explain that the movement of the dots represents average elk herd movement between August and January. Ask students:

- *What does this map depict?* (fall migration, herds moving out of the park when snow begins to fall)
- If needed, prompt students to add the map title and description to the class list.
- **Nine Elk Herds:** If needed, prompt students to add the map type (migratory routes for nine elk herds) to the class list.
- **Who Owns This Land?:** Call attention to the different groups of people that own land that the elk migrate through. Ask students:
  - *What are some impacts to the elk's migration that might arise on these different kinds of land?* (Possible answers: Elk might be hunted if they are on private land, tribal land, or in the wilderness; elk may be impacted by crossing roads, ranching, fencing, and projects that are ongoing on state or local government land.)
- **A Single Elk:** Explain that the next few maps are a narrowed version of the maps we have already seen that focus on one elk's (Elk 22) migration journey.
- **Winter Range:** Click the arrow to start the animation. Explain that the movement of the dot represents one elk's movement (Elk 22) between March and May, the winter range.
- **Hazardous Return:** Call attention to the large number of elk killed by hunters.

#### 4. Deepen understanding of migration mapping through group research.

- Highlight that students have learned some tracking and mapping techniques for elk migration. Prompt students to consider how well these methods might work for other migrating animals (e.g., their focal animal, small birds, insects, amphibians, aquatic animals, urban wildlife). Do they expect similar or different approaches—and why?
- Explain that project groups will now research different types of animal migration maps, which will prepare them to think more strategically about their culminating project map.
- As groups explore the following resources, encourage group members to work together and discuss the strengths and weaknesses of the strategies they learn about, and to add as many methods to the “Animal Migration Tracking Methods” list and as many map names to the “Animal Migration Map” list as they can. If project groups choose to divide the resources between their members, assign at least two of the following to each student or pair to ensure every resource is investigated at least once.
  - **Butterfly Surveillance video**
  - **Tales of a Tail-Feather video**

- [Long-distance Ocean Travels maps](#)
  - [Global Tagging of Pelagic Predators](#)
  - [Tracking Animal Migrations GeoStory](#)
- As groups work, prompt thinking with questions like these to remind students to keep their unit project in mind:
    - *What tracking methods are most appropriate for animals of different sizes?*
    - *Which type of map is best suited to track animal migration by air, land, and sea?*

## 5. Remind students of the possible opportunities for further action.

- Consider again ideas for students to take additional action after the unit concludes, to continue momentum toward helping end negative human impacts on animal migration and extend the impacts of their project work into the local or global community.
- Gauge student interest and feasibility of conducting different courses of action.
  - Identify local migratory organisms. Create a backyard “pit stop” for the most vulnerable—such as a bat box or specific native flowering plants.
  - Author a class letter to Congress, local government, or a local business to encourage an animal migration solution (e.g., building a wildlife crossing bridge). Students can submit copies of their maps and presentations as evidence.
  - Download the [Animal Tracker app](#) or [eBird app](#) and follow and add to scientific knowledge about migrating animals through student citizen science field work.

## Tip

**Step 1:** Alternatively, instead of assigning groups based on interest, students can be assigned an animal, or pre-assigned groups can randomly draw an animal.

## Modification

**Step 3:** Instead of creating the class lists on the board, they can be created in an easily accessible online location.

## Modification

**Step 4:** If there aren't enough devices for each group, the *Long-Distance Ocean Travel maps* and resources from the other sites can be printed out to be investigated by groups or can be displayed on the classroom computer.

## Informal Assessment

Use student entries on the "Animal Migration Tracking Methods" and "Animal Migration Maps" lists to informally assess their ability to describe animal migration route maps and identify different methods used by humans to track animal migration. Use student responses during class and group discussions to gauge their understanding of how animal migration is tracked.

## Extending the Learning

- Read the [Species Range](#) encyclopedic entry.

## OBJECTIVES

## Subjects & Disciplines

### **Biology**

- [Ecology](#)
- Conservation

### **Geography**

- [Geographic Information Systems \(GIS\)](#)

## Learning Objectives

Students will:

- Identify different methods used by humans to track animal migration.
- Explore a variety of resources to learn more about tracking animal migration.

## Teaching Approach

- Project-based learning

## Teaching Methods

- Discussions
- Multimedia instruction
- Research

# Skills Summary

This activity targets the following skills:

- 21st Century Student Outcomes
  - Information, Media, and Technology Skills
    - Information Literacy
  - Learning and Innovation Skills
    - Communication and Collaboration
  - Life and Career Skills
    - Initiative and Self-Direction
- Critical Thinking Skills
  - Analyzing
  - Remembering
  - Understanding
- Geographic Skills
  - Acquiring Geographic Information
  - Analyzing Geographic Information
  - Answering Geographic Questions
- Science and Engineering Practices
  - Asking questions (for science) and defining problems (for engineering)
  - Obtaining, evaluating, and communicating information

## National Standards, Principles, and Practices

### COMMON CORE STATE STANDARDS FOR ENGLISH LANGUAGE ARTS & LITERACY

- **CCSS.ELA-LITERACY.RST.6-8.4:**

Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and

topics.

- **CCSS.ELA-LITERACY.SL.7.1:**

Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on Grade 7 topics, texts, and issues, building on others' ideas and expressing their own clearly.

- **CCSS.ELA-LITERACY.SL.7.2:**

Analyze the main ideas and supporting details presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how the ideas clarify a topic, text, or issue under study.

## NEXT GENERATION SCIENCE STANDARDS

- **Crosscutting Concept 1:**

Patterns

- **Crosscutting Concept 2:**

Cause and effect: Mechanism and prediction

- **MS. Ecosystems: Interactions, Energy, and Dynamics:**

MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

- **MS-LS2: Ecosystems: Interactions, Energy, and Dynamics:**

MS-LS2-1: Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem

- **Performance Expectations: MS-LS2-2:**

MS-LS2-2: Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

- **Science and Engineering Practice 1:**

Asking questions and defining problems

- **Science and Engineering Practice 8:**

Obtaining, evaluating, and communicating information

### Preparation

## BACKGROUND & VOCABULARY

# Background Information

Scientists have been tracking animal migration for more than a century, and methods have evolved with the times. What once simply entailed tracking animal footprints has turned into using GPS tags or collars, radio transmitters, geolocators, camera traps, drones, and physical tags. Tracking animal migration is important to understand more about the animals themselves, and how humans are impacting the movement of animals. The most common way that animal migration tracking data is displayed visually is in the form of a map. This makes the data accessible to a wide audience, shows how the migration routes relate to the landscape features, and can be very impactful in showing changes in animal migration patterns due to human impact.

## Prior Knowledge

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## Recommended Prior Activities

- [Collision! Human Impacts on Animal Migration](#)
- [Why and How Animals Migrate](#)

## Vocabulary

| <b>Term</b>             | <b>Part of Speech</b> | <b>Definition</b>  |
|-------------------------|-----------------------|--|
| <b>animal migration</b> | <i>noun</i>           | process where a community of animals leaves a habitat for part of the year or part of their lives, and moves to habitats that are more hospitable. |
| <b>average</b>          | <i>noun</i>           | ordinary.  |
| <b>detour</b>           | <i>noun</i>           | unplanned or temporary path.   |
| <b>distract</b>         | <i>verb</i>           | to divert or draw attention away from something.   |
| <b>ecosystem</b>        | <i>noun</i>           | community and interactions of living and nonliving things in an area.  |
| <b>feeding ground</b>   | <i>noun</i>           | region where organisms go to eat.  |
| <b>focal</b>            | <i>adjective</i>      | central and important.   |
| <b>hazardous</b>        | <i>noun</i>           | involving the possibility of risk, loss, or harm   |
| <b>impact</b>           | <i>verb</i>           | to influence or have an effect on something.   |
| <b>map</b>              | <i>noun</i>           | symbolic representation of selected characteristics of a place, usually drawn on a flat surface.   |
| <b>method</b>           | <i>noun</i>           | way of doing something.  |



| Term                             | Part of Speech | Definition   |
|----------------------------------|----------------|--|
| migration pattern                | noun           | predictable movements, in time and space, of a group of animals or people.   |
| pelagic                          | adjective      | having to do with the open ocean.  |
| perilous                         | adjective      | dangerous.   |
| solution                         | noun           | an answer to a problem.  |
| species range                    | noun           | native, geographic area in which an organism can be found. Range also refers to the geographic distribution of a particular species. |
| surveillance                     | noun           | observation of a person, community, or situation.  |
| tracking                         | noun           | process in which scientists and resource managers use technology to tag animals and map their movements.                             |
| <b>Yellowstone National Park</b> |                |  |
| National Park                    | noun           | large national park in the U.S. states of Wyoming, Idaho, and Montana.   |

## ACTIVITY 4: CREATE AN ANIMAL MIGRATION MAP | 1 HR 20 MINS

### DIRECTIONS

This activity is part of the [Detours and Distractions: How Humans Impact Migration Patterns](#) unit.

I. Activate students' prior knowledge about their focal animals and create *Know & Need to Know* charts to engage groups in setting research goals.

- Distribute the [Animal Migration Map](#): Know & Need to Know Chart to each student.
- Invite students to answer the questions in their small groups based on their focal animal, assigned in the [Tracking Animal Migration](#) activity, and record their thoughts on their chart:
  - *What do we already know about our animal's migration and how humans impact it?*
  - *What do we need to know about our animal's migration and how humans impact it, in order to create our base layer map that shows the animal's uninterrupted migration pattern?*
- As students are working on their *Know & Need to Know* chart, circulate and prompt with some of the following questions to expand student thinking:

- *What do all animals need to survive? (food, shelter, water, etc.)*
- *What does your animal, in particular, need to survive?*
- *Why do you think your animal might migrate?*
- *How do you think your animal gets to where it needs to go?*
- *How do you think scientists and explorers know where these animals go?*

## 2. Explain group goals for this first session of project work.

- For the remainder of this activity, students will work with their groups to research, gather, and organize information to create the first map layer of their unit project, a map showing the typical migration route of their focal animal. Each group will create one copy of their paper map. This should include a map key (written directly on the map), and accompanying explanations about 1) their animal's habitat and characteristics, 2) why it migrates, and 3) how it migrates.
- Remind students that their final project will include a base map depicting the migration route of their focal animal (the focus of this activity), an ecosystem map layer, a human impact map layer, and suggested solutions to help the animal migrate.
- Distribute the *Animal Migration Map Rubric* to each student and orient students so they are familiar with the expectations before they begin their work.

## 3. Model how to choose the correct map scale.

- Orient student groups to MapMaker 1-Page Maps. Explain to students that based on their research, they will need to choose the correct paper map that best shows their animal's migration pattern on the correct scale. Once groups choose the correct 1-page map for their migration map, they should print the map. Students contribute to one map per group for their final product, but multiple copies should be printed to keep all group members engaged.
  - For example, if they are going to map the migration route of elk in Yellowstone National Park, then a map of Yellowstone and its surrounding areas would be the correct scale (show Elk Migrations of the Greater Yellowstone Ecosystem map example).
  - However, if they are going to map the migration route of the monarch butterfly, which flies across North America, a continental map would be the correct scale (show Monarch Migrations map example).

- Note that for some of the focal animals, students can choose from a variety of maps, based on the animal population. For example, the humpback whale could be mapped on a global scale if students focus on all humpback whales, or it could be mapped on the continental scale (e.g., using a map of Australia) if students focus on just a subpopulation of humpback whales.

#### 4. Guide groups to research focal animals and create the first layer of a migration map. (This step should take up the majority of the activity.)

- Set boundaries for students on where they can do research. See the *Background & Vocabulary* tab for helpful sources.
- Encourage students to limit their research to only what is needed to complete their unit project.
- As needed, provide instruction for effective online research and online literacy.
- As students are working, circulate to remind them of the required project components:
  - Prompt for a key: *What do all of the symbols and colors on your map mean?*
  - Prompt for an animal and habitat description: *Tell me a little about your animal and where it lives.*
  - Prompt for explanations of why and how their animal migrates: *Why does your animal need to migrate? How does it get from Point A to Point B and back again?*
- Additional questions to ask:
  - *How do you think your animal might be tracked?*
  - *Have you encountered any problems in your animal's migration yet?*
- Collect group maps at the end of the activity to assess student work and provide formative feedback.

## Modification

**Step 2:** In place of a hard copy map, students may use a map-making software such as [MapMaker Interactive](#) or [ArcGIS](#) to complete their map layers.

## Tip

**Step 2:** To provide some background information on maps and their components, spend time as needed exploring the [Map](#) encyclopedic entry.

## Modification

**Step 4:** Review each group's Animal Migration Map to provide formative feedback and ensure students are meeting expectations. If your review indicates that many groups need more time to revise or improve their Animal Migration Map, adjust your pacing to provide time before students develop their second map layer, the Ecosystem Map Layer in Lesson 2 of the unit.

## Rubric

The [Animal Migration Map Rubric](#) can be used to assess each group's base layer map. Each group's map should show a typical migration route, include a key, and contain additional information about their animal, its habitat(s), and why and how it migrates.

## Extending the Learning

Have the students create a map, similar to the one they created for their animal's migration, showing a movement pattern they make in their lives. Examples include: going to school every day, going on a vacation, or visiting a friend's house. Students should describe the movement, include a map key, a reason for why they make this movement, and how they get to where they need to go.

## OBJECTIVES

## Subjects & Disciplines

### Biology

- [Ecology](#)
- Conservation

### Geography

## Teaching Approach

- Project-based learning

## Teaching Methods

- Discussions
- Research
- Self-directed learning

# Skills Summary

This activity targets the following skills:

- 21st Century Student Outcomes
  - Learning and Innovation Skills
    - Communication and Collaboration
  - Life and Career Skills
    - Initiative and Self-Direction
    - Productivity and Accountability
- Critical Thinking Skills
  - Analyzing
  - Applying
  - Creating
  - Evaluating
  - Remembering
  - Understanding
- Geographic Skills
  - Acquiring Geographic Information
  - Analyzing Geographic Information
  - Answering Geographic Questions
  - Asking Geographic Questions
  - Organizing Geographic Information
- Science and Engineering Practices
  - Asking questions (for science) and defining problems (for engineering)
  - Obtaining, evaluating, and communicating information

## National Standards, Principles, and Practices

COMMON CORE STATE STANDARDS FOR ENGLISH LANGUAGE ARTS  
& LITERACY

- **CCSS.ELA-LITERACY.RST.6-8.7:**

Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

- **CCSS.ELA-LITERACY.SL.7.2:**

Analyze the main ideas and supporting details presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how the ideas clarify a topic, text, or issue under study.

- **CCSS.ELA-LITERACY.WHST.6-8.7:**

Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.

- **CCSS.ELA-LITERACY.WHST.6-8.8:**

Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

- **Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6-12:**

Research to Build and Present Knowledge, WHST.6-8.7

## NEXT GENERATION SCIENCE STANDARDS

- **Disciplinary Core Ideas LS2.A: Interdependent Relationships in Ecosystems:**

- **Performance Expectations: MS-LS2-2:**

MS-LS2-2: Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

- **Science and Engineering Practice 1:**

Asking questions and defining problems

- **Science and Engineering Practice 8:**

Obtaining, evaluating, and communicating information

### Preparation

## BACKGROUND & VOCABULARY

# Background Information

Mapping animal migration is an important way to understand more about the animals, their movement pattern, and their global relationship. Additionally, creating and reading maps are important skills, and help students to simplify complex patterns and gain new perspectives. Spatial representations are important tools students can use to aid in memory and learning. Utilizing different maps (e.g., state, country, and world maps) not only helps students learn geographical information, but also helps their understanding of geographic perspective and scaling.

## Prior Knowledge

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## Recommended Prior Activities

- [Collision! Human Impacts on Animal Migration](#)
- [Tracking Animal Migration](#)
- [Why and How Animals Migrate](#)

## Vocabulary

| Term              | Part of Speech   | Definition   |
|-------------------|------------------|--|
| animal migration  | <i>noun</i>      | process where a community of animals leaves a habitat for part of the year or part of their lives, and moves to habitats that are more hospitable. |
| detour            | <i>noun</i>      | unplanned or temporary path.   |
| distract          | <i>verb</i>      | to divert or draw attention away from something.   |
| ecosystem         | <i>noun</i>      | community and interactions of living and nonliving things in an area.  |
| focal             | <i>adjective</i> | central and important.   |
| impact            | <i>verb</i>      | to influence or have an effect on something.   |
| key               | <i>noun</i>      | an explanation of symbols and abbreviations used on a map, also known as a legend.   |
| map               | <i>noun</i>      | symbolic representation of selected characteristics of a place, usually drawn on a flat surface.   |
| map layer         | <i>noun</i>      | part of a map representing specific features of a place.   |
| migration pattern | <i>noun</i>      | predictable movements, in time and space, of a group of animals or people.   |
| pole              | <i>noun</i>      | extreme north or south point of the Earth's axis.  |
| scale             | <i>noun</i>      | distinctive relative size, extent, or degree.  |

| <b>Term</b>     | <b>Part of Speech</b> | <b>Definition</b>  |
|-----------------|-----------------------|--|
| <b>solution</b> | <i>noun</i>           | an answer to a problem.  |
| <b>survival</b> | <i>noun</i>           | ability to live.   |
| <b>symbol</b>   | <i>noun</i>           | something used to represent something else.  |
| <b>tracking</b> | <i>noun</i>           | process in which scientists and resource managers use technology to tag animals and map their movements. |



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