

## Photo Description



This image shows hundreds of white snow geese resting together in a large field during their migration. The geese are stopping to rest and find food during their long journey between their winter homes and summer breeding grounds. In the sky above, three geese are flying, showing how they travel long distances in groups.

## Scientific Phenomena

Anchoring Phenomenon: Why do birds gather in large groups and fly together to different places at certain times of year?

Scientific Explanation: Snow geese migrate seasonally, traveling thousands of miles between their Arctic breeding grounds (summer home) and wetland wintering areas (winter home). They follow environmental cues like changing day length and temperature drops that signal when food becomes scarce. Flying in large flocks provides protection from predators, allows them to share information about food sources, and reduces wind resistance through aerodynamic formation flying. These birds stop in productive feeding areas like agricultural fields to refuel before continuing their journey.

## Core Science Concepts

- \* Migration as Adaptation: Seasonal migration is a behavioral adaptation that allows animals to survive by moving to places with abundant food and suitable conditions for breeding or overwintering.
- \* Environmental Triggers: Animals respond to environmental changes (photoperiod, temperature, food availability) that signal when it's time to migrate. These cues are reliable indicators of seasonal changes.
- \* Flock Behavior and Survival: Animals living and traveling in groups benefit from collective advantages including predator detection, cooperative feeding, and reduced individual energy expenditure during flight.
- \* Ecological Relationships: Snow geese depend on specific wetland and agricultural ecosystems that provide food (plants, seeds, vegetation) at different times of year, demonstrating interdependence between organisms and their environments.

### Pedagogical Tip:

When teaching migration, use a sensory timeline strategy: Have students physically walk the migration route in your classroom, marking "rest stops" and "food sources" along the way. This embodied learning helps fifth graders internalize the distance and effort involved in migration, making the concept more concrete than discussion alone.

### UDL Suggestions:

**Representation:** Provide a visual map showing migration routes with distance markers and climate data. Some students may benefit from a simplified route map highlighting just the key waypoints.

**Action & Expression:** Offer multiple ways for students to demonstrate understanding: create a migration journal from a goose's perspective, build a 3D migration route model, or present findings through labeled diagrams rather than written reports.

**Engagement:** Connect to student interests by asking "If you had to travel 3,000 miles, where would you go and why?" before introducing goose migration, making the content personally relevant.

## Zoom In / Zoom Out

### Zoom In: Cellular Level – Energy Processing

When snow geese stop in agricultural fields to eat seeds and plant material, their digestive system breaks down this food at the cellular level. Inside each cell, mitochondria (the "powerhouse" of the cell) convert the chemical energy from food into ATP (adenosine triphosphate), a usable form of energy that powers muscle contractions for flight. During migration, geese must eat constantly to replenish their cells' energy supply, since flying thousands of miles requires enormous amounts of cellular energy production. Without sufficient food stops, their cells cannot generate enough ATP to sustain the physical demands of long-distance flight.

### Zoom Out: Continental Ecosystem Network

Snow geese migration connects multiple ecosystems across an entire continent. These birds depend on a chain of wetland habitats, agricultural areas, and coastal marshes stretching from the Arctic Ocean to the Gulf of Mexico. When one ecosystem is damaged (such as wetland loss due to dam construction or agricultural changes), it disrupts the entire migration network. Climate change affects this system by altering when plants grow in spring and when water freezes in fall, which can cause mismatches between goose arrival times and food availability at each stop. The health of snow goose populations reflects the health of hundreds of interconnected habitats across North America.

## Discussion Questions

1. What do you observe about how the geese are positioned in the field, and what might be the reason they stay together in large groups? (Bloom's: Analyze | DOK: 2)
2. Why might snow geese need to travel to different places at different times of year instead of staying in one location all year? (Bloom's: Understand | DOK: 2)
3. How do you think the geese "know" when it's time to migrate if they've never made the journey before? (Bloom's: Evaluate | DOK: 3)
4. What would happen to the snow geese if the wetlands where they stop to rest were destroyed by human development? (Bloom's: Analyze | DOK: 3)

## Potential Student Misconceptions

Misconception 1: "Geese migrate because they get cold and need to find warmth."

Scientific Clarification: While temperature changes are a signal for migration, geese don't migrate primarily to find warmth. They migrate to follow food sources. Snow geese have thick feathers and down that insulate them well in cold weather. The real trigger is that when winter arrives, the water and ground freeze solid, making it impossible for geese to access the aquatic plants and seeds they need to eat. They migrate south to find unfrozen water and available food, not to escape cold.

Misconception 2: "Baby geese learn the migration route by following their parents, and if parents don't teach them, young geese won't know where to go."

Scientific Clarification: While young geese do learn the route by flying with experienced birds, migration timing is largely instinctual—controlled by internal biological clocks and responses to environmental cues. Young geese have an inborn drive to migrate triggered by photoperiod and temperature changes. Even geese raised in captivity with no experienced birds to follow will show migratory restlessness at the correct time of year. Parents' guidance is important for learning the specific route and stop-over locations, but the "urge to migrate" is built into their biology.

Misconception 3: "All birds migrate, and they all migrate the same way."

Scientific Clarification: Not all birds migrate—some are year-round residents in the same location. Among birds that do migrate, there is tremendous variation. Some birds migrate short distances, others travel thousands of miles. Some migrate daily (like hummingbirds moving up and down mountains), while others migrate seasonally. Some birds migrate alone, while others form massive flocks like snow geese. Migration strategies are shaped by each species' food sources, breeding needs, and evolutionary history.

## Extension Activities

### Activity 1: Migration Route Mapping

Students use a large map of North America to trace the snow goose migration route from the Arctic to southern wintering grounds (typically the Gulf Coast). Have them mark rest stops, measure approximate distances, and calculate how many days the journey might take if geese fly at an average speed of 40 mph. Students can create a data table showing elevation, temperature, and available food sources at different waypoints along the route.

### Activity 2: Flock Formation Physics

Divide students into small groups and have them stand in a V-formation (like flying geese). Rotate who stands at the front. Discuss how each position feels different—those in front face more wind resistance, while those behind experience less. Connect this to real goose behavior and why they take turns leading. Students can then observe video footage of actual geese flying in formation and identify the formation pattern used.

### Activity 3: Environmental Change Impact Simulation

Create a simplified ecosystem card game where students represent snow geese in different scenarios: normal migration (cards show abundant food and safe rest areas), habitat loss (remove some rest-stop cards), and climate change (alter seasonal timing). Groups play through the "journey" and record survival outcomes. Debrief by discussing how real conservation efforts protect migration routes and wetland habitats.

## Cross-Curricular Ideas

### Math Connection: Distance and Speed Calculations

Students can use real migration data to solve word problems involving distance, speed, and time. Example: "If snow geese fly at an average speed of 40 miles per hour and migrate 3,000 miles from their breeding grounds to their wintering grounds, how many hours of flying does this take? If they fly 8 hours per day, how many days will the migration take?" Students can also create data tables showing distances between major rest stops and calculate fuel (food) needed for each leg of the journey, introducing the concept of energy requirements.

### ELA Connection: Migration Narrative Writing

Students write a first-person narrative journal from the perspective of a young snow goose experiencing its first migration. The narrative should include sensory details (what the goose sees, hears, feels), obstacles encountered, and decision points (like whether to stop at a particular rest area). This creative writing assignment helps students internalize the challenges and instincts driving migration while practicing descriptive language and narrative structure. Students can then share stories and identify common themes across their "goose experiences."

### Social Studies Connection: Human Migration and Habitat Protection

Connect animal migration to human migration patterns and the concept of protected habitats. Discuss how indigenous peoples (like the Dene, Inuit, and other groups) have historically tracked and hunted migratory birds, and how this relationship is part of their cultural heritage. Then explore how modern conservation efforts (like the Ramsar Convention on Wetlands and the Migratory Bird Treaty Act) protect migration corridors. Students can research a local or regional wetland refuge and investigate the policies that protect it, understanding how science informs policy decisions.

### Art Connection: Migration Route Mural or Infographic

Students create a large collaborative mural or digital infographic illustrating the snow goose migration route with visual representations of each ecosystem encountered (Arctic tundra, prairie wetlands, agricultural fields, coastal marshes). Each section can include hand-drawn or collaged images of vegetation, weather conditions, predators, and other geese at different densities. This artistic project builds spatial understanding of the migration journey while incorporating scientific accuracy about ecosystem characteristics at each location.

## STEM Career Connection

### Ornithologist (Bird Scientist)

An ornithologist is a scientist who studies birds—their behavior, migration patterns, health, and habitats. Ornithologists might track snow geese using satellite transmitters, count bird populations during migration season, study how climate change affects migration timing, or work to protect important wetland habitats. They spend time in the field observing birds with binoculars and recording data, and also work in laboratories analyzing samples and patterns. Some ornithologists work for universities, wildlife agencies, or conservation organizations.

Average Annual Salary: \$65,000–\$85,000 USD

### Environmental Conservation Officer

A conservation officer protects natural habitats and wildlife populations by enforcing environmental laws, managing protected lands, and educating the public about conservation. They might patrol wetland refuges where migratory birds rest, investigate habitat destruction, work with landowners to protect migration corridors, or manage controlled burns in prairie regions to maintain food sources for geese. These professionals combine outdoor work with education and policy enforcement.

Average Annual Salary: \$55,000–\$75,000 USD

### Climate Scientist / Ecologist

Climate scientists and ecologists study how changing environmental conditions—like rising temperatures, shifting precipitation patterns, and earlier spring thaw dates—affect animal migration and ecosystem health. They use computer models to predict how climate change might disrupt the timing between goose arrival and food availability, and they work to develop adaptation strategies. This work helps governments and conservation groups plan for wildlife protection in a changing climate.

Average Annual Salary: \$70,000–\$95,000 USD

## NGSS Connections

### Performance Expectation:

5-LS1-1: Support an argument that plants get the energy they need to grow chiefly from sunlight.

### Related Standards:

- 5-LS2.A - Organisms in an ecosystem acquire their energy from food, which they use to grow, reproduce, and run life processes.
- 5-LS2.C - Organisms interact in various ways that can be helpful, harmful, or have little effect on each other; these relationships are called symbiotic relationships.
- 3-LS3.B - Individuals of the same kind differ in their inherited traits, and sometimes the differences give individuals an advantage in surviving or reproducing.
- Patterns - Seasonal patterns of animal behavior are predictable and correlate with environmental changes.
- Structure and Function - The shape and structure of wings and body form allow snow geese to fly long distances efficiently.

- Cause and Effect - Environmental changes (temperature, day length) cause predictable changes in animal behavior.

### Science Vocabulary

- \* Migration: When animals travel long distances from one place to another at certain times of year, usually following the same route every year.
- \* Adaptation: A trait or behavior that helps an animal survive and reproduce in its environment.
- \* Flock: A group of birds flying or living together.
- \* Breeding Ground: The area where animals go during the reproductive season to mate and raise their young.
- \* Instinct: A natural behavior that an animal is born knowing how to do, without having to learn it.
- \* Photoperiod: The length of daylight in a 24-hour period; animals use changes in day length as a signal for seasonal changes.

### External Resources

#### Children's Books:

- Stranger in the Woods by Carl R. Sams II and Jean Stoick (explores wildlife habitats and adaptation)
- Camille's Bird by Eve Bunting (poetic story connecting to bird migration)
- Migration Maps by Sara Thomson (informational picture book about animal migrations)

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Implementation Tip: This lesson works best as a multi-day unit. Start with the image as an anchor on Day 1, build understanding of migration concepts over Days 2-3, and conclude with extension activities on Days 4-5. The discussion questions serve well as formative assessments throughout the unit.