



Hawk in Flight Lesson Plan

Overview

In this lesson students use information gathered by satellites to explore the migration of the Swainson's hawk from the western border of Minnesota to the southern portion of South America. Not only will students study the migratory path of the hawk, they will also be able to observe how the vegetation in a particular region of the Earth changes with the seasons. When viewed from space, seasonal vegetation change can be tracked across entire continents, and large scale "green-up" or "brown-down" of regions can be explored over time. Specifically, students will explore the path of the Swainson's hawk relative to time-lapsed satellite images that reveal the relative "greenness" of North and South America over an 8-month period of time. Students will use this imagery to investigate the connections between migratory patterns of the hawk and seasonal climatic change.

Suggested Lesson Sequence	Please see the Migration del Mundo and Seasonal Changes module descriptions.
Lesson Level	Intermediate
Mathematics Connections (Keywords in BOLD)	<ul style="list-style-type: none"> - Students develop spatial visualization skills as they view satellite images of the Earth. - Students use data to calculate photoperiod.
Science Connections (Keywords in BOLD)	<ul style="list-style-type: none"> - Students will conjecture about prompts that may have initiated the hawk's migration; - Students will explore the green-up and brown-down phenomenon - Students will use satellite imagery to observe the migratory path of a Swainson's hawk.
Technology Connections (Keywords in BOLD)	<ul style="list-style-type: none"> - Students will learn that animals can be located using satellite technology.
Lesson Assessment Tools	<ul style="list-style-type: none"> - Assessment and Standards Table (Word) - Assessment Task Description (below) - Authentic Assessment (below)

Materials

- This lesson requires Powerpoint Reader ([Windows](#) / [Mac](#)), [Quicktime Player](#), and [Adobe](#)

Reader.

- Crayons (dark green, light green, brown, light brown, black, white)
- Computer (sound and projection device or large screen TV recommended)
- [Hawk Migration Map](#) (Powerpoint)
- [Hawk Data Table and Questions](#) (PDF)
- [Hawk in Flight Assessment](#) (Powerpoint)
- Pixel the Satellite "[Hawk in Flight](#)" Animation (Quicktime)
- World map
- Optional: Tracking the Motion slideshow ([Powerpoint](#)), stored in the "Osprey Journey" folder

Vocabulary

- Green-up/Brown-down phenomenon - changes in leaf color in a region that take place as seasons change. These changes can be tracked and observed over time through the use of satellite imagery.
- Migration - an animal movement that is triggered by some environmental change that helps the animal survive and have young.
- Migratory path - the route an animal (bird) takes during migration

Procedure

1. Assessing Prior Knowledge: Animal migrations are among the most fascinating science topics for children. Some students may already be aware that animals spend different parts of the year in different locations. Some of the best and well-known examples of animal migration involve birds. Many birds spend the year in more than one location, often flying for long periods of time in transition between winter and summer locations. Begin this lesson by assessing students' prior knowledge about bird migrations.

Initial questions for discussion might include:

- What time of year do most birds build their nests? (*Springtime*)
- Before building their nests in the spring, where do you think the birds *used* to live? (*Motivate the idea that many kinds of birds are moving into the area in the spring from some other location - hence, they must migrate.*)
- Do you see more or fewer birds in the winter, or in the summer? Why? (*Summer - in the winter, many birds fly [migrate] to warmer climates.*)
- What birds have you personally observed migrating through (or in/out) of your state?

2. Contextual Preparation: Distribute the Did You Know? activity sheet. As a class or in small groups, students may discuss the various facts about bird migrations contained in the activity sheet. These questions are meant to heighten students' curiosity about bird migrations.

During this discussion, it is very helpful to have a world map available, so that you may point out the geographic features listed on the Did You Know? activity sheet to emphasize some of the amazing facts about bird migrations.

Following this discussion, show students the Pixel the Satellite animation as a bridge into the lesson activity described below. The animation transcript follows:

"1. In this lesson, we'll explore the life of a very interesting bird called a hawk. 2. There are about 16 different kinds of hawks that live on our continent of North America. 3. Did you know that some hawks, like the Swainson's Hawk (gesturing towards the Swainson's Hawk on the blackboard), don't spend the whole year in North America? 4. Instead, they migrate thousands of miles to the southern part of South America and back every year! (shows map on the blackboard) 5. Of course, these hawks can't buy a ticket on an airplane—they have to fly all this way by themselves! 6. Why do you think a bird would want to fly so far to spend several months of the year thousands of miles away from its nest in North America? 7. And, what clues do you think we might be able to gather in order to understand a hawk's migration? 8. Well, I just heard the news that our fine feathered friends are soon to be on the move, so your teacher will take it from here. 9. See you soo-oon!!!!"

3. Student Activities

Background information. The focal point for this lesson is a sequence of slides that show vegetation changes in North and South America over an 8-month period of time. Imposed onto these images is the actual migrational path of a Swainson's Hawk as it travels from Minnesota to the southern tip of South America. Students might be interested to know that two separate satellites gathered the information seen in these images. First, a satellite imaging system called the "Advanced Very High Resolution Radiometer" gathered the global greenness images. Second, scientists at the University of Minnesota tracked the position of the hawk by attaching a small collar to the bird that sent a signal to a different satellite (called the Argos satellite). The position of the bird was therefore transmitted to scientists. For details on this tracking method, watch the Tracking the Motion slideshow ([Powerpoint](#)), stored in the "Osprey Journey" folder.

- 1) Project the images of the Hawk Migration Map for the class to observe. (Alternatively, students may view the slides at independent computer work stations.) You may wish to show the slide show several times to help students recognize and comprehend the data it contains. After viewing the satellite images, the following questions may be used to stimulate conversation and prepare students for later activities:

What types of patterns or changes in vegetation do you see?

Different color changes on the images show changes in vegetation growth according to seasonal change. A "green-up" occurs when plants are actively growing during warmer

seasons with adequate rainfall. A "brown-down" occurs when plants are dormant during cold or dry seasons. Some places, like the tropics, remain green all year; whereas other places like deserts have a brown color all year.

Where does the hawk spend the "summer"? Where does the hawk spend the "winter"? Why do you think the hawk stays in these places?

The hawk spends the northern hemisphere summer in Minnesota. The hawk spends the "winter" in South America, although this is actually summer in the southern hemisphere. The hawk stays in these places because the climate is warm and the food supply is abundant. This species of hawk preys upon insects and small rodents that require green vegetation for their own survival.

During what times of the year does the hawk migrate? Why do you think the hawk migrates during these times?

The hawk migrates in the fall and spring because of seasonal changes in climate. The hawk migrates to warmer, moist climates where there is green vegetation to support the hawk's food supply.

- 2) After engaging in discussion of the previous questions, students should be given the Hawk Data Table activity sheet, as well as a collection of crayons. The intent of this lesson is to get students thinking about the connection between seasonal changes and animal migration. Specifically, an important goal for this lesson is to help students recognize that the hawk's migration follows the green-up of the Earth.

A way to highlight this is for students to be mindful not only of the surroundings in which the hawk finds itself at any given moment, but also what is happening to the Earth (climate changes) in locations where it *used* to be. In particular, students should focus their attention on the original nesting site of the hawk in northern Minnesota, as well as the present location of the bird along its migration. To help achieve these objectives, the Hawk Data Table activity sheet asks students to observe the slides again, this time with directions to record and recognize connections between the migrational path of the hawk and the color of ground vegetation.

To do so, students are asked to select a crayon that best represents colors they see at various locations on the slide on several selected dates. In particular, students record the color of vegetation where the hawk is on a given date, as well as color of the region from which the hawk began its journey south. The data table thus provides visual cues to help students compare vegetation and migrational data.

- 3) After completing this exercise, students may work in small groups or with the teacher in whole class discussion to answer the Hawk Data Table Questions. Possible answers to

these questions appear below.

Hawk Data Table Questions and Answers

1. What are the colors of the areas where the hawk flies along its path of migration? Why do you think the hawk follows these colors?

The hawk follow green colors because these are places where the vegetation is green and the food supply is abundant.

2. Where does the hawk spend the "summer"? Where does the hawk spend the "winter"? Why do you think the hawk stays in these places?

The hawk spends the "summer" in Minnesota and the winter in South America because the climate is warm and the food supply is abundant.

3. During what times of the year does the hawk migrate? Why do you think the hawk migrates during these times?

The hawk migrates in the fall and spring because of seasonal changes in climate. The hawk migrates to warmer, moist climates where there is green vegetation to support the hawk's food supply.

4. How does the color of land where the hawk spends its "winter" compare with the color of the land where the hawk first began its journey? Why do you think there is a difference between these colors?

The color of the land where the hawk spends its winter in South America is green. During this time, the color of the land where the hawk first spent its journey in Minnesota is brownish with white snow cover.

5. Why do you think scientists use satellite images to study the migrations of animals?

Scientists can tag animals and follow their migrations as the seasons change by observing satellite images of the Earth.

6. What other animals migrate? Do you think their migration paths would be similar or different from a Swainson's hawk? Explain.

Animals such as other birds (e.g. ospreys), whales, turtles, butterflies or salmon migrate. Although these animals would not follow the exact same path as the hawk, many animals migrate as seasons change.

4. Assessment

Students should also be able to explain how the seasons of North America compare to those in South America, and how these seasons have an effect on the migration of a Swainson's hawk. Students should be able to articulate the connection that, as the amount of food or vegetation available for the hawk changes with the seasons, so also does the hawk adapt and begin to migrate to warmer climates where food and shelter are abundant. Thus, the major objective of this lesson is to show that, because this species of hawk preys upon insects and small rodents that require green vegetation for their own survival, the Swainson's hawk must follow the green-up of the Earth caused by the Earth's seasonal changes,

Assessment activity. To assess students on these concepts, distribute the Hawk in Flight Assessment. Students are asked to make inferences about seasonal changes and migrations from the data contained on one slide.

Lesson Extensions for Authentic Assessment

1. Photoperiods (the length of the day) help animals determine when to migrate (see the Hickory Dickory Dock lesson). Using the dates and locations listed on the Hawk Migration Map, students can calculate the photoperiods just prior to the Swainson's hawk migration south and back north again to see if they are similar. These calculations can be done on the "Form B" version of the web site (http://riemann.usno.navy.mil/AA/data/docs/RS_OneDay.html). Use the following data to calculate the photoperiods:

The Swainson's hawk began its migration southward on 9/23/97 when it was located at 44 degrees, 6 minutes N and 96 degrees, 19 minutes W (6 hours West of Greenwich Mean Time) and it began its migration northward on 3/10/98 when it was located 31 degrees, 49 minutes S and 62 degrees, 56 minutes W (3 hours West of Greenwich Mean Time).

2. Write a story or a diary of the hawk that records the details of the hawk's migration from Minnesota to Argentina. What might it see below it on the ground as it travels from week to week? What human languages would the hawk hear as it flies through North and South America? In what types of trees would the hawk stop along the way? Will the hawk see some sandy beaches along its path? Through which countries might the hawk fly on its journey?

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