



# Global Climate Change and Life at High Elevations

## Overview

Students will learn the difference between weather and climate. And gain an understanding of how global climate change is affecting birds.

## California Science Standards

Grade 8: LS-6a  
High School: ES-6c

## Oregon Science Standards

Grade 6: 2L.2  
Grade 7: 2E.1,2  
Grade 8: 2E.4  
High School: 2L.2

**National Standards**  
Content Standard C:  
Life Sciences

**Materials Included**  
\* PowerPoint presentation and script

**Materials Needed**  
\* Projector and laptop  
\* Computer time for students.

**Activity Time**  
Preparation: 10 min.  
Activity Time: 60 min.

**Best Season**  
All Seasons

**Vocabulary**  
\* Climate  
\* Weather  
\* Cache  
\* Adaptation

**Grade Level:** 6th-12th (O.S.S. 6-12th) (C.S.S 8-12th)

## Learner Objectives

Student will:

- Understand climate in a biological context
- Learn how shifting climate patterns affect species distribution
- Learn how birds are used as environmental indicators of changing environmental patterns

## Background Information

Climate and weather differ from one another. Weather is the state of the Earth's atmosphere at a given point in time and a given location. Climate encompasses all patterns of weather over a long period of time (at least 30 years). To monitor and help inform decision makers on global climate change (GCC), the Intergovernmental Panel on Climate Change (IPCC) was established in 1988, by the World Meteorological Organization and United Nation's Environment Programme. According to IPCC publications, in the next century GCC will be responsible for changes in the amount and timing of precipitation, frequency of extreme weather events, rise in sea level and an increase in average world temperatures by 1 to 6.4° Celsius (1.8 to 11.5° F). These changes will affect the ecological processes, distribution and abundance of many organisms. Climate change is not a new phenomenon to the Earth's history, ice ages and warmings have helped shape geography and species distribution world wide. The trouble happens when climate change happens faster than species can adapt. Our planet is warming ten times faster than it did after the last ice age. According to a study published in *Nature* in 2003, approximately 280 individual species have been documented as being affected by GCC.

Studies have shown how birds are being affected by GCC. Scientists have recorded changes in the timing of spring migration, location of migration routes, choice of habitat, range of distribution, and reproductive behavior. For example, American Robins are arriving to their breeding grounds in the Rocky Mountains two weeks earlier than 20 years ago, snow still covers the ground and food sources, increasing the risk of starvation. The North American Tree Swallow is nesting nine days earlier, in correspondence with warmer spring temperatures. Many species, including the Rufous Hummingbird, have shifted their range farther north. Tucans in Costa Rica were historically seen in low lands, but are now found in mountainous areas. What does this mean for species that live at high elevations and northern

# Lesson Plan

latitudes? Scientists are particularly concerned for high elevation species. One reason for concern is that these species may not have new habitats to move into as GCC habitats to shift up in elevation. Researchers at Ohio State University have been studying the effects of GCC on Gray Jays, a species found at Crater Lake National Park.

Gray Jays are generally found in mixed conifer and conifer-deciduous habitat in subalpine and boreal forests, occupying the same area year round. Sometimes known as “Camp Robbers” Gray Jays are bold around humans and are often seen at campsites and picnic areas at high elevations looking for hand outs (National Parks Service does not permit visitors to feed wildlife). Unlike other members of the corvid family (Jays, Crows, Ravens), Gray Jays are rarely seen where there are permanent human settlements. Gray Jays cache large amounts of food: one observer recorded 1,000 caches in a 17 hour day. This adaptive behavior helps them survive harsh winters. Unlike most hoarders that rely on seeds and nonperishable stashes to last the winter, Gray Jays cache arthropods (invertebrates with segmented legs), berries, fungi and even bits of vertebrate flesh. A large, specialized salivary gland produces a sticky substance that Gray Jays use to encase their food and attach it to trees, keeping food out of reach of ground dwellers. The cold winter temperatures act as a refrigerator preserving their food. Gray Jays are also very early nesters, laying eggs in early March when there are still heavy snows. The food that was cached in the fall helps feed both parents and young until later in the spring.

Ornithologists studying Gray Jays have noticed concerning trends due to GCC. As winters become increasingly mild, caches of perishable food are spoiling and not lasting the winter. Additionally, studies have shown that Gray Jays are breeding earlier, in part because food cached is not lasting. These earlier breeding attempts tend to be less successful. This is likely due in part to incubating females being exposed to harsh winter storms. As a species that already occupy high elevation habitats, what will happen to Gray Jays if warming trends continue?

## Getting Ready!

1. Read background information and review GCC PowerPoint presentation.
2. Secure laptop and projector.
3. Make copies of the *Student Journal: Global Climate Change and Life at High Elevations*.



Photo by Jim Livaudais



Distribution of the Gray Jay

### Quick Definitions:

**Boreal forest:** *A northern forest characterized by conifers and long winters.*

**Tree line:** *Not a real line, but a zone where trees get smaller and increasingly stunted until conditions are too harsh for growth.*

**Cache:** *A site or location where food, typically nonperishable but can be perishable, is hidden or stored by an animal for consumption at a later time.*

# Lesson Plan

## Discuss!

1. Share with students the PowerPoint presentation on GCC and it's effect on high elevation species.
2. Have a discussion about what measures students can take at home and at school to help reduce our impact on GCC.
3. Ask students some of the suggested questions.
4. Have students fill out the Student Journal: GCC Pledge and carbon calculator.

## Extension Activity:

For a more in depth activity, have students research the effects of GCC on animal populations. Secure time in the computer lab and assign student research teams. Have students research the effects of climate change on a specific species. What is happening the population numbers and distributions? Students should create a PowerPoint presentation and present their research to the class.

Students should try to find information on what habitat their focus species uses, how the habitat is being affected by climate change and human use, and the effect of GCC on the species.

Some possible species that students could research:

Gray Jay, Northern American Tree Swallow, Marbled Murrelet, Shooty Shearwater, Snowy Plover.

More information can be found online at:

<http://www.fws.gov/birds/imbd.html>

[http://www.birdday.org/a2007\\_theme.php](http://www.birdday.org/a2007_theme.php)

<http://www.epa.gov/climatechange/>

## Suggested Questions:

*How will GCC affect migrating birds?*

*What will happen to high elevation species as lower elevation habitats shift up?*

*How will loss of bird species affect human agriculture?*

*What measures can we take to help stem GCC?*

*How is GCC affecting the Gray Jay?*

*What is a boreal forest?*

*What is climate? Weather?*