

Lesson: Fantastic Birds and Where to Find Them**Date:** Created 2/2/2018**Subject /grade level:** Life Sciences/Middle School and High School**Materials:**

- Biodiversity Spotlight Handout/Webpage
- Maps Worksheet/PowerPoint (to display for students at the front of the classroom)
- Create a Reserve Worksheets
- A computer connected to the internet with speakers (*optional*)
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This lesson should take a little over one hour of class time total but can be easily split between multiple days.

NC SCOS Essential Standards and Clarifying Objectives

Bio 2.1.3 Explain various ways organisms interact with each other (including predation, competition, parasitism, mutualism) and with their environments resulting in stability within ecosystems.

Bio.2.2 Summarize how humans modify ecosystems through population growth, technology, consumption of resources and production of waste.

Next Generation Science Standards

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.

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

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

HS-LS2-7: Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

HS-LS4-5: Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

NGSS Crosscutting Concepts

Patterns: Students will be evaluating a species distribution by visualizing occurrence data.

Cause and Effect: Students will be evaluating the effect of human population growth on species and ecosystems.

Nature of Science

Scientific Knowledge is Open to Revision in Light of New Evidence: This lesson presents both scientific concepts (endemism, and co-occurrence) but also lets students draw their own conclusions from the data itself allowing for students to see that data is messy and hardly ever completely black and white.

Lesson objective(s):

- Analyze spatial occurrence data for Red-cockaded Woodpecker and Longleaf Pine.
- Interpret multiple forms of spatial information including point, polygon and heat maps.
- Construct a conservation plan through interpretation of spatial data.
- Understand scientific concepts including: distribution, co-occurrence, keystone species, and biodiversity loss.
- Explain how human activity is related to habitat loss and species extinction.

Essential Questions

- How do you find out where animals occur?
- What are natural history collections and how are they used?
- What biotic and abiotic factors influence a species' distribution?
- How are human activities affecting Red-cockaded Woodpeckers and the upland pine ecosystem?

Essential Vocabulary

Distribution and range

Species

Scientific name

Occurrence data

Natural history collection
Endemism
Ecoregion
Endangered species
Keystone species

Differentiation strategies to meet diverse learner needs:

This lesson gives multiple strategies for delivering content and evaluating learners. Choose class-wide discussions vs worksheets and group work vs individual work based on learners needs. Consider mixing approaches to give each learner the chance to demonstrate gains.

ENGAGEMENT (10 minutes of class discussion)

- a) Describe a scenario about walking in the woods and hearing or seeing a bird. Alternatively you could bring students outside and ask them to observe birds in their school yard.

“You’re walking in the woods on a science field trip. Huge pine trees are towering over you. The soil is sandy and dry, and the wind is blowing through the wire grass when suddenly you hear a rapid tapping noise. Is someone doing construction out here? As you look around puzzled, your friend remarks that she hears a woodpecker, and suddenly your confusion subsides. Your teacher thinks it’s a Red-cockaded Woodpecker (*Picoides borealis*), but anyone who can build a case for that identification will earn extra credit. You decide to make it your mission to think like a scientist and determine if the Red-cockaded woodpecker lives in these woods.

Have students listen to the Red-cockaded Woodpecker call and tree-drumming (<http://www.xeno-canto.org/species/Picoides-borealis>) or view images on Arkive (<https://www.arkive.org/red-cockaded-woodpecker/picoides-borealis/image-G104694.html>).

- b) Discuss why animals live in only certain areas, how scientists know where animals occur, and why we should care.

Questions to engage students with during discussion.

Q: What factors could determine where an organism occurs?

A: Biotic factors including resources (food, water, and shelter) and interactions with other organisms such as competition, parasitism, predation, and commensalism. Abiotic factors including climatic and soil conditions.

Q: How do you determine the range or distribution for a plant or animal? Where would you go to find that kind of information?

A: Natural history collections are like libraries for biodiversity (the variety of life) and are the largest sources of information about life on our planet. Most collections minimally contain information about the who, what, when, and where of each specimen. Natural history collection data are one of science’s best kept secrets because the vast majority of museum information are locked away with the specimens in boxes and drawers— until now. Natural history collections are now digitizing (converting a resource into an electronic format) their specimens and sharing them online.

Q: What are the key characteristics for identifying a Red-cockaded woodpecker?

A: Red-Cockaded Woodpeckers are medium sized woodpeckers with a barred back, black and white horizontal stripes, and a black cap and nape that encircle large white cheek patches. Males have a small red streak on each side of the black cap called a “cockade” (hence their common name).

EXPLORATION (20 minute activity)

Either:

1. Engage the entire class with this series of questions using the Maps PowerPoint provided
2. Have students work independently on the Maps Worksheet.
3. Divide the class into groups of 2-4 and have students work through the Maps Worksheet together.

Option 1 guided exploration questions**Slide 1 (Map 1)**

Heat maps are a visual representation of data using colors. In these maps warmer colors (red and yellow) represent locations with more specimen records and cooler colors (blue and purple) represent places with less specimen records.

- Ask the students to describe the Red-Cockaded Woodpecker’s general distribution/range.
- Would it be possible see a Red-Cockaded Woodpecker in a natural area near you? Why, or why not?

- These data come from natural history collections. Spend time talking about what natural history specimens are and how they are used.

Slide 2 (Map 2)

Now, we will look more closely at where Red-cockaded Woodpeckers occur throughout their range. Take a look at the Map 2. The map displays the specimen records as points along with general ecoregions for the United States.

- Name the top ecoregion where Red-cockaded Woodpeckers are found according to this map

Slide 3 (Map 3)

- Next, we can look at the species' occurrence at an even finer scale by using a map of forest types for the southeast. Map 3 displays Red-cockaded Woodpecker specimen records as orange points over a visualization of forest types. Pink areas are primarily pine forests, blue areas are dominated by oak, turquoise areas are mixed upland hardwoods, purple are pine/hardwood forests and the white areas represent no data.
- Based on Map 3, what forest types are preferred by Red-cockaded woodpeckers?
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Stop at Slide 3 (Map 3 for now)

Big Idea Questions for Discussion

- What are some potential factors that could affect a species' distribution?
- What inferences can you make about Red-cockaded Woodpecker's ecoregion and forest type preferences from the data given?

EXPLANATION (5-10 minutes of class discussion)

Conclude the slide show/worksheet time by leading students in a class discussion focused on these key questions:

- Do we have enough information from these maps to make management decisions for Red-cockaded Woodpeckers?
- What additional data would you need to better understand the distribution of the Red-cockaded Woodpecker?
- How would you go about collecting the information you need?
- Why should we care where plants and animals occur?

ELABORATION (Less than 5 minute video/ reading assignment followed by 10 minutes of discussion/worksheet work)

After the students have had the opportunity to explore the data for themselves, give them more information on the Red-cockaded Woodpecker by either:

- Reading the Biodiversity Spotlight on Red-cockaded Woodpecker
- Watching <https://www.youtube.com/watch?v=mA7RCuLddG4> from the N.C. Wildlife Resources Commission

Return to the worksheet and/or slide show and go to Map 4

Red-Cockaded Woodpeckers are one of the few birds that are endemic to (i.e., found only in) the United States. They live in mature southern pine forests with a preference for Longleaf Pines (*Pinus palustris*). Red-Cockaded Woodpeckers use pine trees for foraging and probe the tree's bark looking for beetles, ants, roaches, and other insects.

Scientists are always collecting and analyzing new data to see if it either supports or does not support previous findings. Nothing is ever black and white in science.

Does Map 4 support the statement above in blue?

Which of the following did you observe for distribution of Longleaf Pine relative to the Red-cockaded Woodpecker?

- Distribution of Longleaf Pine overlaps completely with the Red-cockaded woodpecker.
- Distribution of Longleaf Pine is more extensive than the Red-cockaded Woodpecker species.
- Distribution of the Red-cockaded Woodpecker is more extensive than the Longleaf Pine.

What are some of the benefits to using natural history collections data to evaluate distribution? Are there drawbacks?

EVALUATION (10 minutes to complete the worksheet and 5-10 minutes of discussion of answers after worksheets are collected from students).

Design a Reserve Worksheet.

Students will be asked to evaluate a final map and draw in where they would place a reserve for the Red-cockaded Woodpeckers based on both occurrence data from natural history collections and projections of human population growth.

