



## Activity 3.6: Ecological Mismatches

Grades 5 – 6

**Description:** In Part 1: Modeling an Ecosystem, students begin with an activity that illustrates the connections between plants, animals, and abiotic factors in an ecosystem.

In Part 2: Ecological Mismatches, they read an article that illustrates an ecological mismatch between migratory birds and their food sources caused by changing climates. They answer questions about the reading and have a class discussion about the potential impacts of ecological mismatches on natural ecosystems and on agricultural food production.

**Materials:**

**Part 1**

- Yarn
- Food web cards

**Part 2**

- Reading and questions handout
- Pens and pencils
- Highlighters (optional)

**Total Time:** One 45-minute class period

**National Science Education Standards:**

**C3.a** All organisms must be able to obtain and use resources, grow, reproduce, and maintain stable internal conditions while living in a constantly changing external environment.

**C3.c** Behavior is one kind of response an organism can have to an internal or external environmental stimulus.

**C3.d** An organism's behavior evolves through adaptation to its environment.

**C5.c** Extinction of a species occurs when the environment changes and the adaptive characteristics of a species are insufficient to allow its survival.

**AAAS Benchmarks:**

**5D/M4** All organisms, both land-based and aquatic, are interconnected by their need for food. This network of interconnections is referred to as a food web. The entire Earth can be considered a single global food web, and food webs can also be described for a particular environment. At the base of any food web are organisms that make their own food, followed by the animals that eat them, then the animals that eat those animals etc.

**4B/H9** Although Earth has a great capacity to absorb and recycle materials naturally, ecosystems have only a finite capacity to withstand change without experiencing major ecological alterations that may also have adverse effects on human activities.

**5D/H2** If a disturbance such as flood, fire, or the addition or loss of species occurs, the affected ecosystem may return to a system similar to the original one, or it may take a new direction, leading to a very different type of ecosystem. Changes in climate can produce very large changes in ecosystems.

**5D/H3** Human beings are part of Earth's ecosystems. Human activities can, deliberately or inadvertently, alter the equilibrium in ecosystems.

**Guiding Questions:**

- What are the different elements in an ecosystem and how do they interact?
- What happens when phenology or species distributions change in an ecosystem?



- What is an ecological mismatch and how does it impact ecosystem function?

### Assessments

- Post-reading questions

### Vocabulary

- **Migrate:** When species move periodically from one region or climate to another, usually for feeding or breeding.
- **Ecosystem:** An ecosystem is a community of living organisms (plants, animals, and microbes) in conjunction with the non-living components of their environment (things like air, water, and mineral soil), interacting as a system.
- **Ecological mismatch:** When a predator/prey relationship is interrupted by a change in the timing of life-cycle events. For example, when insects hatch early so that when migrating birds arrive, the insects are gone and there are none left for the bird to eat.

### Pre-Activity:

If your students have not covered ecosystems, you may want to give a brief overview of food webs and ecosystem functions.

### Procedure:

#### Part 1: Modeling an Ecosystem

1. Tell students: We have been learning about how climate change may be affecting plants. *Do you think climate change affects animals? In what way?* Ask students to give examples of animals that may be affected by climate change. Take student answers and write them on the board.
2. Today they are going to explore in a little more detail the connections in a regional ecosystem and how those connections might be affected by changing climates.
3. Pass a picture card out to each student.
4. Have students stand in a circle either in the classroom or outside. Explain to the students that they are going to create an ecosystem. Students can pass the ball of yarn to any student who has a card that is connected to their own in an ecosystem. For example:
  - Student 1 – I have a bird, and I will pass the yarn to Student 2 because they have a tree and birds eat nuts.
  - Student 2 – I have a tree, and I will pass the yarn to Student 3 because they have water and trees need water to grow.
  - Student 3 – I have water, and I will pass the yarn to Student 4, because they are a fish and they swim in water.
  - Student 4 – I have a fish, and I will pass the yarn to Student 5 because....
5. Have the first student hold onto the loose end of the string and pass it on to the next student. Every time the yarn is passed, the student should hold onto their piece of yarn. As students pass the ball back and forth, they will create a web between them.



6. When all of the students are holding one part of the web, have them close their eyes.
7. Pluck a string in the middle of the web, and ask students to raise their hands if they felt the tug. Most, if not all students will feel the tug. Have them open their eyes, and look to see how many students have their hands up. Explain that this is because everything in an ecosystem is connected.
8. Have one student drop his or her string and ask students what happened to the web.
9. Explain that the web they just made is a model of an ecosystem. All the different components are connected and when you disturb one, it affects all the others in the system.
10. Revisit the introductory discussion: *How might climate change impact an ecosystem? Might changes in one area, say plant life cycles, impact other parts? Do you think impacts on plants can affect animals?*

## **Part 2: Ecological Mismatches**

### **This can be done in class or as a homework assignment**

11. Tell students that they are going to read an article about one way climate change can create an ecological mismatch that impacts both plants and animals.
12. Pass out the handout “Climate Risks Greater for Long Distance Migratory Birds.” The handout contains pre-, during, and post-reading questions. Have students work on the pre-reading questions before they read the article.
13. The article and during reading questions can either be used as homework or as an in-class reading assignment. Depending on your students’ reading levels, students can read and answer the questions in groups or individually.
14. After students are finished, they should complete the post-reading questions. Have a class discussion regarding student answers to the reading questions, or collect the sheets as an in-class assessment.



# Climate risks greater for long distance migratory birds

Adapted from: Mark Kinver, Science and environment reporter, BBC News  
<http://www.bbc.co.uk/news/science-environment-11408439>  
25 September 2010

Birds that migrate long distances are more vulnerable to shifts in the climate than ones making short journeys, a study suggests.

Scientists say that as spring arrives earlier and earlier at breeding sites in Europe, it makes it harder for the birds to attract a mate or find food.

The researchers warn that the "increasing ecological mismatch" can lead to a decline in bird populations.

"The study was based on a very large dataset of 117 migratory bird species that fly from Africa or southern Europe to northern Europe." explained co-author Nicola Saino, from the University of Milan. Data was collected for more than 50 years.

The international team of researchers wanted to see if the spring arrival time of the birds at their breeding sites had changed over the past 50 years.

**“By arriving late, the birds are probably missing the best period in which to breed”**

**Professor Nicola Saino  
University of Milan**



Swallows are among the species that make long distance migrations to northern Europe

To do this, they used the birds' arrival day at bird observatories in northern Europe. The team compared the arrival day with that year's temperatures.

"We know that temperatures affect the progress of spring - the higher the temperatures in the first months of the year, the earlier spring arrives," Professor Saino told BBC News.

Earlier this year, researchers from the United Kingdom published a study that suggested that spring was arriving in the United Kingdom 11 days earlier than 30 years ago.

Professor Saino and the team found that spring was beginning earlier, but not all of the birds were migrating earlier, to match spring's early arrival. "The birds that have not kept track with the changes have declined more in northern Europe."

The species that declined were mostly species making long distance migrations from sub-Saharan areas in Africa. This group included many different species including ducks, swallows, and warblers.



## CHICAGO BOTANIC GARDEN

"The most likely problem is that there is an ideal time in spring for the birds to breed. When they arrive later, the birds miss the best time to raise their young," he said.

The insects that provide food to the birds and their chicks are hatching earlier because of the warmer spring. This means that when birds arrive later to lay their eggs and raise their chicks, there is not enough food for the chicks.

He added that this "ecological mismatch" was likely to be the main reason for the decline in the birds' populations.

The data show that the birds are reaching the nesting sites earlier, but not early enough to keep up with the advance of spring.

The long-term consequence could be that populations continue to decline, but Professor Saino cautioned that it was a complex issue.



Warmer starts to the year are resulting in plants coming into leaf earlier, the study suggests

### More on This Story

The findings appear in the journal *Proceedings of the Royal Society*.

#### Related Stories

- [Season shifts 'alter food chains'](#) 09 FEBRUARY 2010, SCI/TECH
- [Birds 'off the pace' with warming](#) 20 AUGUST 2008, SCI/TECH



Name: \_\_\_\_\_ Date: \_\_\_\_\_ Room: \_\_\_\_\_

## Ecological Mismatches

### Pre-reading questions:

1. Based on your activity with the yarn that demonstrated connections within an ecosystem, what do you think an ecological mismatch is?
  
  
  
  
  
  
  
  
  
  
2. What do you think might be a connection between birds migrating and climate change?

### During reading questions:

1. Why is when birds migrate important?
  
  
  
  
  
  
  
  
  
  
2. What is happening to the birds' migration patterns that researchers think is due to climate change?
  
  
  
  
  
  
  
  
  
  
3. What do researchers think are the impacts of the birds' migration patterns as described in the article?



Name: \_\_\_\_\_ Date: \_\_\_\_\_ Room: \_\_\_\_\_

## Ecological Mismatches

### Post-reading questions:

1. The article stated that birds that migrate long distances are at greater risk when the climate changes quickly. Explain why that is.
2. What evidence does the article use to make its arguments?
3. One concern with birds and climate change is that there will be “ecological mismatches” between birds, bird nesting, and their food sources. What do you think this means? Based on what you read, why is this a concern?
4. How has this reading changed your opinion about the impact of climate change on ecosystems?



CHICAGO BOTANIC GARDEN

**TEACHER ANSWER KEY:**  
**Ecological Mismatches**

**Pre-reading questions:**

1. Based on your activity with the yarn that demonstrated connections within an ecosystem, what do you think an ecological mismatch is?
  
  
  
  
  
  
  
  
  
  
2. What do you think might be a connection between birds migrating and climate change?

**During reading questions:**

1. Why is when birds migrate important?
  
  
  
  
  
  
  
  
  
  
2. What is happening to the birds' migration patterns that researchers think is due to climate change?
  
  
  
  
  
  
  
  
  
  
3. What do researchers think are the impacts of the birds' migration patterns as described in the article?





Name: \_\_\_\_\_ Date: \_\_\_\_\_ Room: \_\_\_\_\_

**TEACHER ANSWER KEY**  
**Ecological Mismatches**

**Post-reading questions:**

1. The article stated that birds that migrate long distances are at greater risk when the climate changes quickly. Explain why that is.
  
  
  
  
  
  
  
  
  
  
2. What evidence does the article use to make its arguments?
  
  
  
  
  
  
  
  
  
  
3. One concern with birds and climate change is that there will be “ecological mismatches” between birds, bird nesting, and their food sources. What do you think this means? Based on what you read, why is this a concern?
  
  
  
  
  
  
  
  
  
  
4. How has this reading changed your opinion about the impact of climate change on ecosystems?