

Climate Change and Questions of Justice



THE
**CHOICES
PROGRAM**
BROWN UNIVERSITY

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Introduction: The Challenge of a Unified Response

“Coming here today, I have no hidden agenda. I am fighting for my future. Losing my future is not like losing an election or a few points on the stock market. I am here to speak for all generations to come. I am here to speak on behalf of the starving children around the world whose cries go unheard. I am here to speak for the countless animals dying across this planet because they have nowhere left to go. We cannot afford to be not heard.”

—Severn Suzuki, speaking on behalf of the Environmental Children’s Organization at the UN’s Earth Summit, 1992

After addressing delegates of governments from across the world, Severn Suzuki became known as “the girl who silenced the world in five minutes.” Thirteen-year-old Suzuki and three of her peers had raised money to attend the Earth Summit in Rio de Janeiro, Brazil, where leaders and officials of 172 countries were meeting to establish an agenda to address global environmental issues. At the Summit, Suzuki stood before this vast audience of international power-holders and urged them to consider the futures of their children—the futures of young people like her.

Ultimately, the Earth Summit resulted in 165 governments agreeing that climate change was a shared and dangerous problem. As of 2017, 196 countries have signed the United Nations Framework Convention on Climate Change (UNFCCC), promising to work together to reduce or prevent increases in the amounts of greenhouse gases (the gases

that cause climate change) in the atmosphere. The UNFCCC set in motion a series of climate change conferences that continue to this day.

Developing responses to climate change that are acceptable to all members of the international community is no easy task. The challenge is to take into account the many different concerns of countries, ordinary people, businesses, and activists in creating an effective set of policies to address this shared problem. While scientists argue that human-caused climate change is an urgent matter, policy makers disagree about the severity of the threat and how to respond.

These disagreements have made it difficult for national governments to develop a unified response to climate change, even after more than twenty years of meetings and conferences. The slow pace of this process has led people and groups outside of national governments to develop their own responses. Just as Severn Suzuki, with her 1992 speech, challenged the idea that only national leaders have a stake in environmental issues, organizations and individuals are finding ways to raise their voices and create change. Local governments around the world are designing plans to help



Country delegates at a 2014 United Nations (UN) Climate Change Conference in Bonn, Germany.

Jan Golinski, UNClimatechange (CC BY 2.0).

Climate Change and Questions of Justice

Teacher Resource Book



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Climate Change's Effects on Living Things

Objectives:

Students will: Work in groups to consider how climate change will affect a variety of plants and animals in the United States as well as the services they provide to people.

Practice communication and presentation skills.

Visually represent connections between climate change and its effects on plants, animals, and people.

Required Reading:

Students should have read the Introduction and Part I of the student text and completed “Study Guide—Introduction and Part I” (TRB 6-7) or “Advanced Study Guide—Introduction and Part I” (TRB-8).

Videos:

There are short, free videos designed to be used with this lesson at <www.choices.edu/climatechange>.

Handouts:

“Organism Profiles” (TRB 12-25)

“Effects of Climate Change Graphic Organizer” (TRB-26)

In the Classroom:

1. Focus Question—Write the question “What are the effects of climate change?” on the board. Ask students to use their reading to generate a list of the major effects climate change will have. Record this list on the board. You may also want to have students watch the Choices videos for this lesson and then ask if there are any effects of climate change students want to add to their list.

2. Group Work—Divide the class into groups of three or four. Distribute different profile and question pages from the “Organism Profiles” (sugar maple trees, honey bees, lobsters, cod, corn, mangroves, and salmon) to each group as well as the “Effects of Climate Change Graphic Organizer.” You may want to give each group one “Organism Profile” or give

some groups two. Explain that each group will be learning about different organisms, or living things, that live in and around the United States. Students will make predictions about how climate change will affect those organisms and why those effects are important to people. Each group should read and follow the instructions on the worksheets.

3. Presentations—After students complete their assigned “Organism Profiles” and fill out their group’s section of the graphic organizer, have each group present a three-minute summary of what they learned about their assigned organism(s) to the class. Instruct students to individually fill in the rest of the graphic organizer as groups are presenting.

4. Diagramming Connections—After each group has presented, have everyone come together in a large group. Explain that the class will now work together to create a web diagram on the board that shows the relationships between climate change and its effects on living things. Start with climate change in the center and ask students to help you create a diagram to show how climate change, its effects, the organisms they learned about, and people are related by linking each with arrows. See the incomplete sample of a web diagram on the next page for an idea of what this could look like.

Reassure students that it is okay if the diagram gets messy. Encourage students to reference their notes as well as the list of climate change’s effects they generated at the start of class. Students should be prepared to explain the relationships depicted in the diagram.

“Diagramming Connections” (TRB-27) includes some ideas of terms and characters to include in the web diagram. You can choose to give this sheet to students or you may want to use it as a guide for yourself in prompting the class with some of the specific people and professions listed. You may also want to ask students to come up with their own characters to add to the diagram or challenge them to think about where they might put themselves in the diagram.

5. Class Discussion—After finishing the diagram, have students reflect upon the process of making predictions about how climate change will affect living things. Did any themes emerge regarding how climate change’s impacts on plants and animals relate to its effects on people? Were students surprised by any of these connections? Was it difficult to make predictions about how living things might be affected by climate change? Why or why not? What other information would have been useful in order to make more accurate predictions? Is it possible to learn this type of information, and if so, how might students go about finding it?

Suggestions:

It may be helpful for students to have Part I of the student text available as they complete this activity. It may also be useful to project or have students reference a basic map of the United States. Encouraging students to annotate the “Organism Profiles,” marking important concepts as well as words and phrases they do not know, may also help them in completing the exercise.

In addition, if you choose to give each group of students more than one organism from the “Organism Profiles” it may be useful to pair the lobsters profile with the cod profile. The cod profile could also be given to a group that needs more of a challenge.

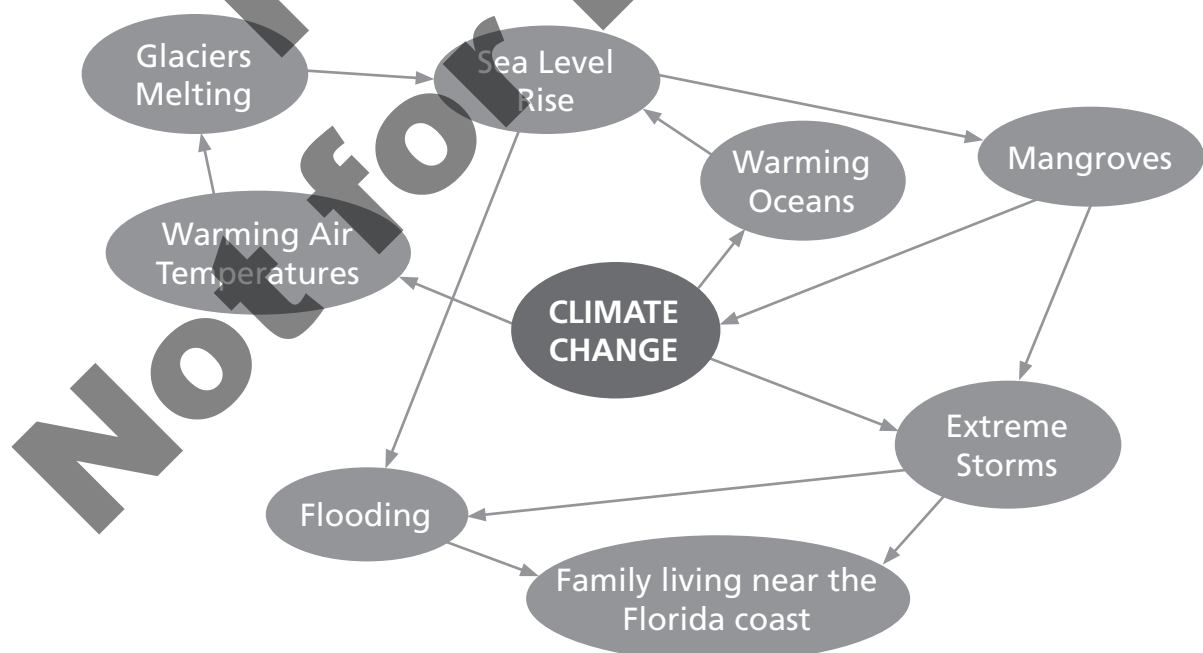
Homework:

Students should read Part II of the student text and complete “Study Guide—Part II” (TRB 30-31) or “Advanced Study Guide—Part II” (TRB-32).

Extra Challenge:

Direct students to Greenpeace’s collection of Postcards from Climate Change at <http://postcardsfromclimatechange.org>. Have students watch one or a few of the videos and identify the ways climate change is already affecting plants, animals, and people in the United States and around the world. The “Postcard from the Oregon Coast” may be especially useful. Do students see any themes emerging regarding how climate change is affecting living things? How do the ways climate change affects the natural world impact human societies?

Incomplete Sample of a Web Diagram



Organism Profile: Sugar Maple Trees

Instructions: Read the information below about sugar maple trees. Drawing on this information as well as what you have already read about the effects of climate change, work with your group to complete “Questions: Sugar Maple Trees.” After completing these questions, fill in the section of the “Effects of Climate Change Graphic Organizer” about sugar maple trees and prepare a three-minute presentation to give to the class. In the presentation, your group should summarize what sugar maples are, how climate change might affect them, and why that is important to people.

Sugar Maple Trees



Joshua Mayer (CC BY-SA 2.0).

- Sugar maple trees, which exist throughout the northern parts of the central and eastern United States and further north in Canada, produce the sap used in making maple syrup. Wood from sugar maples is also used to make furniture, musical instruments, and hardwood floors (including the floors of basketball courts and bowling lanes).
- Sugar maples are known for their leaves changing colors in the fall—they go from green to yellow, peach, burnt orange, and red. These colorful leaves attract tourists to New England, which helps the economies of northeastern states.

- Sugar maple trees can be tapped for syrup when they are forty to fifty years old, and they can live to be four hundred years old. It takes a long time for them to grow and reproduce. Also, being trees, sugar maples cannot move or change locations; in order to change where they exist geographically, they rely on the wind to carry their seeds to new places.
- Sugar maples are highly sensitive to climate. It is especially difficult for sugar maples to stay healthy through warm winters and summer droughts, which are becoming increasingly common in the southern part of their range. When the trees are unhealthy, their sap contains less sugar, and it takes more sap to produce each bottle of syrup. Changes in winter and spring temperatures can also alter when the sap harvesting (or “sugaring”) season begins and how long it lasts.

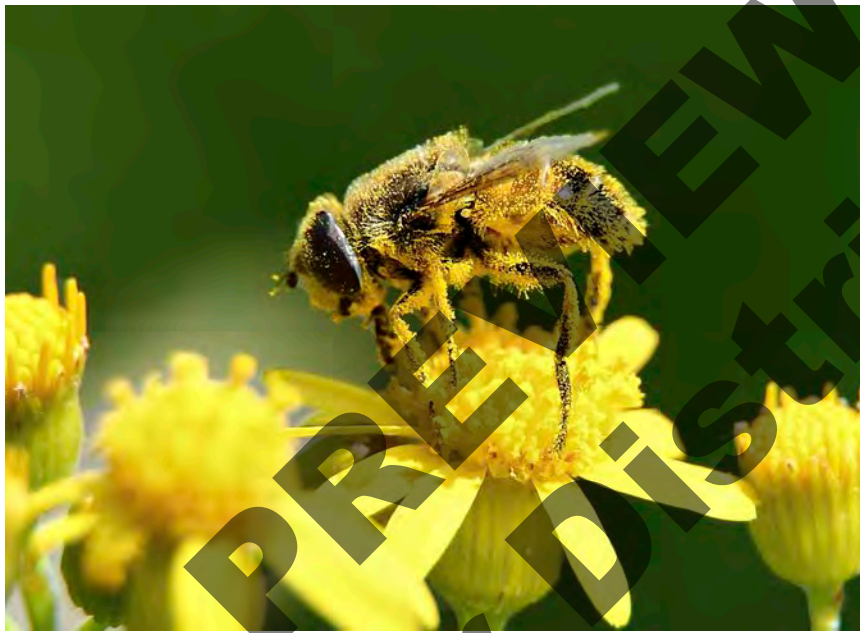
Questions: Sugar Maple Trees

1. How might temperature changes associated with climate change affect sugar maple trees?
2. Why are sugar maple trees important to people?
3. Why might it be more difficult for sugar maple trees to shift their geographic range in response to temperature changes than it would be for animals such as fish or birds?
4. Where do you think sugar maple trees will exist a century from now? Where might they no longer exist and why?
5. It is critical for maple syrup producers to start sugaring (harvesting sap) at the right time. If they start to harvest too early, bacteria may get into the trees and block sap from coming out. If they start to harvest too late, they miss out on the sap from the early part of the season, which makes the best syrup. Based on what you have read about sugar maples, how might climate change affect the businesses of maple syrup producers?

Organism Profile: Honey Bees

Instructions: Read the information below about honey bees. Drawing on this information as well as what you have already read about the effects of climate change, work with your group to complete “Questions: Honey Bees.” After completing these questions, fill in the section of the “Effects of Climate Change Graphic Organizer” about honey bees and prepare a three-minute presentation to give to the class. In the presentation, your group should summarize what honey bees are, how climate change might affect honey bees, and why that is important to people.

Honey Bees



ForestWander.com (CC BY-SA 2.0).

- Honey bees can survive in nearly every part of the world except around the North and South Poles. They came to the United States from Europe more than four hundred years ago.

- While honey bees can pollinate nearly any flowering plant, some crops, such as almonds, can only be pollinated by honey bees. More than \$15 billion worth of U.S. crops are pollinated by bees each year. While they are heavily used in industrial agriculture, honey bees still rely on wild plants in order to survive.

- Honey bees gather nectar from flowers, which they use to make honey. Through this process, honey bees get covered with plant pollen, which they transport from flower to flower, enabling the plants to reproduce. Honey bees have coevolved with many of the plants they pollinate so that they emerge from their hive after the winter just at the time when flowers are blooming. It is important that this timing coincides—both so the bees can collect nectar from the flowers as food and so the plants can successfully reproduce.
- In recent years, honey bees have been emerging from their hives earlier in the year than in the past. Scientists have observed that this seasonal change is more pronounced near cities, where temperatures are generally higher than in rural areas.
- Honey bees are vulnerable to extreme cold—even if one winter night gets too cold, they may struggle to keep all the bees in the hive warm enough to survive.

Questions: Honey Bees

1. How might temperature changes associated with climate change affect honey bees?
2. Why are honey bees important to people?
3. Honey bees are currently able to live in many different places around the world with a wide variety of climate conditions. What might this suggest about honey bees' ability to adapt to changes in climate?
4. How might climate change affect the timing of when bees emerge from their hives in the spring?
5. Scientists believe climate change will affect the timing and seasonality of many organisms' life-cycles. But they also know that climate change will not affect all plants and animals in the same ways. Why might this cause a problem for the relationship between honey bees and the plants they pollinate? Why might this matter for large-scale agriculture in the United States?

Organism Profile: Lobsters

Instructions: Read the information below about lobsters. Drawing on this information as well as what you have already read about the effects of climate change, work with your group to complete “Questions: Lobsters.” After completing these questions, fill in the section of the “Effects of Climate Change Graphic Organizer” about lobsters and prepare a three-minute presentation to give to the class. In the presentation, your group should summarize what lobsters are, how climate change might affect lobsters, and why that is important to people.

Lobsters



Paula Ouder, Louisiana State University (CC BY 2.0).

- North American lobsters are most common in the northwestern Atlantic Ocean, from the colder waters off the coast of Maine to the relatively warmer waters off the coast of New Jersey.
- Lobsters are economically very important in the Northeastern United States. They are eaten as a luxury food item and also attract tourists to fishing towns and restaurants. Lobsters have become a cultural symbol in many parts of New England.

- Lobsters have hard shells to protect them from predators like cod. In order to grow, lobsters molt, which means they shed their shells. When a lobster comes out of its old shell, it is soft and absorbs water to increase its body size. Lobsters are most vulnerable to being eaten by predators or being infected with diseases while still soft after molting. Once it sheds its old shell, a lobster will eat a lot to obtain the necessary nutrients to create a new hard shell as quickly as possible. These hard shells cannot form if the ocean is too acidic.
- Lobsters are very sensitive to water temperature. The water in which they live needs to be warm enough for lobsters to survive and have enough energy to molt and reproduce. At the same time, lobsters need a lot of oxygen to be dissolved in the water in which they live, and warmer temperatures reduce the amount of dissolved oxygen present. If they do not have enough oxygen, lobsters may die or become more vulnerable to disease. Because of this, lobsters need to live in water that is warm enough to molt and reproduce but cold enough to get oxygen.
- Warmer waters make it easier for the type of bacteria that causes “lobster-shell disease” to thrive and spread.

Questions: Lobsters

1. How might increasing ocean temperatures associated with climate change affect lobsters?
2. How might increasing ocean acidity levels associated with climate change affect lobsters?
3. Why are lobsters important to people?
4. Where do you think lobsters will exist a century from now? Where might they no longer exist and why?
5. How might warming ocean temperatures affect lobster fishers and their families in New Jersey?
How might warming ocean temperatures affect lobster fishers in Maine?

Organism Profile: Cod

Instructions: Read the information below about cod. Drawing on this information as well as what you have already read about the effects of climate change, work with your group to complete “Questions: Cod.” After completing these questions, fill in the section of the “Effects of Climate Change Graphic Organizer” about cod and prepare a three-minute presentation to give to the class. In the presentation, your group should summarize what cod are, how climate change might affect cod, and why that is important to people.

Cod



August Linnman (CC BY-SA 2.0).

- Atlantic cod live on both the east and west sides of the Atlantic Ocean. In North America, they can be found as far south as the North Carolina coast and as far north as Greenland.
- Cod have been a staple of New England’s fishing industry since the seventeenth century. In 1602, English fishers even named Cape Cod after the highly abundant fish. Many people still eat cod today; it is commonly used in recipes like “fish and chips.”

- Many stages of the cod life cycle—especially their reproduction, the growth and development of young cod, and adult cod’s feeding behaviors—are highly sensitive to temperature. They cannot survive in water that is too warm.
- Tiny organisms called phytoplankton are an important food source for young cod as they develop and grow. Changing temperatures and circulation patterns of ocean currents may be altering the distribution of phytoplankton. This could make it difficult for young cod to get enough food at this important stage in their life cycle.
- Adult cod eat shellfish, such as lobsters, and smaller fish—even young cod.

Questions: Cod

1. How might increasing ocean temperatures associated with climate change affect cod?
2. Why are cod important to people?
3. Recently, scientists and people who fish have noticed that many cod are disappearing from the southern part of their range. Why might this be happening?
4. How might the disappearance of cod in some regions affect lobster populations in those areas?
How might this affect lobster fishers in those places?
5. Some lobster fishers have recently noticed more black sea bass, a fish that is usually found further south but is known to eat baby lobsters, in the same area as lobsters. With this new information, how might you revise your prediction from the previous question about what might happen to lobster populations?