



## Activity 4.3: Impacts of Climate Change

### Grades 5 – 6

#### **Description:** Part 1: Global Impacts of Climate Change:

Students will begin to make connections between their actions and climate change. Students will participate in a jigsaw to teach one another about the global impacts of climate change on humans and the natural world. In the next activity, students will research impacts of climate change in a specific area of the world.

Part 2: Regional Impacts of Climate Change: Students will research the impacts of climate change for a particular state, region, or country around the world. Students use their research to create a presentation, poster, newsletter, or letter to a government official. Students present their research to the class.

#### **Materials:**

##### **Part 1**

- “Effects of Climate Change” handout
- Computers with Internet access
- Pens or pencils

##### **Part 2**

- “Effects of Climate Change” charts from Part 1
- Internet access
- Supplies to make posters, videos, or alternate presentations

**Total Time:** Three to four 45-minute class periods, plus additional time outside of class (Parts 1 and 2)

#### **National Science Education Standards:**

**F #2-4.** Science in Personal and Social Perspectives – natural resources, environmental quality, natural and human-induced hazards, science and technology in local, national, and global challenges.

#### **AAAS Benchmarks:**

**4C/M7** Human activities, such as reducing the amount of forest cover, increasing the amount and variety of chemicals released into the atmosphere, and intensive farming, have changed Earth's land, oceans, and atmosphere. Some of these changes have decreased the capacity of the environment to support some life forms.

**3C/H4** The human species has a major impact on other species in many ways: reducing the amount of Earth's surface available to those other species, interfering with their food sources, changing the temperature and chemical composition of their habitats, introducing foreign species into their ecosystems, and altering organisms directly through selective breeding and genetic engineering.

**3C/H3** In deciding on proposals to introduce new technologies or curtail existing ones, some key questions arise concerning possible alternatives, who benefits and who suffers, financial and social costs, possible risks, resources used (human, material, or energy), and waste disposal.

**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.



**8C/H5** Decisions to slow the depletion of energy resources can be made at many levels, from personal to national, and they always involve trade-offs involving economic costs and social values.

**7D/M3** Trade-offs are not always between desirable possibilities. Sometimes social and personal trade-offs require accepting an unwanted outcome to avoid some other unwanted one.

### Guiding Question

- How is climate change impacting different countries around the world?

### Assessments

- Regional Impacts of Climate Change – Research Checklist
- Student Presentation on the impacts of climate change on their chosen country

## Part 1: Global Impacts of Climate Change

**Time:** One class period

### Notes:

Text for the climate change impact descriptions is adapted from The Nature Conservancy website, available: <http://www.nature.org/ourinitiatives/urgentissues/global-warming-climate-change/threats-impacts/> and the NASA Global Climate Change – Vital Signs of the Planet website: <http://climate.nasa.gov/vital-signs/>.

### Procedure:

1. Remind students what they discovered when they calculated their carbon footprint.
2. Ask students: “How do we contribute to climate change?”
3. Tell students: “Once, all climate changes occurred naturally. Before the Industrial Revolution, human activity released very few gases into the atmosphere, but now through burning fossil fuels and cutting down trees we are increasing the greenhouse gases in the atmosphere.” Ask students to recall the lab activity from Unit 2, with two cans, one can had a bag around it, representing greenhouse gases, and the other did not. The can with the bag had a higher temperature.
4. Ask each student to think of something they do that releases greenhouse gases into the atmosphere, and ask them to explain the steps from that activity to releasing greenhouse gases (for example: If a student talks about using a hair dryer, you might ask them if there is gas coming out of the hair dryer. There isn’t, but in order to generate electricity, coal is burned at a power plant, and the power plant releases greenhouse gases.
5. Students will likely generate many examples on their own, but here are some additional examples you may wish to provide: When do you send greenhouse gases into the air?



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Whenever you...

- Watch television
- Use the air conditioner
- Turn on a light
- Use a hair dryer
- Ride in a car
- Play a video game
- Listen to a stereo
- Wash or dry clothes
- Microwave a meal
- Use a dishwasher

... you are sending greenhouse gas into the air.

6. Ask students:
  - Why should people care about the environment?
  - Why should we work to prevent climate change?
7. Tell students that they will be learning and teaching one another about impacts of climate change. According to the Nature Conservancy, there are eight major impacts of climate change.
8. Distribute the student handout “The Effects of Climate Change.”
9. The students will learn and teach about the impacts through a jigsaw. Assign each impact to an “expert group” of three or four students (depending on the number of students in the class, you may also allow students to choose their impact). Students can research their impact using The Nature Conservancy website, <http://www.nature.org/ourinitiatives/urgentissues/global-warming-climate-change/threats-impacts/>, additional online sources, or the fact sheets provided. Students can do additional research as needed to complete the three questions for each impact:
  - What does it mean?
  - How does climate change cause this effect?
  - What are the consequences?Encourage students to look up words or concepts they do not understand.
10. Once their research is completed, place students into jigsaw groups of eight students, one student with each impact. The students will teach one another about the impacts of climate change and fill in the chart. Make sure that students are teaching one another, and not just copying off each others’ charts.
11. When students have completed the chart, ask the students to reflect in their journal:
  - Which effect of climate change will have the most impact of your life, and why?
  - What can you do to prevent this from occurring?
12. The chart can be collected as an assessment, and should be placed in the students’ portfolios.



**Additional resources:**

- Information about the economic effects of climate change across the United States from the Union of Concerned Scientists. Click on a map point and choose “hot spot details” for economic impacts <http://www.climatehotmap.org/>
- Additional information about the jigsaw classroom technique is available here: <http://www.jigsaw.org/>



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

## Part 1: Global Impacts of Climate Change

Climate change has effects on animals, plants, and humans. In this activity you will become an expert on one of the effects of climate change, and teach your classmates about that effect. You will also learn about other effects of climate change from your classmates.

**Instructions:** Using the Internet (<http://www.nature.org/ourinitiatives/urgentissues/global-warming-climate-change/threats-impacts/>) or the fact sheets provided, research one effect of climate change. You should understand how climate change causes the effect, and some of the consequences. Make sure to use your own words!

<b>Effect of climate change</b>	<b>What does it mean?</b>	<b>How does climate change cause this effect?</b>	<b>What are the consequences?</b>
<b>Changing Landscapes</b>			
<b>Economic Losses</b>			
<b>Higher Temperatures</b>			



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<b>Effect of climate change</b>	<b>What does it mean?</b>	<b>How does climate change cause this effect?</b>	<b>What are the consequences?</b>
<b>Increased risk of drought, fire, and floods</b>			
<b>More heat-related illness and disease</b>			
<b>Rising seas</b>			
<b>Stronger storms and increased storm damage</b>			
<b>Wildlife at risk</b>			



### **Climate Change Impact: Higher Temperatures**

Heat-trapping gases emitted by power plants, automobiles, deforestation, and other sources are warming up the planet. **In fact, The ten hottest years on record have all occurred since 1998, including the warmest years on record – 2005 and 2010.**

High temperatures are to blame for an increase in heat-related deaths and illness, rising seas, increased storm intensity, and many of the other dangerous consequences of climate change.

During the twentieth century, the Earth's average temperature rose one degree Fahrenheit to its highest level in the past four centuries – believed to be the fastest rise in a thousand years.

The Intergovernmental Panel on Climate Change (IPCC), which includes more than 1,300 scientists from the United States and other countries, forecasts a temperature rise of 2.5 to 10 degrees Fahrenheit over the next century if emissions of heat-trapping carbon emissions aren't reduced.

**Don't let average temperatures fool you:** A one-degree increase may be found in one place, a 12-degree increase in another place, and yet other areas may become much colder.

### **Climate Change Impact: Changing Landscapes**

Changing temperatures are causing vegetation shifts and conservation challenges.

Rising temperatures and changing patterns of rain and snow are forcing trees and plants around the world to move toward polar regions and up mountain slopes.

These vegetation shifts will undermine much of the work the conservation community has accomplished to date, with the potential to permanently change the face of Conservancy preserves, local land trusts, and even our national parks.

In the tundra, thawing permafrost will allow shrubs and trees to take root. In the Great Plains of the United States, grasslands will likely become forests. And New England's fiery fall foliage will eventually fade as maple and beech forests shift north toward cooler temperatures.

As plant communities try to adjust to the changing climate by moving toward cooler areas, the animals that depend on them will be forced to move. Development and other barriers may block the migration of both plants and animals.

Some species and communities such as polar bears and alpine meadows may be left without any remaining viable habitat, putting much of our treasured wildlife at risk.



**Climate Change Impact:  
Wildlife at risk**

Climate change could cause one-fourth of the Earth's species to be headed for extinction by 2050.

Rising temperatures are changing weather and vegetation patterns across the globe, forcing animal species to migrate to new, cooler areas in order to survive.

The rapid nature of climate change is likely to exceed the ability of many species to migrate or adjust. Experts predict that one-fourth of Earth's species will be headed for extinction by 2050 if the warming trend continues at its current rate.

Many species are already feeling the heat:

In 1999, the death of the last golden toad in Central America marked the first documented species extinction driven by climate change.

Due to melting ice in the Arctic, polar bears may be gone from the planet in as little as 100 years.

In the tropics, increased sea temperatures are causing more coral reefs to “bleach,” as the heat kills colorful algae that are necessary to coral health and survival.

Several U.S. states may even lose their official birds as they head for cooler climates — including the Baltimore oriole of Maryland, black-capped chickadee of Massachusetts, and the American goldfinch of Iowa.

**Climate Change Impact:  
Increased risk of drought,  
fire and floods**

Climate change is making floods, fires, and droughts more frequent and severe.

Climate change is intensifying the circulation of water on, above, and below the surface of the Earth — causing drought and floods to be more frequent, severe, and widespread.

Higher temperatures increase the amount of moisture that evaporates from land and water, leading to drought in many areas. Lands affected by drought are more vulnerable to flooding once rain falls.

As temperatures rise globally, droughts will become more frequent and more severe, with potentially devastating consequences for agriculture, water supply, and human health. This phenomenon has already been observed in some parts of Asia and Africa, where droughts have become longer and more intense.

Hot temperatures and dry conditions also increase the likelihood of forest fires. In the conifer forests of the western United States, earlier snowmelts, longer summers, and an increase in spring and summer temperatures have increased fire frequency by 400 percent and have increased the amount of land burned by 650 percent since 1970.





**Climate Change Impact:  
Rising Seas**

Sea-level rise from climate change could displace tens of millions of people.

As the Earth heats up, sea levels rise because warmer water takes up more room than colder water, a process known as thermal expansion. Melting glaciers compound the problem by dumping even more fresh water into the oceans.

Rising seas threaten to inundate low-lying areas and islands, threaten dense coastal populations, erode shorelines, damage property and destroy ecosystems such as mangroves and wetlands that protect coasts against storms.

Global sea level rose about 17 centimeters (6.7 inches) in the last century. The rate in the last decade, however, is nearly double that of the last century.

A 36-inch increase in sea levels would swamp every city on the East Coast of the United States, from Miami to Boston.

Worldwide, approximately 100 million people live within three feet of sea level. Sea-level rise associated with climate change could displace tens of millions of people in low-lying areas – especially in developing countries. Inhabitants of some small island countries that rest barely above the existing sea level are already abandoning their islands, some of the world’s first climate change refugees.

**Climate Change Impact:  
Stronger Storms and Increased  
Storm Damage**

Climate change will cause storms, hurricanes, and tropical storms to become more intense.

Scientific research indicates that climate change will cause hurricanes and tropical storms to become more intense — lasting longer, unleashing stronger winds, and causing more damage to coastal ecosystems and communities.

Scientists point to higher ocean temperatures as the main culprit, since hurricanes and tropical storms get their energy from warm water. As sea surface temperatures rise, developing storms will contain more energy.

At the same time, other factors such as rising sea levels, disappearing wetlands, and increased coastal development threaten to intensify the damage caused by hurricanes and tropical storms.



**Climate Change Impact:  
Heat-related Illness and Disease**

Climate change brings health risks to the world's most vulnerable communities.

As temperatures rise, so do the risks of heat-related illness and even death for the most vulnerable human populations.

In 2003, for example, extreme heat waves caused more than 20,000 deaths in Europe and more than 1,500 deaths in India. Scientists have linked the deadly heat waves to climate change and warn of more to come.

In addition to heat-related illness, climate change may increase the spread of infectious diseases, mainly because warmer temperatures allow disease-carrying insects, animals and microbes to survive in areas where they were once thwarted by cold weather.

Diseases and pests that were once limited to the tropics—such as mosquitoes that carry malaria—may find hospitable conditions in new areas that were once too cold to support them.

The World Health Organization (WHO) estimates that climate change may have caused more than 150,000 deaths in the year 2000 alone, with an increase in deaths likely in the future.

**Climate Change Impact:  
Economic Losses**

Climate change is already affecting economies around the world.

Climate change is affecting businesses and economies at home and around the world. If action is not taken to curb global carbon emissions, climate change could cost between 5 and 20 percent of the annual global gross domestic product, according to a British government report. In comparison, it would take 1 percent of GDP to lessen the most damaging effects of climate change, the report says.

These global costs will be felt by local communities and businesses:

In southern New England, lobster catches have plummeted because of heat stresses and growing parasite threats due to rising sea temperatures.

Ski resorts located in the lower altitudes of the Swiss Alps have difficulty obtaining bank loans because of declining snow.

In Lake Erie, climate change may significantly lower lake levels, altering shoreline habitats and costing millions for the relocation of ports and shore infrastructure.

Globally, more intense hurricanes and downpours could cause billions of dollars in damage to property and infrastructure. Declining crop yields due to prolonged drought and high temperatures, especially in Africa, could put hundreds of thousands of people at risk for starvation.

High sea temperatures also threaten the survival of coral reefs, which generate an estimated \$375 billion per year in goods and services.



## Part 2: Regional Impacts of Climate Change

**Time:** Two to three class periods, plus additional time outside of class

**Materials:**

**Part 2**

- “Effects of Climate Change” charts from Part 1
- Internet access
- Supplies to make posters, videos, or alternate presentations

**Procedure:**

1. Introduce the activity by telling students: thus far, in the unit, you have learned that individuals have a role in climate change (“Are You Bigfoot”); that climate change affects people in different ways (“Faces of Climate Change”); and that climate change has many types of impacts (“Impacts of Climate Change”). For this activity, you will be using all three of these activities as background to research the effects of climate change in a particular state, country, or region around the world.
2. Students will work in groups to research the major impacts of climate change detailed in Activity 4.2 and Part 1 of 4.3 (e.g.: economic losses, effects on wildlife, etc.) for a particular country or region. You may have students choose groups (two to four students in a group would be ideal) and regions/countries, or you may assign these. Some suggestions for regions/countries include:

<i>Australia</i>	<i>Brazil</i>	<i>Canada</i>
<i>Central Africa</i>	<i>China</i>	<i>Greenland</i>
<i>India</i>	<i>Italy</i>	<i>Middle East</i>
<i>New Zealand</i>	<i>South Africa</i>	<i>U.S.A.- Alaska</i>
<i>U.S.A. – Gulf coast</i>	<i>U.S.A. – Midwest</i>	<i>U.S.A. – West Coast</i>

However, students may also choose a country to which they have particular ties, or in which they are particularly interested.

3. Tell students they will be researching the impacts of climate change in their particular region/county and presenting the information to their class in a creative manner. Hand out the “Regional Impacts of Climate Change Research Checklist” so that students can keep track of the information they have found, and where the information comes from.



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4. For the presentation, it is up to you how you'd like students to present their research. Some options include: a poster, a video they film themselves or prepare on the computer, a skit, a newspaper/newsletter, comic book, travel guide, website, etc. You may have each group choose how they'd like to present the information, or choose one format that all students should follow.

**Extensions:**

- Groups can research a charity that is helping with climate-change-related issues in their region of the world. Students can work as groups or as a class to raise money for their selected charity.
- Students can present their research to other classes in the school to educate them about regional impacts of climate change.



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

## Regional Impacts of Climate Change – Research Checklist

1. Our region/country: \_\_\_\_\_

**Directions:** Research the “Effects of Climate Change” in your region or country. You will use this information to make a presentation to your teacher/class. If you need help with what the effects mean, refer back to your chart “The Effects of Climate Change” from Activity 3.

Effect of climate change	How our country/region is affected by this impact of climate change	Where we found this information (cite)
Changing Landscape		
Economic Losses		



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

<b>Effect of climate change</b>	<b>How our country/region is affected by this impact of climate change</b>	<b>Where we found this information (cite)</b>
<b>Higher Temperature</b>		
<b>Increased risk of drought, fire, and floods</b>		
<b>More heat-related illness and disease</b>		



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<b>Effect of climate change</b>	<b>How our country/region is affected by this impact of climate change</b>	<b>Where we found this information (cite)</b>
Rising seas		
Stronger storms & increased storm damage		
Wildlife at risk		



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2. Website of a charity that helps with climate change in our region/country:

3. What does this charity do?

4. Additional questions we have: