Choices Program- Brown University
Climate Change & Questions of Justice

Instructions in Brief

The following packet is laid out in sequence. If a worksheet follows a reading you are intended to stop and complete that sheet at that point. You will culminate this work with a Choices/Options activity and by creating a 5th option for Climate Change Policy. Good Luck.

1- Intro Reading

2- Reading Part 1

3- Study Guide 1

4- Organism Profiles Activity

5- Reading Part 2

6- Study Guide 2

7- Carbon Taxes Activity

8- CO2 Emissions Activity

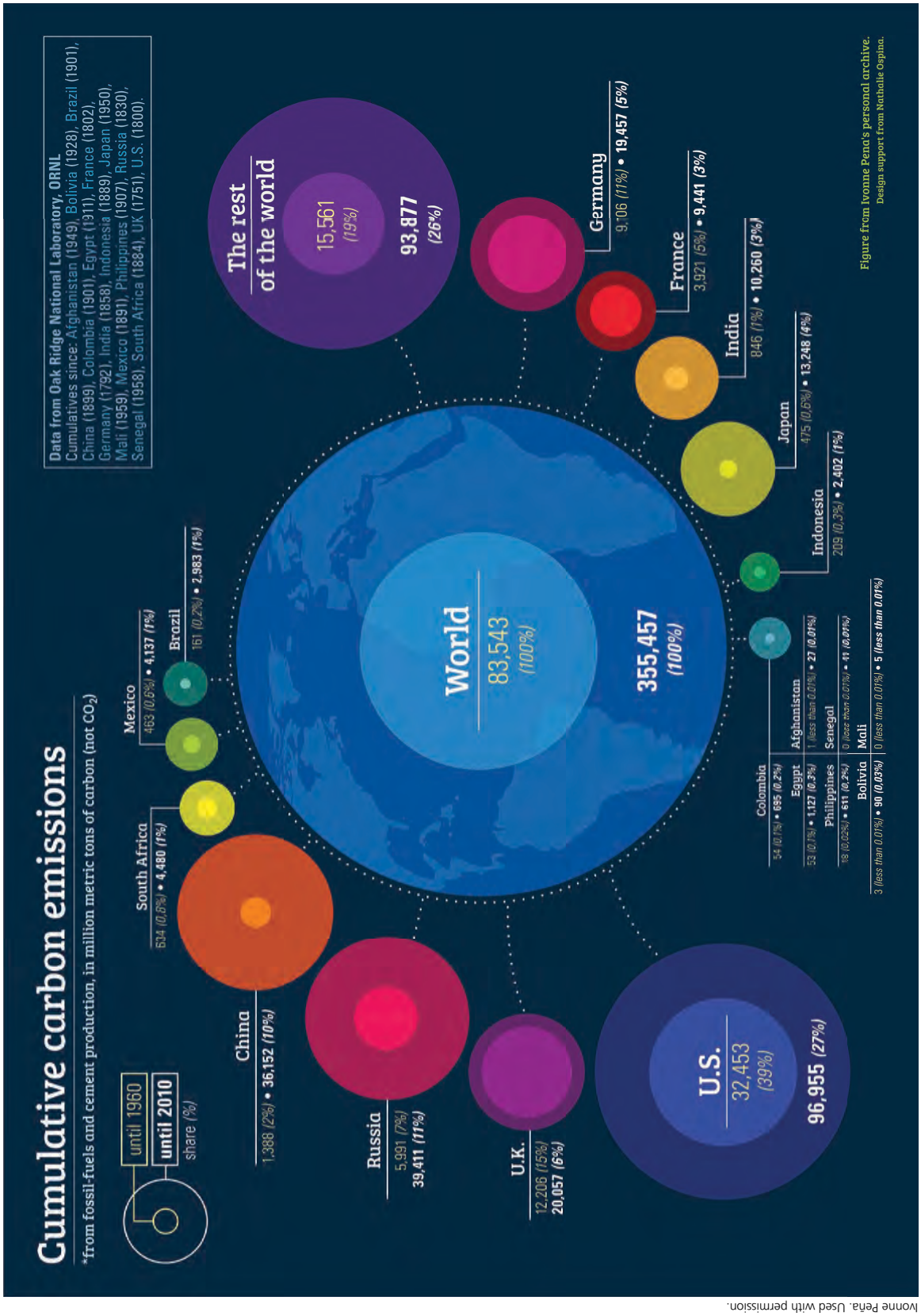
9- Reading Part 3- The Case Studies

10- Study Guide 3

11- Create Your Own NGO

12- Choices/Options Moving Forward

Cumulative Global Carbon Emissions



Ivonne Peña. Used with permission.

This infographic shows the cumulative carbon emissions of various countries—both until 1960 and until 2010. These carbon emissions have contributed to global climate change.

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, 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, the largest gathering of international leaders in history. 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 150 governments agreeing that climate change was a shared and dangerous problem. 196 countries have now 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 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 effective ways to raise their voices and create change. Local governments around the world are designing plans to help their communities adapt to the new conditions caused by climate change.

Jan Golinski, UNclimatechange (CC BY 2.0).

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

Kris Krüg (CC BY-SA 2.0).

People marching outside a 2009 UN Climate Change Conference in Copenhagen, Denmark.

Several state governments have voluntarily adopted stricter environmental standards. Nongovernmental organizations (NGOs) work to influence policy and educate the public. Even corporations are seeing business opportunities in providing more environmentally friendly products.

In the coming pages, you will explore the pressing need for an effective response to climate change and take on the challenge of determining what that response should be. You will begin by examining the causes and effects of climate change and by analyzing the efforts to respond to this global problem. You will explore eight case studies that show how different parts of the world are experiencing a changing climate. The readings highlight many of the issues that make developing a unified response to climate change so difficult. As you read, keep these questions in mind:

- How does climate change affect different regions of the world?
- Who is vulnerable to climate change?
- Who is responsible for climate change?
- How could the international community respond to climate change in a fair and effective way?

After completing your readings, you will have a chance to grapple with these same questions during a climate conference simulation with your classmates. You will take on the roles of national leaders, representatives of NGOs, and technical experts to debate and discuss questions of climate justice.

Part I: The Causes and Effects of Global Climate Change

Understanding Climate Change

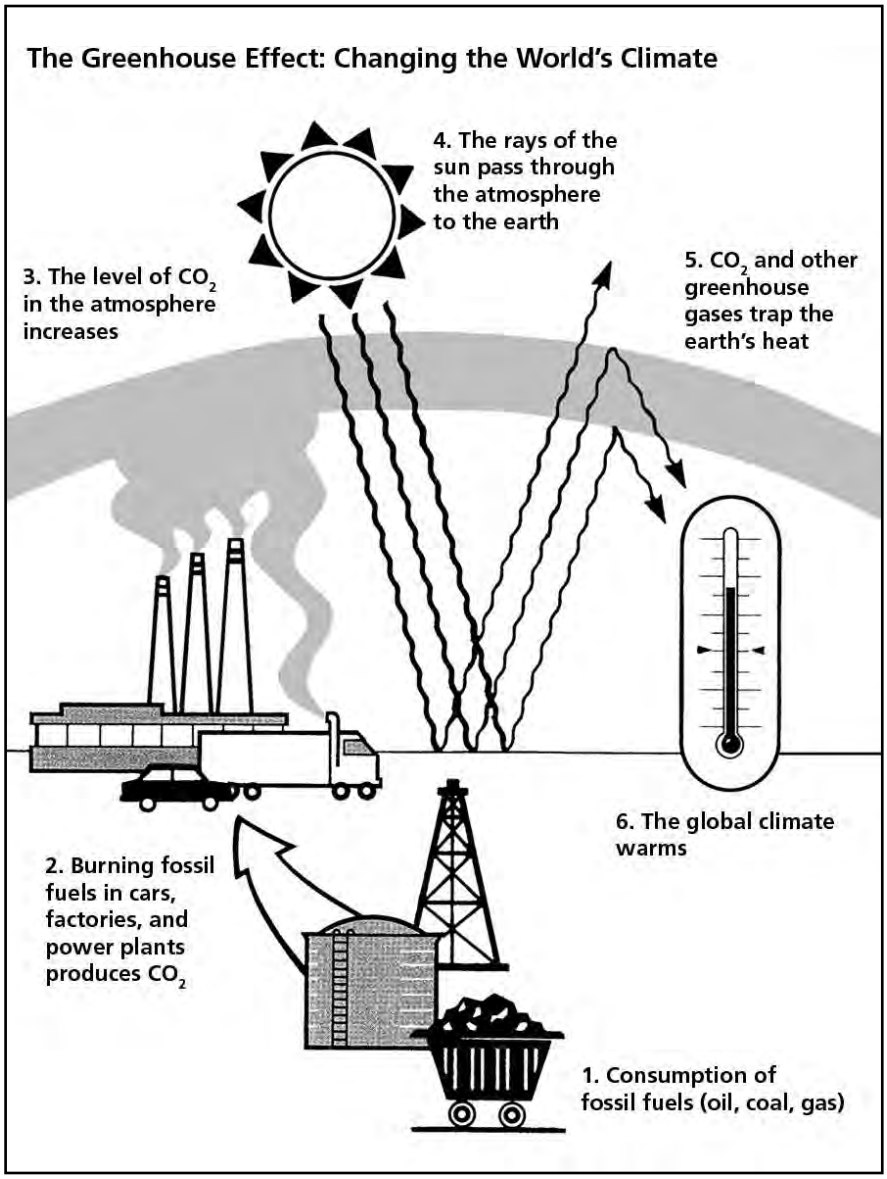
Wherever we live, we become familiar with our local climate. Some of us may live in regions where it snows or rains frequently, places where summers are hot and dry, or in tropical or arid regions. Weather, rainfall, temperature, and human activity affect the types of plants, trees, and animals that live in our region and contribute to our local climate.

What is climate change?

The term, "climate change" can refer to any significant shifts in temperature, rainfall, wind, and other environmental factors that occur over decades or more. The earth's climate has undergone natural variations throughout the entire history of the planet. Today, the climate change we hear about most often refers to changes caused primarily by human activity that alters the composition of the atmosphere.

The earth's atmosphere is made up of numerous gases that make life possible. Gases such as carbon dioxide (CO_2), methane, nitrous oxide, and water vapor exist naturally in the atmosphere and warm the earth to a temperature at which humans can live. These gases make up only a small percentage of the atmosphere. They are called "greenhouse gases" because they trap heat in the atmosphere by absorbing energy that would otherwise be radiated back into space. The process works the same way that a greenhouse for plants prevents heat from escaping beyond its glass panels.

To get a sense of how important these gases are to life on Earth, we can look at how they affect temperature. The earth's current average temperature is 59˚F. Without greenhouse gases, the earth's average temperature would drop to around 0˚F, potentially making the planet cold enough for all water on Earth to freeze.



Over the past 150 years, human activity, primarily the burning of fossil fuels, has increased the amount of these greenhouse gases in the atmosphere. With more greenhouse gases, the earth gets warmer, which is why climate change today is often referred to as "global warming."

Mattes (public domain via Wikimedia Commons).

The roof and glass walls of a greenhouse let the sun's energy in and keep heat trapped inside, creating an environment warm enough for certain plants to grow. Gases like CO_2 and methane in the Earth's atmosphere are called "greenhouse gases." This is because they perform a similar function to the glass of a greenhouse: allowing in sunlight and trapping heat.

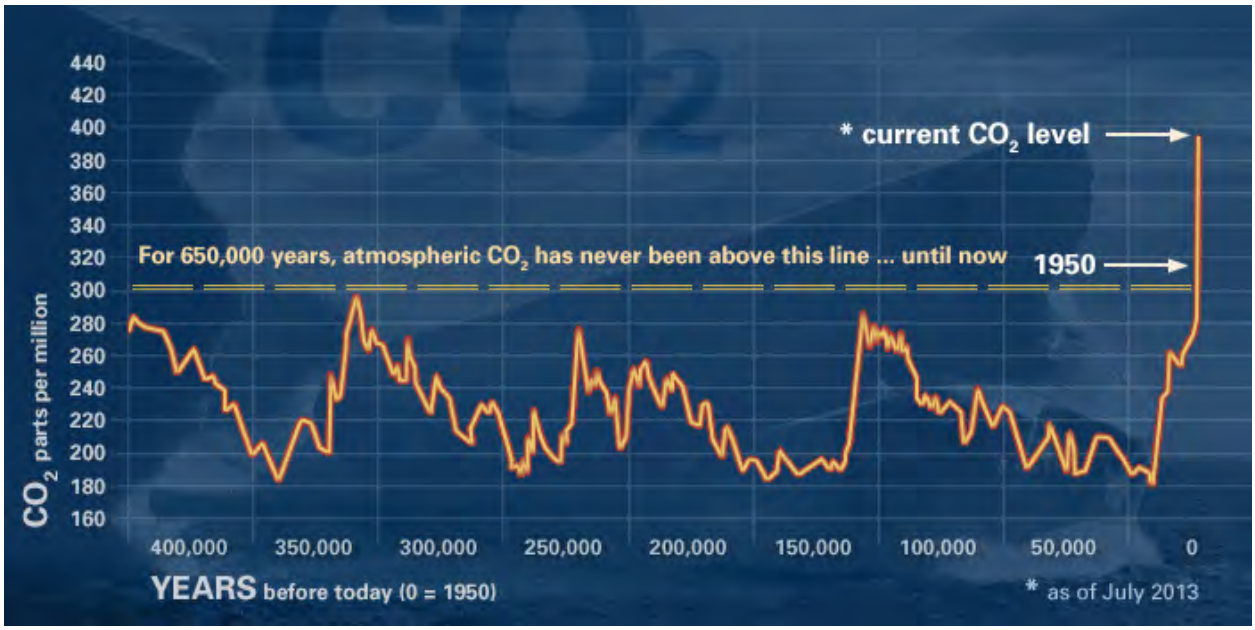
Often, the topic of climate change will come up after an extreme weather event like a hurricane or a blizzard. When there is a long heat wave or a series of powerful storms, we might think that we are witnessing climate change. But while it is tempting to attribute these weather patterns to "global warming," in truth, we cannot say climate change is happening based on our own observations over a few days, months, or even years. Scientific data collected over a period of decades has led to the conclusion that the earth's climate is drastically changing.

> ***"Even with climate change, you will occasionally see cooler-than-normal summers or a typically cold winter. Don't let that fool you."***
>
> —James E. Hansen, director of the NASA Goddard Institute for Space Studies, 2012

What is causing climate change?

Humans' use of fossil fuels (coal, oil, and natural gas) produces CO_2 and is the leading cause of climate change. Fossil fuels were formed from plants and animals that lived millions of years ago. In ages past, their remains were buried deep within the earth's crust and were transformed into petroleum and natural gas by intense heat and pressure. Since the start of the Industrial Revolution in the late eighteenth century, human consumption of fossil fuels has soared, and the amount of CO_2 in the atmosphere has increased by more than 40 percent.

Some scientists say that humans' impact on the climate traces back to the origins of agriculture. As farming replaced hunting and gathering as the dominant means of survival for humans, people cleared land of trees so that it could be used to grow crops or raise livestock. Farmland now takes up almost half of the earth's land surface, replacing what were once vast expanses of forest and woodlands. Because trees absorb CO_2, the deforestation meant that less CO_2 was being removed from the atmosphere. As a result, the percentage of greenhouse gases in the atmosphere gradually increased. However, it was not until humans began emitting large amounts of greenhouses gases into the atmosphere by burning fossil fuels for transportation, industry, heat, and electricity that this increase became pronounced.



NASA.

This graph shows the recent dramatic increase in atmospheric CO_2 levels compared to the past four hundred thousand years.

How did industrialization contribute to the use of fossil fuels?

With the beginning of industrialization in the late 1700s, Britain was the first country to replace wood with fossil fuels as its main source of energy. In addition to clearing forests, people used increasing amounts of coal to meet Britain's ever-growing appetite for energy. In the 1800s, industrialists expanded coal mining and developed oil-drilling techniques. By the turn of the twentieth century, the United States had taken the lead in forging an industrial economy powered by coal and oil. Today, these two fuel sources, along with natural gas, supply roughly 80 percent of the world's energy. In 2012, coal alone was responsible for 43 percent of the total CO_2 emissions from human activity.

CO_2 accounts for the majority of the greenhouse gas emissions from human activity. On the one hand, CO_2 is essential for life on Earth. For example, plants require it just as animals need oxygen. But it is the large and rapid increase in CO_2 emissions from human activity that is causing the earth to warm more now than it has in the past.

What is the evidence of climate change?

Research shows that the earth's average surface temperature has risen 1.4˚F over the past one hundred years. This may not seem

Courtesy of Leonard Bentley (CC BY-SA 2.0 via Flickr).

This photograph shows the British Houses of Parliament in the early twentieth century. Visible at the left of the image, factories belching smoke into the atmosphere were only yards away.

like a large change, but it is significant when we consider that a decrease of only 9˚F in global average temperature is the difference between our current world temperature and the coldest point of an ice age.

The rapid rate of change also concerns scientists—most of this warming has taken place since 1970. The overwhelming agreement among scientists that the climate is drastically changing is based on rising temperatures and other evidence as well. Ocean temperatures and acidity levels have risen, glaciers (large masses of ice) around the world are shrinking in size, and extreme weather events have increased in frequency.

How is climate science produced?

Science is sometimes thought to be a set of permanent facts. But the body of scientific knowledge is ever-changing as scientists continually work to refine our understanding of the natural world. This is also true of climate change science—how it is produced continues to develop and improve.

Climate change is a global phenomenon that has different effects in different regions of the world. Many of these effects will not be fully apparent for decades. This makes it difficult to predict all the impacts climate change will have. Increasingly, scientists are making these projections through climate models—mathematical representations of how human and environmental systems interact.

To construct a climate model, scientists spatially divide each of the earth's components (land, atmosphere, ocean, and ice) into boxes on a computer. For each box, researchers enter known information about those components and how they interact with the others. They test the model's accuracy by running a simulation into the past and comparing the model's results with what we observed actually happened. Once the model is adjusted to be as accurate as possible, scientists run simulations into the future to make projections about how the earth's climate will change in years to come.

Doug Clark, Western Washington University (public domain via U.S. National Ice Core Laboratory).

Scientific researchers extract cores of ice from a glacier in British Columbia, Canada in July, 2010. Scientists can extract ice samples from thousands of feet below the earth's surface. By analyzing the ice cores, they can study variations in climate going back eight hundred thousand years. Using ice samples, scientists have determined that the amount of CO_2 in the atmosphere was relatively constant until 150 years ago, when it began to rise more than it ever had before. The goal of these studies is to increase our understanding of past climate conditions so we can (1) see how the climate has changed up to the present and (2) develop computer models to predict the impact of climate change in the future.

Why do some people doubt climate change science?

Despite an overwhelming consensus among scientists regarding the reality of climate change, some people have expressed doubts about climate change science. They claim that the information from climate models should not be trusted because scientists are just making predictions.

It is true that since we cannot know precisely what the earth's future environment will be like, there is uncertainty associated with climate models' projections. For instance, we cannot know future greenhouse gas emissions levels exactly; they will depend on many factors including international negotiations, regional political decisions, unforeseen natural events, and technological developments. Despite these uncertainties, the scientific community broadly accepts that climate change will have dramatic effects.

Furthermore, making informed predictions to help plan for the future and manage risk is common in many sectors. Public health officials create plans for disease outbreaks even if there is uncertainty about the likelihood of an epidemic. The military prepares for many possible conflicts. School administrators plan for a range of potential disruptions—students arriving late, teachers being out sick, and emergency situations like fires and floods.

In each case, decision makers incorporate the best information they have into planning for the future and continue to adapt their course of action as new information becomes available. This is especially important for climate change, where the decisions we make today will impact the environment we live in for decades.

The Effects of Climate Change

Rising temperatures are just one aspect of climate change. The term "global warming" has sometimes been replaced with "global weirding" because there are so many effects of climate change beyond increasing temperatures.

What are the impacts of climate change?

The effects of climate change include rises in sea level, extreme weather events, and threats to human health. Already, many parts of the world are beginning to feel the effects of climate change, while the risk of even greater impacts multiplies each year.

Oceans: Climate change could raise the level of the world's seas by up to three feet by 2100. Rising sea levels are caused by polar ice caps melting and by ocean waters expanding as they warm (as water increases in temperature, it expands to take up a greater volume of space).

Much of the world's population and many of the planet's most fragile ecosystems could become more vulnerable to coastal flooding. Experts predict that densely-populated coastal cities, such as Calcutta, New York, and Shanghai, could experience more floods. In

Bre LaRow (CC BY 2.0).

A lobster boat off the coast of Maine in the United States. In recent years, lobster populations have suffered dramatic declines in coastal Massachusetts, Rhode Island, and Connecticut. Scientists attribute the decline in southern New England to rising water temperatures associated with climate change.

Sergey Vladimirov (CC BY 2.0).

On July 29, 2010, temperatures in Moscow, Russia reached 100°F for the first time in the 130 years that measurements have been kept. The record temperature came in the midst of a heat wave that lasted for more than three weeks. The heat wave also caused hundreds of forest fires, created smog that blanketed Russia, and contributed to the death of thousands of Russians who were vulnerable to the extreme temperatures and poor air quality. Above, people in Moscow seek relief from the heat by wading in a fountain in a city park.

the southeastern United States, some homes and coastal properties could be under water within the next thirty years as a result of sea level rise.

Numerous low-lying island countries, such as the Carteret Islands, the Marshall Islands, and Kiribati are becoming engulfed by the sea. Some of their residents, often called the first climate change refugees, have begun to leave the islands. People who lived on the Carteret islands have already been forced to evacuate, and Kiribati has purchased land from Fiji, over one thousand miles away, so its citizens seeking refuge from sea level rise have somewhere to go.

The ocean also absorbs some of the excess CO_2 in the atmosphere. With more CO_2, oceans become more acidic, which is harmful to marine life and could negatively affect ocean ecosystems for centuries.

Extreme weather events: Climate change is affecting weather patterns around the world. In recent years, scientists have observed greater extremes of temperatures (conditions that are either extremely hot or extremely cold), increased numbers of heat waves, and more droughts in many regions of the world.

In addition to temperature extremes, the number and strength of powerful storms has increased. This may be caused by rising ocean temperatures increasing the amount of water that evaporates into the atmosphere. The additional warm water vapor makes storms more powerful. Rising sea levels also increase the amount of damage storms cause, meaning storms that have been less of a problem in the past are now becoming more dangerous. For instance, flooding in the Northeastern United States from Hurricane Sandy in 2012 may not have been as widespread and damage may not have been so costly were it not for the impacts of climate change on the seas.

Scientists are generally cautious about saying that climate change caused a particular event. Instead they look for patterns over time and are confident that climate change increases the chance that extreme weather events will occur more frequently.

Health: Climate change impacts human health in many ways. Heat waves and air pollution increase the risk of heat stroke, certain allergies, asthma, and heart disease, especially among people living in urban areas. For example, the 2003 summer heat wave in Europe contributed to over seventy thousand deaths.

In addition, droughts threaten reliable and affordable access to clean water for drinking and food production, which are essential components of good health.

Extreme weather events often have tragic death tolls and destroy the resources needed to promote health among members of affected communities. For instance, powerful storms can restrict transportation, damage medical facilities, and cause power-outages, limiting access to health care. More frequent and intense floods can lead to water contamination and the spread of waterborne diseases like cholera and diarrhoea.

Mark Knobil (CC BY-SA 2.0).

A hospital in Bangladesh for people afflicted with cholera, a waterborne disease. Increases in water temperatures caused by climate change may contribute to the spread of this disease.

Changes in temperature and rainfall may also shift the geographic ranges of insects that help spread certain diseases. For instance, dengue fever, a mosquito-borne disease of tropical and subtropical regions, returned to the United States in 2009 after being absent for almost seventy-five years.

Species Migration: As drastic and varied environmental changes unfold, some species will be able to adapt to new conditions. Others may have to change their geographic range and relocate to more suitable locations where they have a better chance of survival. Species that cannot adapt or relocate may die out and go extinct.

Plants and animals are generally shifting their habitat ranges either towards the North and South Poles or towards higher altitudes to avoid warming temperatures. Various seasonal aspects of plant and animal life cycles are also being affected, like the migration patterns of birds and insects. For example, moths on Mount Kinabalu in Borneo are flying higher up the mountain (at an average rate of 220 feet in altitude per decade) to escape increasing temperatures.

Many species will not be able to adapt or move fast enough to keep up with the changing climate. Moreover, if species have to move to find new places to live, their migration routes may be blocked by human-made obstacles like dams, roads, and cities or competition with other species. In these cases, the likelihood of species extinction may increase. Each of these effects—species relocations and extinctions—can disrupt entire ecosystems and the valuable services they provide to human societies.

Food and agriculture: The changing climate directly affects food production and could increase costs. With increasing temperatures and changes in rainfall patterns, crop yields in some locations may improve, while in others they may decline. Overall, the negative impacts of climate change will outweigh the positive ones. The yields of major crops like wheat, rice, and corn will decrease in many regions of the world.

USDA (CC BY 2.0).

In August 2012, an official from the U.S. Department of Agriculture and a farmer inspect a soybean field in Missouri affected by drought. At the time, the Department of Agriculture estimated that about 60 percent of the United States was experiencing extreme drought.

More frequent droughts and floods will make food production more difficult for farmers. They may have to completely alter how they approach agriculture in the case of drastic climate change by growing different crops, changing irrigation practices, and using greater quantities of chemical pesticides.

In addition, increasing ocean temperatures associated with climate change will impact fisheries, which are important to both the food supply and economies of many countries. Furthermore, these effects will take place at the same time as global demand for food is increasing, which together can contribute to rising food prices.

Conflict and Security: Climate change and its far-reaching environmental effects may also be contributing to political conflict and security concerns in countries around the world. In less wealthy countries, where governments are often unable to respond quickly or adequately to disasters, a series of poor harvests or the collapse of fisheries could force millions of refugees across borders, causing violence or governmental collapse.

Alternatively, governments could become more authoritarian in order to deal with the security risks. For example, the Southeast Asian country of Myanmar was devastated by a cyclone (hurricane) in May 2008. Despite nearly 140 thousand deaths, the displacement of one million people from their homes, and widespread disease and starvation, the military rulers did not allow humanitarian aid workers to enter the country until weeks after the storm.

Increasingly severe weather systems such as hurricanes, monsoons, or droughts could lead to military conflicts over access to clean water and food supplies. Many attribute the conflicts in Sudan to disputes over natural resources such as land and oil reserves. The violence in New Orleans, Louisiana after Hurricane Katrina in 2005 is also an example of what some people in desperate situations resort to. Some believe that climate change

contributes to tensions in the Middle East, with warmer, drier conditions leading to increased instances of drought and food scarcity. The U.S. military is particularly concerned about the effects of climate change because many U.S. military bases lie at sea level and are threatened by the prospect of rising oceans.

> ***"The area of climate change has a dramatic impact on national security…. Rising sea levels, severe droughts, the melting of the polar caps, the more frequent and devastating natural disasters all raise demand for humanitarian assistance and disaster relief."***
>
> —Former U.S. Secretary of Defense Leon Panetta, 2012

Conclusion

You have just read a brief overview of the causes and effects of climate change and have seen that a warming world is already influencing the lives of plants, animals, and people across the globe. While our understanding of how global warming works and why it is happening have steadily improved over the past few decades, the question of what to do about climate change remains.

In Part II of the reading, you will explore how governments and other groups, including businesses and nongovernmental organizations, are working both to prevent dangerous climate change and to cope with its effects. You will begin to consider who is responsible for the problem of climate change, who is most at risk, and why a unified international strategy for dealing with a changing climate has not yet emerged.

Name:_____

Study Guide—Introduction and Part I

Vocabulary: Be sure that you understand these key terms from the Introduction and Part I of your reading. Circle terms that you do not know.

emissions
agenda
delegates
Earth Summit
United Nations Framework Convention on Climate Change (UNFCCC)
greenhouse gases
international community
activists
voluntarily
nongovernmental organizations (NGOs)
corporations
justice
carbon dioxide (CO_2)
fossil fuels
global warming
extreme weather event
hurricane
deforestation
industrialization
glaciers
climate model
consensus
ecosystems
smog
climate change refugees
acidic
urban
species migration
crop yields
authoritarian
displacement

Questions:

1. What human activities have caused climate change? Give at least three examples.

2. a. Coal, oil, and natural gas supply _____ percent of the world's energy.

   b. In 2012, coal led to _____ percent of human CO_2 emissions.

3. Over the past hundred years, the earth's average surface temperature has increased by _____˚F. The difference between the current global average temperature and the coldest point of an ice age is _____˚F.

4. List three environmental changes that are evidence of climate change.
   -
   -
   -

5. a. The level of the world's seas could rise by _____ feet by 2100.

   b. What are two main reasons that sea levels are rising?
   -
   -

6. Who are the first climate change refugees? Why did they have to leave their homes?

7. What effects will higher levels of CO_2 have on oceans and the organisms that live there?

8. List four types of extreme weather events that scientists have observed to be occurring more frequently now than in the past.
   -
   -
   -
   -

9. Describe three negative effects that climate change can have on human health.
   -
   -
   -

10. In which directions might plants and animals shift their geographic ranges in response to warming temperatures?

11. What changes might farmers need to make in order to continue growing food in a changing climate?

12. Explain two scenarios in which climate change could lead to conflict or insecurity.
   -
   -

Name:_____

Advanced Study Guide—Introduction and Part I

1. Explain the connection between fossil fuel use, the greenhouse effect, and climate change.

2. Describe what the chart on page 5 of your reading demonstrates about the change in atmospheric CO_2 levels throughout history and in recent decades.

3. How do scientists use climate models to project future climate conditions? Why do some people question these projections?

4. Which of the effects of climate change do you think might affect you and your community the most?

Name:_____

Part I: Causes and Effects of Global Climate Change

Instructions: Use information from your reading to fill in the spaces below. In the bottom half of the sheet, fill in each shape with at least two examples of how climate change affects each topic listed.

Causes

Climate Change
Define climate change:

Greenhouse Gases
What are they?

What effect do they have on the atmosphere?

What does CO_2 stand for?

Fossil Fuels
What are the three main fossil fuels?

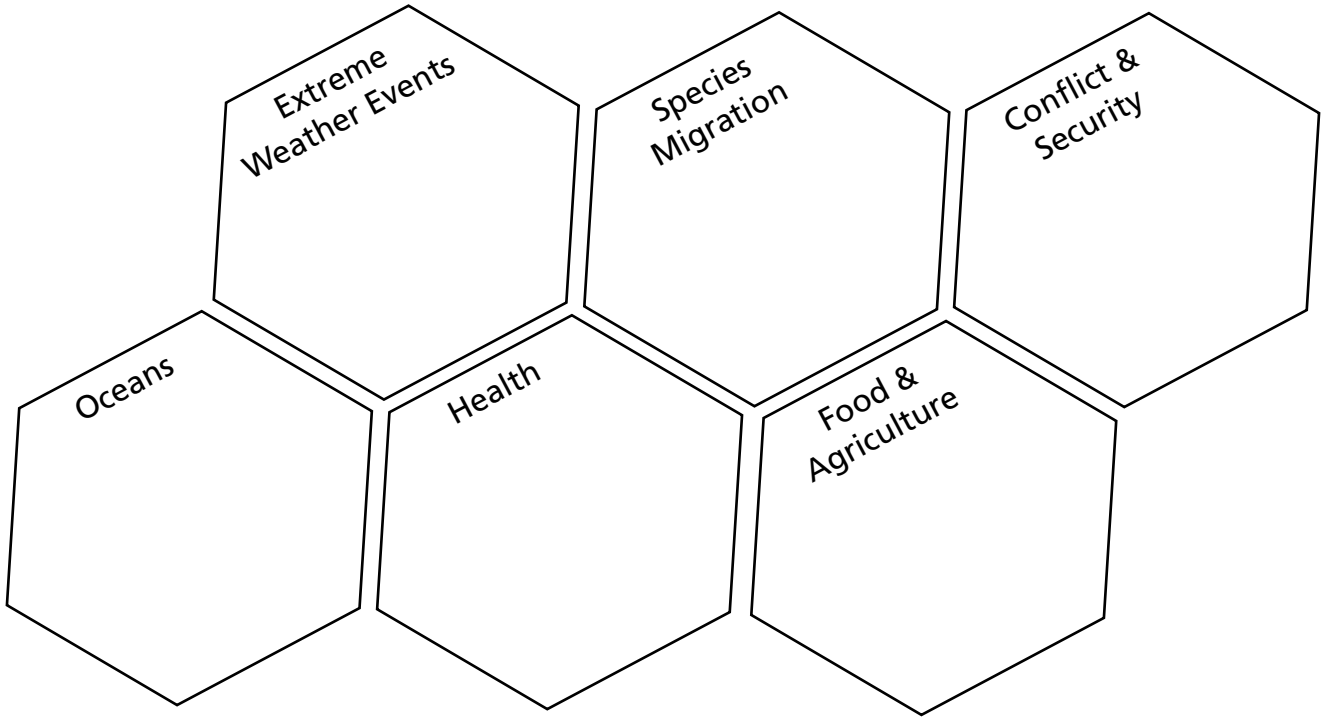
-
-
-

How were fossil fuels formed?

Deforestation
Do trees absorb or emit CO_2?

What effect does deforestation have on levels of CO_2 in the atmosphere?

Effects

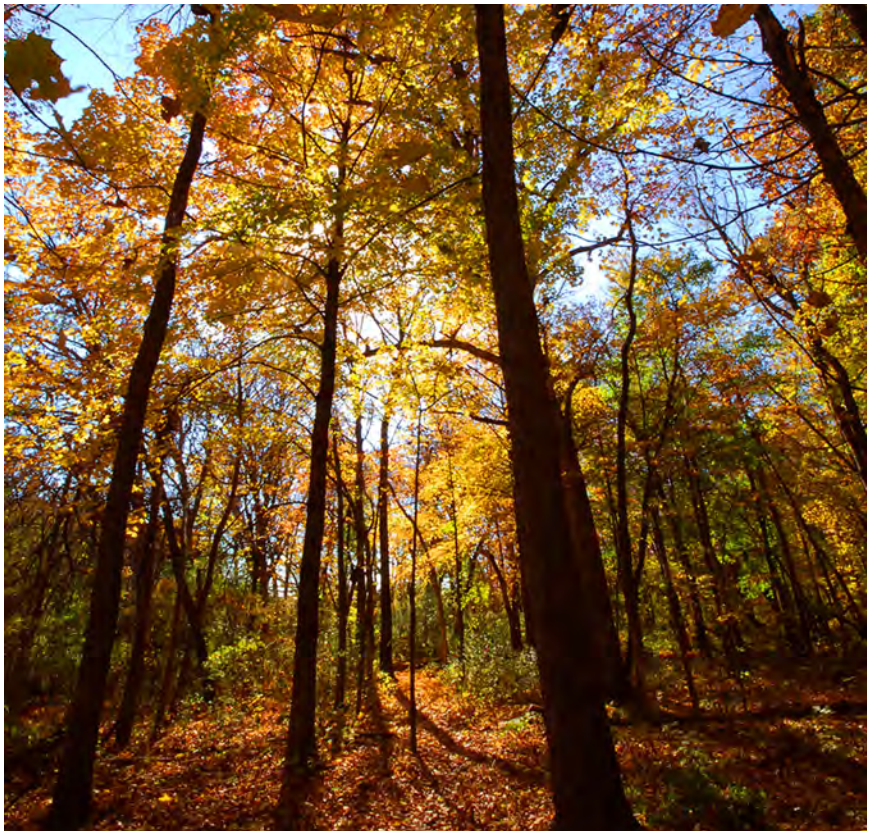


Name:_____

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 northeastern 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 like 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?

Name:_____

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?

Name:_____

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 to 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. So 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?

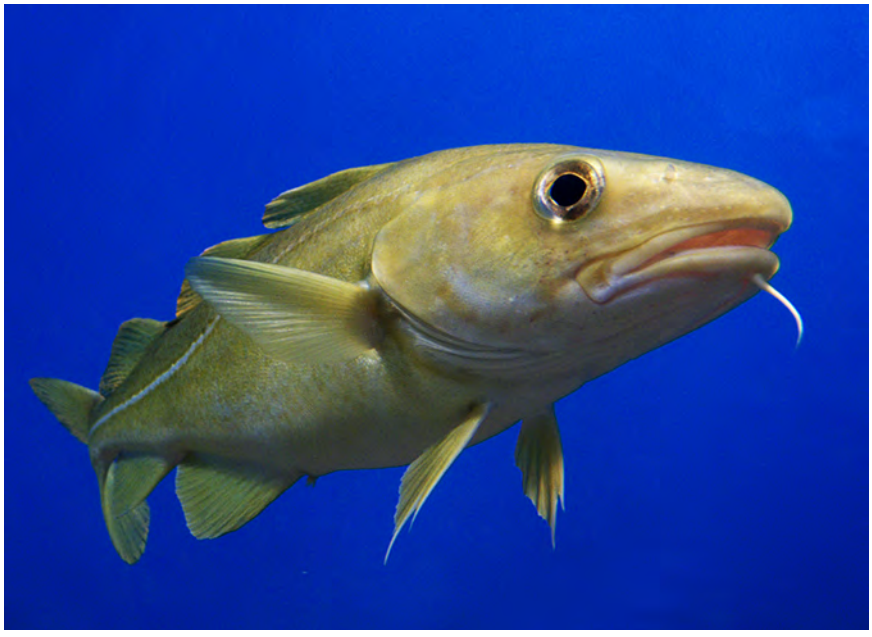
5. How might warming ocean temperatures affect lobster fishers and their families in New Jersey? How might warming ocean temperatures affect lobster fishers in Maine?

Name:_____

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?

Name:_____

Organism Profile: Corn

Instructions: Read the information below about corn. 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: Corn." After completing these questions, fill in the section of the "Effects of Climate Change Graphic Organizer" about corn and prepare a three-minute presentation to give to the class. In the presentation, your group should summarize what corn is, how climate change might affect corn, and why that is important to people.

Corn

- Most corn that is grown in the United States is grown in the Midwest, which has been experiencing more frequent droughts during corn's summer growing season as well as more intense rainfall in the rest of the year.
- In the United States, corn is used primarily to feed livestock (like cattle), to make ethanol (a type of fuel), and for common food ingredients like corn starch and corn syrup.
- Corn is very sensitive to temperature; it cannot grow in temperatures that are too hot. Corn is also very sensitive to water levels; it needs a lot of water to survive, but that water cannot come in the form of heavy rains that could wipe out the crop.
- Corn requires a lot of processing plants, storage facilities, and irrigation infrastructure. These buildings and systems are permanent structures that cannot be easily moved.

Questions: Corn

1. How might changes in temperature and rainfall associated with climate change affect corn?

2. Why is corn important to people?

3. Where is corn grown now? Where do you think corn may need to be grown a century from now and why?

4. Why might it be especially difficult to change where corn is grown in the United States?

5. How might climate change affect corn yields? How might the amount of corn that is available affect its price?

6. How might climate change's effects on corn influence the price of beef?

Name:_____

Organism Profile: Mangroves

Instructions: Read the information below about mangroves. 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: Mangroves." After completing these questions, fill in the section of the "Effects of Climate Change Graphic Organizer" about mangroves and prepare a three-minute presentation to give to the class. In the presentation, your group should summarize what mangroves are, how climate change might affect mangroves, and why that is important to people.

Mangroves

Pat Williams (CC BY 2.0).

- While more than 40 percent of the world's mangrove forests are found in Asia, there are mangroves in parts of the southeastern United States. Mangroves can be found along the coasts of Florida, Louisiana, and Texas.
- Mangrove trees, which live in saltwater, provide a habitat for many types of fish, birds, and other wildlife, including honey bees. They are very important for both commercial and recreational fishing in the states where they are found.
- While they are known for their ability to adapt to changing water conditions, mangrove forests may still face challenges associated with climate change. If sea levels continue to rise, mangroves may have trouble finding new places suitable for them to grow because much of the land at higher elevations has been developed with roads and buildings.
- Mangrove forests store a lot of carbon. Mangroves can absorb over 30 percent more carbon per acre than tropical forests, keeping that carbon out of the atmosphere. They also help filter and clean water.
- Mangroves help slow coastal erosion and act as a buffer to storms, protecting more inland areas from flooding.

Questions: Mangroves

1. How might climate change affect mangroves?

2. Why are mangrove trees important to people?

3. Why might climate change's impacts on mangrove forests affect other plants and animals as well?

4. Why might preserving mangrove forests be useful in reducing the amount of greenhouse gases in the atmosphere?

5. Why might preserving mangrove forests be useful in protecting people from some of the effects of climate change?

Name:_____

Organism Profile: Salmon

Instructions: Read the information below about salmon. 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: Salmon." After completing these questions, fill in the section of the "Effects of Climate Change Graphic Organizer" about salmon and prepare a three-minute presentation to give to the class. In the presentation, your group should summarize what salmon are, how climate change might affect salmon, and why that is important to people.

Salmon

Andrew Russell (CC BY 2.0).

• Some species of salmon live in the northern half of the Pacific Ocean while others live in the northern half of the Atlantic Ocean. Salmon also live in coastal and river habitats.

• For years, salmon has been one of the most commonly eaten fish in the United States. While much of this salmon is farmed, about one-third of the salmon eaten in the United States is wild, coming primarily from Alaska.

- Salmon hatch from eggs in freshwater streams. After maturing for a certain amount of time, young salmon migrate from those freshwater streams to saltwater oceans, where they can live for up to seven years. Once they are fully mature, adult salmon migrate back to the same freshwater streams where they hatched in order to reproduce. This journey takes a lot of energy to complete—many salmon die in the process. With warmer waters, salmon's long migration will require even more energy, causing salmon to experience more exhaustion and stress.
- When young salmon migrate from freshwater to saltwater, they enter the ocean just at the time when the small organisms that they eat, called zooplankton, are most abundant. It is important that this timing aligns, so the young salmon can get enough to eat.
- Many people eat salmon, as do numerous other animals, such as seals, whales, and bears. Adult salmon eat smaller fish, such as herring, as well as other marine animals like shrimp, which have hard shells.

Questions: Salmon

1. How might ocean temperature changes associated with climate change affect salmon?

2. Why are salmon important to people?

3. Scientists have observed that it takes salmon less time to mature in warmer waters. How might increasing water temperatures affect the timing of young salmon's migration into the ocean? Why is this timing important for their survival?

4. Like people, when salmon are tired and experiencing stress, they may be more susceptible to diseases. How might climate change influence salmon health?

5. Many marine animals, like lobsters and shrimp, have hard shells to protect them from being eaten by predators. These shells are necessary for their survival. How might ocean acidification affect these shelled animals? How might this affect salmon populations?

Name:_____

Effects of Climate Change Graphic Organizer

Instructions: As you listen to your classmates' presentations, complete the chart below. Be sure to include at least two ways climate change will affect each organism as well as at least two reasons why those effects matter to people.

Organism name	How might climate change affect this organism?	Why does this matter to people?
Sugar Maple		
Honey Bee		
Lobster		
Cod		
Corn		
Mangroves		
Salmon		

Part II: Responses to Climate Change

The atmosphere is a shared resource, which makes climate change an international problem that has no borders. To deal with a global problem, policy proposals are made at multiple levels—international, national, and local. This makes agreeing on climate change policies difficult.

Vulnerability and Responsibility

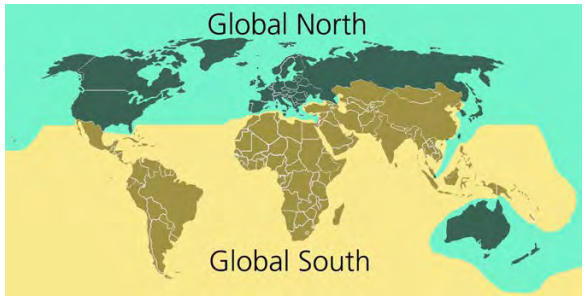
While climate change is a shared concern, it does not affect places and peoples evenly. There are great disputes about who should be held responsible for causing climate change and for repairing its damage.

Who is most vulnerable to the effects of climate change?

Some countries are more vulnerable to the harmful effects of climate change than others. For example, the country of Tuvalu, a small island in the Pacific that is home to more than ten thousand people, could become unin-

The Global North and the Global South

The "global North" and the "global South" are labels used to differentiate the richer parts of the world from the poorer. The global North includes much of Europe and North America, while the global South refers to large parts of Asia, Africa, and South America. Because most of the richer countries are concentrated towards the north of the globe and most of the poorer countries are towards the south, these geographical labels were adopted. But the terms are not perfect—relatively rich Australia lies in the Southern Hemisphere, while some poorer countries are situated towards the north. For this reason, some people use the terms "developed countries" and "developing countries" instead.



The global North and the global South have political issues with deep historical roots. During the nineteenth and early twentieth centuries, the most powerful countries of what is today the global North competed to establish colonies abroad. Most of these colonies were in the global South. The powerful countries used colonies to gain access to raw materials and to open up new markets for their manufactured goods. They often justified their exploitation of people and resources in the colonies by claiming that they were on missions to "civilize" native communities. By the turn of the twentieth century, Britain, France, and other colonial powers controlled nearly the entire continent of Africa and much of Asia. U.S. colonies included the Philippines and Cuba.

Although almost all of the colonies gained independence by the 1960s, the impact of colonialism has continued to influence international relations. Economic links between the former colonies and the former imperial powers remain important. In addition, leaders in the global South argue that colonialism is the source of many of the problems that currently afflict their countries—from ethnic strife to widespread poverty. International cooperation is complicated by the differences in the priorities that rich and poor countries have and by poor countries' fear that they will be overpowered by the global North. These challenges are apparent in international negotiations about how to respond to climate change, especially when the question arises of who is most vulnerable to its effects and who should be held responsible.

Heinrich-Böll-Stiftung (CC BY 2.0).

A slum on the coast of Lagos, Nigeria. Because of devastating poverty, people have been forced to live in areas that face extremely high risks of flooding and damage from storms.

habitable in the next fifty years as sea levels continue to rise. Within individual countries, impacts vary by region as well.

Even within local communities, some people may be more vulnerable to the effects of climate change than others. This often depends on where they live and how much their basic needs like food, water, and shelter are affected by changing climate conditions. For example, during Hurricane Sandy in 2012, the people who were most affected were those in lower-income communities, like the Red Hook area in Brooklyn, New York. People in poorer neighborhoods may not have access to health care or the ability to evacuate their homes. Because of this, they tend to be more vulnerable than those who have greater means to recover from disasters.

In many countries, poor communities live in environmentally unsafe areas because this is where housing is cheapest. In Nigeria, for example, poor people moving from rural areas into the city of Lagos often end up settling in swamps or the lowest-lying parts of the coast, where they are most exposed to flooding.

Poverty is important in determining vulnerability to climate change. People in the world's forty-eight poorest countries are five times as likely to die from climate-related disasters. Poor countries are ill-equipped to deal with extreme weather and health issues. They often lack effective infrastructure (like hospitals and running water systems) to deal with the impacts of climate change, and their citizens often live in homes that cannot withstand intense storms. Most importantly, countries in the global South are the most likely to already be experiencing issues like water scarcity, food shortages, poor sanitation, and limited access to safe housing. Any worsening of these problems by climate change is bound to be catastrophic.

How have histories of colonialism influenced vulnerability to climate change in the global South?

The economies of many countries in the global South rely heavily on a single agricultural crop. This is a legacy of colonial times, when imperial powers would encourage each of their colonies to produce only one good or crop. Relying on only one crop makes these countries particularly vulnerable to unpredictable changes in climate and changes in the world markets. If the price of their primary good goes down or if they experience one poor crop yield, their entire economy fails and they experience vast food shortages. This, in turn, makes coping with the effects of climate change an even greater challenge.

How does the question of responsibility affect the response to climate change?

The forty-eight poorest countries in the world, which are home to 12 percent of the world's population and often experience the greatest effects of climate change, are only responsible for emitting less than 1 percent of total greenhouse gas emissions. This gap between responsibility and vulnerability com-

plicates any response to climate change and raises important questions:

- Should wealthier countries that emitted more greenhouse gases over the past two hundred years bear more of the responsibility and take on more of the costs of dealing with climate change's effects?
- Should poorer countries that are trying to develop economically cut their greenhouse gas emissions, even if it slows their economic growth?

> ***"Developing countries...are historically least responsible for the emissions that result in climate change, but most vulnerable to its impacts."***
>
> —Jessica Ayers, Massachusetts Institute of Technology, 2011

The dispute over responsibility for past and future emissions is one of the most difficult issues in determining how to respond to climate change. It is costly to respond to climate change; cutting emissions means putting limits on industry by demanding less use of fossil fuels, which few countries want to do.

What is "climate justice"?

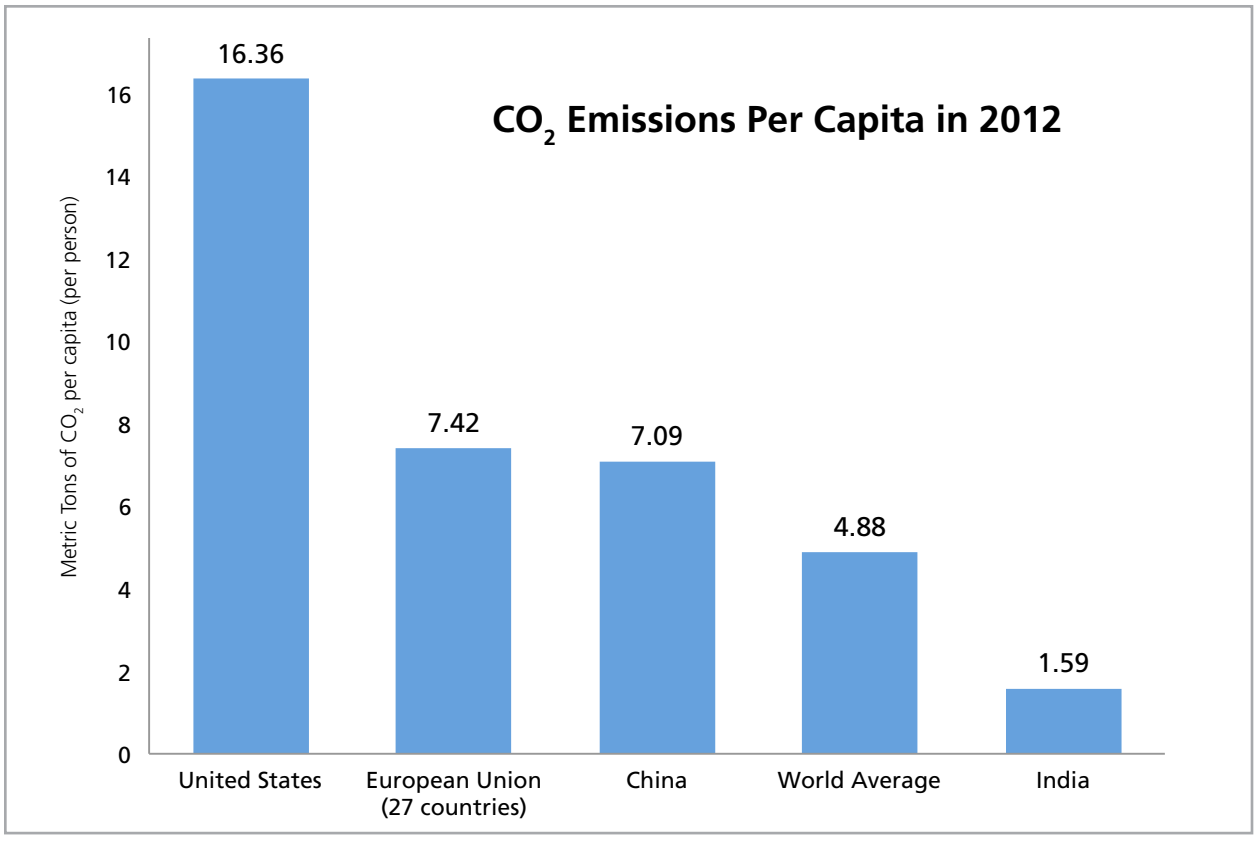
Some activists call for "climate justice" in which countries pay the costs of dealing with climate change proportionately depending on the extent of responsibility for emissions. Those countries that contributed most to the problem would pay the most. Poorer countries, bearing less responsibility for greenhouse gas emissions, would pay less. But it is difficult to motivate wealthier countries to take responsibility, particularly given that they are the least vulnerable to the effects of climate change.

The Tragedy of the Global Commons

The global commons are spaces and resources of the earth that are, by their very nature, shared. Originally, the word "commons" referred to the open fields in the United States and Britain prior to the seventeenth century. In many areas, residents were allowed to use their village's public lands for activities like grazing livestock. Today, "commons" implies any resource that a community has a joint right to access, and the global commons are resources that the entire world has a right to access. These include the deep seabed, the high seas, the Antarctic, outer space, and the atmosphere. No person or country can claim ownership over these spaces; they are international.

The atmosphere is part of the global commons because it cannot be separated according to national boundaries—it cannot be fenced. Instead, all countries, territories, and peoples utilize the atmosphere and benefit from it. While the shared nature of the global commons means that everyone can benefit from them, it also means that everyone can impact them. The carbon dioxide (CO_2) emissions of one country do not only affect that country, but alter the state of the atmosphere for all.

Because no single government has authority over the global commons, it is often difficult to protect them as this requires international cooperation and agreement. The temptation for many countries is to use as much of the global commons as possible, despite the potential for damaging it, because they assume that other countries would do the same. In the case of the atmosphere, this is particularly problematic. Countries allow the emission of harmful substances (such as greenhouse gases) into the atmosphere because the industries that emit those substances give countries economic benefits. Despite knowing that more greenhouse gases lead to climate change, few countries are willing to cut down their emissions so long as other countries continue emitting. This is similar to the historic common land, where each farmer would want to add more animals to his herd, leading to the land being overgrazed. When free access to a resource makes the destruction of that resource seem inevitable, we call it the "tragedy of the commons."



This graph shows the average amount of CO_2 gas emitted per person in 2012 for the United States, twenty-seven countries in the European Union, China, and India. The world average is also shown.

There is also dispute over how responsibility should be calculated. On the one hand, some believe that those countries that are emitting the most greenhouses gases at this moment should be held responsible. This places much of the burden of responsibility on newly developing countries like China, which currently emits the most greenhouse gases in the world. On the other hand, China has a large population, which means it does not have the highest per capita (per person) emissions. Newly developing countries like China also do not have long-standing histories of greenhouse gas emissions the way countries like the United States do. Because there are different ways to define responsibility, it is difficult to decide how to create a response focused on "climate justice." This raises another important question:

- Should responsibility be based on current emissions, per capita emissions, or the emissions accumulated over history?

The International Response to Climate Change

In 1992, the largest gathering of international leaders in history met in Rio de Janeiro, Brazil at what became known as the Earth Summit. 150 governments agreed on the principle of preventing dangerous climate change, and 196 countries have now ratified the UN Framework Convention on Climate Change (UNFCCC), an agreement to limit greenhouse gas emissions. The agreement stated that while climate change is a shared problem, different countries have different levels of ability to respond, and that wealthier countries should provide funds to address the problem.

Most importantly, the UNFCCC created a system in which countries could continue meeting regularly in order to reach the general goals established in Rio. Each of these yearly meetings is referred to as a "Conference of the Parties" (COP). The COP meetings include government representatives, United Nations (UN) officials, environmentalists, and corpora-

Jan Golinski, UNclimatechange (CC BY 2.0).

A press conference held by Secretary General of the UN, Mr. Ban Ki-moon (center) at the 19th Conference of the Parties in Warsaw, Poland. November 19, 2013.

tions that contribute to considerations of how to address the principles agreed to in 1992.

Why have governments struggled to create a unified response to climate change?

It has been difficult for countries to agree on how to limit greenhouse gas emissions and to decide on who should make changes to prevent future problems. The economy of a particular country, its values, and its political structure all contribute to its stance on climate change. For instance, the European Union believes that effective climate change policy must begin with widespread and immediate changes in national and industrial behavior to reduce CO_2 emissions. The United States and Japan prefer to focus on developing technology to protect and repair the atmosphere in the future. Poorer countries are primarily concerned with reducing their vulnerability to the effects of climate change.

Despite the principles laid out in the UNFCCC, one of the greatest obstacles in negotiations is deciding who is financially responsible—who should pay. It is initially expensive to reduce greenhouse gas emissions because it requires turning away from fossil fuels that are currently the cheapest and most widely used form of energy. But it is also expensive to cope with the effects of climate change.

Determining which course of action to take is particularly tricky because industrialized countries have already reaped the benefits of vast greenhouse gas emissions. This raises important questions:

- Should wealthier countries (historically responsible for the most emissions) be required to contribute money to help poorer countries deal with the effects of climate change?
- Should countries from the global South be subject to restrictions on emissions while they are trying to industrialize?

One of most significant international agreements, the Kyoto Protocol to the UNFCCC, has fallen victim to these thorny questions.

Important International Conferences

Where?	When?	What?	Important Developments
Stockholm, Sweden	1972	UN Conference on the Human Environment	Puts the environment on the UN agenda; establishes that it is the responsibility of national governments to protect the environment
Rio de Janeiro, Brazil	1992	Earth Summit / UN Conference on Environment and Development	Signing of the UNFCCC, which acknowledges the problem of climate change and includes major agreements to stabilize emissions but sets no mandatory limits
Kyoto, Japan	1997	COP-3 (Conference of the Parties)	Adoption of the Kyoto Protocol to the UNFCCC, which creates binding emission reduction targets for countries that ratify the protocol
Marrakech, Morocco	2001	COP-7	Adoption of National Adaptation Programmes of Action (NAPAs) for short-term protection against climate change effects
Copenhagen, Denmark	2009	COP-15	Goal of creating a successor to Kyoto is not achieved; Copenhagen Accord (drafted by the United States, China, Brazil, India, and South Africa) only requires that countries pledge to voluntarily reduce emissions
Cancún, Mexico	2010	COP-16	Many high emitting countries pledge to voluntarily reduce emissions
Durban, South Africa	2011	COP-17	Agreement to establish a legally binding deal committing all countries by 2015
Doha, Qatar	2012	COP-18	Adoption of National Action Plans (NAPs) for long-term protection against climate change effects; agreement to extend the life of the Kyoto Protocol until 2020
Lima, Peru	2014	COP-20	In the Lima Accord, all countries (both rich and poor) agree to voluntarily put forward plans to reduce domestic greenhouse gas emissions; there are no requirements regarding amount of emissions reductions
Paris, France	2015	COP-21	Deadline to settle a new, binding international agreement on emissions reduction to replace the Kyoto Protocol

What is the Kyoto Protocol?

The Kyoto Protocol to the UNFCCC, which was negotiated in 1997, laid out clear emissions restrictions for thirty-seven wealthier countries and reduction targets that poorer countries could volunteer to pursue.

Some countries have viewed the Kyoto Protocol as unfair, because it does not impose restrictions on China or India, both of which are substantial CO_2 emitters. For this reason, in 2007 countries agreed that a new agreement must be drawn up to replace the Kyoto Protocol. In addition, many countries (including Canada and New Zealand) refused to submit to any more emissions restrictions under the existing protocol. The United States did not ratify the protocol at all, making the country exempt from all of the treaty's commitments.

Since 2007, the COP meetings have focused on trying to create a successor agreement to replace the Kyoto Protocol (which is set to expire in 2020), but the vast differences among countries, as well as participating corporations and organizations, have stalled cooperation. At the COP meeting in December 2014, governments from all countries, rich and poor alike, agreed for the first time to voluntarily create plans to reduce their domestic greenhouse gas emissions. While major issues remain (including the amount of emissions reductions, if any, each country will commit to) policymakers say these plans will form the basis of a 2015 international climate change agreement to replace the Kyoto Protocol.

The light emitting diode (LED) bulb on the left uses over 75 percent less energy than the incandescent light bulb on the right.

What is mitigation?

Responses to climate change are generally categorized into two groups: **mitigation** and **adaptation.** The term "mitigation" means efforts to reduce the harm of something. Mitigation of climate change means reducing greenhouse gas emissions with the goal of preventing harmful effects of climate change.

Many different mitigation strategies have been proposed and used over the past few decades. The production and distribution of many goods and services involves fossil fuels. For instance, plastic bags, water bottles, many plant fertilizers, clothing items, and most cosmetics are all made from oil. Reducing people's demand for these things is one way of decreasing carbon emissions. Increasing energy efficiency (producing more energy with less fuel) across industries is another. Examples of this include using more efficient heating, cooling, and lighting systems in buildings.

Industry standards and regulations can be used to promote mitigation efforts. For instance, requiring certain levels of fuel efficiency for cars or changing building codes can decrease greenhouse gas emissions throughout an industry. Adding labels to products with information about how they were produced can also reduce emissions by changing what consumers choose to buy.

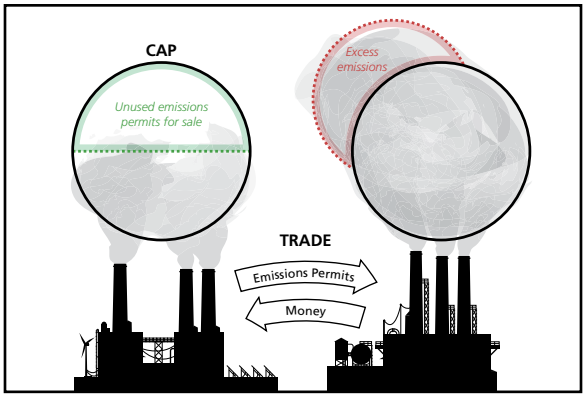
Kim Hansen (CC BY-SA 2.0).

A wind farm outside of Copenhagen, Denmark, which supplies 4 percent of the power for the city. Wind spins the blades of the wind turbines, which connect to generators inside the turbines that create electricity.

Another strategy involves reducing the emissions intensity of fuel sources. This means switching from fuels like coal and oil, which emit a lot of CO_2 when used, to fuels like natural gas, which emit less.

Furthermore, increasing the use of zero-emissions energy sources is important in reducing the amount of greenhouse gases that end up in the atmosphere. Nuclear energy as well as energy produced from renewable sources like solar, wind, and water power do not emit any CO_2 when used.

But zero-emissions energy sources come with their own set of problems. There are safety concerns about nuclear energy production and the storage of its radioactive waste.



Alexander Sayer Gard-Murray.

A cap-and-trade system sets a limit to the amount of greenhouse gases companies can emit. It allows companies that want to emit more than their share to buy emissions permits, or allowances, from other companies that emit less.

There is also a question of whether renewable energy can be produced at a low enough cost and a large enough scale to be widely used. Both businesses and people can be reluctant to pay more for zero-emissions energy when they can pay less for energy from fossil fuels.

What economic policies encourage mitigation?

Different types of policies encourage the use of these mitigation strategies. Several countries have implemented **carbon taxes**, which require emitters to pay fees for the amount of CO_2 they emit. The money generated from the taxes can then be used to invest in other things, like the development of renewable energy.

In **cap-and-trade** systems, a limit, or "cap," to the total amount of emissions is set. Permits that allow companies to emit certain amounts of greenhouse gases are then either given away or auctioned off. If one company wants to emit more CO_2 than it has permits for, it can buy permits from another company. Likewise, if a company does not need to use all of its permits, it can sell them to other companies. Both carbon taxes and cap-and-trade strategies attempt to put a price on carbon. If the price is too high, the economies of participating countries will suffer. If the price is not high enough, emissions levels will not drop significantly and may even rise in the long term.

Geoengineering

A few people have proposed some more extreme ways of fighting the effects of climate change: firing chemicals into clouds to change rainfall patterns, shooting pollution into the atmosphere to block sunlight coming towards the earth, and using machines to suck CO_2 out of the atmosphere and burying it underground. These strategies, collectively known as "geoengineering," use large-scale technological fixes to drastically change the planet's environment. While they attempt to reduce or slow some of the effects of global warming, these strategies are not aimed at addressing climate change's underlying causes. There are many serious safety risks associated with geoengineering, as well as the potential for unknown side effects—especially because there is no way to test such large-scale projects before implementing them. Furthermore, these strategies are expensive, and only the most wealthy countries would be able to afford them. With countries in the global North in control of geoengineering efforts, the interests of countries in the global South could be lost.

What is adaptation?

While mitigation efforts are aimed at reducing the amount of greenhouse gases in the atmosphere, adaptation focuses on adjusting to the effects of climate change.

In the decades following the 1992 Earth Summit, international leaders primarily directed their attention to mitigation. They hoped that through decreasing CO_2 emissions, many of the potential negative effects of climate change could be avoided. Disagreements among countries about how to actually implement mitigation strategies have meant that progress on reducing greenhouse gas levels has been slow. These efforts to reduce emissions continue, but even if all human emissions of CO_2 somehow stopped today, emissions from the past that have accumulated in the environment would still cause continued climate change. Scientists and policy makers have now recognized that mitigation alone is not enough.

The Cancún COP in 2010 declared that adaptation must be equal in priority to mitigation. This means that greater attention is now being paid to helping countries and communities adapt to the effects of climate change.

Some examples of adaptation strategies include urban planners in coastal cities taking into account sea level rise and flood surges that accompany extreme storms, farmers planting different crops that are more resilient to droughts and floods, and governments implementing early warning systems for more frequent and intense extreme weather events and disease outbreaks.

Improved access to health care and economic opportunity are also important in reducing people's vulnerability to the effects of climate change. For instance, creating new types of jobs in communities that have been dependent on fishing will make the problem of shrinking fish populations (caused by climate-related changes in ocean conditions) less catastrophic. People will have other options for how to make a living. Adaptation needs and priorities vary significantly depending on the environmental, social, and economic conditions of different countries, regions, and individual communities.

What are National Adaptation Programmes of Action?

The increasing emphasis on adaptation, and the fact that adaptation needs are very specific to particular places and peoples, has led to the development of National Adaptation Programmes of Action (NAPAs). The world's poorest and most vulnerable countries have submitted NAPAs, which are plans that outline their most urgent needs regarding climate change adaptation, to the UNFCCC. Each NAPA consists of a ranked list of projects the country has identified as its highest priorities in adapting to climate change. The UNFCCC has a fund of roughly $500 million provided

by wealthier countries to help implement those plans, although this is not nearly enough to fund all the NAPAs. So far less than a quarter of NAPA projects have been funded.

NAPAs, adopted at the COP in Marrakech, Morocco in 2001, focus on countries' most immediate adaptation needs. Later, in Doha, Qatar in 2012, National Adaptation Plans (NAPs) were adopted by the COP to address more medium- and long-term projects to adapt to a changing climate.

Practical Action Bangladesh. Used with permission.

Bangladesh, one of the most vulnerable countries to sea level rise, has adapted in some places by creating farms that float on water.

While decisions about the global response to climate change are made at the international level, NAPAs and NAPs depend on extensive input from local stakeholders (people and organizations who have an interest in or are affected by an issue). Both NAPAs and NAPs are intended as ways for members of local governments and communities to participate in making decisions about how their country will adapt to climate change. They are structured this way so that adaptation plans are not imposed from above, but rather driven by the concerns and priorities of the people in each country. For although climate change poses risks on an international scale, many impacts of climate change are experienced locally.

> ***"The lesson from climate change is... risks do not register their effects in the abstract; they occur in particular regions and places, to particular peoples, and to specific ecosystems."***
>
> —Jeanne X. Kasperson and Roger Kasperson, 2001

Paying for Adaptation

Many challenges and questions arise in determining how to pay for adaptation to climate change. Mitigation efforts, such as emissions reductions, have positive effects that are felt around the world, whereas adaptation tends to have more local benefits. As a result, mitigation has been more appealing for wealthy countries to fund because they will directly experience its positive effects. Consequently, much more money overall has gone towards mitigation efforts than towards adaptation. Of the initial funding provided to poorer countries for both mitigation and adaptation as of November 2012, up to 80 percent focused on mitigation.

In addition, while it is generally agreed upon that money to help poorer countries cope with climate change's effects should go to the most vulnerable countries first, which countries and projects should get prioritized is hard to determine. This is especially challenging when there is a limited amount of money available and contributions from wealthy countries are voluntary (not required). Although an agreement from the 15th COP in Copenhagen, Denmark promised roughly $50 billion to go towards adaptation by 2020, some experts believe that only about one-tenth of that amount will be available by that point.

Finding a way for local communities to participate in decision-making about climate change adaptation on national and international levels can be challenging. For example, the top priority project in Bangladesh's NAPA was to establish more forests in coastal areas to protect against sea level rise and more frequent extreme weather events. The NAPA process included input from people living in coastal communities, but their participation was mostly sought out to confirm what higher-up officials and other "experts" had already decided were the top concerns. As a result, this project focused on dealing with the physical effects of climate change, while the local stakeholders wanted instead to focus on improving social and economic conditions so they would be less vulnerable. In this case, the priorities reflected in the NAPA did not match those of the local people.

What is sustainable development?

Sustainable development is a way of using resources that protects both environmental and human well-being in the long term. Responding to climate change—through both mitigation and adaptation—can be intimidating to countries because they are worried about it hurting their economic growth. Acknowledging this concern, international agreements and conferences have stressed the importance of sustainable development to combine economic improvement and climate change prevention. The goal of sustainable development is to meet the economic and social needs of the present generation without compromising or depleting the resources that future generations will have.

In the case of climate change, this principle is particularly important as the most severe effects of our actions today will most likely only be seen in decades to come. Fossil fuels, in particular, are not a sustainable source of energy. In addition to the harmful effects of the greenhouse gases released when people use them, the supply of coal, oil, and natural gas is limited. These energy sources take a long time to form, for they are made from the remains of plants and animals that lived millions of years ago. People are using them up at a faster rate than they are being regenerated, which makes humans' current use of fossil fuels unsustainable over a long period of time. Furthermore, as they become less easily available, they will also become more expensive.

Why do countries pursue sustainable development?

Sustainable development is a principle that both rich and poor countries try to follow. Many European countries, for instance, promote the use of bicycles to reduce reliance on fossil fuels. Efforts like this show that, in the global North, resources can be used sustainably without sacrificing a high standard of living.

In the global South, renewable energy is an important aspect of sustainable development, providing struggling communities with effective and efficient power sources. For example, some regions of the Philippines use solar power to pump and purify drinking water, and remote villages in north Peru generate electricity using the high levels of rainfall they experience. These sustainable development efforts both reduce the emission of greenhouse gases and provide employment opportunities.

Many policy makers and economists see sustainable development as a huge opportunity for the global South. They suggest that poorer countries can "grow green" by using technology that was not available when richer countries first industrialized. Because of this, sustainability is often included in the conditions of loans offered by wealthy countries to the governments of the global South. Sustainable development also has the potential to help many poorer countries become less reliant on foreign aid.

National and Local Responses to Climate Change

Frustration with the slow pace of the UNFCCC process to combat climate change has motivated other people and groups to propose their own responses. This has happened at different levels, from national governments to small interest groups. For example, more than six hundred presidents of colleges and

universities in the United States have vowed that their institutions will become carbon neutral (contributing no additional CO_2 into the atmosphere) by 2050. In many parts of the world, national and local governments are passing their own rules about climate change. Organizations, businesses, and individuals are also devising responses to the climate change.

National governments: Some countries are opting to take a dramatic stance on climate change despite the lack of legally binding international agreements. Denmark has vowed to end all usage of fossil fuels by 2050 and is a leading user of energy from wind turbines. Costa Rica, aiming to be carbon neutral by 2021, imposed a carbon tax on fossil fuels. Part of the money from this tax goes towards forest conservation. The United States, though it is the largest historical emitter, has demonstrated less enthusiasm. In November 2014, the United States announced a new goal of reducing its emissions 26 to 28 percent below 2005 levels by 2025.

Local governments: Although the United States has been slow to take action on climate change at a national level, individual states have not shied away from creating climate change policy. For instance, Massachusetts became the first state to place limits on greenhouse gas emissions from power plants in 2001. This led to the establishment of the country's first cap-and-trade program, the Regional Greenhouse Gas Initiative, involving nine states along the East Coast of the United States.

In 2006, California passed a "Global Warming Solutions Act" that requires emissions be reduced by nearly 30 percent statewide by 2020. In 2008, Ohio adopted a law that directs the state towards using efficient and renewable energy for a large proportion of its energy needs, in order to cut down on the use of fossil fuels. Individual cities and towns are also making climate change a policy priority. In fact, by 2013, some 3,500 local governments from all over the world had agreed to reduce greenhouse gas emissions.

Businesses: Governments are not the only institutions that have responded to concerns about climate change. Even businesses, long seen as the enemies of climate change policy, have become increasingly invested in reducing the impact on the climate.

When the Kyoto Protocol was signed, oil producers, vehicle manufacturers, and electrical trade associations vowed to prevent the ratification of the agreement. Because of their economic strength, they have had the political power to stall many mitigation policies. However, in September 1997, oil corporation BP announced that it would voluntarily measure its emissions and research how to reduce levels of greenhouse gases.

By acknowledging the effect of fossil fuels on the environment, BP set off a revolution in how corporations approached climate change. Companies and industry representatives began to actively participate in the COP meetings and presented formal reports on their own attempts to fight climate change. Businesses began investing in forestry projects, which aimed to provide more CO_2-absorbing plants, and started promoting the idea of emissions trading.

Some people claim that these companies are only trying to appear more environmentally friendly to improve their public image. For instance, while BP ad-

Henrik Boegh (CC BY-SA 3.0).

Public bicycles and abundant bike lanes are part of Denmark's policy to reduce CO_2 emissions from cars by making Copenhagen a cycling city.

Friends of the Earth (CC BY 2.0).

Campaigners from Friends of the Earth International participate in a peaceful march to demand "climate justice" during UN talks in Copenhagen. December, 2009.

vertises its strong commitment to renewable energy, nongovernmental organizations like Greenpeace have drawn attention to the fact that the company invests significantly less money in alternative energy sources compared with its investments in oil and gas. In addition, ExxonMobil, one of the world's largest oil and gas companies, prominently advertises its commitment to reducing the risk of climate change. But at the same time, the company provides millions of dollars each year to organizations that promote the denial of human-caused climate change and to campaigns for politicians who are against climate change mitigation policies.

It remains true that corporations lobby against policies like carbon taxes and that the amount of money oil companies put towards alternative energy is much less than what they spend to increase oil extraction. However, even the fact that businesses are feeling pressure to present a new, green face and that customers are increasingly drawn to companies that express concern about the environment is significant.

The media: For a long time, media coverage of climate change, especially in the United States, attempted to balance claims of global warming with counter-claims that climate change was not real or that human activity was not causing it. This has declined as overwhelming scientific evidence of human-caused climate change has emerged.

Media coverage of climate concerns has ballooned in recent years. This means people around the world are more knowledgeable about climate science and how the atmosphere is changing. It also means that there is greater awareness of climate-related incidents such as severe storms. Because of the media's growing emphasis on climate change, populations around the world are more conscious of the dangers it poses to them and others. As a result, people are more likely to demand that their government take action.

Nongovernmental organizations (NGOs): Putting pressure on government is one of the key functions of "green groups," environmental advocacy organizations such as Friends of the Earth and Greenpeace. These organizations, like the media, are responsible for increasing public awareness of climate change. They frequently engage with people about their personal greenhouse gas emissions, as well as launching organized efforts to confront politicians. Other types of NGOs focus on

providing on-the-ground assistance to communities trying to decrease their vulnerability or in climate change-affected areas that need disaster relief. Examples of these include Oxfam, Christian Aid, and the International Federation of Red Cross and Red Crescent Societies.

The influence of NGOs is becoming increasingly central to climate change negotiations on national and international levels. The number of organizations authorized to participate in COP meetings has expanded considerably over the years, including many from both the global North and the global South. In fact, at some COPs, representatives from NGOs have outnumbered government negotiators. At these meetings, the organizations take part in negotiation sessions, distribute reports, hold side events, and interact with the press.

While growth in the number and diversity of organizations attending negotiations has led to greater influence, it has also led to divisions within the NGO community. These organizations do not have uniform priorities and often disagree on things like the viability of alternative energy or how to prioritize between mitigation and adaptation. NGOs, therefore, do not present a wholly unified force during negotiations.

Barriers to Action on Climate Change

Global climate change has been on the agenda of local governments, international leaders, and nonprofit organizations for decades, yet sometimes it can seem like not much has been accomplished. Many significant obstacles stand in the way of responding to climate change.

What are the most significant obstacles to responding to climate change?

Cost: Reducing greenhouse gas emissions can be a costly endeavor. Right now fossil fuels are the cheapest source of energy. This is largely because of benefits called subsidies that governments provide, which make energy from fossil fuels cheaper to produce, lower the price consumers have to pay for that energy, and increase the price energy producers receive. Furthermore, fossil fuels are used in manufacturing goods, in generating electricity, and in other industrial activities central to a country's economic growth. In comparison, other sources of energy, such as wind farms or nuclear power plants, are expensive to build.

Mitigation policies like carbon taxing or cap-and-trade systems attempt to make fossil fuels more expensive so that companies will find alternative energy more attractive. Unfortunately, this means that the price of products would increase, and neither businesses nor individual people want to pay more. If goods in one country increase in price, that country is at a disadvantage when trying to sell its products in global markets.

Many experts say that for mitigation to work, society and culture will have to change so that we use less energy. This would require a transformation in how we live our lives, challenging the way homes are constructed, the kinds of food available to eat, and even the idea of individuals owning cars. Many people see this as a cost in quality of life. Ultimately, any sort of change will generate resistance. Even reducing a country's vulnerability through adaptation, often seen as the "cheap" version of climate change policy because it does not scale down industry, demands funding. Obtaining this funding can be a serious challenge to governments and other organizations.

> ***"[I]t's always easier to shell out money for a disaster that has already happened, with clearly identifiable victims, than to invest money in protecting against something...in the future."***
>
> —James Surowiecki, *The New Yorker*, 2012

The North-South divide: The historical tensions between rich and poor countries can complicate the processes of climate change negotiation. While individual countries have different priorities and interests, poorer countries often feel they are not being treated

fairly. It frustrates countries from the global South when mitigation proposals restrict their ability to grow economically, making it harder for them to build roads, provide electricity, improve education, and create jobs for their citizens. They want the same opportunities that wealthier countries have had to pursue prosperity.

Cartoon by Nicholson from The Australian www.nicholsoncartoons.com.au. Used with permission.

Many poorer countries are also rightfully concerned about being overpowered in negotiations. The global North has more bargaining power in the international system—rich countries have the money to control world markets, which means they can control the economies of other countries. Wealthier countries often use their power to pursue their own national interests. Poorer countries, on the other hand, do not have the economic influence to push other countries to compromise. The result is that the most vulnerable countries have the least success including their interests in international agreements.

Most importantly, countries of the global South struggle to afford mitigation and adaptation projects, despite the fact that they will be most intensely affected by climate change. The countries that can afford these policies do not face such immediate or hard-hitting effects and therefore find the problem of climate change less urgent.

Political disagreement: Political factors often make responding to climate change difficult. At the international level, government officials can be pressured by leaders from other countries, by economic concerns, and by groups of people within their own country who have strong and specific interests. These competing demands mean that even though the risks associated with climate change are clear, some leaders may end up prioritizing other issues.

In addition, whatever agreements are accomplished at the international level ultimately come back to individual countries to carry out. For this reason, political conflicts at national and local levels also help determine what action people take to mitigate and adapt to climate change.

For example, there is strong partisan disagreement among politicians in the United States about climate change. The disputes include concerns about the impact of climate change mitigation on jobs and businesses, what role the international community should play in making policy, and even debates about climate science.

Furthermore, in many democratic countries, government leaders are elected every few years. It can be difficult for a country to make lasting decisions about global warming if its primary leaders change so frequently. Also, with politicians regularly up for re-election, they may choose to focus on issues that provide short-term benefits to the people who might vote for them as opposed to focusing on mitigation and adaptation strategies that are initially expensive but reduce longer-term risks. This way, a politician is more likely to retain his or her power and influence, even if the risk of dangerous future climate conditions continues to grow.

In addition, certain industries have a stronger presence in some countries than in others. Some of these industries (like renewable energy and agriculture) may benefit from responding to climate change while others (like oil and coal production) will not. This second category of industries can put immense pressure on government officials to make decisions that support the continued use of fossil fuels. Corporations in these industries do this through lobbying, providing funding for political campaigns that align with their interests, threatening to withdraw financial support from individuals or institutions if certain political decisions are made, and carefully crafting advertisements and publicity campaigns.

Communication: Climate change is a tricky issue for scientists, journalists, policy makers, and the general public to talk about. The concept of climate change can be hard to fully grasp because it refers to changes that occur over long periods of time. Because global warming's effects may not be visible from one day to the next, climate change is less easily relatable to people's daily lives and can be easy to ignore or put off until later.

> ***"You will never see a headline that says 'Climate change broke out today.'"***
>
> —Andrew Revkin, *New York Times* reporter, 2007

Furthermore, scientists who study climate change try to think of all the intricate details involved in the systems they study and often use highly specific terminology. As a result, they sometimes struggle to express to the public what the one or two main take-away points of their research are and why their findings matter.

Scientists are also trained to emphasize what they do not yet know and to make all potential uncertainties very clear. Government officials and journalists generally want to hear what scientists *do* know so that these discoveries can help inform important policy decisions. This tension in communication style often makes scientific conclusions about climate change appear less confident in the media than they really are. Scientists' careful explanations of uncertainty get misinterpreted as meaning that they are not sure of their findings. This may be one reason why the broad scientific consensus about the dangers of climate change has been misrepresented.

Finally, climate change is often talked about as having potentially catastrophic effects. Emphasizing the dangerous impacts of climate change can make the issue feel overwhelming and hopeless. If people feel that there is no possible solution to the problem of climate change, they may not be motivated to take action to slow or stop its effects. Thinking carefully about how we talk about climate change and making sure to highlight how much we can do is crucial to keeping people engaged with the issue.

Conclusion

You have read about the causes and effects of climate change, tracing its impacts on areas as varied as health, species migration, agriculture, and international security. You have explored contested understandings of who is responsible for global climate change, who is most vulnerable to its effects, and who has the ability to respond. You have also thought through different types of responses—mitigation and adaptation—weighing the benefits and barriers associated with each.

Climate change is a global issue with locally felt effects. While you have read about the complex web of international climate change conferences and the variety of local actors involved, you will next dive into case studies about how specific communities around the world are experiencing and responding to climate change.

Study Guide—Part II

Vocabulary: Be sure that you understand these key terms from Part II of your reading. Circle terms that you do not know.

vulnerability
responsibility
rural
infrastructure
water scarcity
world markets
develop economically
economic growth
global commons
emissions per capita
Conference of the Parties (COP)
Kyoto Protocol
ratify
National Adaptation Programmes of Action (NAPAs)
emissions restrictions
mitigation
adaptation
energy efficiency
renewable energy
carbon tax
cap-and-trade system
geoengineering
National Adaptation Plans (NAPs)
stakeholders
sustainable development
carbon neutral
manufacturers
subsidies
bargaining power

Questions:

1. Describe the global North and global South. Which continents does each encompass? What level of development and wealth?

   Global North:

   Global South:

2. What does it mean to be vulnerable to something?

3. Give two examples from your reading of how poorer communities or countries are especially vulnerable to the effects of climate change.

   •

   •

4. Circle one: The countries that are most vulnerable to the effects of climate change are the **most / least** responsible for the emissions that cause climate change.

Name:_____

5. Describe the COP meetings. What are they and what is their purpose? Who attends?

6. a. What is the goal of mitigation policies?

b. How do carbon taxes and cap-and-trade systems attempt to achieve this goal?

7. What does adaptation mean?

8. Describe an example of sustainable development.

9. How do nongovernmental organizations work to address climate change?

10. What are the barriers to responding to climate change?

Advanced Study Guide—Part II

1. How do legacies of colonialism affect relations between the global North and global South?

2. How does poverty affect vulnerability to climate change?

3. How is climate change a case of the "tragedy of the commons"?

4. Describe climate justice in your own words.

5. Do you think that responsibility for climate change should be based on current emissions, per capita emissions, or emissions accumulated over history? Provide examples to support your answer.

6. Which barrier to action on climate change do you think could most easily be overcome and why? Which might be most challenging to overcome? Why?

Name:_____

Part II: Responses to Climate Change

Instructions: Use information from your reading to fill in the spaces below. In the bottom half of the sheet, fill in each box with at least two examples.

Vulnerability

What does it mean to be vulnerable to something?

People in the world's forty eight-poorest countries are _____ times as likely to die from climate related disasters as people in wealthier countries.

Responsibility

What are three ways of determining responsibility for climate change?

-
-
-

People in the world's forty-eight poorest countries have emitted only _____ percent of total greenhouse gas emissions.

Mitigation

What is the goal of climate change mitigation strategies?

Adaptation

What is the goal of climate change adaptation strategies?

	Examples of mitigation	Examples of adaptation
Local level		
National level		
International level		

Are Carbon Taxes a Good Idea?

Instructions: Read the following introduction and then read the excerpts from editorials on carbon taxes. Consider how each author might answer the key question, "Are carbon taxes a good idea?" While you are reading, underline two opinions and circle two facts in each article. After reading each source, fill in the "Carbon Tax Graphic Organizer." Once you are finished, answer the "Questions About the Editorials."

Around the world, people rely on the media to keep them informed about the most important issues that affect them and their neighbors. The information provided by the media helps people form opinions and ask tough questions of their governments. In a democracy, where the interests of the public are supposed to define how the government acts, this information is vital to ensuring the country functions well.

With a global problem like climate change, the media plays a particularly important role. It gives ordinary people access to climate science and predictions about climate change and also provides insight into what kinds of policies could be used to address the issue. Editorials or opinion articles play a key role, making a case for or against a certain set of policies. In editorials, writers use various types of evidence to try to convince the readers that their opinion is right. These might include referencing what experts have said, sharing personal stories or anecdotes, making comparisons to historical events, or highlighting data and statistics that back up their points.

The following editorials address the policy of taxing carbon. Putting a tax on carbon emissions is a mitigation policy that aims at making "dirty" energy from fossil fuels more expensive and therefore less economically appealing. Some people believe that this is an effective and fair way to reduce carbon emissions, while others argue that it is pointless, expensive, and damaging to the economy.

Name:_____

Editorials: Source A

"A Carbon Tax that America Could Live With"
by N. Gregory Mankiw

Published in *The New York Times*, August 2013.

N. Gregory Mankiw is a professor of economics at Harvard University. He was an advisor to former U.S. President George W. Bush.

Every day, we all make lifestyle choices that affect how much carbon is emitted. These decisions are personal but have global impact. Economists call the effects of our personal decisions on others "externalities."

The main question is how we, as a society, ensure that we all make the right decisions, taking into account both the personal impact of our actions and the externalities. There are three approaches.

One approach is to appeal to individuals' sense of social responsibility. This is what President Jimmy Carter did during the energy crisis of the 1970s. He encouraged Americans to adjust their thermostats and insulate their homes. I can still picture Mr. Carter sitting in the chilly White House, wearing his cardigan sweater.... But expecting most people to act this way is unrealistic. Life is busy, everyone has his or her own priorities, and even knowing the global impact of one's own actions is a daunting task.

The second approach is to use government regulation to change the decisions that people make. An example is the Corporate Average Fuel Economy, or CAFE, standards that regulate the emissions of cars sold. The President's Climate Action Plan is filled with small regulatory changes aimed at making Americans live more carbon-efficient lives.

Yet this regulatory approach is fraught with problems. One is that it creates an inevitable tension between the products that consumers want to buy and the products that companies are allowed to sell. Robert A. Lutz, the former General Motors executive...says, "CAFE is like trying to cure obesity by requiring clothing manufacturers to make smaller sizes."...

Fortunately, a policy broader in scope is possible, which brings us to the third approach to dealing with climate externalities: putting a price on carbon emissions. If the government charged a fee for each emission of carbon, that fee would be built into the prices of products and lifestyles. When making everyday decisions, people would naturally look at the prices they face and, in effect, take into account the global impact of their choices. In economics jargon, a price on carbon would induce people to "internalize the externality."...

Among economists, the issue is largely a no-brainer. In December 2011, the IGM forum asked a panel of forty-one prominent economists about this statement: "A tax on the carbon content of fuels would be a less expensive way to reduce carbon-dioxide emissions than would a collection of policies such as 'corporate average fuel economy' requirements for automobiles." 90 percent of the panelists agreed.

Editorials: Source B

"Paying for It"
by Elizabeth Kolbert

Published in *The New Yorker*, December 2012.

Elizabeth Kolbert has been a staff writer at The New Yorker *since 1999. Her works include political profiles, book reviews, comment essays, and extensive writing on climate change.*

It's been almost a century since the British economist Arthur Pigou floated the idea that turned his name into an adjective. In "The Economics of Welfare," published in 1920, Pigou pointed out that private investments often impose costs on other people. Consider this example: A man walks into a bar. He orders several rounds, downs them, and staggers out. The man has got plastered, the bar owner has got the man's money, and the public will get stuck with the tab for the cops who have to fish the man out of the gutter. In Pigou's honor, taxes that attempt to correct for this are known as Pigovian, or, if you prefer, Pigouvian (the spelling remains wobbly). Alcohol taxes are Pigovian; so are taxes on cigarettes. The idea is to incorporate into the cost of what might seem a purely personal choice the expenses it foists on the rest of society.

One way to think about global warming is as a vast, planet-wide Pigovian problem. In this case, the man pulls up to a gas pump. He sticks his BP or Sunoco card into the slot, fills up, and drives off. He's got a full tank; the gas station and the oil company share in the profits. Meanwhile, the carbon that spills out of his tailpipe lingers in the atmosphere, trapping heat and contributing to higher sea levels. As the oceans rise, coastal roads erode, beachfront homes wash away, and, finally, major cities flood. Once again, it's the public at large that gets left with the bill. The logical, which is to say the fair, way to address this situation would be to make the driver absorb the cost for his slice of the damage. This could be achieved by a new Pigovian tax, on carbon....

Perhaps because a carbon tax makes so much sense—researchers at M.I.T. recently described it as a possible "win-win-win" response to several of the country's most pressing problems—economists on both ends of the political spectrum have championed it. Liberals like Robert Frank, of Cornell, and Paul Krugman, of Princeton, support the idea, as do conservatives like Gary Becker, at the University of Chicago, and Greg Mankiw, of Harvard.... A few weeks ago, more than a hundred major corporations, including Royal Dutch Shell and Unilever, issued a joint statement calling on lawmakers around the globe to impose a "clear, transparent and unambiguous price on carbon emissions," which, while not an explicit endorsement of a carbon tax, certainly comes close. Even ExxonMobil, once a leading sponsor of climate-change denial, has expressed support for a carbon tax....

Several countries...already have a carbon tax. Were the United States to impose one, it would have global significance. It would show that Americans are ready to acknowledge, finally, that we are part of the problem. There is a price to be paid for living as we do, and everyone is going to get stuck with the bill.

Name:_____

Editorials: Source C

"California Drivers Brace for Costly New Gas Tax"

by William La Jeunesse and Laura Prabucki

Published on FOX News website, August 2014.

William La Jeunesse and Laura Prabucki are correspondents for FOX News Channel, a U.S. news television channel.

Californians already pay the nation's second highest gas tax at sixty-eight cents a gallon—and now it will go up again in January to pay for a first-in-the-nation climate change law.

"I didn't know that," said Los Angeles motorist Tyler Rich. "It's ridiculous."

"I think it's terrible," added Lupe Sanchez, pumping $4.09-a-gallon gas at a Chevron near Santa Monica. "The economy, the way it is right now with jobs and everything, it's just crazy."

When gas prices go up, motorists typically blame oil companies, Arab sheiks, and Wall Street speculators. This time they can blame Sacramento and former Gov. Arnold Schwarzenegger for passing a bill requiring California to reduce carbon emissions to 1990 levels by 2020.

The tax on carbon already raised about $1 billion in revenue by requiring manufacturers and utilities to buy credits for each ton of carbon emitted into the atmosphere. At the beginning of next year, the law will also apply to oil and gas. Refiners and distributors say they will pass another $2 billion in costs on—largely to consumers.

"Ultimately it hurts the consumer," said California Independent Oil and Marketing Association spokesman Mike Rohrer. "It is going to affect anyone who has a vehicle. Be it a motorist that is commuting back and forth to work or a trucker just moving goods throughout the state of California, the cost is immediately going to increase because whatever we have to pay for in carbon credits ultimately we have to pass through to the consumer."

Estimates of the cost of the tax vary. The California Air Resources Board, the Golden State's premier anti-pollution agency, predicts the new tax will raise gasoline prices [by] twenty cents to $1.30 per gallon. A prominent state senator who helped author the bill estimated the cost at forty cents a gallon. Environmental activists downplay the cost, but hail the impact....

By the end of the decade, the state is expected to collect $5 billion in revenue by charging businesses and consumers for the right to pollute. So far the state collected $833 billion by selling "carbon credits" to polluters.

"They have generated close to a billion dollars in revenue just from the carbon tax credit auctions that have been going on for over a year. Where has that money gone?" asked Rohrer.

"And why do we have to tax the consumer to make this happen for clean air? Everyone is for clean air but let's not hurt the consumer in the process and not giving them a full explanation of how this exactly works and why."

Editorials: Source D

"Bring in Carbon Taxes"
by the Dhaka Tribune editorial team

Published in the *Dhaka Tribune*, August 2014.

The Dhaka Tribune *is a Bangladeshi English-language daily newspaper published nationwide from Bangladesh's capital, Dhaka.*

Satellite observations indicate that the rate of loss of the planet's two largest ice sheets in Antarctica and Greenland has more than doubled since 2009.

With evidence growing of the speed of climate change, it is more important than ever for Bangladesh as a nation on the frontline to integrate addressing climate change into all aspects of policy.

The government should move to taxing carbon emissions through levies on the production, distribution, and import of fossil fuels. The main aim will be to reduce the growth of greenhouse gas emissions and bring related benefits by stimulating investment in efficiency and renewable energy.

Income-generated or, just as importantly, taxpayer funds saved from reducing or even eliminating subsidies on fossil fuels could be allocated to improving living standards and supporting adaptation and mitigation projects.

Many existing carbon offset and trading schemes in the leading industrialised nations, which are historically responsible for man-made climate change, are currently being used to subsidise forests within those nations, rather than generating funds to help poorer people in more vulnerable countries. We need to be more pro-active ourselves in addressing the challenges ourselves, rather than waiting for more international support.

Care needs to be taken not to jeopardize living standards for people in rural areas who rely more directly on diesel fuel for their livelihoods.

One way to do this would be to divert subsidies to people affected. Alternatively the tax could be phased in a revenue neutral manner by simultaneously reducing other import duties or levies so that total taxation on consumption does not increase.

Name:_____

Editorials: Source E

"Statement on the State of the Union Address"
by Peabody Energy

Published on Peabody Energy's website, January 2014.

Peabody Energy is the world's largest private-sector coal company. It primarily deals with the mining, sale, and distribution of coal for electricity generation and steelmaking.

Following U.S. President Obama's State of the Union address, Peabody Energy urges the Administration to adopt energy policies that help families and businesses by capitalizing on greater use of coal, America's true all-of-the-above energy advantage.

Coal is the nation's lowest-cost and most abundant energy resource. This past year, coal generation rebounded 5 percent due to its lower costs, while gas generation fell 11 percent.

Affordable energy access is especially important at a time when a record 115 million Americans qualify for energy assistance, 48 million Americans suffer in poverty, and more than half of Americans have said a $20 increase in their utility bills would create hardship.

Peabody also encourages the Administration to rethink its plan around carbon to avoid policies that will further drive up energy costs and create a regressive tax that will hurt those with low and fixed incomes the most.

The path to achieve our economic and environmental goals is continued use of advanced "supercritical" generation. This is the best technology available off-the-shelf and the standard supported by 78 percent of the American people, according to a recent Harris omnibus poll conducted on behalf of Peabody. Every large, new, advanced coal plant delivers the equivalent carbon benefit of removing 1 million cars from the road.

The United States should join leading nations such as Japan and Australia in recognizing the importance of low-cost electricity and the punishing effects of flawed carbon targets on families, businesses, and the economy.

The U.S. carbon-based economy also benefits dramatically from coal, which fuels both the essentials and conveniences of modern society, improving health, longevity, and quality of life. A recent study on the social cost of carbon concludes that the benefits from fossil fuel energy outweigh the so-called cost of carbon by a magnitude of fifty to five hundred times, based on empirical data, not modeled predictions.

Name:_____

Carbon Tax Graphic Organizer

Instructions: Fill in the graphic organizer about each of the editorials. In addition to recording each article's author, publication date, and where it was originally published, include whether each source claims carbon taxes are a good idea, a summary of each article's main argument, and a piece of evidence used by each writer in support of his or her argument.

Source	Are carbon taxes a good idea?	Main argument	Evidence used
Source A Author: _____ Date: _____ Publication: _____			
Source B Author: _____ Date: _____ Publication: _____			
Source C Author: _____ Date: _____ Publication: _____			
Source D Author: _____ Date: _____ Publication: _____			
Source E Author: _____ Date: _____ Publication: _____			

Name:_____

Questions about the Editorials

1. Why does Mankiw (in Source A) think that relying on "individuals' sense of social responsibility" is not a good way to fight climate change?

2. To whom do the authors of Source D think the funds from carbon taxing should go?

3. Who does Kolbert (in Source B) say would bear the expense of carbon taxes? Who do La Jeunesse and Prabucki (in Source C) say would bear the expense?

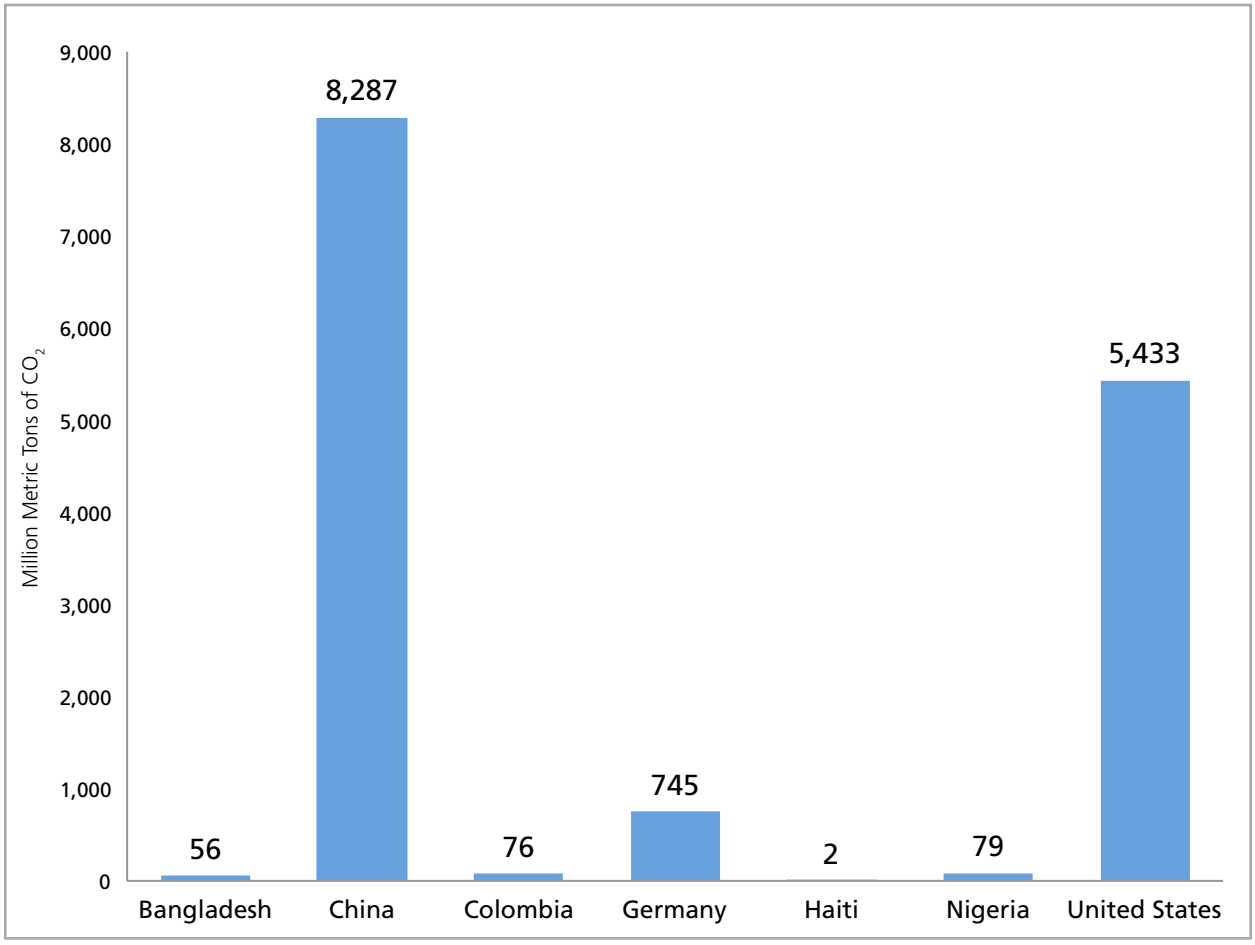
4. In both Source B and Source E, the authors use the word "cost." What does the word refer to in each source? Why do you think the authors chose this word?

5. Where was Source D published? How might this relate to the point of view expressed in the article?

6. How might Peabody Energy's business interests influence its article (Source E)? Why might the company want to convince readers to adopt the opinions expressed in its article?

7. Why do you think some readers might trust the author of Source A (Mankiw) to give them the best guidance on carbon taxes more than they trust the authors of Source B (Kolbert) or Source C (La Jeunesse and Prabucki)?

Total CO_2 Emissions in 2010



1. What information is represented on the x-axis (horizontal axis)?

2. What information is shown on the y-axis (vertical axis)?

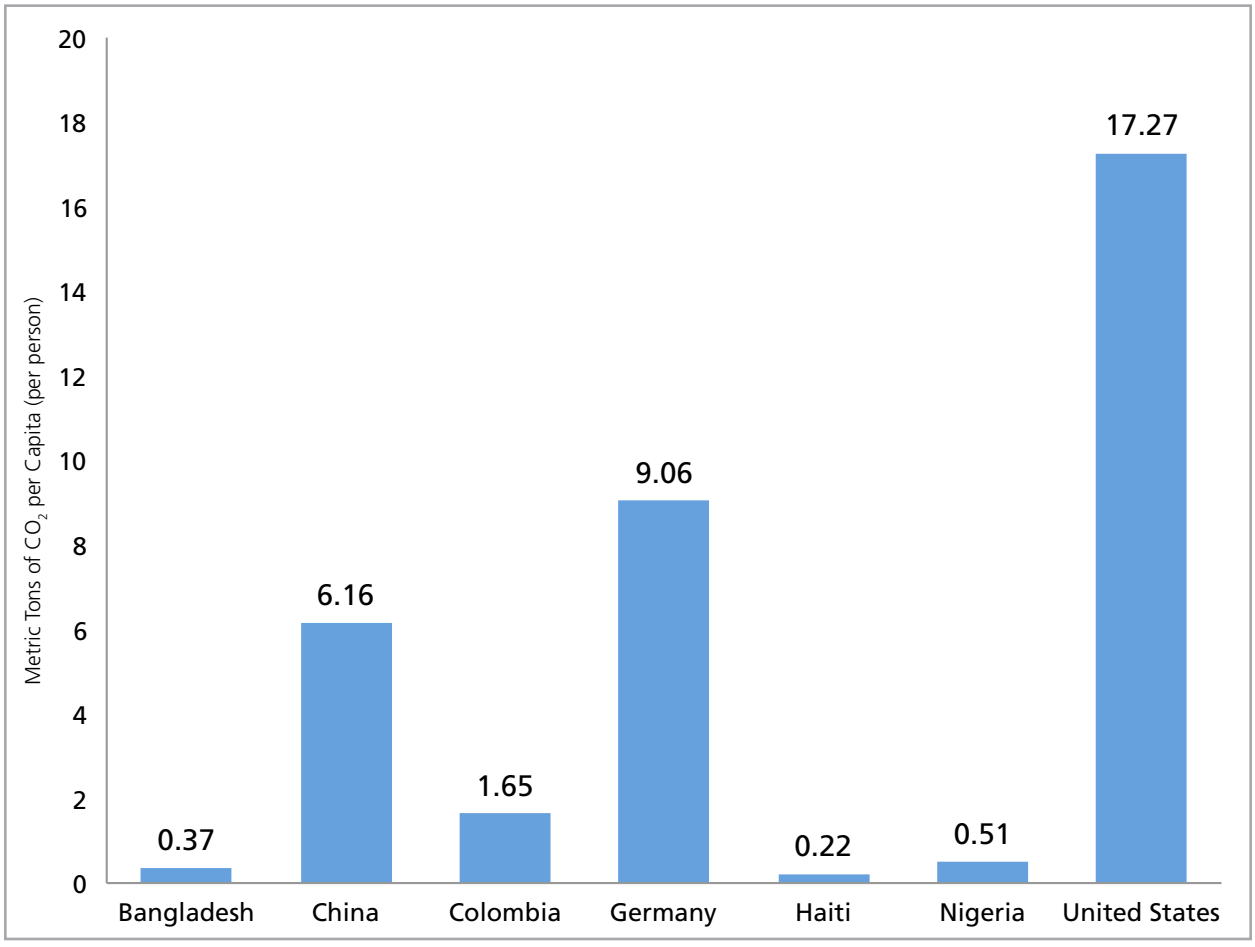
3. Which country emitted the most CO_2 in 2010?

4. How many more million metric tons of CO_2 did China emit than the United States in 2010?

Bonus: Fill in the blank: U.S. emissions are _____ percent of Chinese emissions.
(Hint: divide U.S. emissions by Chinese emissions and multiply by 100.)

Name:_____

CO_2 Emissions Per Capita in 2010



Data from Carbon Dioxide Information Analysis Center (CDIAC). Graph by the Choices Program.

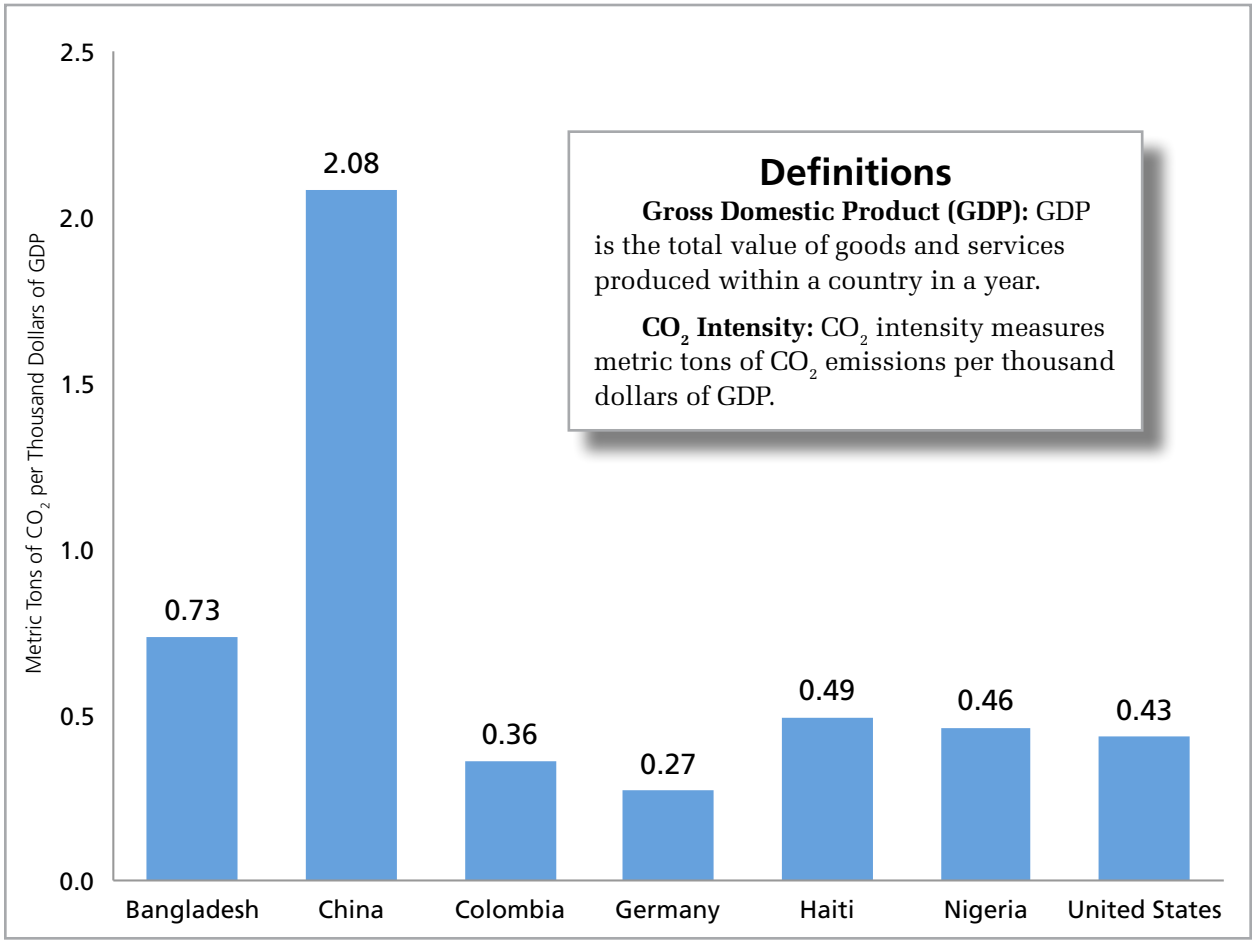
1. What information is represented on the x-axis (horizontal axis)?

2. What information is shown on the y-axis (vertical axis)?

3. Fill in the blanks. Germany emitted _____ metric tons of _____ per person in 2010.

4. Which country emitted the most CO_2 per person in 2010?

CO_2 Intensity in 2010



Data from Carbon Dioxide Information Analysis Center (CDIAC). Graph by the Choices Program.

1. Which country has the highest level of CO_2 intensity?

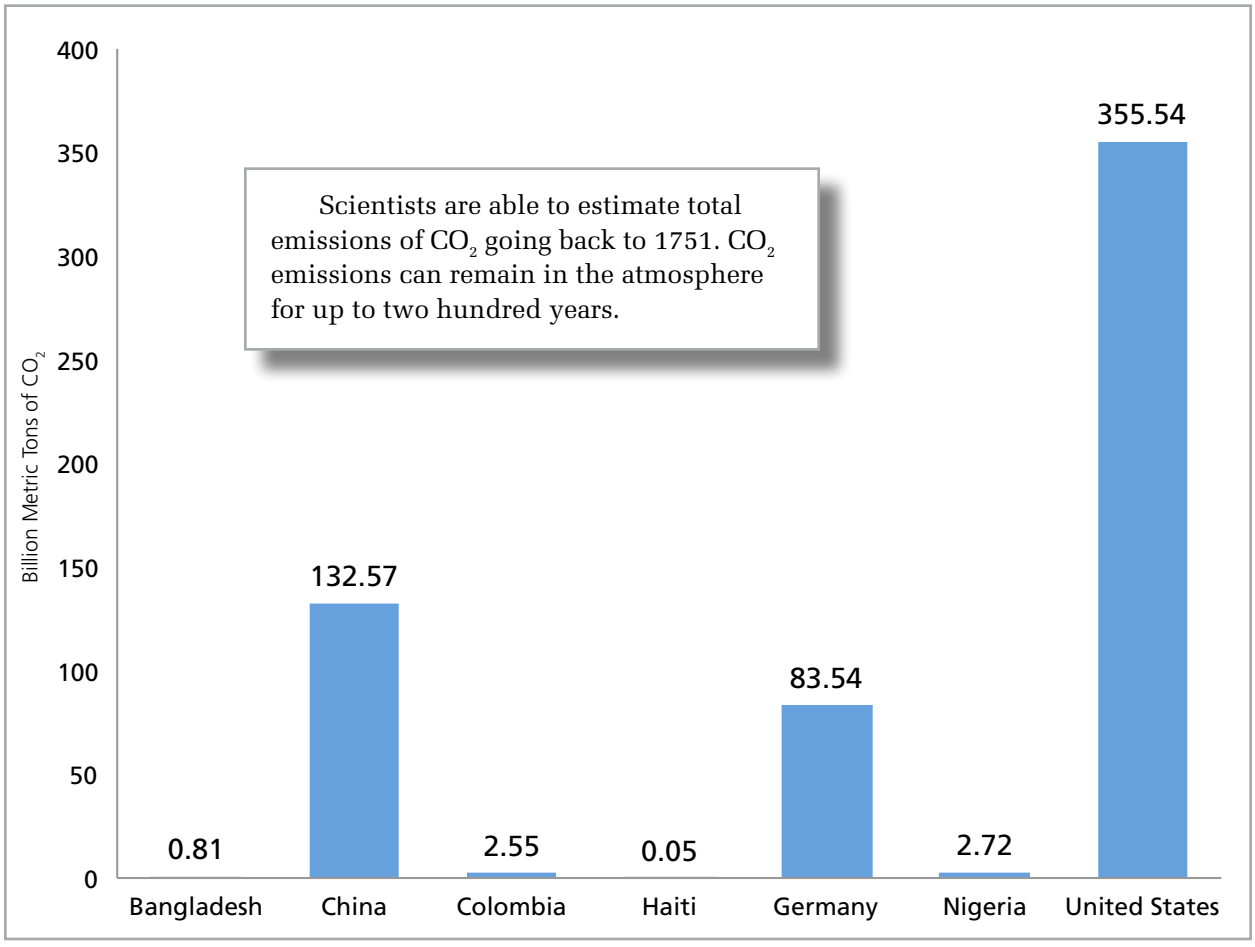
2. Fill in the blanks: Bangladesh produces _____ metric tons of CO_2 for every _____ dollars of GDP.

3. Why might a country have a high level of CO_2 intensity?

Bonus: Fill in the blank: The U.S. has high emissions levels and a high GDP. This graph shows that the U.S. and Haiti have similar CO_2 intensities. The graph of total CO_2 emissions by country shows that Haiti has low emissions levels. Given this information, Haiti's GDP must be _____. Briefly explain your reasoning. (Hint: Refer back to the definition of CO_2 intensity and how it is calculated.)

Name:_____

Historical Emissions of CO_2 through 2010



1. Which country has the highest level of historical CO_2 emissions?

2. Approximately how many more billion metric tons of CO_2 has the United States emitted than China?

3. Give a one sentence explanation of why you think Bangladesh's historical CO_2 emissions are nearly undetectable on this graph.

Part III: Case Studies

The case studies you are about to read are not meant to be exhaustive or comprehensive. They are designed to highlight a range of effects climate change has on people and places around the world and to explore various methods of response.

Each case study includes a table with basic information about the country covered (for those that focus on cities or states, information about the specific regions are included in the text of the case). You will be given the population of each country and its gross domestic product (GDP) per capita. GDP per capita is an estimate of the economic output per person within a country and gives a sense of a country's economy and its citizens' incomes. A higher GDP per capita generally means the population of that country is more wealthy and the government has more money for pursuing various policies. A lower GDP per capita, on the other hand, suggests a poorer population with limited government funds.

In addition to population and GDP per capita, the table for each case will show the average person's life expectancy and the carbon dioxide (CO_2) emissions per capita (per person) in that country. Use the information in these tables as you consider each case and compare it with others. As you read, keep these questions in mind:

- What might be the priorities of the people living in each country?
- To what degree is each country responsible for the greenhouse gas emissions that are warming the planet?
- Which effects of climate change might be of greatest concern to each country?
- To what extent can each country respond to the effects of climate change?
- Who are the people driving efforts to respond in each place?

After reading these case studies, you will begin to consider what responses to a changing climate, both locally and internationally, you believe to be most fair and effective.

California, United States

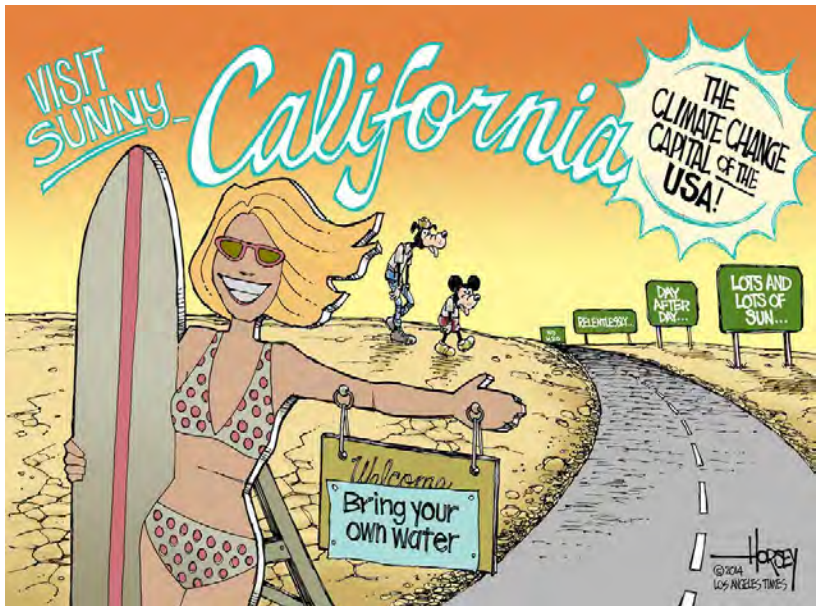
The story of California's 2006 Global Warming Solutions Act provides a window into climate change mitigation politics.

With over thirty-eight million people, California has the highest population of any U.S. state. If it were a country, its economy would be eighth largest in the world. Both of these factors contribute to California's ability to influence the rest of the United States, helping it set policy trends that the rest of the country may soon follow. Californians have a history of being interested in environmental issues. This public support has helped the state lower its emission levels (California emits 9.9 metric tons of CO_2 per capita, while the U.S. average is almost double that amount). Looking more closely at California can help us see how mitigation policies can be established more locally than at the international level.

United States	
Population	316.1 million
GDP per Capita	US$53,143
Life Expectancy	79 years
CO_2 Emissions per Capita	17.6 metric tons

How is California experiencing climate change?

California Governor Jerry Brown recently called California the "epicenter of climate change." The state is experiencing a suite of climate change's effects—flooding, lower crop yields, extreme heat, drought, and wildfires—which are expected to worsen in the coming century.



About thirty-two million people live in California's coastal cities, which are highly vulnerable to climate change. Many of these cities are important shipping hubs that bring critical goods to the United States. Sea level rise associated with global warming will increase the risk of flooding and damage to highways, power plants, airports, and other infrastructure along California's coast. California also produces 99 percent of the United States' almonds, artichokes, figs, grapes, kiwis, olives, and numerous other crops. Changes in water supply and temperature related to climate change will reduce crop yields in the state and affect the many farming communities that depend on agriculture for work.

In addition, California is already prone to drought, and climate change may make future droughts more intense. Bitter political conflicts have erupted within the state as well as between California and its neighbors about how scarce and precious water resources should be shared. An extreme drought has already caused tens of thousands of farm workers to lose their jobs and has cost the agriculture industry well over a billion dollars. Hot, dry conditions also increase the risk of wildfires, which can destroy people's homes. Some experts predict that the area of land in California affected by wildfires will increase by over 70 percent in the next hundred years.

Loco Steve (CC BY 2.0).

Climate change is affecting agriculture in California, which grows much of the United States' fruits and vegetables. Water shortages from more intense droughts could threaten farmers' ability to water their crops.

How is California responding to climate change?

California has taken the lead on climate change mitigation within the United States. In 2006, California passed a law called the Global Warming Solutions Act, which requires that by 2020, the state reduce its greenhouse gas emissions to the levels they were in 1990. If California meets this goal, its 2020 emissions would be nearly 30 percent less than they would have been without the law, bringing the state close to what the Kyoto Protocol would have required.

The law also includes plans for a statewide cap-and-trade system for major emitters, one of the first in the United States. This program is seen as a

"test case" as to whether a cap-and-trade system can successfully curb emissions without hurting the economy. Environmental regulations in California have influenced national policies in the past. If the program is successful, some say it will increase the chance that the United States could adopt a similar program nationally.

Bob Nichols, USDA. 20131030-FS-RBN-211.

U.S. Forest Service Chief Tom Tidwell (left) and Smokey Bear (right) honoring then Governor of California Arnold Schwarzenegger (center) for signing and implementing California's Global Warming Solutions Act of 2006.

Establishing California's Global Warming Solutions Act was not easy. Even after the law was passed, it was nearly overturned. Oil companies, even those from other states, funded much of the opposition to the law. These companies claimed their disapproval was fueled by concern that the law would cause many Californians to lose their jobs. But many others, including California's governor at the time, believed the companies were worried that their own profits would suffer under the law.

> ***"Does anyone really believe that these companies, out of the goodness of their black oil hearts, are spending millions and millions of dollars to protect jobs?... It's not about jobs at all, ladies and gentlemen. It is about their ability to pollute and thus protect their profits."***
>
> —Former Governor of California Arnold Schwarzenegger, 2010

Oil companies were not the only groups that resisted. Some environmental groups were concerned that the cap-and-trade system did not put strong enough limits on emissions. They feared that it would be ineffective in mitigating climate change and that it would not do enough to stop oil companies from polluting areas where many poor people live. Despite so much controversy, the law remained in effect, and California implemented its cap-and-trade system in 2013.

By 2020, experts say the state's cap-and-trade program will be generating $5 billion per year (as companies purchase emission permits). California plans to put this money towards other climate change mitigation and adaptation projects, and at least 25 percent of the money will go towards programs that benefit poor communities. The state has also partnered with the Canadian province of Quebec, linking their cap-and-trade systems together, and plans to continue joining with other programs.

California continues to push forward in climate change mitigation. In January 2015, Governor Brown announced a new goal for the state, calling for 50 percent of its energy use to come from renewable sources by 2030. Even though California is not a national government, the state is providing a model for mitigation on a national and international scale.

China

China's recent and rapid development demonstrates how economics influences both vulnerability to and responsibility for climate change.

China	
Population	1.4 billion
GDP per Capita	US$6,807
Life Expectancy	75 years
CO_2 Emissions per Capita	6.2 metric tons

The People's Republic of China is the world's largest country by population size and the second largest by land area. The vastness of the country means that there is huge variation in culture, living standards, and environmental conditions across provinces.

For more than thirty years, China's economy has been steadily growing, which has drastically reduced poverty. At the same time, there has been a rise in inequality between China's rich and the country's poor. The case of China illustrates the impact of economics on both vulnerability to and responsibility for climate change.

How is China experiencing climate change?

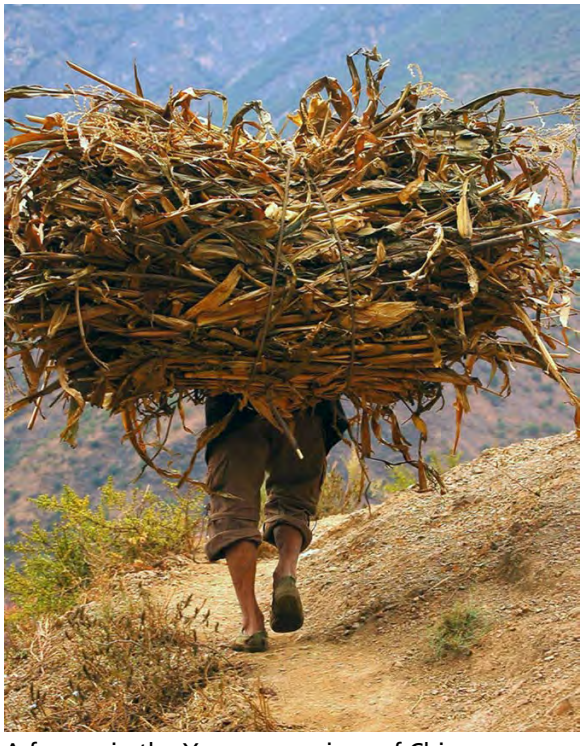
The impacts of climate change in China are often overlooked in the local media and in political discussions. Nevertheless, climate change affects China in many important ways; the country faces risks of flooding, extreme weather, and food and water scarcity. Some scholars have even claimed that China is the country most vulnerable to the effects of

This map shows China's population density (how many people live in each square kilometer of territory). China has the highest total population of any country in the world, and much of its population is concentrated along the coast.

climate change. China's meteorological administration has said that in parts of the country, the speeds at which temperatures are rising have consistently topped the global average.

Dramatic temperature increases mean that people in China can expect to experience severe social effects of climate change. Some of the most densely populated cities in the world are situated along China's coast. The city of Shanghai, for example, has a population density of more than 9,900 people per square mile (far exceeding Los Angeles' population density of 8,200). In addition, the rural areas surrounding these coastal cities have much larger populations than inland areas towards the west. Because of the concentration of people living along the coast, sea levels rising by only one meter could displace sixty-seven million people when their homes are flooded (more people than the entire population of the United Kingdom).

China's strict residential laws (known as the *hukou* system) that restrict the ability of people to migrate could make this even more devastating. In particular, it is very difficult to move from rural areas in the countryside into a city. Rural residents are much poorer than those who live in the cities, and most do not have the opportunities to earn a living other than through farming. As a result, these people are hard-hit by crop failures caused by extreme weather or changes in the lengths of seasons. In the countryside, a lack of hospitals and other services and infrastructure means that rural residents find it extremely difficult to recover from the effects of climate change. These factors, combined with how difficult it is for people to leave rural areas, make China's rural population especially vulnerable to the effects of climate change.



Frog and Onion (CC BY 2.0).

A farmer in the Yunnan province of China.

How is China responding to climate change?

Despite China's vulnerability to many dangerous effects of climate change, the Chinese government has been reluctant to commit to strong mitigation agreements. This is because China's economy is dependent on manufacturing that requires a great deal of energy and that relies largely on coal. Until recently, China was a very poor country, and it is still using the rapid growth of its industries to relieve poverty. Promising to reduce emissions from fossil fuels might slow China's economic growth.

China's reluctance to increase its mitigation efforts have had international consequences. For example, the main reason that the United States refused to ratify the Kyoto Protocol was that the treaty did not require emissions reductions from countries in the global South, like China and India.

> ***"We still have 150 million people living below the poverty line and we therefore face the arduous task of developing the economy and improving people's livelihood. China is now at an important stage of accelerated industrialization and... we are confronted with special difficulty in emission reduction."***
>
> —Former Chinese Premier Wen Jiabao, 2009

In fact, China currently emits the most greenhouse gases of any country, accounting for about 30 percent of the world's CO_2 emissions. This is partially because it has a large population; the amount of greenhouse gas emissions per person in China is actually less than half that in the United States.

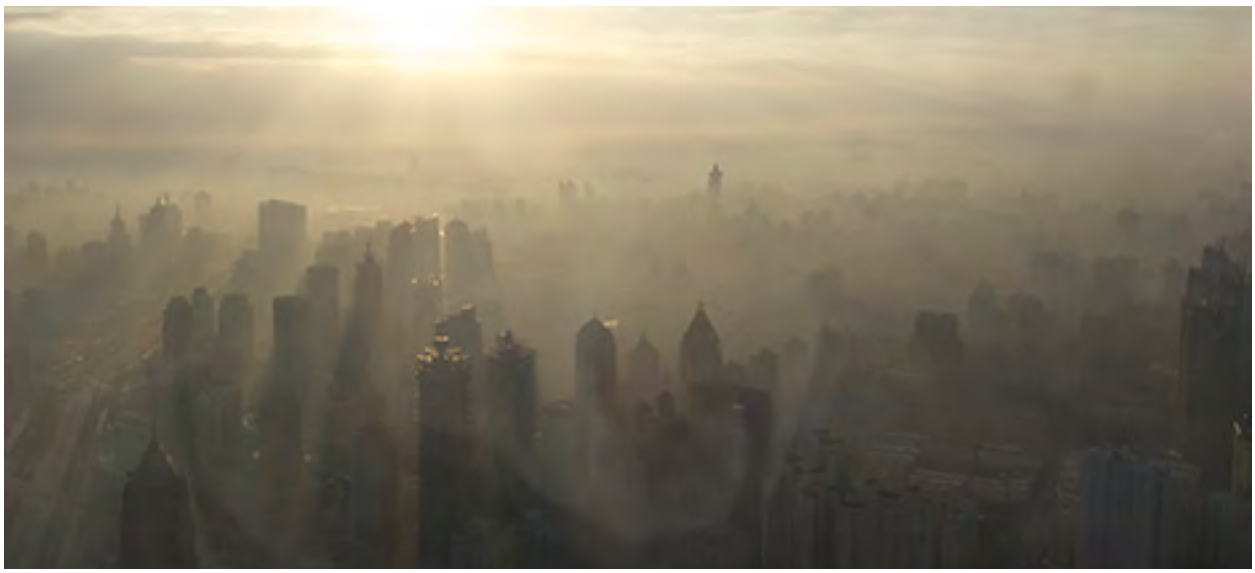
China's status as the "factory of the world" also contributes to the country's high emissions levels. Many of the products used across the world are manufactured in China, so some claim that emissions have been "exported" to China. This means that despite China's position as the biggest emitter, it may not be the most responsible for climate change because it is merely emitting gases on behalf of the countries that are buying its goods.

But China is starting to show greater interest in reducing its dependence on fossil fuels. In November of 2014, Chinese President Xi Jinping announced a joint emissions reduction agreement with U.S. President Obama. This represents China's first ever commitment to cap its CO_2 emissions. Many believe this agreement is an important step in setting the stage for international climate talks in 2015.

In addition, China is showing an increasing interest in alternative energy. The country has become the world's leading investor in renewable energy technology both at home and abroad. China now produces more wind turbines and solar panels than any other country. China wants to be at the forefront when renewable and zero-emissions energy sources become more widely used globally. Its goal is to grow economically by providing all of the technology for this type of energy.

Michael Mandiberg (CC BY-SA 3.0).

Furthermore, China has an interest in reducing its use of fossil fuels like coal because they are causing thick smog in many Chinese cities. This smog makes people sick, reduces tourism, and makes the public frustrated with the government. China is already experimenting with some cap-and-trade schemes in cities suffering from smog problems and has announced its intentions to shut down all coal plants in Beijing by 2016. China is beginning a policy transformation that will improve the prospects of the global fight against climate change.



BriYYZ (CC BY-SA 2.0).

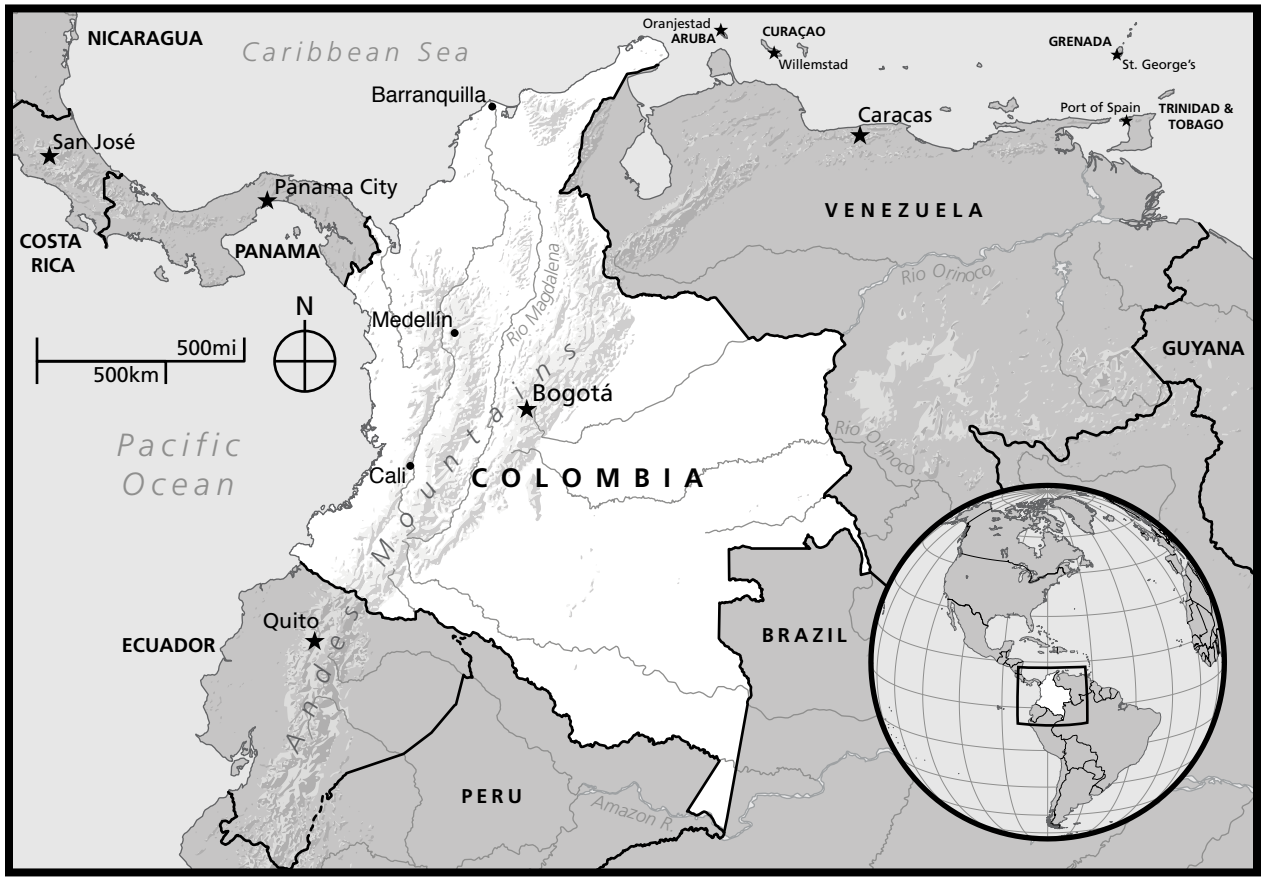
Thick smog blanketing the city of Shanghai.

Colombia

Shifting distributions of malaria cases in Colombia that are closely tied to temperature show how climate change could affect human health.

Colombia	
Population	48.3 million
GDP per Capita	US$7,826
Life Expectancy	74 years
CO_2 Emissions per Capita	6.2 metric tons

Colombia was part of a territory under Spanish colonial rule until it gained its independence in 1819. Throughout the nineteenth century, this territory broke up into multiple smaller countries until the Republic of Colombia as we know it today emerged in 1903. Colombia is now the fourth largest country in South America by land area, and it has the third largest economy in the continent, though a large portion of its population lives in poverty. The country has highly varied geography, with densely populated mountainous regions in the northwest, tropical rainforests that are home to many different plant and animal species in the southeast, and low-lying coasts on both the Pacific and Atlantic Oceans. Its economy is based on exporting goods like coffee, sugar, and bananas as well as oil and coal production (it is the fourth largest coal exporter in the world). Despite political instability and violence associated with the drug trade, Colombia's economy is quickly growing and it is becoming a more important player on the global stage. Studying how climate change affects Colombia can help us better understand how climate change affects human health.



McKay Savage (CC BY 2.0).

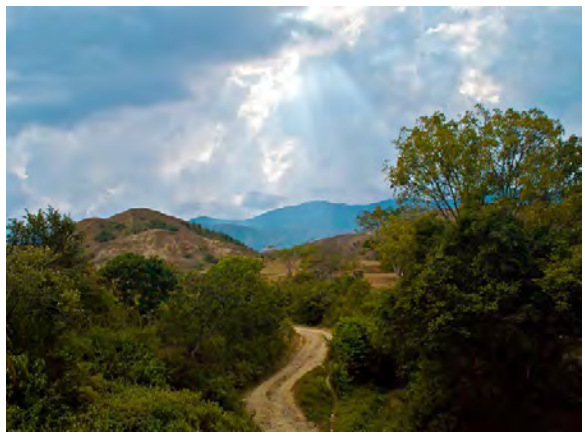
Colombian coffee is known as some of the best in the world. Certain types of Colombian coffee beans need to be hand-picked and hand-sorted, which makes it possible for small family farms to compete in the international market. Coffee plants are very sensitive to climate conditions, and climate change may be increasing the prevalence of disease among the plants.

How is Colombia experiencing climate change?

Because of the diversity of landscapes present in the country, Colombia is experiencing a wide range of climate change's effects. Between 1990 and 2000, increasing temperatures shrunk the glaciers (large masses of ice) in the Colombian Andes Mountains by over 80 percent, and the glaciers are continuing to melt even more quickly. From 2002 to 2007, Colombian glaciers shrunk, on average, by three square kilometers each year. At this rate, experts project these glaciers to completely disappear between 2010 and 2020. This affects the amount of water available for drinking and farming as well as for electricity generation (almost 80 percent of the electricity produced in Colombia is from hydropower). In addition, like in many other coastal countries, flooding from sea level rise could displace many people and cause huge losses in the croplands that are vital to Colombia's economy.

Colombia may also experience some of the health effects of climate change. About 18 percent of Colombia's population is at risk of malaria infection, a disease that affects over 300 million people around the world each year. Malaria can be deadly if not treated quickly, and in many parts of the world, malaria medicines are no longer effective to treat it. A certain type of mosquito spreads the parasite that causes the disease, and where these mosquitoes are able to live is highly dependent on climate conditions. While the environmental factors that determine where mosquitoes live are highly complex, both the malaria parasite and the mosquitoes that carry it generally thrive in warm temperatures.

For decades, the disease has been present only in the country's lower elevation regions, and its overall prevalence has even decreased throughout the country. Nevertheless, as temperatures have risen over the past few decades, more cases of the disease have emerged at higher elevations. With warming temperatures, the mosquitoes that spread malaria may be able to live in the higher, traditionally cooler, areas of the country—bringing malaria to those regions where it had not been common before. This means that climate change may put the dense populations of Colombia's mountainous regions at greater risk of malaria.



javierg0190 (CC0 1.0 via Pixabay).

A rural road in Colombia. Colombia has a highly varied landscape with the Andes mountains, lowland coasts, and tropical rainforests.

James Gathany, Centers for Disease Control and Prevention's Public Health Image Library. ID #7861.

Certain types of mosquitoes, called Anopheles mosquitoes, can carry the malaria parasite and spread the disease to humans.

"Our latest research suggests that with progressive global warming, malaria will creep up the mountains and spread to new high-altitude areas."

—Menno Bouma, London School of Hygiene & Tropical Medicine, 2014

How is Colombia responding to climate change?

Before the mid-2000s, Colombia focused primarily on climate change mitigation projects that were also seen as economic opportunities. For example, it participated in programs that allowed wealthier countries to assist with projects, like new fuel-efficient bus systems, to reduce greenhouse gas emissions in Colombia. These projects helped Colombia pursue sustainable development while also helping wealthier countries reach their emissions reductions goals to prevent continued global climate change.

Colombia's response to climate change has recently shifted. In 2010 and 2011, the country experienced devastating rainfall, flooding, and cold from a cyclical climate condition called La Niña, which shifts ocean and air temperatures in the southern Pacific into a roughly ten month cold phase. The intense flooding affected four million Colombians and caused more than US$7 billion in damages related to loss of livestock, homes, and infrastructure. It is not clear how La Niña (and its warmer counterpart, El Niño) is linked to global warming, but the extreme weather made people in Colombia more concerned about the effects of a changing climate. After this environmental disaster, Colombia shifted its focus to adaptation. This is similar to various other countries in South America, like El Salvador and Uruguay, where recent climate-related disasters led government officials and the public to pay more attention to climate change.

"Colombia is not a country with high polluting emissions, but we want to assume our responsibility with the planet and its future."

—Colombian President Juan Manuel Santos, 2010

Colombia has now made climate change adaptation a national priority. Policies to combat the effects of climate change are integrated into many country-wide plans and projects. For example, Colombia created an Adaptation Fund to help farmers recover from the damaging effects of the 2010-2011 La Niña, and it is working on writing a National Adaptation Plan for the UNFCCC. In addition, as part of the Colombian National Pilot Study of Adaptation to Climate Change, the country has increased its malaria monitoring and prevention efforts. Colombia has recently developed new maps, mathematical models, and early warning systems to help plan for changes in patterns of malaria exposure. Collaboration between government ministries that focus on climate and those that focus on malaria is increasing. Because of these efforts, Colombia has become internationally recognized as a leader in South America on climate change issues.

Freiburg, Germany

Careful city planning and changes in lifestyle in the city of Freiburg show what is possible when a highly developed urban community prioritizes reducing its emissions.

Germany	
Population	80.6 million
GDP per Capita	US$45,085
Life Expectancy	81 years
CO_2 Emissions per Capita	9.1 metric tons

Freiburg is a wealthy city in the southwest of Germany that is home to many university professors. Nearly 12,000 of its 229,000 citizens work in environmental management or environmental science, including renewable energy research. With the average income in Freiburg almost 30 percent higher than the rest of Germany, the city generally has a high standard of living and has become internationally known for its environmentally friendly practices. For example, per capita CO_2 emissions from transportation in Freiburg are only 29 percent of the U.S. average.

Because Freiburg was heavily bombed during World War II, it had to rebuild much of its infrastructure after the war ended. This means that many of the buildings and roads in Freiburg today were constructed relatively recently, some with environmental concerns in mind. Freiburg serves as an example of how carefully-thought-out city planning can enable changes in lifestyle and make possible a highly developed urban community without harmful greenhouse gas emissions.

Andrew Glaser (CC BY-SA 3.0).

The "Solar Settlement" is a residential area in the Vauban quarter of Freiburg that uses solar panels to produce more energy than it uses. All the homes in this community are carbon neutral.

How is Freiburg experiencing climate change?

With over 1,800 hours of sunshine each year, Freiburg is one of the hottest, sunniest locations in Germany. Climate change is expected to increase the risk of heat-related health problems like heat stroke in southern Germany. There also may be more forest fires. In addition, fresh water will become more scarce in the region in the coming century, especially during the summer. On the other hand, Freiburg is within a major wine producing region of Germany, and global warming is expected to help the grape harvest. Overall, these environmental impacts are much less severe and immediate than in many other parts of the world. This makes adaptation less of a priority for the people of Freiburg, allowing them to focus more on mitigation strategies.

How is Freiburg responding to climate change?

Freiburg has worked to minimize its impact on the environment for decades. As early as 1996, city officials declared that Freiburg would strive to reduce its CO_2 emissions by 25 percent by 2010. Although it did not quite meet this goal, the city is now striving for a 40 percent reduction of emissions by 2030. Even more ambitious, it is hoping to become carbon neutral (contributing no additional CO_2 into the atmosphere) by 2050.

"Freiburg should not, nor does it want to, rest on its laurels, content with being a charming, engaging 'feel good city'.... Today, the city is also seen as a model combination of 'soft' ecology and 'hard' economy. Environment policy, solar engineering, sustainability, and climate protection concepts have become the mainstays of economic, political, and urban development."

—City of Freiburg Green City Office

Ken Hawkins (CC BY 2.0).

Riding bicycles is a popular form of transportation in Freiburg.

Cora Went. Used with permission.

Easy access to public transportation in Freiburg makes it possible to have fewer cars in the city.

Freiburg is an international hub for research on renewable energy sources, especially solar. Solar panels are on many buildings—businesses, universities, private homes, churches, city hall, and even the soccer stadium. Some of the city's electricity is also produced by processing trash.

Some sections of Freiburg have gone even further in their efforts to reduce greenhouse gas emissions. The Vauban Quarter is a region of Freiburg built in 1998 that is close to the city center. There are no parking spots on the streets, and many people in Vauban do not have cars (the city has an extensive public transportation system and bikes are very popular). The few people who do have cars must purchase expensive parking spots from one of the two garages in the area. Houses are specially designed to minimize energy needs, and cooperative living is common. This builds community among the residents, many of whom take pride in their environmentally friendly lifestyle.

While Freiburg has taken some dramatic steps towards sustainability, it is just one of many cities across the globe that is trying to reimagine how urban life and the natural world can more harmoniously coexist. This is especially important because by the year 2050, two-thirds of all human beings worldwide will live in cities.

Freiburg is a member of ICLEI-Local Governments for Sustainability, an international association of cities and local governments dedicated to sustainable development. While the ICLEI (International Council for Local Environmental Initiatives) is currently based in Germany, its member cities and towns are spread across the world in over eighty countries. This type of international organization helps create partnerships among cities so they can learn how other places are working towards reducing CO_2 emissions and building greater resilience against the effects of climate change.

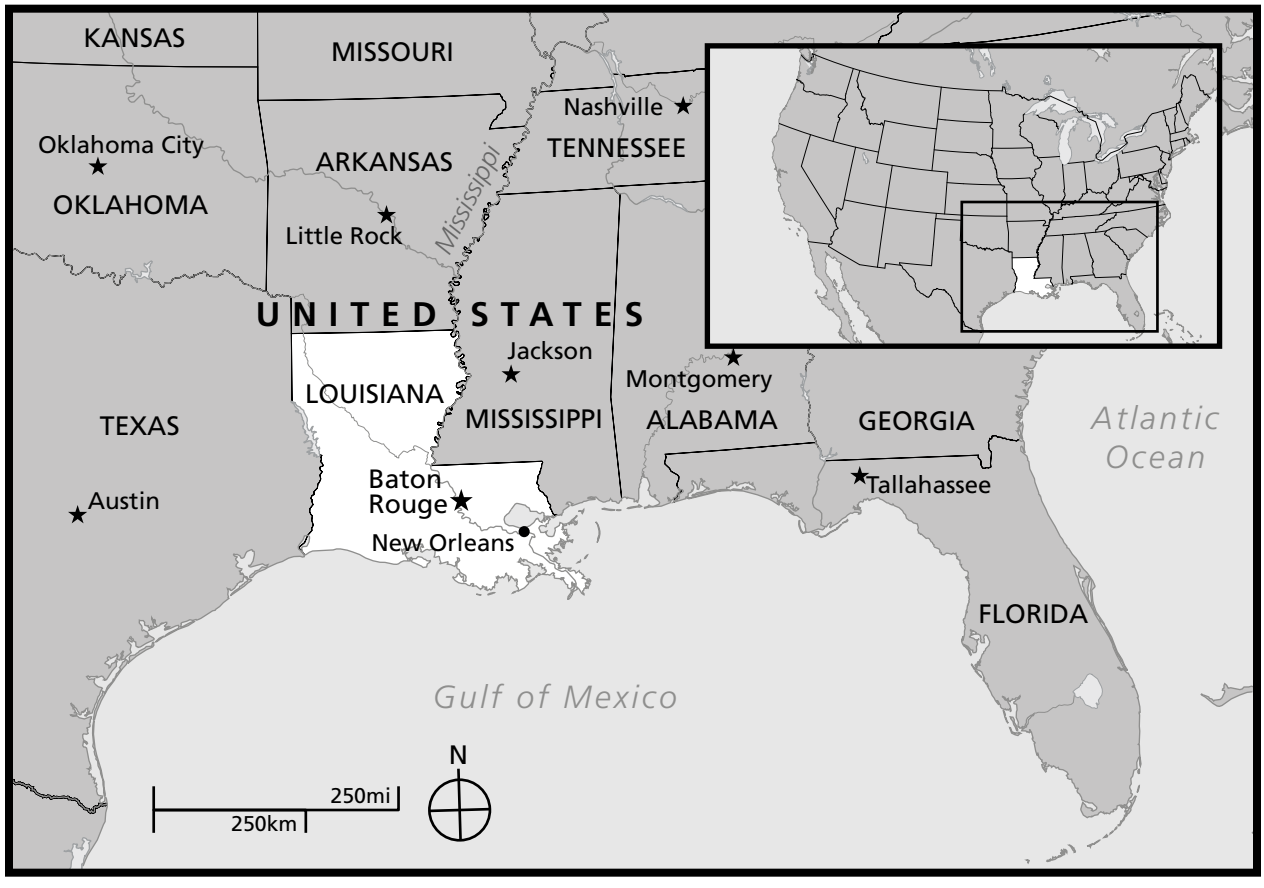
New Orleans, Louisiana, United States

The destruction Hurricane Katrina caused in the city of New Orleans shows the dangers that extreme storms and sea level rise—both associated with climate change—pose to U.S. coastal cities.

United States	
Population	316.1 million
GDP per Capita	US$53,143
Life Expectancy	79 years
CO_2 Emissions per Capita	17.6 metric tons

New Orleans is a major port and Louisiana's largest city, with a population of over 370,000. Located on a delta of the Mississippi River, New Orleans is sandwiched between Lake Pontchartrain to the north and the Gulf of Mexico to the south and east. Much of New Orleans lies several feet below sea level and depends on levees (natural or artificial ridges made of soil and sand that line a body of water to prevent water from overflowing) and floodwalls to keep the city dry.

For years, New Orleans has struggled with high levels of poverty—as of 2012, 29 percent of the population was living in poverty, nearly twice the national average of 15 percent. The city has become deeply segregated based on income with certain neighborhoods housing poorer residents and other neighborhoods housing the wealthy. Looking more closely at how New Orleans is experiencing and responding to climate change shows the dangers U.S. coastal cities face.



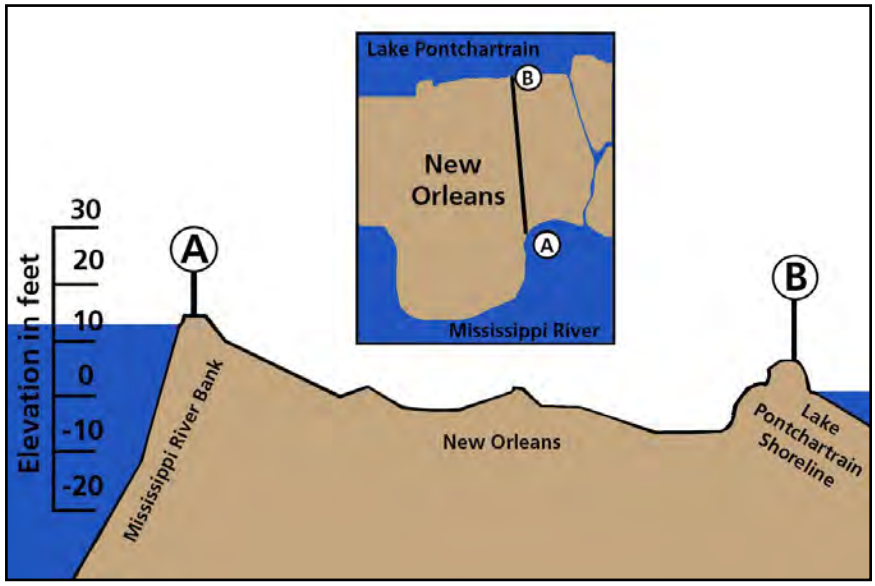
Infrogmation (CC BY 2.5).

A woman walks her dog along the levee next to the floodwall of the 17th Street Canal, which separates the city of New Orleans from the neighboring town Metairie. This photograph was taken a few months after Hurricane Katrina. Repair work to the floodwall on the New Orleans side of the canal is visible in the background on the right.

How is New Orleans experiencing climate change?

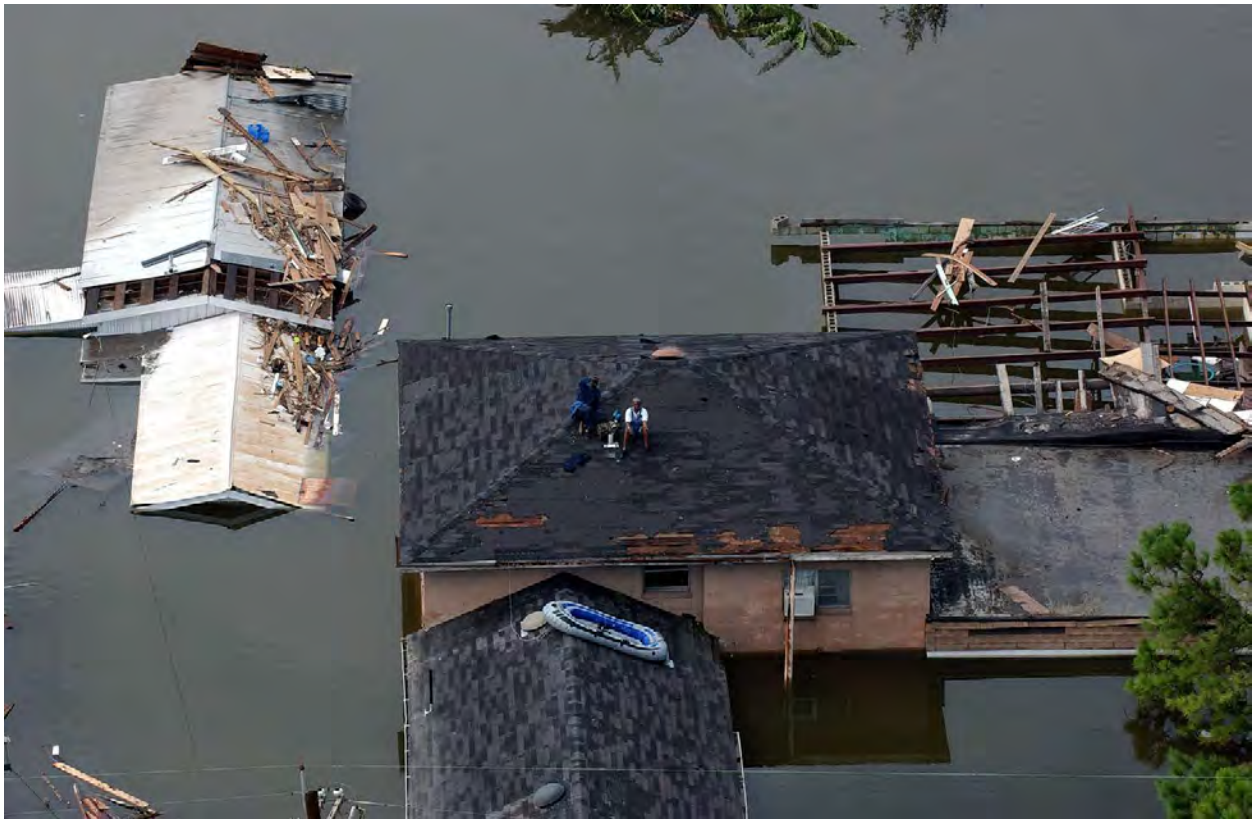
Experts have identified New Orleans as one of the cities in the world most vulnerable to rising sea levels. (Other U.S. cities that are especially vulnerable include New York, Miami, Los Angeles, and Seattle.) Since its founding close to three hundred years ago, New Orleans' coastal location and low elevation have made the city vulnerable to storms and floods. The earliest settlements were built on the higher elevation shores of the Mississippi River, but as the city expanded, people constructed homes at lower elevations. Although the city has a long history of confronting storms and floods, scientists predict that New Orleans will be increasingly threatened by changes in the global climate. Rising sea levels pose a growing challenge for the low-lying city, and scientists project that hurricanes coming off the warming waters of the Gulf of Mexico will be more frequent and severe.

In August 2005, Hurricane Katrina devastated New Orleans. Levees and floodwalls were breached, and water surged into the city. About 80 percent of New Orleans flooded, with some places under more than twenty feet of water. The structural failure of the levee system, coupled with inadequate warnings and insufficient rescue operations, had disastrous effects for residents. The hurricane claimed over 1,800 lives, mostly in the New Orleans area, and forced 1.4 million people to evacuate. Within one month of the hurricane, people from New Orleans were seeking refuge in every state of the country. While Katrina caused intense flooding in most New Orleans neighborhoods regardless of wealth, areas stricken with poverty were least able to cope with the effects of the hurricane.



Original source: Midnightcomm (public domain via Wikimedia Commons). Modified by the Choices Program.

This graphic shows a cross section of New Orleans. Much of the city, which lies between two major bodies of water, is below sea level. While the vertical scale of this image is exaggerated compared to the horizontal scale, it shows how vulnerable the city is to flooding if its levees and floodwalls fail.



Jocelyn Augustino, FEMA.

New Orleans residents wait to be rescued from the roof of their home as floodwaters from Hurricane Katrina surround them. Nearby houses are almost completely underwater.

In poorer areas, people often did not have access to cars or other forms of transportation as the hurricane approached, leaving many stranded and unable to escape.

Although scientists generally do not attribute specific extreme weather events to climate change (and therefore do not say that climate change *caused* Hurricane Katrina), global warming will increase the frequency and intensity of storms like Katrina in the coming century.

> ***"What amazed many worldwide was that these extensive failures, often attributed to conditions in developing countries, occurred in the most powerful and wealthiest country in the world."***
>
> —Community and Regional Resilience Initiative Research Report, 2008

How is New Orleans responding to climate change?

The severity of Hurricane Katrina and the destructive toll it took on the city of New Orleans sparked a national discussion about how to prepare for the city's future in the face of a changing climate. These conversations have largely focused on ways New Orleans can adapt to climate change, as opposed to how it can increase mitigation.

Local and national attention has focused on rebuilding the city to be better prepared for rising sea levels, stronger storms, and changes in precipitation patterns. Efforts include elevating existing buildings by several feet, constructing new escape routes through roofs, and improving emergency response plans. In the years following Katrina, Congress approved funding for multibillion dollar engineering and construction projects to build floodwalls, water pumps, and a chain of levees over one hundred miles long to protect New Orleans from future storms.

While many people have returned to the city, New Orleans' population as of 2013 is only about 80 percent of what it was before Katrina. Many areas of the city remain in ruins as construction and repair projects have been delayed.

> ***"Looking to the future, we must prepare for the unpredictable impact climate change will have on coastal communities like New Orleans.... We who live in the world's deltas or on the edges of great oceans are the most immediate laboratory for innovation and change, and our success or failure will be the symbol for the world's ability to accomplish great things, or not."***
>
> —Cedric Grant, deputy mayor of the City of New Orleans, 2010

The conservation and restoration of coastal wetlands are also important for increasing New Orleans' climate change resilience. For centuries, coastal wetlands (areas of swamps and marshes) provided a natural barrier to storms and flooding for residents of New Orleans. Today, the rate of the loss of wetlands in New Orleans is among the highest in world—an area of wetlands the size of one football field is lost every thirty minutes. Oil and gas industries have destroyed wetlands by dredging canals (deepening canals by scooping out mud and sand from the bottom) and building thousands of miles of pipelines in coastal Louisiana. Levees and dams on the Mississippi River have slowed the flow of sediment from the river that restores wetlands.

Many nongovernmental groups have pressed the state and federal government to do more to halt the destruction of these crucial wetlands, not only for the sake of wildlife, but for the sake of residents in New Orleans and the region. Some strategies would be to plant more cypress trees and marsh grasses along the coast as well as to divert water from the Mississippi River to replenish the wetlands with sediment. However, because these diversions would impact local people and businesses, determining where they should occur is challenging. Without significant action, much of coastal Louisiana could be underwater by the end of the century. This makes clear just how important local adaptation efforts are in the face of international leaders' failure to take strong action against climate change.

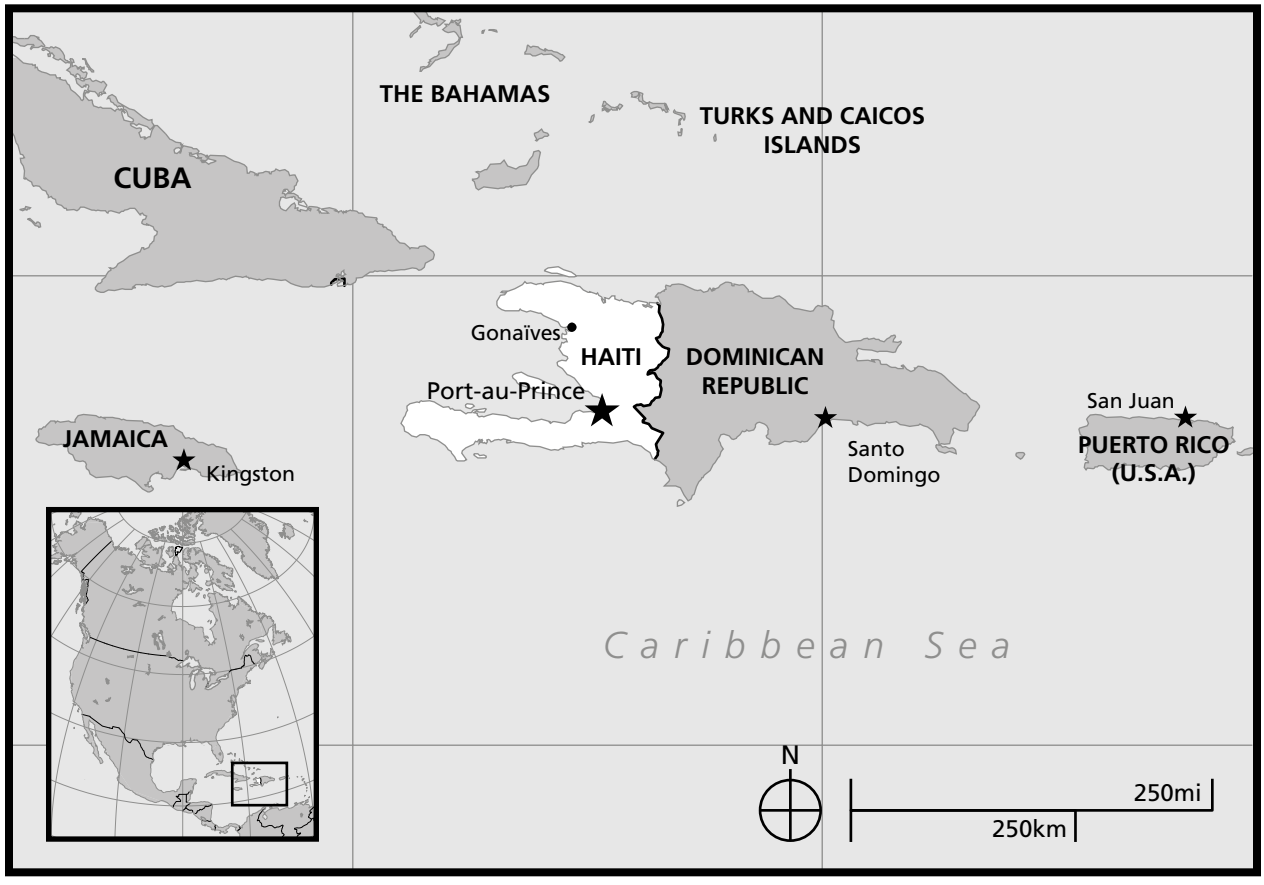
Haiti

Comparing the impact of Hurricane Jeanne on the Dominican Republic with the devastation it caused in Haiti illustrates how poverty increases vulnerability to climate change and reduces the ability to adapt.

	Haiti	Dominican Republic
Population	10.3 million	10.4 million
GDP per Capita	US$820	US$5,826
Life Expectancy	63 years	73 years
CO_2 Emissions per Capita	0.2 metric tons	2.1 metric tons

Haiti is one of two separate countries that occupy the island of Hispaniola in the Caribbean Sea. Haiti was a French sugar plantation colony populated largely by slaves that won its independence from France in 1804. The second country, the Dominican Republic, was a Spanish colony for three hundred years and became independent from Spain in 1820. Although these countries share the same island and have populations of around ten million people each, there are major differences between the two.

One of the most important differences is that Haiti is a much poorer country than the Dominican Republic. Nearly 60 percent of Haiti's population lives on less than $1.25 a day, compared to under 3 percent of the population in the Dominican Republic. Comparing Haiti and the Dominican Republic helps show how poverty increases vulnerability to extreme weather events and other effects of climate change. In addition, the case of Haiti illustrates how poverty can limit the capacity to adapt to climate change.



How is Haiti experiencing climate change?

Sharp differences in the effects of extreme weather on Haiti and the Dominican Republic show how poverty can contribute to vulnerability of the population. The location of the island of Hispaniola in the Caribbean Sea places it in the path of hurricanes and tropical storms. Climate change contributes to more intense storms that come with strong winds and high levels of rainfall. When a powerful hurricane named Jeanne tore over the island in 2004, it killed more than three thousand people in Haiti but only about twenty-five people in the Dominican Republic. Flooding caused many of the deaths in Haiti. For more than thirty hours, torrential rains and walls of mud poured down Haiti's steep hillsides and collected in rivers that gushed into the city of Gonaïves where many of the deaths occurred.

Sophia Paris. UN Photo #49043.

A woman stands in front of her home in Gonaïves, Haiti three days after Hurricane Jeanne. Many homes in Haiti are poorly built, crowded together in unsafe locations, and lack basic infrastructure like electricity and plumbing. Haiti's government does not have enough capacity to respond to disasters and depends heavily on international assistance.

The storms destroyed crops, contaminated water supplies, and left more than 250,000 people in Haiti homeless.

There is a direct link between poverty and the amount of damage that occurred in Haiti during Hurricane Jeanne. It is because of this link that people in Haiti were more vulnerable than those in the Dominican Republic. Haiti's steep and hilly terrain was once covered with trees and rainforests that absorbed the rain and reduced the threat of mudslides caused by tropical downpours. Today, Haiti is largely deforested because trees are used as the leading source of energy. Haitians have cut down 98 percent of Haiti's trees to use as fuel for cooking, to sell as charcoal in Haiti's cities, or even to export.

Fred W. Baker III, Department of Defense.

A Haitian child carrying a food aid package from the U.S. military, which provided disaster relief after an earthquake hit Haiti in 2010.

Kendra Helmer, USAID.

A farmer growing cabbage in Haiti, where 60 percent of the population works in agriculture.

This deforestation has put hillsides at greater risk of soil erosion and the kinds of flash flooding that led to the deaths of so many people during Hurricane Jeanne. In contrast, because of the availability of electricity and other fuel sources in the Dominican Republic, the people there do not rely on harvesting trees for energy and do not face the same problems from deforestation.

> ***"The crucial thing, because we're a country facing both an energy security crisis and a food security crisis, is how can we reconcile energy security and food security?"***
>
> —Gael Pressoir, Haitian nonprofit founder and business owner, November 2009

Constant erosion of fertile soil in Haiti makes planting trees to reforest the land more difficult. In addition, the fact that most farmers do not own the land they farm means that they often have little incentive to build embankments or to plant and protect trees to limit erosion and flooding. As erosion worsens, farmers face more challenges because the best soil has been washed away.

Farmers will also have to contend with other effects of climate change. Rising sea levels will lead to increased storm surges of salt water in low-lying agricultural areas. This salt water can contaminate fresh water sources and damage soil, making growing crops more difficult. Furthermore, higher temperatures and greater variation in rainfall patterns in Haiti have already led to more droughts during the dry season and more intense rain during the rainy season. These changes present challenges to farmers who lack information about new rainfall patterns and struggle to adapt to changing growing seasons.

Looking to the future, reduced agricultural production due to climate change is one of the most serious issues facing Haiti. Haiti's economy depends on farming and about 60 percent of Haitians work in agriculture. Damage to

Haiti's farms and crops results in food scarcity and increases in the cost of basic goods for Haitians.

How is Haiti responding to climate change?

Haiti has developed a NAPA (National Adaptation Programme of Action) to address its vulnerability to climate change. But, because it is the poorest country in the Western hemisphere, it needs outside funding to implement the program.

The NAPA prioritizes strengthening the Haitian government's ability to anticipate and respond to the effects of climate change. For example, improving disaster preparedness is crucial, as is providing access to clean water sources and electricity. Other goals include reducing vulnerability to flooding through forest restoration, educating farmers about climate change and improving agricultural practices, and improving living standards in rural areas. Ultimately, the most ambitious goal is to relieve poverty in order to reduce vulnerability to climate change.

While this process of planning is important, actually implementing a NAPA is particularly challenging in Haiti. Haiti's government struggles to provide even the most basic services to its citizens and depends on the UN, other countries, and many international NGOs for help with climate change adaptation. This creates confusion as different organizations sometimes fail to coordinate their activities or prefer to fund their own adaptation projects rather than those proposed by the Haitian government. Uncertain political conditions in Haiti have at times made international donors reluctant to contribute funds. Other issues also complicate the response. For example, many Haitian farmers, facing more immediate problems like daily hunger, delay learning about and adapting to climate change.

Poverty both makes Haiti more vulnerable to climate change and makes responding more challenging. This creates a tragic cycle that is difficult to break.

Nigeria

Social conditions in Nigeria bring to light how women are especially vulnerable to climate change and that they play an important role in resisting environmental degradation.

Nigeria is a multiethnic, multireligious country in West Africa. It is situated directly south of the Sahel (the transition area between the Sahara Desert and sub-Saharan Africa), and its southern border is located on the coast of the Gulf of Guinea.

Nigeria is one of the top oil producing countries in the world, processing more than 2.5 million barrels of oil a day. This oil has caused a great deal of political conflict in Nigeria. The practices of oil companies like Shell and Chevron in the region have received criticism from local communities, particularly from Nigerian women. Looking closely at Nigeria can help us understand the relationship between gender and responses to climate change.

Nigeria	
Population	173.6 million
GDP per Capita	US$3,006
Life Expectancy	52 years
CO_2 Emissions per Capita	0.5 metric tons

How is Nigeria experiencing climate change?

The geographical variation in Nigeria means that it is vulnerable to a wide range of effects of climate change. In the north, the Sahel region already experiences severe heat and water scarcity. Increasing temperatures will lead to extreme drought and heat-related

Susan Elden, UK Department for International Development (CC BY-SA 2.0).

Women attend a health education session in Northern Nigeria.

illness, driving the people of this region into a state of desperation. In the south, high concentrations of people living along the coast are vulnerable to flooding as sea levels rise. Slums and other inadequate forms of housing are scattered along the most hazardous parts of coastal areas and wetlands. Here, poor people live in constant danger of flooding, particularly as their homes cannot withstand extreme weather. Indeed, poor people in Nigeria face some of the greatest vulnerability to climate change.

Poor women face this vulnerability to the extreme. In Nigerian society, women are often confined to very traditional roles; they are required to live on the homestead and farm enough to feed their families, to whom they are primary caregivers. These roles often expose women to greater impacts from climate change. For example, it is typical in rural areas for women to have the responsibility of collecting water for the household. As temperatures increase and water sources become more scarce, women will have to walk greater distances (often in extreme heat) to access water.

In addition, some women are denied education. Without an education, they have no choice but to work in agriculture, which is highly sensitive to climate variability. Their agriculture is usually for subsistence—that is, they farm what they eat and do not make money from their harvests. As a result, women typically lack the financial means to try different adaptation strategies like adjusting their farming techniques or moving to places with more fertile soil. All of this is compounded by the fact that women are often denied the opportunity to participate in decision-making processes, so their opinions and needs are rarely considered in government policies.

How is Nigeria responding to climate change?

While the Nigerian government does have some climate change-related policies, local populations and nongovernmental organizations play a vital role in responding to the threat of climate change. In the Sahel, for instance, local communities are sharing insights on new agricultural practices as well as resources, such as seeds for growing crops, to help each other adapt to changes in climate. In the Niger River Delta, because of the relationship between gender and climate vulnerability, women's organizations have been especially important to activity around global warming.

In the 1990s, communities in the Niger Delta (an area rich in oil reserves) began to express discontent with the practices of large oil companies. These corporations were degrading the environment in the Delta. Most notably, they were burning flares of natural gas during oil drilling, despite the fact that this was illegal in Nigeria. In Europe and North America, the natural gas that is released during oil extraction is collected and used in multiple ways, like for generating electricity or making chemicals. In Nigeria, however, oil companies burned the gas because this was cheaper. Oil

companies burning natural gas in Nigeria have contributed more greenhouse gas emissions than the whole of sub-Saharan Africa combined. The flares also released toxic gases that threatened public health in the surrounding villages.

In 1995, a group of activists calling for Shell to stop this flaring were hanged by the military dictatorship of the time after being falsely accused of murder. Later, during a nonviolent protest in 1999, police and government soldiers brutally attacked protesters and targeted the women who were involved. In response, women's organizations banded together to fight the oil companies that were funding the government and its use of violence. During a ten month occupation of Shell's facilities, they demanded that flaring in Nigeria be completely phased out by 2007.

Sosialistisk Ungdom (CC BY-ND 2.0).

In addition to gas flaring, Shell and other companies have spilled an estimated 1.5 million tons of oil into the Niger Delta ecosystem over the past fifty years. This damages sensitive habitats for wildlife and contaminates local water sources, threatening the millions of people who rely on them for drinking, cooking, cleaning, bathing, and fishing. In January 2015, Shell agreed to pay more than $80 million to the Bodo community in the Niger Delta for the losses caused by two major oil spills in 2008 and 2009.

> ***"Shell's day will surely come for there is no doubt in my mind that the ecological war that the Company has waged in the Delta will be called to question and the crimes of that war be duly punished."***
>
> —Ken Saro-Wiwa, Nigerian writer and environmental activist, on being sentenced to death by hanging, 1995

Throughout the early 2000s, Nigerian women's groups (and their international partners) continued to demand changes in the practices of oil companies operating in the Delta. These women's groups were eventually able to persuade the Nigerian courts in 2006 to demand Shell end all flaring in the western part of the Niger Delta. In spite of this, the practice of gas flaring continues in Nigeria.

Nigerian protests against oil companies like Shell show that while women are particularly affected by climate change, their increased vulnerability can transform into even greater determination to take action.

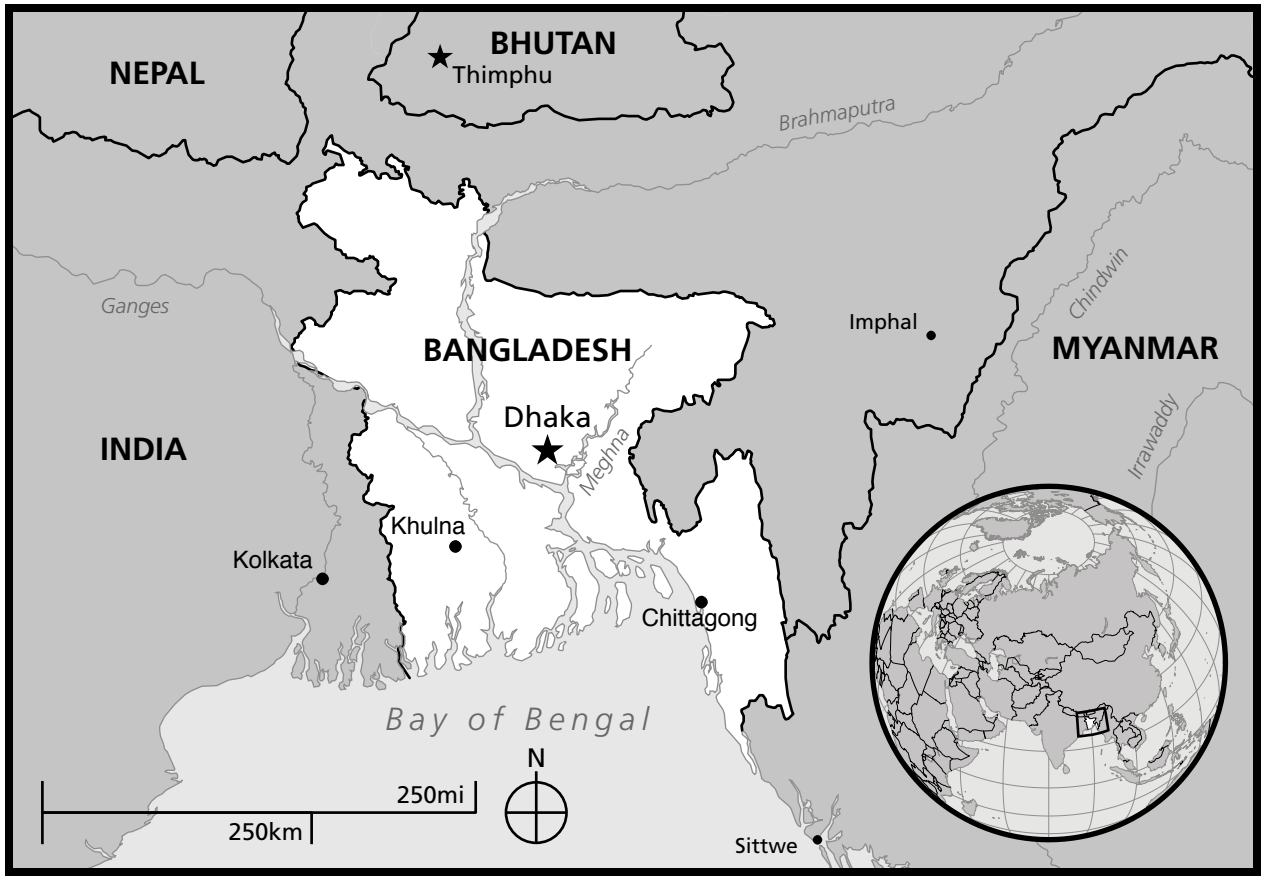
Bangladesh

The determination of many poor local communities in Bangladesh to fight climate change shows the importance and effectiveness of locally-led adaptation.

Bangladesh	
Population	156.6 million
GDP per Capita	US$829
Life Expectancy	70 years
CO_2 Emissions per Capita	0.4 metric tons

Bangladesh is among the most densely populated countries in the world. One of the most prominent geographic characteristics of Bangladesh is the Ganges Delta, where the Ganges, Brahmaputra, and Meghna Rivers come together. This merging of the three rivers means that the area has richly fertile soil and expansive wetlands (areas of swamps and marshes).

The combination of this distinctive geography and the large Bangladeshi population has resulted in people living on *chars*, which are small river islands. While the economy of the country is based largely on fishing and manufacturing—with seafood, clothing, and textiles as key exports—small-scale agriculture is the typical way of life on the *chars*. *Char* residents (as well as other rural Bangladeshi populations) live very interdependent and communal lives, often sharing resources and working together in the face of challenges. Because of this, Bangladesh provides a fascinating example of locally initiated responses to climate change.



Marufish (CC BY-SA 2.0).

The low land elevation and prominence of rivers makes Bangladesh particularly prone to flooding.

How is Bangladesh experiencing climate change?

Because it is dominated by rivers and coastlines, Bangladesh is one of the world's most vulnerable countries to flooding. It is frequently hit by severe storms, and rises in sea level quickly envelop the already scarce and overpopulated land. Salt water has already begun to seep into sources of drinking water and into farmers' soils, making growing certain crops like rice much more challenging. As climate change causes rising sea levels and intensifying storms, Bangladesh will face more weather-related deaths, declines in public health, and too little land for a growing population.

Inhabitants of *chars* and wetlands are particularly vulnerable, and some of the islands are fully submerged for large parts of the year. This means that *char* residents have to migrate to other islands or the river shores until they can return to their homes. Their only other option is to move to cities, where urban slums are rapidly growing. Both in these quickly built slums and on the *chars*, there is no infrastructure for sanitation or clean drinking water. Waterborne diseases like cholera are common and spread quickly. Because the poorest people live in the most vulnerable areas, the effects of climate change hit them especially hard. These people are unlikely to be able to afford health care or to replace possessions lost in extreme weather.

Tony Cassidy (CC BY-SA 2.0).

Textile students at a school in Bangladesh.

Bangladeshi people building houses on stilts so their homes are protected from flooding.

How is Bangladesh responding to climate change?

In Bangladesh, as in many countries in the global South, responses to climate change tend to rely on reducing poverty in order to decrease vulnerability. To do this, Bangladesh has focused primarily on education. Improving education helps increase Bangladesh's resilience to the effects of climate change in various ways. Better education allows for more career opportunities. This means that educated young people do not need to rely on agriculture and can instead pursue careers in sectors like manufacturing that are less sensitive to a changing climate. Bangladesh has also promoted a link between education and migration. In attempts to reduce the pressure of a large population living on increasingly scarce land, Bangladesh has pursued what some call an "intentional brain drain." The goal is to educate Bangladeshi youth so that they can easily emigrate to other countries that need people with their qualifications.

In addition, the Bangladeshi government was one of the first countries to create a National Adaptation Programme of Action (NAPA), yet the country's national government quickly realized that the NAPA would not be adequate in addressing the threat posed by climate change. As a result, Bangladesh created a more comprehensive national strategy and action plan for dealing with climate change. This plan included setting up two funding systems—one for wealthier countries to help fund climate change mitigation and adaptation efforts in Bangladesh and another for the Bangladeshi government to fund its own projects to counter climate change.

Many of the most effective adaptation efforts in Bangladesh have originated within poor, local communities. The dedication of these communities has resulted in small scale adaptation efforts that have made Bangladesh a leader in the field. Ranging from floating farms that defy the restrictions of limited land to innovations in how homes are built to resist flooding, adaptation in Bangladesh has been an astounding example of community-led development.

In Kundetar Village, for example, a committee of local women has partnered with Gana Unnayan Kendra (a local NGO) and Oxfam to establish more effective disaster preparedness. These women have created a local network within their community for anticipating extreme weather events. They constantly listen to both Bangladeshi and foreign radio stations for any indication that bad weather could be approaching. If they do expect extreme weather, the women place important tools and resources in high places so they are accessible if flooding occurs.

An important benefit of locally-led adaptation is that it is defined by the very people who are experiencing the problems. This has not necessarily been the case with the national climate change response in Bangladesh. When drawing up its NAPA, the Bangladeshi government failed to adequately involve local populations in its deliberations. As a result, the priorities of the NAPA did not directly match the priorities of the Bangladeshi people, particularly the poor. Local efforts allow people to engage in adaptation in a way that aligns with their needs and cultures. Local adaptation strategies also tend to be more easily shared because they are communal in nature and require the participation of all local inhabitants.

> ***"It's difficult for the people of many countries like Bangladesh to face the double burden of poverty and impacts of climate change.... For the sake of sustainability of environment and development, we need to act now without delay, individually, locally, nationally, regionally, and globally."***
>
> —Prime Minister Sheikh Hasina of Bangladesh, 2013

Local adaptation efforts are not sufficient in the fight against global climate change. There are often funding shortages for the widespread use of adaptation techniques, and poor, local communities often lack the political power to demand climate change policy from the national government or international community. Furthermore, these populations often cannot implement many climate change mitigation strategies because they are responsible for so little of the world's greenhouse gas emissions.

Name:_____

Study Guide—Part III

Vocabulary: Be sure that you understand these key terms from Part III of your reading. Circle terms that you do not know.

comprehensive
Gross domestic product (GDP) per capita
life expectancy
population density
residential laws
exported
malaria
parasite
elevation
city planning
cooperative living
delta
levees
segregated
wetlands
embankments
emigrate

Questions:

1. a. What is California's Global Warming Solutions Act? Describe two goals or plans that are included in the law.

   b. Is this an example of mitigation of adaptation?

2. What are two main reasons that China currently emits more greenhouse gases than any other country in the world?

3. How might warming temperatures cause malaria to spread to new areas in Colombia?

4. a. What policies and features of Freiburg, Germany have resulted in fewer cars in the city?

   b. Is this an example of mitigation or adaptation?

5. Why are coastal wetlands important in New Orleans?

6. a. Why is deforestation more common in Haiti than in the Dominican Republic?

b. What effect does deforestation have on flooding?

7. What are two reasons why women in Nigeria are especially likely to be faced with the negative effects of climate change?

8. a. How have a small network of women in Bangladesh worked together to be better prepared for natural disasters?

b. Is this an example of mitigation or adaptation?

Name:_____

Advanced Study Guide—Part III

1. In the Bangladesh case study, the prime minister states that many countries "face the double burden of poverty and impacts of climate change." How does the comparison of Haiti and the Dominican Republic demonstrate that the burden of poverty increases vulnerability to climate change?

2. What geographic and economic similarities do New Orleans and Bangladesh share? How do the two places face similar challenges from climate change? How do they face different challenges?

3. How does the case of Shell in Nigeria demonstrate a clash of citizens, oil companies, and the government on issues related to climate change? Consider the competing interests of each group, what types of power each group has, and what actions they have taken.

4. Look at the country information boxes at the beginning of each case study. Based on this information and the readings, which countries (out of those included in the case studies) do you think are the most responsible for climate change? What information did you use to draw your conclusions?

5. Look at the country information boxes at the beginning of each case study. Based on this information and the readings, which countries do you think are both least responsible for climate change and also have the fewest financial resources to deal with the challenges of climate change? What information did you use to draw your conclusions?

Part III: Case Studies

Instructions: Fill in the boxes below on the case studies. In each box, include at least two specific examples. In the far right column, also mark mitigation efforts with an "(M)" and adaptation efforts with an "(A)."

	How is this place experiencing climate change?	How is this place responding to climate change?
California, United States		
China		
Colombia		
Freiburg, Germany		
New Orleans, Louisiana, United States		
Haiti		
Nigeria		
Bangladesh		

Name:_____

Looking at the Case Studies

Instructions: Examine your photos and answer the following questions for each. Your group will be asked to share its impressions with the class. Keep in mind that photos cannot give you a complete picture of any place or society, and you should be careful about drawing conclusions from the photographs.

1. Describe the photo (the setting, architecture and landscape, what is happening, etc.). If there are people in the photo, what are the they doing? How would you describe their appearance (gender, age, expressions, body language, clothing, etc.)?

2. How does this photo relate to what you know about the place it portrays?

3. Does this image offer any clues about life in this place? For example, does the photo reveal anything about wealth, employment, religion, transportation, or geography?

4. Does this image raise questions for you about this place and its experiences with climate change?

Name:_____

Creating Your Own NGO

Instructions: In this exercise, you will work with your group to determine your top priorities with respect to climate change and to design a nongovernmental organization (NGO) to address them. Keep in mind that your organization will not be able to address all aspects of climate change. Its goals must be realistic in scope, for your organization will only have a small staff and a limited budget. Your organization will need a name, logo, mission statement, 1-3 concrete projects or programs, and a publicity tool. The publicity tool can take the form of a poster, brochure, or website layout.

1. In what location, region, or community will your organization work?

2. List four major challenges related to climate change that this community faces. These can include both the dangerous effects of climate change and barriers to an effective response.

   a.

   b.

   c.

   d.

3. Rank the challenges you listed above according to urgency and importance by writing numbers next to each (1 = highest priority) and circle the 1-2 challenges your organization will work to address.

4. What is the overarching goal of your organization? Use this overarching goal to write a 1-2 sentence mission statement for your organization. Mission statements are short and to the point, and it is okay if your mission statement refers to larger issues that your individual organization will not be able to completely address. For example, CARE's mission is: "To serve individuals and families in the poorest communities in the world." You may want to refer to one of the challenges you listed in Question 2 in crafting your mission statement.

5. How will your organization pursue this mission? List 1-3 specific projects or programs your NGO will take on. These should be concrete and realistic, given the size of your organization.

6. What is your organization's name? Try to choose a name that conveys your organization's mission and that will be easy for the public to remember.

Creating a Publicity Tool

On a separate sheet(s) of paper, create a publicity tool for your organization. This could be a poster, brochure, or sketch of a website layout. Make sure your publicity tool includes your organization's name, logo, and mission. The logo should be simple, memorable, and take into account your target audience (for example, a logo for an organization that works primarily with government officials may look different from one that works primarily with young people or the general public). It should be easy for someone who sees your publicity tool to quickly get a sense of what your organization does, what problem(s) it is trying to address, and why its work is important. While you want your publicity tool to be informative, you should also limit the amount of text you include.

Options: Graphic Organizer

Name: _____

	According to this option, what is "justice"?	Who does this option think should face mandatory emissions restrictions?	How does this option think adaptation should be paid for?	According to this option, are international agreements an effective way to deal with climate change?	What are this option's views about economic development?
Option 1: Past Emitters Must Pay					
Option 2: Responsibility Must be Shared by All					
Option 3: Economic Growth and Development Must Come First					

Options in Brief

Option 1: Past Emitters Must Pay

Wealthy, industrialized countries have long histories of using fossil fuels, histories that are now affecting the wellbeing of poorer countries. After over a century of irresponsibly using fossil fuels and spewing greenhouse gases into the atmosphere, the global North has not yet faced significant consequences of its actions. Instead, poorer countries that are not responsible for the harmful emissions causing climate change are now suffering first and worst. A fair global system must hold past emitters accountable and demand that they bear the expense of both mitigation and adaptation. Poorer countries should not have to pay for the devastation wrought by climate change and should be allowed to industrialize without emissions restrictions, just as wealthier countries have. Justice demands that historic emitters be held responsible for their past actions.

Option 2: Responsibility Must be Shared by All

Rising industrial powers in the global South are already contributing large proportions of the world's greenhouse gas emissions. As more countries begin to industrialize, their use of fossil fuels and the effects they have on the environment will become disastrous. There cannot be justice without the prevention of future wrongs, and everyone must do their part. A fair international system should create mandatory restrictions on the use of fossil fuels by all countries based on their current emissions rates. Poorer countries should "grow green" by investing in renewable energy and taking the lead in sustainable development. The effects of climate change (which are already being felt) should be fought with adaptation strategies funded through voluntary contributions from wealthier countries. This global problem requires a global solution where everyone takes responsibility.

Option 3: Economic Growth and Development Must Come First

The use of fossil fuels is vitally important to economic growth. Creating mandatory emissions limits will make industry expensive, restricting the ability of poor countries to develop and weakening the economies of countries in the global North. Only an international system that assures the right of all people to pursue prosperity and improve economically is rooted in justice. As long as people around the world remain poor, they remain highly vulnerable to the effects of climate change. There should be no mandatory emissions restrictions or financial contributions included in an international climate change agreement. Mitigation efforts should be taken on voluntarily at a local level where communities are able and willing to enact them. Climate change adaptation will be less necessary with the reduction of poverty, and it should remain a domestic rather than an international issue. Countries with growing economies will be able to develop technological solutions to counteract the worst effects of climate change.

Option 1: Past Emitters Must Pay

> **"Climate justice endorses that polluters must pay. We must have a system that those who use SUVs, not the one[s] who use bicycles, pay."**
>
> *—Kofi Annan, former Secretary General of the United Nations, 2014*

It is time that the countries with long histories of greenhouse gas emissions take responsibility for their harmful effects on the environment. Over a century of fossil-fuel driven industry in the global North has resulted in unprecedented spewing of greenhouse gases into the atmosphere. Throughout history, the United States has dumped more than three times the amount of carbon dioxide (CO_2) into the atmosphere than newly industrializing countries like China and well over one hundred times the amount emitted by many poorer countries like Nigeria and Bangladesh. We are already seeing the impact of these past emissions on our climate, and we must demand that industrialized countries pay for histories of pumping CO_2 into the atmosphere.

Climate change is a global problem, but its effects are most intensely felt by countries in the global South that have not contributed to the world's greenhouse gas emissions. The effects of climate change are costly—both financially and in human suffering—and preventing further damage requires large investments in adaptation projects. Why should people in the poorest countries pay the greatest price when industrialized countries created the problem? Many countries in the global South have long histories of being economically and politically oppressed by countries in the global North. This means that they are usually poor, do not have substantial industries, and cannot afford to adapt to a changing climate.

In order for our international system to be fair, countries with histories of high emissions must accept strict limitations on their use of fossil fuels and provide funding to help those who are already facing the effects of climate change. Countries in the global South should not have to face emissions restrictions that limit their development or bear the costs of adaptation. They should have the opportunity to industrialize and enjoy the prosperity experienced by wealthier countries. Furthermore, promoting the economic development of poorer countries in this way will help reduce their vulnerability to climate change's effects. Justice requires that we hold historic emitters accountable. These wealthier countries must bear the expenses of climate change mitigation and adaptation, acknowledge their responsibility, and allow poorer countries to gain an even footing in the global economy. Any alternative would not be fair to the people in the global South who are suffering first and worst from climate change.

Option 1 is based on the following beliefs

- Justice requires accountability for past wrongs.
- Those most responsible for creating the problem of climate change must bear the costs of solving it.
- Major reductions in greenhouse gas emissions by historic emitters will be enough to prevent dangerous climate change.
- International agreements about climate change should prioritize addressing the needs of countries that are most vulnerable to the effects of climate change.

What policies should we pursue?

• Historic emitters must accept mandatory emissions restrictions and pursue sustainable development.

• Historic emitters must pay for adaptation efforts—including agricultural assistance, disaster preparedness, and health care improvements—in countries most vulnerable to climate change.

• The global South should be allowed to develop without emissions restrictions, just as the global North was in the past.

Arguments for

1. The countries that have created the problem of global warming must be held responsible for fixing it. As a global community, we cannot ignore the past emissions that have brought us to the edge of catastrophic climate change. For an international system to be grounded in justice, it must hold countries accountable for historical emissions.

2. Countries with low emissions records are already suffering the consequences of global climate change and do not have the ability to mitigate or adapt. These countries are entitled to assistance from those responsible for causing the problem.

3. Poor countries trying to reduce the small amounts of greenhouse gases they emit will not make a significant difference. For climate change mitigation to be effective on a global scale, the countries that have emitted the most over time must take the lead.

4. Historically responsible countries have reaped the benefits of decades of industrial growth with little regulation; they can afford to pay for mitigation and adaptation (both on their own soil and in other countries that need it most).

5. Poor countries need a chance to develop economically and must be either allowed to increase their greenhouse gas emissions or helped by industrialized countries to pursue sustainable development. Economic development will also reduce poorer countries' vulnerability to climate change.

6. International negotiations that result in mandatory rules and restrictions are the only way we will make any meaningful progress in preventing and dealing with climate change.

Arguments against

1. The United States will not agree to any international treaties with binding emissions cuts that do not restrict future emissions from countries in the global South. This was made clear by its decision not to ratify the Kyoto Protocol. Without the United States' participation, any large-scale attempts at mitigation will not be effective in curbing emissions.

2. China currently has the largest total emissions of any country, and its use of fossil fuels will only increase in the future. Without restrictions on rapidly industrializing countries like China and India, an international system would not prevent future dangerous climate change.

3. Restricting the emissions of some countries but not others will give the latter an advantage in the global market. This is unfair to citizens of countries facing restrictions, which will almost certainly lose jobs to other countries that will take the lead in industry.

4. The citizens of historically high-emitting countries are not as directly or immediately vulnerable to climate change's effects. Leaders of these countries will not be able to justify sweeping emissions restrictions to their citizens. As these countries are also the most powerful in the international community, it is unlikely that an effective agreement will be reached without their political support.

Option 2: Responsibility Must be Shared by All

Climate change is a serious global problem, and it demands a global solution. Yet international negotiations so far have failed to produce any meaningful action. We need to be practical about the types of emissions reductions the most powerful, highest emitting countries will realistically agree to in order to make any progress in preventing the dangerous effects of climate change. The Kyoto Protocol was the closest we have come to requiring binding emissions reductions from countries around the world. Yet because it did not restrict emissions for rapidly industrializing countries—like China and India—the United States, among other countries, refused to ratify it.

> **"Emissions are rising fastest in emerging economies and in the interest of their poorest citizens on the front line of climate change, they must play a bigger role than in the past."**
>
> *—Jan Kowalzig, Oxfam's climate expert, 2014*

China currently emits more greenhouse gases than any country in the world. Many other countries are poised to greatly increase their greenhouse gas emissions as they, too, continue to industrialize. Why should these countries be given free rein to continue damaging the environment? To be most fair, we should establish across-the-board emissions restrictions according to all countries' current emissions levels. We are all in this problem together, and we must all do our part in reducing emissions. This approach will be most effective in preventing future greenhouse gas emissions and will also make countries like the United States more likely to sign on. In addition, wealthier countries will not feel that they are at risk of falling behind in the international market and, as a result, will be more likely to voluntarily contribute funding to help the countries most affected by climate change to adapt.

At the same time, we cannot deny the importance of development to support economic growth and increase climate change resilience around the world. Reducing the use of fossil fuels will shift international attention to sustainable development as wealthy and poor countries alike look towards more efficient renewable energy sources like solar and wind power. Sustainable development will allow countries around the world to meet the immediate economic and social needs of their citizens without compromising the future state of the planet. National governments, independent business owners, and large corporations could all contribute to making sustainability a central part of the economy by investing in sustainable projects. We cannot let the short-term economic costs of establishing new energy infrastructure outweigh the long-term benefits of sustainable development in mitigating a global climate crisis.

Option 2 is based on the following beliefs

- Justice requires that we stop current wrongs and prevent future harm.
- A situation that is global in nature requires that everyone takes responsibility, with those who are most able to pay giving financial support to others.
- Mandatory emissions restrictions for all countries is the only way to reach an agreement that will involve the entire global community and prevent dangerous climate change.
- All countries and organizations should have equal participation in negotiating an agreement on global climate change.

What policies should we pursue?

• There must be across-the-board emissions restrictions proportional to countries' current emissions levels, and emissions caps should be established to prevent both the global North and the global South from emitting large amounts of greenhouse gases in the future.

• We should encourage all countries to focus on sustainable development and environmentally friendly means of production.

• Wealthier countries should be encouraged to voluntarily provide funding for adaptation efforts in the countries most affected by climate change.

Arguments for

1. U.S. or European cuts would be pointless if China, India, and other countries in the global South continue to increase emissions, particularly as China is currently responsible for the most CO_2 emissions of any country.

2. Until now, the United States has refused to ratify international treaties because these agreements have not dealt with current or future emitters. Demanding reductions from other countries will make the United States more open to an international agreement. Reducing the focus of blame on the global North will also make wealthier countries more likely to contribute funds for adaptation efforts.

3. Emissions restrictions for all countries provide the most realistic chance of reaching an international agreement and will be the quickest route to concrete action at a global scale. This practical approach is essential, for the longer we wait, the more expensive mitigation and adaptation will be.

4. Across-the-board emissions restrictions will encourage sustainable development, allowing countries to improve economically without endangering future climatic conditions.

5. To protect the future state of the environment, we must prevent future greenhouse gas emissions. Climate change poses a dire threat to life as we know it, and we must do all we can to prevent catastrophe.

6. We cannot stop striving for mandatory regulation from the international system. Though international negotiations have failed to produce meaningful agreements so far, they provide the only chance to prevent dangerous climate change and realize justice on a global scale.

Arguments against

1. Poor countries deserve the chance to industrialize the way that the United States and other wealthier countries did. Restricting their use of fossil fuels would prevent this.

2. The greenhouse gases in the atmosphere that are currently causing climate change are from the past. It is unfair not to hold industrialized countries accountable for this accumulation of greenhouse gas emissions.

3. Some countries already need to pursue expensive adaptation efforts in the face of their vulnerability to climate change. They should receive financial assistance from the countries whose past actions are causing the changes in climate that are affecting them today. This funding should be mandatory, for voluntary contributions will not be enough.

4. Limiting the economic development of countries in the global South by regulating their emissions will slow poverty reduction. Continued poverty will keep these countries vulnerable to the effects of climate change.

Option 3: Economic Growth and Development Must Come First

Climate change is not our most immediate problem. Billions of people around the world struggle with poverty and hunger every day. How can we justify an international focus on expensive climate change mitigation and adaptation strategies when this is the case? In order for the health and education of people in the global South to improve, international attention must turn towards economic development and poverty reduction. Most importantly, all countries should be able to grow their economies by increasing their industrial activity.

"It is prudent to do what we reasonably can to reduce carbon emissions. But...we don't believe in harming economic growth.... For many decades at least, [fossil fuels] will continue to fuel human progress as an affordable energy source for wealthy and developing countries alike."

—Prime Minister Tony Abbott of Australia, 2014

It is not fair for countries in the global North, which have already reaped the benefits of cheap industrialization, to prevent countries in the global South from doing the same. There should be no mandatory restrictions on fossil fuel use, for all countries should have the right to industrialize cheaply and pursue prosperity. Individual countries, as well as local organizations, can choose to take on voluntary emissions restrictions and adaptation measures where they are able and their populations are willing. This may indeed be faster than holding out for a comprehensive global agreement on climate change. With internationally funded economic development increasing poorer countries' resilience to climate change, additional adaptation measures should not be the concern of the international community. Furthermore, any attempts by the United Nations (UN) to barge in and tell people how to adapt to climate change will fail. The UN is a giant bureaucracy that is out of touch with local needs. It tramples on local governments and ignores citizens' input.

Continuing to hope for global climate change mitigation is unrealistic—it is just too expensive and no one wants to give up a higher quality of life for the sake of reducing greenhouse gas emissions. This makes reaching an international agreement on mitigation essentially impossible. Wealthier countries should instead encourage private businesses and organizations to focus their efforts on scientific research to develop new technologies that can help us deal with the effects of climate change. If countries each pursue their own economic growth, the market will generate solutions to the problem of global warming.

Option 3 is based on the following beliefs

• Justice is allowing everyone the opportunity to pursue prosperity and economic improvement.

• The international community is not responsible for funding and promoting mitigation and adaptation. These are domestic concerns that should be dealt with by national governments of individual countries according to the interests of their populations.

• Businesses should have a key voice in considerations of climate change policies. In a thriving economy, technological solutions will be developed that can eliminate the harmful effects of climate change.

• Policies generated by local people will be more successful than those forced upon them by international leaders who are not engaged with local concerns.

What policies should we pursue?

• There should be no mandatory restrictions on the use of fossil fuels, which are currently the cheapest energy sources. Local and national governments as well as businesses and other non-governmental groups can choose to take on voluntary emissions reductions.

• The international community should encourage individual countries to pursue economic growth so they have money available to research and develop new technologies—both renewable energy options that could reduce emissions and geoengineering techniques that could help deal with the effects of climate change.

• Monetary aid from wealthier countries should continue to focus on the economic development of poorer countries, not on climate change adaptation.

Arguments for

1. The most catastrophic effects of climate change are not as immediate or important as the economic needs of people. Economic development will give governments more money to fund public health initiatives, education improvements, and poverty reduction efforts. Expensive attempts at climate change mitigation would cripple countries' economies, making less funding available to deal with these pressing issues.

2. Climate change prevention is just too expensive. Realistically, it will never happen.

3. Countries have a right to develop, and people have a right to pursue prosperity. This requires the use of fossil fuels. It is unfair to deny more than half the world the benefits of industrial development.

4. Restricting countries' development increases their vulnerability to climate change by preventing both poverty reduction and the creation of diverse job opportunities.

5. Technology has the potential to prevent the most dangerous effects of climate change. We should make sure we have the money to pursue innovative technologies that can counteract these effects.

6. International climate change talks have failed to produce any meaningful agreements, and international laws restrict the ability of countries to develop in ways that are suited to their unique local contexts. It is unrealistic to rely on the international community to effectively protect the interests of all peoples.

Arguments against

1. Pursuing sustainable development would allow countries to prioritize the economic needs of their peoples and address issues like health, education, and poverty while also limiting greenhouse gas emissions.

2. We cannot rely on mere hopes of developing new technology as a silver bullet to "solve" the issue of climate change. People are already suffering as a result of global warming. We cannot wait any longer to take action. Furthermore, geoengineering and other technologies that aim to reverse the effects of climate change are dangerous and cannot be tested. They do not address the source of the problem.

3. Pursuing efforts to reduce greenhouse gas emissions is essential. Unchecked industrialization could have disastrous environmental effects, potentially resulting in many parts of the world becoming uninhabitable. These long-term human costs outweigh any short-term economic expense. In addition, proactive mitigation strategies will save money in the long run by preventing future damages and lessening the need for expensive adaptation efforts.

4. Because climate change is a global problem, solving it will require a coordinated, international effort. Voluntary action will not be enough because the people and groups that are motivated to act often are not the ones who have caused the problem.

Name:_____

Focusing Your Thoughts

Ranking the Options

Which of the options below do you prefer? Rank the options from "1" to "3."

_____ Option 1: Past Emitters Must Pay

_____ Option 2: Responsibility Must be Shared by All

_____ Option 3: Economic Growth and Development Must Come First

Beliefs

Rate each of the statements below according to your own personal beliefs:

1 = strongly support 2 = support 3 = oppose 4 = strongly oppose 5 = undecided

_____ Climate change poses a grave and immediate threat to all life on earth.

_____ Poverty, violence, poor education, and broken healthcare systems around the world are more urgent issues than climate change.

_____ Climate change is a global problem that can only be effectively addressed through international cooperation.

_____ International negotiations move too slowly to have an impact and do not take into account local needs.

_____ Individual countries should not be held responsible for dealing with problems affecting the citizens of other countries.

_____ Wealthier countries should be required to help poorer countries cope with the effects of climate change.

_____ Countries today must be held accountable for their past greenhouse gas emissions.

_____ Sustainable development is the only fair, safe, and realistic way to grow economically.

_____ Climate change mitigation through reducing CO_2 emissions is unrealistic.

_____ Economic development in poorer countries is the most effective form of climate change adaptation.

_____ Mitigation can only be effective if everyone is doing it.

_____ Technology to effectively counter the effects of climate change will be developed and can be relied on.

_____ People today need to make sacrifices in their way of life to safeguard the world for future generations.

Creating Your Own Option

Your next assignment is to create an option that reflects your own beliefs and opinions. You may borrow heavily from one option, combine ideas from two or three options, or take a new approach altogether. You should strive to craft an option that is logical and persuasive. Be careful of contradictions. For example, your option cannot present climate change as a pressing concern that must be dealt with immediately while also promoting reliance on technology that has not yet been developed.

Your Own Option

Instructions: In this exercise, you will offer your own recommendations for the basis of a new international agreement on climate change. Your responses to "Focusing Your Thoughts" should help you identify the guiding principles of your proposal.

1. What values should form the basis of the next international climate treaty?

2. What issues should the international community prioritize in this treaty?

3. What international policies should the UNFCCC adopt to put your values into action?

4. What are the two strongest arguments opposing your option?
   a.

   b.

5. What are the two strongest arguments supporting your option?
   a.

   b.

6. How would your suggestions for a treaty affect:
   a. Countries in the global North?

   b. Countries in the global South?