

Activity 4.1: Faces of Climate Change

Grades 10 – 12

Description: In this activity, students will learn about how climate change affects individuals in other parts of the world.

Time: Depends on what option the teacher chooses. This lesson could serve as a culminating activity that takes two periods or it could serve as an introduction to a research project that will take at least one week.

National Science Education Standards:

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

AAAS Benchmarks:

7.D, F, G - Human Society – Social Trade-Offs (7D/H1-H2), Social Conflict (7F/H1, H2a), Global Interdependence (7G/H4).

Guiding Questions:

- How does your character’s life compare to your life?
- How is your character’s life affected by climate change?
- How can people from different perspectives agree on solutions to climate change?

Teacher Notes: This lesson is meant to serve as the culmination of the entire study of climate change. Students should be familiar with many aspects of the topic such as the causes, certain biogeochemical and ecological effects, and the various forms of data that have been used to form our current understanding of the topic. It could also be used as an introduction to an in-depth analysis of the impact of climate change on humans and the inequality that exists between those who are mainly responsible for the current situation and those who will be most affected.

The duration of this lesson is entirely dependent on how in-depth the teacher wishes to analyze the climate-change situation. If using this activity as a two-period culmination, then half of the cards distributed to students should include an italicized statement to allow all students to pair up evenly. Use the Faces of Climate Change – Counterpart Checklist to help determine which cards should be included to ensure each student has a counterpart with whom to pair up.

Jigsaw activities can be an effective way to convey a large amount of information in a small amount of time. However, students do not always take an active role during this type of activity, choosing instead to simply let others copy their work without actually discussing anything. You may want to address this concern at the beginning of the activity with all students. During the activity, constant circulation helps keep students on task. Encourage students to take their roles

Materials:

- Character cards (30 per class set) with each “impact group” copied on a different color paper. Impact group cards are also numbered 1 – 6 in the bottom left-hand corner, if colored paper is not available.
- Student handouts
- Butcher paper
- Map or globe (optional)



seriously, because day 2 discussions are dependent on students becoming fully invested in their characters.

Pre-Activity:

- Make copies of the character cards, making sure to copy each of the six “impact groups” (climate refugees, concerned citizens, economic/political, fishing/agriculture, health/medical, scientist/specialist) on a different color paper.

Procedure:

DAY 1

1. Begin the lesson by reviewing what students have learned about climate change from past lessons. Review causes, effects, and supporting evidence. You may want to hand out student portfolios from Units 1 and 2 for them to review.
2. Tell students that today’s activity will require them to make connections between what they learned in previous lessons about the global impacts of climate change. Students will learn more about the effects of climate change on the Earth, animals, and plants, but they will also learn about the economic, social, and political impacts of climate change on humans from all walks of life.
3. To begin the activity, students should form groups of six students each. This will be the “home group.”
 - Distribute one different-colored/numbered card to each student in the home group. The group should have cards numbered 1-6.
 - Inform students that they will be adopting the identity of this person for the next two days. Each person in class has a different identity and represents someone who will be affected by climate change.
 - Hand out the student packet titled “Faces of Climate Change.”
4. You may want to have students find where their character lives on a map or globe. You can project a large map, and map out the location of each character, so that students can see the global range of the characters.
5. Students should read the information on their card and write a summary of what they learned on their student workpage.
6. Students should then be instructed to join groups with other students who have the same color/number card. This will make six different “impact groups” of five students each if all thirty cards are used (note: impact groups can be found on the sheet below labeled Faces of Climate Change – Impact Groups). As noted in the Materials box at the beginning of this activity, each impact group (eg: concerned citizens, climate refugees, etc.) should be copied on a different color paper.
7. Inform students that each group is made of people who have a unique perspective on climate change based on their individual scenario. These perspectives are health/medical, climate refugees, scientist/specialist, economical/political, fishing/agriculture, and concerned citizens.



8. Members of the group should introduce themselves and read their summarized information from their student workpage. As each student is sharing their information, the other group members should fill out the appropriate portions of their workpage.
9. Once all students have introduced themselves and shared information, the group should determine which of the six unique perspectives is represented by their group. Then, they should discuss what information needs to be shared with the other students in their home group.
10. Students should separate from their impact groups and rejoin their home group.
11. In their home groups, students should share what they learned in their impact group. Other group members should fill in the appropriate portions of their workpage.
12. Once all students have shared what was learned in their impact groups, the teacher should bring the class back together to review the day's activity. The review could be a Summary-Go-Round in which each student shares something new that they learned about climate change or a new perspective that they gained from the activity.

DAY 2

1. Introduction: Review the activity from the previous day. Inform students that they will continue to assume the identity of the person whose card they received at the start of the activity yesterday. The goal for this day of the activity will be to meet someone who is directly related to your person through either the causes or effects of climate change; share your side of the story; and work together to come up with possible solutions to our current problem in the context of your characters.
2. Instruct students to locate their new partner by looking at the italicized sentences on their card. Half of the class has an italicized prompt that will direct them to someone else in the class. The students who have a prompt should read the prompt aloud (in turn). The other half of the class does not have a prompt, and should instead listen and try to find the appropriate partner. (Note: In order to determine that each italicized card will be matched with its corresponding card, refer to the Faces of Climate Change – Counterpart Checklist in the materials for this lesson.)
3. Once partners have found each other, they should introduce themselves and explain their story as they did yesterday. After both sides have finished, the pair of students should discuss possible, reasonable solutions that address the needs and concerns of both people.
4. Solutions should be written on butcher paper or some other large piece of paper in order to facilitate their presentation to the class.
5. Students will present their list of solutions to the class. When a group presents, they should introduce each other and then briefly state their side of the story. Then, they should present their solutions and explain the reasoning behind them.



CHICAGO BOTANIC GARDEN

6. Closure: Wrap up the activity by having students respond to the following exit slip questions:
- Describe how climate change will affect each of the following areas: fishing/agriculture, health/medicine, ecology of the Earth, climate refugees, economical/political, and the everyday lives of average citizens.
 - What are some possible solutions to the current climate-change problem? Which of the solutions presented today do you feel is the most reasonable? Please explain why you feel this way.

Assessment: Student understanding of objectives and concepts will be assessed via class discussions, summary sheet from day 2, completion of workpage, and exit slip responses.

Extensions: This activity can be used as a two-period culminating activity or it could be used as a springboard to a more in-depth weeklong project in which students make public service announcements through the eyes of their character to introduce others to the unique effects of global climate change. The teacher may also wish for the pair of students that form during day 2 of the activity to make a presentation instead. If there is not time for a project, the exit slip questions could be assigned for homework instead of an in-class assignment. Lastly, it is also possible for this activity to serve as a stand-alone assignment for a teacher who wishes to incorporate climate change into their curriculum but simply does not have time for the other experiments and activities.

Useful Websites:

<http://www.cier.umd.edu/> The Center for Integrative Environmental Research is a site devoted to challenges of climate change from ecological, economical, and social perspectives.

<http://www.pewclimate.org/> The Pew Center on Global Climate Change brings together businesses, politicians, scientists, and other experts who discuss climate change and work together to develop a solution that is both ecologically and economically sustainable.

Student Work Pages: Faces of Climate Change packet



NAME _____ DATE _____ PERIOD _____

FACES OF CLIMATE CHANGE

Directions: Use this page to summarize information regarding your individual character, your impact group, and also your home group.

PART 1: WHO ARE YOU?

1. Read your Faces of Climate Change Card and fill in the table below based on what you learn. Be sure to summarize the information in your own words.

NAME		OCCUPATION	
IMPACTS			
PHYSICAL	ECONOMIC	CULTURAL/SOCIAL	ECOLOGICAL

2. Now it is time to make a group with all of the other students in your class with the same color card as you.
3. This is your impact group, which consists of other characters who will be affected by climate change in a similar way. There are six possible impacts, and they are listed below. Circle the impact that you feel best represents your group.

CLIMATE REFUGEES	CONCERNED CITIZENS	ECONOMIC/POLITICAL
FISHING/AGRICULTURE	HEALTH/MEDICAL	SCIENTIST/SPECIALIST

4. Please explain why you made this choice.
5. Share your information with everyone else in your impact group. Record their information on the Impact Group Recording Sheet. **Do not simply pass around the information and allow others to copy! You will need to take on the role of the character in part 2 of the activity.**



CHICAGO BOTANIC GARDEN

Impact Group Recording Sheet

NAME	OCCUPATION	IMPACTS			
		PHYSICAL	ECONOMIC	SOCIAL/CULTURAL	ECOLOGICAL



CHICAGO BOTANIC GARDEN

6. Decide what your group feels is the MOST IMPORTANT information that should be shared with the members of your home group. Summarize your group's thoughts in the space below.

7. Now it is time to return to your home groups and share what you have learned. While other group members are sharing, write down what you learn in the table below. Be sure to note their specific impact group as well as their shared information.

GROUP	IMPACTS			
	PHYSICAL	ECONOMIC	SOCIAL/CULTURAL	ECOLOGICAL



CHICAGO BOTANIC GARDEN

8. You have now finished the first day of this activity. In the space below, summarize what you have learned about climate change so far from this activity. Also, be sure to discuss a new perspective or point of view that you learned about that you may not have thought about before.



PART 2: WE CAN WORK IT OUT

1. During the second day of the activity, you will remain the same character as yesterday. However, you will now meet someone else with a perspective on climate change that is linked to yours. Half of the cards in class have an *italicized statement* that will direct that character to another character in class. If you have the *italicized statement* on your card, you must find the other character. If you do not have the statement, you must listen to what the other characters are saying and try to find your partner.
2. Once you have found your partner, you must each share your information with each other as you did yesterday in your impact group. Record that information in the table below.

NAME	OCCUPATION	IMPACTS			
		PHYSICAL	ECONOMIC	SOCIAL/ CULTURAL	ECOLOGICAL

3. How is your character's perspective on climate change linked to that of your partner's character? Please explain your answer by giving specific examples from the cards.



CHICAGO BOTANIC GARDEN

FACES OF CLIMATE CHANGE – COUNTERPART CHECKLIST

Listed below are the cards with italicized prompts and their matching cards. Ideally, all pairs of cards are used during the activity. If you do not have enough students to use all the cards, make sure that the pairs you choose create equal impact category groups.

ITALICIZED PROMPT CARD	MATCHING CARD
<i>Erin Bernard</i>	Debbie Freeland
<i>Maria Agaba</i>	Bradley “Buddy” Wells
<i>Dante Randal</i>	Duane Randal
<i>Dr. Devin Jara</i>	Alexa De La Fuente
<i>Dr. Annabeth Clark</i>	Dr. Damaris Joro
<i>Mary Catherine Kerrigan</i>	Theo Ikummaq
<i>Thea Zorbas</i>	Dr. Jennifer Swan
<i>Paul Sachs</i>	Kenneth Cox
<i>Amy Russell</i>	Rizwan Khan Al-Doubhi
<i>Giancarlo Cassini</i>	Camille Cartier
<i>Eddie Kim</i>	Gabriel Sanchez
<i>Jim “J.R.” Rogers</i>	Dr. Jamie Nagani
<i>Caitlin Harris</i>	Sarah Hanes
<i>Catherine Freeman</i>	Jost Rickman
<i>Stephanie Cornell</i>	Isabela Pierce

FACES OF CLIMATE CHANGE – IMPACT GROUPS

Indicate which cards are part of each impact category. For convenience, the cards themselves also have the number noted on the bottom left corner.

CATEGORY	CARDS
CLIMATE REFUGEES (1)	Mary Catherine Kerrigan, Theo Ikummaq, Alexa De La Fuente, Camille Cartier, Thea Zorbas
CONCERNED CITIZENS (2)	Caitlin Harris, Gabriel Sanchez, Giancarlo Cassini, Duane Randal , Kenneth Cox
ECONOMIC/POLITICAL (3)	Eddie Kim, Bradley “Buddy” Wells, Paul Sachs, Dante Randal, Erin Bernard
FISHING/AGRICULTURE (4)	Jost Rickmann, Rizwan Khan Al-Doubhi, Jim “J.R.” Rogers, Catherine Freeman, Maria Agaba
HEALTH/MEDICAL (5)	Dr. Annabeth Clark, Dr. Damaris Joro, Sarah Hanes, Isabela Pierce, M.D., Ph.D., Debbie Freeland
SCIENTIST/SPECIALIST (6)	Dr. Devin Jara, Amy Russell, Dr. Jamie Nagani, Dr. Jennifer Swan, Stephanie Cornell

FACES OF CLIMATE CHANGE – Character Cards follow



Dr. Devin Jara – 34 years old

I am a glaciologist in Greenland. Contrary to its name, Greenland actually has many glaciers and is also home to one of the largest, called the Greenland Ice Sheet, which is 2 miles thick and about the size of Mexico. I study an outlet glacier, which is a small extension of a larger glacier. My glacier is currently melting at the edges and falling into Scoresby Sund, which is Greenland’s largest fjord.

Physical Impacts

Global – There is no denying that glaciers are melting all around the world. The proof is in the pictures. If the Greenland Ice Sheet were to melt, sea levels would rise by an estimated 20 feet, which would put many coastal areas completely underwater.

Regional – My own glacier has melted significantly in the past ten years. In 2005, the water lost from area glaciers was 44 trillion gallons, which is enough to supply the New York metro area for more than a century. To make matters worse, as the melting water falls through the glacier and slides along the bottom it can accelerate a glacier’s movement into the ocean.

Economic Impacts

As water levels rise, what will happen to coastal towns? Floods are already one of the leading causes of storm damage throughout the world. Hurricane Katrina in Louisiana and the tsunami of 2004 that hit Indonesia are recent examples of how devastating floodwaters can be. Many coastal areas are simply not equipped to handle the damage.

You don’t hear much about the countries that were affected by the tsunami anymore. Have these areas even recovered yet?

Social/Cultural Impacts

As sea levels rise, where will all of these people go when their homes are under water? As they move inland there will be less space for everyone. What will happen if we run out of space and certain necessities such as food or fuel?

Ecological Impacts

As dense fresh water enters the oceans, it will mix with salt water and could potentially change ocean currents. Most people don’t know that ocean currents drive our weather and if these change, the weather changes too. This could change many environments throughout the world. What will happen to local plant and animal life?



Dr. Annabeth Clark – 40 years old

I am a physician who works at Stroger Hospital in Chicago, Illinois. I was just a med student doing my E.R. rotation during the heat wave in 1995 that killed more than 700 people, but now I am an attending physician and I have recently noticed an increase in deaths due to heat waves. I have seen many people come and go throughout my career, but it is difficult to accept this, especially because I feel so helpless. I cannot fix our planet as easily as I can fix a broken bone.

Physical Impacts

Global – The average temperature of the Earth has increased since the Industrial Revolution back in the 1850s. The past 25 years have produced temperatures higher than any others in the past 1000 years. Also, high temperatures used to arrive later in the year and not as often as they are now.

Regional – No one in the E.R. wants to relive what happened back in 1995. We simply could not handle all of those people. Urban areas tend to be affected more because concrete absorbs heat during the day and releases it at night, which prevents the cooling that is needed to help people cope with extreme daytime temperatures. In 2003, 35,000 people died in Europe due to a heat wave. Could that happen here?

Economic Impacts

Here at Stroger, we help anyone who walks through our doors. If patients cannot afford medical care, the county pays for them by using tax dollars. Many Cook County residents were outraged over the sales tax increase in 2008, and I can only imagine what will happen if more and more people need treatment due to heat-related symptoms. Where will the hospital get its money? Will residents want to pay to help us again? Will they even be able to?

Social/Cultural Impacts

As usual, it seems like the working-class people of our city will once again be hit the hardest by this new threat of climate change. Cities are usually warmer than the surrounding suburbs or rural areas and many residents in the city simply can't afford air-conditioning. This isn't right. We need people to see that this issue affects us all.

Ecological Impacts

We are fortunate here in Chicago to only be experiencing a rise in heat-related symptoms and not any infectious diseases.

I wonder what is happening in tropical locations where disease is already a problem. How will doctors help people who live in areas where diseases such as malaria already take so many lives?



Mary Catherine Kerrigan – 16 years old

For as long as I can remember, my family has lived in the same house just outside of Fairbanks, Alaska. Eighty percent of the land surface throughout the state has permafrost beneath it. Normally, the soil stays frozen all year long, but it has started to thaw. This has caused our house to sink as the soil gets softer and our house keeps pushing it further down. We are now almost 5 feet underground! We need to move soon or else we might not be able to get everything out.

Physical Impacts

Global – In the Northern Hemisphere, 24 percent of land has permafrost beneath it. As temperatures continue to rise and this soil continues to thaw it could permanently change the makeup of the land. The amount of permafrost in the Arctic has already decreased 15 percent in the past century. Not only will buildings be affected, but plants and animals as well.

Regional – My neighbors are experiencing the exact same thing as us. What are we going to do? I feel like Alaska is losing one of its defining features. We live so close to Mt. McKinley that I have come to think of it as a member of my family. I see it almost every day. I can't imagine what it will be like to move and not be able to see it again.

Economic Impacts

My family does not have enough money to keep moving. Hopefully, we will find a place that is not as affected by warming temperatures. My grandfather built our home more than 50 years ago on what he thought was solid ground. How can we be sure our next place is not also on permafrost? What will happen to local businesses that sink into the ground? What will they do if all of their customers leave? I read online that for every 4 degrees Celsius increase in temperature, it will cost the global economy up to 3 trillion dollars to make up for what is lost.

Social/Cultural Impacts

Part of the allure of living in Alaska is the connection that you feel with all life on Earth and the Earth itself. Now I feel like I am losing that connection. Humans have changed the Earth and now it is causing us to change too. I also feel for native people here and in Canada who rely on animals such as caribou to survive. They will have to change their way of life because of people like me. That is not right at all.
I would like to meet one of these people to apologize.

Ecological Impacts

Not all of Alaska stays permanently frozen underground. Areas where the soil thaws every year create unique habitats with unique organisms. We will lose these species and these environments if something is not done soon. I already have noticed that certain animals don't come around as often as before.



Giancarlo Cassini – 61 years old

I am a collector and dealer of rare and antique maps. Clients from all over the world visit my shop in Paris, where my family has been in the cartography business for more than 300 years. I mainly deal with traditional maps made by hand. However, my son wants to continue the family legacy, but with a modern twist. He is currently studying to get a geography degree with a specialization in GIS. I don't fully understand everything he tries to explain to me, but it basically involves using GPS technology similar to what's in my car to map and study the world. In his classes, they have discussed the challenges that they currently face due to global climate change and will continue to face in the future.

Physical Impacts

Global – As temperatures rise and ice continues to melt, sea levels will rise too. This will change coastlines and force us to redraw the maps of the world. While large landmasses will only be slightly changed for now, small islands could be wiped off the map forever. Also, as large portions of ice break away and fall into the ocean, landmasses will physically change. This will have to be reflected in new maps.

Regional – We are not immune to the effects of climate change in my country. My brother, who lives in Le Havre, a coastal town in northwest France near the English Channel, is worried that he will have to move if the ocean rises as high as predicted.

Economic Impacts

I am not sure how climate change will affect me economically. I joke that it will keep me and other cartographers in business because we will have to keep remaking maps, but most maps aren't made by hand anymore. Just about everything is done by computers and if new maps are needed every few years, I imagine that they will be made by computers because it is much faster. I will most likely continue to sell antique and outdated maps, but some of the outdated maps will only be 19 years old. That is quite alarming.

Social/Cultural Impacts

It is an interesting time to be a mapmaker. In the past we used to make maps to chart our world and its discovery, but now we will make them to chart the progress of its change. How many maps will need to be made before things turn around? I also worry about how climate change will affect my cousin who owns a vineyard. France is known for its wine and she has won many awards. She says it is all about the location of her land, which allows just slightly more rain to fall on her grapes than her neighbors. Will this change as the Earth changes? *Will we lose part of our French culture to the changing Earth? Are other Parisians worried about this?*

Ecological Impacts

I understand that all plants and animals on Earth are related, but I really don't know much beyond that. My cousin knows all about the relationship between soil, rainfall, and other nutrients because these combinations affect her wine. I can only imagine that changes in any one of these factors will affect natural areas throughout this region and probably the world.



Jost Rickmann - 45 years old

I live in Northern Holland, outside of a town called Waardpolder, on a farm near the coast of the North Sea. I raise dairy cows, and I sell my milk and cream so that it can be made into cheese and yogurt. Our climate is perfect for producing dairy products due to its cool wet winters and mild summers. We have reclaimed many acres of land from the North Sea by building a series of dikes and seawalls, and have drained the land to produce broad, flat fields that are ideal for grazing dairy cattle. Most of our country is less than 1 meter above sea level, and some areas are several meters below sea level. Our country is small and densely populated, so we must be very efficient in our use of the land and its resources. Most farms in our country are small, but our farm yields are among the highest in the world.

Physical Impacts

Global - We have all read and heard about rising sea levels due to a rise in the average temperature of the ; world government organizations have said that by the 2100, sea levels will rise by an average of more than .5 meters. As the climate changes and the warms, there will be greater threats from more severe storms throughout the world.

Regional - With 41,526 square kilometers, Holland has a population of about 16 million people. If flooding occurs on a mass scale, many people will be displaced from their homes and workplaces. Rising sea levels will wreak havoc on our way of life. The people, and the land itself, would be swept away, costing the Dutch their livelihood and possibly their lives.

Economic Impacts-

If flooding should occur, land will become scarce. Scarcity increases price and will cause conflict between differing economic classes of people. If we do have major flooding, wealthier people will be able to keep the lifestyle that they had before, but we have had so many poor immigrants from North Africa and the Middle East, and I am concerned about what the displacement of these poorer people will do to my country. We have many people here in the Netherlands, and we need all the land we have in order to feed them and others in Europe. If the land is under water, we will lose billions of euros in lost agricultural products.

Social/Cultural Impacts

Future environmental conditions will directly impact the Netherlands' land mass. Its people and government will have to adapt to rising sea levels by building more and higher dams and seawalls. If the North Sea rises as predicted, and winter storms become more severe, people will have to relocate at least until the waters recede. Migration of entire towns could turn into a long-term issue if our flood-control technologies cannot keep up with climate change.

Ecological Impacts

The rate at which the temperature and sea level rises will probably be too high to allow many different plants and animals to adapt or migrate. Many native plant and animal species are threatened with extinction in the Netherlands; new species from other parts of Europe and Western Asia might take over if they can migrate quickly enough. This will change one of the most unique and beautiful aspects of this country forever.



<p>Amy Russell – 36 years old I am a marine biologist doing research on Antarctic zooplankton populations through Wood’s Hole Oceanographic Institute in Massachusetts. In particular, I have been collecting and recording data on a species of Antarctic krill call <i>Euphausia superba</i>. Krill are tiny shrimp-like invertebrates and historically, they have been present in huge numbers and serve as a primary food source for all types of larger animals from squid to whales. Over the last eight years however, our data suggests that the numbers and distribution of these organisms have been fluctuating dramatically. The goal of my research is to determine if this fluctuation is due to climate change, or is the result of some other factor that we are not now aware of.</p>	
<p>Physical Impacts Global - If climate change is involved with the decrease in Antarctic krill populations, what effect is it having on zooplankton populations in other marine environments? Regional - Our data shows a steady decrease in Antarctic krill populations. If this trend continues, it could be a strong indicator of regional disruption of Antarctic ocean temperatures. Without stable and abundant <i>Euphausia</i> populations, populations of secondary and tertiary consumers in the Southern oceans will, I believe, be negatively affected as well.</p>	<p>Economic Impacts If in fact, the cause of the fluctuations in <i>Euphausia</i> populations is a result of climate change, this is a strong indication that we could see profound decreases in fish species that have important economic value. Additionally, the Southern Ocean and the Antarctic ice shelf are a driving force in determining much of global weather patterns. Disruption of the long-term thermal stability of this region will have extensive economic impacts in the densely populated regions of South America, North America, Africa and Europe. <i>Imagine...a small, seemingly insignificant crustacean like Euphausia serving as a global “canary in the coal mine” for a goat herder in Algeria.</i></p>
<p>Social/Cultural Impacts Climate change is taking place within the context of many other ongoing changes in the Antarctic, including observed increases in chemical contaminants entering the Southern Oceans from other regions, overfishing, land-use changes that result in habitat destruction and fragmentation, rapid growth in the human population, and cultural, governance, and economic changes.</p>	<p>Ecological Impacts As climate change continues, most of the land-based Antarctic ice sheet is actually likely to thicken if projected warming increases snowfall. There is a small risk, however, that the West Antarctic ice sheet will retreat in coming centuries. This is because the West Antarctic ice sheet is moored in an oceanic basin, where slippery mud covers the basin floor. This unique setting makes the ice sheet potentially unstable. Given the uncertainty of continued climatic shifts, it is difficult, at best, to predict the long term ecological impacts of climate change in the Southern Ocean region.</p>



Rizwan Khan Al-Doubhi - 72 years old

I have lived in the Saharan part of North Africa for all my life, mainly in what is now known as Algeria. I am a Berber and we are a proud and ancient nomadic people. My people have lived here for thousands of years. We move from place to place to find grazing land and water for our herds of goats. The goats have provided my people with most of our needs. But now, the sun seems to shine hotter, the rains do not come as often, and we have to move farther and farther to find grazing land for our goats. I am an old man, and have had a good life blessed with many children, but now I am troubled for the future of my grandchildren.

Physical Impacts

Global - For more than 4,000 years, my people have lived off this land, and we have survived many changes. It seems now that the world is changing faster and faster. Is this the beginning of the end for the world we have known for so long? I wish someone could tell me what the future holds for my people.

Regional - For as long as I can remember, my people's land has had mild winters with much rain. This allowed us to survive the hot, dry summer months. But now, there is less rain in the winter, and our summers are hotter than in past years. The water we need for our goats is so much more difficult to find, and we have to move farther and farther every year.

Economic Impacts

Our wealth as a people has been based on our livestock. We ask others for little else in order to survive. Now our goats are thinner. They produce less milk, less meat, and produce fewer young. Many die from diseases that we never knew of before. Without strong, growing herds of our animals, we will not be able have the way of life we have known for generation after generation.

Social/Cultural Impacts

My people have been in this land since before Muslim settlers arrived. Our traditions and way of life have sustained us for many, many years, and they have been passed on from one generation to the next. Our children have learned those traditions from their parents and grandparents. I am afraid now that it is all coming to an end. I only hope that my life ends before my peoples' traditions and culture disappear completely.

Ecological Impacts

Just as we have to move further and more often to find food and water for our goats, the animals and plants that we have shared this land with for thousands of years must travel more to find what they need to live. In the past, the lion and the cheetah would sometimes attack and eat our kid goats; we respected these animals for their courage and cunning, but would kill them when they came near our herds. Now we rarely see these beautiful and noble creatures. In some ways this a good thing for us, but what does this tell us about our land and all the creatures who live here together?



Eddie Kim – 28 years old

I am a carbon-offset analyst. Companies call me to analyze their carbon footprint and then I suggest ways in which they can balance the negative impact they are having on the environment by helping someone who is having a positive impact. Many companies cannot or will not effectively reduce their carbon emissions for many different reasons. I offer them ways to address this problem. The most popular option is for the larger company to pay a smaller company that is carbon-neutral, such as a wind farmer, so that he or she can continue to generate clean energy and even possibly expand their business.

Physical Impacts

Global – Although the best way to slow down the process of global climate change is for major culprits such as coal-fired power plants to reduce their emissions, I offer an attractive alternative. Ideally, as companies find ways to reduce emissions without reducing profits, they are encouraging other companies to generate clean energy that can help prevent CO₂ levels from rising.

Regional – I’m originally from Minnesota, but my job takes me all around the Midwest. We have many farms in my home state, but we can’t compete with Iowa. Farmers in this state are given royalties from power companies to use their land for wind farming.

It seems to me like the sky’s the limit. This is clean, renewable energy, and it supports farmers. Who wouldn’t want this?

Economic Impacts

By giving money to support clean-energy initiatives, wind power technology may become cheaper over time. Right now it is difficult for people to commit to so-called “green technology” because the initial cost is often more than traditional technology. Although it has been shown that you will save money in the long run, it is difficult for people and companies to think that far ahead. However, as this technology becomes more widespread through offset payments, the price should come down, which will benefit everyone.

Social/Cultural Impacts

I feel that supporting clean energy such as wind farming is a win-win situation for everyone involved. It supports businesses by not forcing them to make drastic changes, which could drive up costs for consumers. It also supports our farmers. I think everyone in our society would agree that putting less CO₂ into the atmosphere is a good thing. If the Senate passes its own version of cap and trade legislation like the House did back in June 2009, then I think business will be booming!

Ecological Impacts

The majority of scientists feel that elevated carbon dioxide levels are the main reason the Earth’s temperature continues to increase. If we can stop the amount of CO₂ in the atmosphere from increasing, then we could possibly prevent all of the massive problems such as flooding, ecosystem changes, and extinction of plants and animals from happening. However, if we could find a way to decrease the CO₂ in the atmosphere, that would be even better.



Caitlin Harris - 16 years old

My life is all about the mountains. I started out skiing as a little girl where I grew up outside of Park City, Utah. Now I'm a competitive downhill skier, and I'm hoping to make the U.S. Olympic Team in 2014. I love training up in the mountains...just me, and the mountain and nature and the snow. There's no other place that I feel more alive and more connected to the world than when I'm up there by myself coming down that mountain at 75 miles an hour. It's just now, I've got to be really careful, because I'm seeing more and more exposed rocks and bare ground where there used to be six feet of snow.

Physical Impacts

Global - There's less snow all around the world than there used to be. I mean, it was raining most of the time up in Vancouver this past winter when they really needed snow for the Olympics. Even in Europe, they have to make more snow, make it earlier, and keep making it all season, just so they can keep the runs open.

Regional - The winter temperatures out here don't seem to be as low as they were when I was younger, and the amount of the snowpack has decreased too. I read that the Rockies are getting about 15 to 30 percent less moisture in the spring snowpack since the 1950s, and here in Utah the spring snowmelt starts 10 to 30 days earlier than it did 30 years ago. What all this means is less and less snow for me to ski on... it's a total bummer for sure.

Economic Impacts

Outdoor recreation in Utah alone generates more than \$5 billion in direct revenue, produces more than \$4 billion in retail sales and supports more than 65,000 jobs. The majority of that is related to winter snow sports, like skiing and snowboarding. And if we don't have snow in the winter like we used to, then this place is going to lose a whole bunch of money and jobs faster than we realize.

Social/Cultural Impacts

What would the world be like if there wasn't a Park City, or Vail, or Kitzbuhel, or San Moritz? Skiing is my life, and for so many others it is too. I don't know what I'd do if I couldn't ski anymore, I mean I'd totally freak. I just couldn't deal with it. It scares me, more than it should I guess.

Sometimes I think I need a shrink just to help me deal with it all.

Ecological Impacts

I grew up skiing, but along the way I grew to love the land and the animals and plants that are found around here. I love to fly fish for trout in the rivers, and I do a lot of my summer training up in the mountains, so I know what a big impact snowpack has on the rest of the ecosystems in this area. Without decent snowpack, there's not enough water to go around for all the fish, ducks, and elk. And what about us? We get our water from the same source, and we're using it up faster and faster every year. What happens if we start running out?



Dr. Jamie Nagani - 32 years old

I just completed my doctoral studies in wildlife biology from Montana State University. My research involves correlating ground water levels to populations of migratory waterfowl, in particular mallard ducks, on the Central Flyway. As an undergraduate, I was a biology major and I did my graduate work in water resource management. I was just hired as a consultant to the Kansas Department of Fish and Wildlife to head up a study that seeks to offer solutions to the problem of reduced populations of migratory waterfowl on agricultural lands in western Kansas.

Physical Impacts

Global - Although we don't know exactly how climate change will affect global water resources, it is clear that global water resources are already stressed. This is independent of the effects of climate change, and any additional pressure from climate change will only increase the struggle for available water resources. The models we now have generally show that precipitation will increase at high latitudes and decrease at low and middle latitudes.

Regional - With a warmer climate, droughts and floods in the Western Plains states could become more frequent, severe, and longer-lasting; there will be too much water at times, and not enough at other times. The drought of the late 1980s and floods of the late 1990s showed dramatically what the impacts might be if climate change leads to a change in the frequency and intensity of water distribution across the Midwest and Plains states.

Economic Impacts

Since 1998, the cost of Mississippi River Drainage (MRD) flooding has been above \$22 billion, with an additional \$12 billion having been spent on flood-control measures.

The drought of 1998 cut corn production by 45 percent and other grain crops by 31 percent. This translates to direct and indirect losses of more than \$10 billion. If we were to experience a sustained period of substantially reduced precipitation levels, losses would no doubt exceed the 1988 losses by as much as 40 percent.

Social/Cultural Impacts

The future effects of climate change on water resources will depend not only on climatic changes but non-climatic changes as well. Increased demand for water for agriculture, industrial, and residential purposes will create a delicate balance that could be easily tipped if in fact climate change does have negative impacts on precipitation levels and frequency in this region. Water is our most important resource, and a struggle for what we once took for granted will have far-reaching impacts on the social and cultural fiber of this area for generations to come.

Ecological Impacts

The effects of changes in water availability will have severe and long-term impacts on the ecology of the Plains states. These include reduction and depletion of habitat for wildlife, a shortage of available food resources, increased vulnerability to predation, migration and concentration of species as they compete for available resources, and a general loss of biodiversity. I do think with proper water-management planning on our agricultural lands, we can develop a model for water use in other places.



Dr. Damaris Joro – 44 years old

I am an epidemiologist working at a site near Mt. Kilimanjaro in Tanzania, Africa. I have personally seen what climate change can do to my patients. Due to the warmer temperatures, insects such as mosquitoes have become more prevalent and malaria is becoming an even bigger problem than it already was. We have also noticed more cases of cholera and African sleeping sickness.

Physical Impacts

Global – Waterborne infectious disease will increase throughout the world as temperatures continue to rise. Warmer temperatures mean more insects will survive and be able to lay eggs. It is possible that more generations will be born than in previous years. Also, these insects may be around for longer periods of time especially if freezes and frosts that typically decrease populations don't happen as early or as often as they should.

Regional – Malaria has always been a problem, but we have seen more cases lately. Personally, I think the warmer temperatures are to blame. Locals have mentioned that they don't remember the rains being so heavy and so frequent either. I think this may be the reason cholera has become more widespread since the rainwater brings waste with it down into our valley.

Economic Impacts

As more and more people get sick, how will this affect the local economy? Tourism is popular throughout this country, but especially near Kilimanjaro. Many people want to climb it, and local people help tourists on their quest. Villagers cannot help tourists if they are suffering from malaria. Also, will tourists still want to come here once they realize that disease is on the rise?

Social/Cultural Impacts

I find it difficult to treat my patients as they question why there are so many sick people in their village. These people are not the ones responsible for the increase in temperatures, but they are the ones who are suffering the most.

Ecological Impacts

Can we expect even more types of infectious disease in the future as insects move up here from areas further south? I think this is already happening because of the increase in sleeping sickness. The tsetse flies that carry this disease don't usually live around here. Did they come from the south?



<p>Sarah Hanes - 55 years old I am a clinical psychologist at Oxford University researching the effects that environmental stresses have on individuals and communities. These stresses include fears of climate change, post-traumatic stress disorder after having survived natural disasters as well as environmental catastrophes like the Gulf Oil Spill of 2010. On so many levels, and across all political, ethnic, cultural, and economic spectra, people around the globe are worried. My work seeks to understand the stress this causes in peoples’ lives, and what short- and long-term impact this stress has on their lives.</p>	
<p>Physical Impacts Global - The effects of climate change, as well as natural disasters related to climate change like hurricanes and droughts, have been well documented throughout the world, and no region is immune from these negative impacts. Many regions of the world are experiencing higher rates of severe storms, longer dry periods, and faster-rising temperatures. People around the globe are aware of the challenges that we as a planet face in the near future, and many are experiencing psychological stress because of this. Regional - Communities that have developed systems to solve problems affecting critical local issues felt a sense of being empowered and “in control.” The issues relating to my research suggest that one of the major effects of climate change and natural disasters is that communities and individuals often feel powerless, and at times, hopeless in their ability to change what they see as an uncertain future.</p>	<p>Economic Impacts Peoples economic lives will, on average, be severely disrupted if the predictions for future climate-change events are correct. Jobs will be lost, as well as created, but the net result points to a society that will be forced to endure major economic stress caused by the loss or disruption of economically vital industries. Agriculture, shipping, transportation, manufacturing, as well as municipal services like water and electrical utilities will be forced to endure major changes. There are no useful estimates as to what the cost will be to economies globally.</p>
<p>Social/Cultural Impacts Continued global warming will have significant impacts on the social and cultural fiber of regions throughout the world, and will surely influence and increase mental health issues. This will be especially evident in the case of climate-related natural hazards, in which property losses and dislocation from homes and communities causes serious and long lasting psychological stress. Family and community dislocations create a special stress for children and those of lower income and social status.</p>	<p>Ecological Impacts People all over the world are beginning to realize the importance of having a healthy planet and sustainable biodiversity in their lives. Whether a simple farmer in China, an attorney in Spain, or a young, competitive woman skier and outdoor enthusiast in Utah, they all seem to suffer from a perceived loss of “nature” in their lives. Climate change will obviously have major impacts on not just habitats, but inhabitants as well.</p>



Dr. Jennifer Swan - 41 years old

I am the director of environmental education at the Chicago Botanic Gardens. Currently, I am coordinating a citizen-based plant monitoring website called Project BudBurst, which is a national field campaign for citizen scientists of all ages and backgrounds. Its goal is to engage people throughout the United States and around the world in the collection of important climate-change data based on the timing of leafing, budding, and flowering of common herbaceous and woody plant species. In particular, I'd like to encourage students and other young people to observe and record their information about important events in the seasons of their local plants, and add to the already collected data their findings. I am convinced that engaging and educating our young people about the forces that are driving climate change is the best hope for developing citizens and scientists that can develop and implement solutions to this, our planet's most pressing problem.

Physical Impacts

Global - When citizens from around the globe become engaged in recording and sharing data about significant events in the lives of plants and animals, they become part of the solution to map, develop evidence for, and draw conclusions about climate change on this planet.

Regional - Just like politics, all climate issues are local. By collecting and sharing data, all of the members of our communities can develop a better understanding of how climate change is affecting our own part of the world.

Economic Impacts

Having long-term data relating to plant life events will allow scientists around the world to make more accurate predictions about how climate change will affect our planet. Having this knowledge will allow us to better prepare for the inevitable economic losses that result from alteration of the Earth's weather and climate

Social/Cultural Impacts

The goal of Project BudBurst is ultimately to connect citizens from all walks of life in the work to understand and be concerned about the challenges posed by global climate change. Young people, and especially students, are encouraged to become part of this community of citizen-scientists and in the process, share your knowledge and understanding with your own community.

Ecological Impacts

Many plant species are already being adversely affected by climate change. Species ranges are shifting at an ever-increasing rate. Many important native plants are disappearing from their historic ranges, and invasive species are seeing a general expansion of their ranges.

The disruption of plant species that form the basis of most food chains in an ecosystem will have far-reaching impacts on other organisms as well.



Theo Ikummaq – 53 years old

I am an Inuit hunter. I was born in an igloo near Iglulik, which is located in Northern Canada. My people and I have lived in the Arctic for generations. We are a subsistence culture, which means we live off the land just like our ancestors did. We get everything from the Earth and take only what we need. However, not everyone on Earth lives as we do, and now I feel that our way of life is at risk. As temperatures warm, the world around us is changing. We must change along with it or I fear that we will not survive.

Physical Impacts

Global – I fear that areas around the world are experiencing the same thing that I am. I don't think that any of our neighbors in this part of the world will be spared. As ice melts and water levels rise, what will become of these people and their way of life?

Regional – Where is all of the sea ice? It seems that every few years there is less than before. It has seemed like this for the past 30 years. Some areas that used to be frozen well into the summer are now thawing in the spring. Hunting seals has been difficult because they are becoming rare in the area. The landscape is changing.

Economic Impacts

My ancestors relied heavily on animals to get what they needed, and I still do too. However, my family also makes native arts and crafts to be sold to those in the modern world. We already pay more for supplies because of where we live. If the land continues to change and we continue to lose our animals, we will have to pay for even more supplies from the modern world. I can't afford that, because I don't have the money and I don't want to abandon my culture.

Social/Cultural Impacts

Our way of life was already threatened by modern life. Many of the young generation have chosen to leave our villages for modern towns and guaranteed jobs in the mining and oil industries. This angers me because they receive money for polluting the world that I respect. Have they already forgotten what it means to be Inuit? If they will not follow our traditions, then what will become of us? I don't want to be forgotten.

Ecological Impacts

The Earth is not the same. The balance is gone. There is less ice, more water, and the animals stay away almost as if they are punishing us. Where are they going? They must have gone where there is more ice. All parts of the Earth are connected and now those parts are changing. I don't think the land will ever be the same again.



Bradley “Buddy” Wells – 45 years old

I work for Exxon-Mobil and we have a long history of helping the people of the world meet their energy needs through sources such as oil and natural gas. No one seemed to mind what we did years ago when gasoline was cheap and people would drive wherever they wanted whenever they wanted. Nowadays, so many people are quick to point their fingers at us as the main cause of global warming. However, I don’t feel that climate change is caused by human activity. The jury is still out. There are many other sources of greenhouse gases besides fossil fuels. The temperature of the Earth has gone up and down throughout its history and now is no different. The Earth has actually been warmer than it is right now and we are all still here. I think we’ll all still be here in the future too.

Physical Impacts

Global – So many other factors play a role in the climate of the Earth, but people tend to overlook those. The sun experiences cycles of increased activity in the form of sunspots and the solar flares that often follow them. During this time the sun releases more energy and last time I checked, when something releases more energy, it gets hotter. Who’s to say that the sun isn’t responsible for the increase in global temperatures we’ve seen recently?

Regional – Whenever I drive out to inspect one of my company’s sites I can’t help but notice all of the cows grazing in nearby pastures. I read that cows release 100 million tons of methane per year, which is 75 percent of all methane released by all animals. Methane is a greenhouse gas that is 21 times more potent than CO₂. Maybe people should point their fingers at cows instead of us?

Economic Impacts

It would be great if we all could use energy sources that didn’t release CO₂ into the atmosphere. It would also be great if the entire world joined hands and sang songs of peace, but it just isn’t going to happen. At least not for a while. The reality is that oil and natural gas are proven fuels that are supported by proven technology. We can’t ask companies to reduce their emissions overnight because that would cost them too much money and consumers would have to foot the bill. We also can’t ask people to completely switch to alternative energy sources such as solar or wind power, because those simply are not proven yet. They don’t provide as much energy as fossil fuels, and the infrastructure to deliver them on a large scale is simply not there.

Social/Cultural Impacts

I don’t know why everyone is so quick to blame oil companies for global climate change. I think these people need to remember that my company didn’t produce gas-guzzling SUVs and force people to buy them. We didn’t cause all Americans to drive to the grocery store when it’s only one mile away. We merely found the oil, extracted it, and gave it to the demanding public. It’s the American dream to own a vehicle and hit the open road. It’s tough to argue with that, right?

Ecological Impacts

The Earth is heating up and animals and plants might be affected because of that, however these very same animals and plants have survived ice ages and other weather events before. Why are we worried that they won’t survive this current change? Nature will find a way. I read that the extra CO₂ in the atmosphere may actually help plants since they need it for photosynthesis. That should please all of these tree-huggers.



<p>Gabriel Sanchez – 48 years old I live in a rural town just outside of Van Horn, Texas. We are the leading state in wind farming and it makes me sick, both literally and figuratively. All of these politicians and corporate suits spew their hot air about how great this technology is. Well, they have never had to live near one of those turbines! I swear it is as loud as when my neighbor revs his big block truck engine! I also think it is making me and my wife sick. We need to do something about the mess we've gotten the planet into, but I don't think this is the answer.</p>	
<p>Physical Impacts Global – The average wind farm can operate for about 20 years and does not generate any carbon dioxide during its lifetime. It is estimated that relying on wind power will prevent 1.5-3 billion tons of CO₂ from entering the atmosphere. Regional – It sure sounds like wind farming has a great impact on the Earth, but I just don't like what it is doing to my home state. The entire landscape is changing. I can't look out across the horizon without those turbines rearing their ugly, spinning blades. Texas is known for its ranches and open lands, but with these wind farms you can't escape the mark of man and that troubles me.</p>	<p>Economic Impacts Thanks in part to wind farms, but also to fossil fuel production, Texas leads the country in energy production. But we also lead it in energy consumption. It is because of this that we pay 56 percent more than people in other states. Many ranchers and even schools are turning to wind farming because they will get paid for putting turbines on their property. I can't argue with wanting to earn money, and wind farms do generate new jobs, but I wonder what will happen in 20 years when these farms are no longer operational. Can a ranch that was converted to a wind farm be converted back? Where will we get our food if we keep using farmland for something else? Will we learn our lesson too late?</p>
<p>Social/Cultural Impacts I feel that by converting to wind farms, my ranching buddies are losing their Texas identity, but that's their choice. Something that I do have control over is the health of my family. Ever since they built that oversized windmill practically in my backyard I just haven't felt right. I get more frequent and more intense headaches than I ever did. I also get these dizzy spells every so often. I haven't slept well in months either! Doctors can't figure it out. They think it's in my head. I think it's those turbines above my head.</p>	<p>Ecological Impacts I read that increases in CO₂ worldwide are threatening many animal and plant species because their environments are changing. Despite what some people may think of Texans, we do have a healthy respect for wildlife and I want to help them any way that I can. Again, I'm not sure if wind farms are the answer. When driving past the turbines I have noticed a large number of dead birds that must have hit the blades while they were flying. There are many wildlife refuges along the Gulf Coast. These lands are used by migrating birds every year as they travel north or south. I fear that by trying to save them with wind power, we may actually be doing them more harm than good.</p>



Camille Cartier – 31 years old

I love living in Paris. I like to think we have the best architecture, food, wine, and fashion boutiques in all of Europe. Although some of my fellow Parisians would call me crazy, I even like to visit the tourist traps like the Eiffel Tower and the Arc De Triomphe. The only thing I don't quite care for is the warm summer weather. We usually escape to southern France to enjoy the cooler mountain temperatures and change in scenery. However, lately it seems like some of the city's warmth is following us. The past few summers have been warmer than usual. I hope this is not a trend.

Physical Impacts

Global – I recently read that it is best to refer to global warming as global climate change because some spots on Earth will actually get cooler. It all depends on what happens to the ocean currents near a particular area. So, Europe may warm up, but I wonder what might happen in the Southern Hemisphere?

Regional – I still remember the summer of 2003 in which almost 15,000 people died from the August heat in France alone. It is difficult to find buildings with air condition in this country because we rarely have to endure such temperature extremes. Most of Europe is the same way. I read that these heat waves are predicted to become more frequent as the average temperature of the Earth increases. Where am I going to go to avoid this?

Economic Impacts

I fear that the European economy may suffer if summers continue to get hotter. If people visit our cities, will they stay even if they are uncomfortable? Once word gets out, will more people plan to vacation elsewhere? What about the wonderful food of France? So much is dependent on our rainfall and temperatures. If these change, will we still be known for our food and wine? I'm sure we could still produce something, but will it be the same?

Social/Cultural Impacts

Many Parisians spend their summers away from the city and away from tourists. My family has always traveled to southern France. However, it is predicted to be warmer and drier down there in the coming years. We will have to change our vacation plans if this is true. Also, there are many wineries in the Provence region where we have our cottage. In the past, dry years have really hurt the winemakers. I fear France may lose the ability to produce its famous wines if the climate does not cooperate.

Ecological Impacts

Another reason why I like southern France is because it is mainly countryside that has not been changed by people except for the occasional vineyard. However, if more and more people leave cities to avoid the heat, what will that do to the wildlife? Humans have already taken so many habitats from animals around the world. This will only make matters worse.



Jim “J.R.” Rogers - 51 years old

I live on a 3200-acre farm in west central Kansas and have a prosperous wheat, corn, and sorghum business. Most of the crops we harvest are eventually turned into animal feed for livestock and poultry producers. On average, I can produce nearly five times the grain per acre that this farm produced in the 1920s. This allows other Americans to buy low-cost, high-quality beef, pork, and chicken that is always available. Things became a little tougher these last few years, since we’ve been in a drought situation. For three generations, my family has used the groundwater from below our land to irrigate our crops to increase the yield. Now there’s talk about reducing our Annual Groundwater Allocation (AGA). It seems that the aquifer we draw from isn’t being recharged at the same rate it used to be.

Physical Impacts

Global - I’ve read and heard so much about this global warming thing, but I’m not totally convinced; the world has always gone through droughts, floods, ice ages, and times where it was tropical everywhere. We’re only here for a blink of eye; we should use what we have to make the best of it.

Regional - Locally, we have had an unusually long dry spell, it seems like spring comes earlier every year, and the last few summers have seen temperatures go into the 100s for days in a row. All this put together means less and less water for irrigating my fields, which means lower yields per acre of land. *I’m all out of ideas. Can someone help me get more water for my crops?*

Economic Impacts

Right now, we’re not seeing profits like they we’re six or eight years ago. It’s not like we’re in trouble right now, but it has been tough. The economy overall hasn’t been good, and that only makes things worse. For example, we should have turned around two of our older combines for new ones, but money and credit are tight, and so we’re just going to keep the old ones. I’m not the only one doing that sort of thing; everybody is cutting back where they can, and since agriculture drives our local economy, when agriculture cuts back other people are bound to lose their jobs. How will people survive these tough times?

Social/Cultural Impacts

There are a lot of my friends and my Dad’s friends who have been here since before the Dust Bowl Era... There are quite a few who remember it and had to live through it. But that’s just what they did; they lived through it. Sure it’s been dry here the last few years, but it’s been dry before and it’ll be dry again sometime in the future. It is causing stress and tension in a lot of folks around here, but we’ll live through it, like we always have.

Ecological Impacts

In the fall and winter, we lease out some of our acreage to duck and goose hunters. My land has traditionally been perfect for migrating waterfowl, and these birds have used the potholes and scattered wetlands for breeding in the spring and stopping off on their way south in the fall. But I’ve seen many of the potholes go dry, the three major wetland areas on my property are getting smaller every season, and we definitely have seen fewer birds each year. The lowered groundwater levels aren’t just affecting my wheat and sorghum, I guess.



Kenneth Cox - 72 years old

I live just a few miles from Glacier National Park in Montana, outside of a town called Kalispell. The Big Sky state hasn't always been my home. I grew up in northern Wisconsin during the War, but I wanted to see other places, so I took a job with the National Park Service in 1958. They sent me here to Glacier when I was 20 years old. The land here was so different than it was back home in Boulder Junction, and I fell in love with it from the get go. I spent 38 years working for the Park Service, and the last 14 as a volunteer. In those 52 years, I've spent a good deal of time up in the high country, during all seasons of the year, and so you might say I know it pretty well. Let me tell you, it's not the same as it was back when I started working here, especially the glaciers that give this place its name. There's plenty of other evidence to back me up too.

Physical Impacts

Global- Climate change is happening. Glaciers, snow cover, ice caps, ice sheets, and icebergs are melting all over the world, and the rate of this melting is increasing every year. As this ice melts, it causes ocean levels to rise, and disrupts the normal flow of ocean currents like the Gulf Stream. This in turn has powerful effects on weather and climate all over North America, Africa, and Europe.

Regional- The glaciers that give Glacier National Park its name have shrunk rapidly since the Park was established 100 years ago in 1910, mostly due to changes in regional as well as global climate. These changes include steady increases in daily minimum temperatures, and persistent droughts. This warming is most likely going to continue, and the Park's glaciers are predicted to completely disappear by 2030. I'll be 92 then...I hope I'm not here to see that.

Economic Impacts

Glacier is the 11th most visited national park in the United States, and generates around \$1 billion every year in tourism revenues. Most of the visitors are from out of state, and their spending supports more than 4,000 jobs in Montana. Will they still come to Glacier if there aren't any glaciers to see?

Social/Cultural Impacts

Glacier National Park has been here as a park for 100 years, and its mountains began rising about 70 million years ago. The park dominates this region. Its beauty and majesty are a part of the people who live here. For people like me, it's been the most important thing in my life after my wife and children. You can't stop change, but in this case I wish I could. I feel like I'm losing, like we're all losing a dear old friend.

Ecological Impacts

Glacier is the best place in the lower 48 states to see the west as it was at the time that Europeans first explored this region. All the major predators, including bears, wolves, lynx, wolverines, and mountain lions, along with mammals such as mountain goats, bighorn sheep, and elk are present in good numbers here in Glacier. Climate change, and the reduction of snowpack and glaciers, will force these animals out of their historic ranges and push them further north.



Isabela Pierce, M.D., Ph.D. – 37 years old

I am an Assistant Director of the Center for Global Health at the Center for Disease Control in Atlanta, Georgia. My specialty and area of responsibility is developing computer models for future potential outbreaks of vector-borne diseases at various mean global temperatures. What this means in simple terms is how will occurrences of diseases that are transmitted from person to person by another organism, like malaria or West Nile Virus, be affected by climate change. Unfortunately, this is a difficult task because at this time, scientists do not have an understanding of disease vector ecology needed to make reasonable or useful predictions. It will be important for us to acquire multiple data sets from multiple sources, such as climatologists, wildlife biologists, and epidemiologists, in order to build on our understanding of the effects of climate change on vector-borne diseases.

Physical Impacts

Global - The global effect of climate change as it relates to human health is clearly far-reaching. As global climate is altered by increased levels of greenhouse gases, we will see further environmental changes, which in turn will likely result in unforeseen outbreaks of many vector-borne diseases.

Regional - On a regional level, many areas where a particular disease was previously rare or unknown will experience increased incidences of these diseases. For instance, as temperature increases, the malaria parasite reproduces at a higher rate, and mosquitoes take blood meals more frequently, thereby increasing the rate of transmission in humans. This is but one example; there are many others.

Economic Impacts

Over the next 20 years, the cost to the United States alone due to climate-related healthcare is estimated to be nearly impossible to predict, but it will surely exceed many trillions of dollars. Globally, the costs are even more staggering. At a time when many, if not most, of the world's economies are struggling to meet the demands of growing populations, climate-related health costs will push many of those nations into a state of economic chaos, unless they begin to plan for this now.

Social/Cultural Impacts

Increases in rates of human infections of various vector-borne diseases will cause unforeseen social and cultural disruption. Increased mortality rates will result in the breakdown of family units due to the loss of one or more parents, and as family units fail, local, regional, and national governments will likely find themselves unable to deal with the resulting unrest, poverty, and competition for rationed medical care that will likely occur.

Ecological Impacts

Normal ecological interactions between host and vector organisms will be challenged due to the alteration of numerous abiotic factors such as temperature and water availability. All organisms, including those that produce human diseases, will be affected by climate change.



Stephanie Cornell - 34 years old

I am a marine biologist and master scuba diver running eco-tours to the Great Barrier Reef out of Cairns, Australia. The Great Barrier Reef is the most extensive structure ever built by living creatures and the only life form on Earth visible from the moon. This unique ecosystem supports the greatest concentration of organisms on this planet, including more than 1,500 species of fish, 350 different kinds of coral, 4000 species of mollusks, and 10,000 species of sponges. There are many species that have only been recently identified, and there are, most likely, many more yet to be discovered. I am concerned that rising levels of carbon dioxide and global temperature will have severe and long-lasting impacts on the diversity of this remarkable marine ecosystem.

Physical Impacts

Global - Oceans have a powerful and far-reaching role in determining the Earth’s climate and weather patterns. As the Earth warms, much of that heat is absorbed by the oceans. In what ways will the rise in ocean temperatures affect global climate and weather patterns?

Regional - The oceans also absorb a great deal of carbon dioxide. When carbon dioxide dissolves in water, it forms a weak acid, lowering the pH of the oceans. Most marine organisms and corals in particular, are very sensitive to changes in the pH of the ocean. Lowered pH, along with other factors, reduces the ability of corals to grow and reproduce. We don’t really fully understand the long-term effects this will have on the Great Barrier Reef.

Economic Impacts

More than two million people visit the Reef each year. They generate more than \$1.5 billion dollars (U.S.) in revenues for the northeastern Australia economy. The loss of this source of revenue would have serious impacts on a region that relies so heavily on tourism.

Social/Cultural Impacts

The Great Barrier Reef is truly a living wonder of the world, and has been building itself for roughly 600,000 years. Though I wish they could, most people will never experience the beauty of this delicate ecosystem, but simply by its existence, it adds so much to our world.

Ecological Impacts

As the Earth’s climate continues to be altered at an ever-increasing rate, the impact on corals and coral reefs worldwide will be devastating. Bleaching of reefs, reduced reproductive levels, and increased ranges of organisms that feed on corals, as well as a reduction in the overall diversity of the Great Barrier Reef are all believed to be directly related to increased levels of CO₂. It is seldom easy to rally the world around the plight of these often inconspicuous corals, but they are an important indicator of the potential for climatically related human health issues. *I should join forces with officials from the Center for Disease Control, and share our data in order to see if there is a correlation between coral losses and water-borne diseases in humans.*



Alexa De La Fuente – 20 years old

I live on the island chain of the Maldives, which is southeast of India. My country is beautiful. We have many different animals that call our coral reefs home. We rely on the ocean to sustain our lives. My entire family has fished tuna for as long as I can remember. As a result of the tsunami on December 26, 2004, our island is devastated. Now, we are scared of rising sea levels and our island disappearing because we are the lowest country in the world. Our highest point is only 7 feet above sea level.

Physical Impacts

Global – I read that sea levels rose by about 7 inches in the 20th century, and that they are predicted to rise 7-23 more inches in the 21st century. The shape of the Earth’s landmasses will be changed forever.

Regional – As sea levels rise, will I still have a country or will we be wiped off the face of the Earth? Our government has looked into purchasing lands in neighboring countries such as India and Sri Lanka, but will this be enough to fit all of my people?

Economic Impacts

So many people in my country rely on the ocean for their livelihood. Our two biggest industries are tourism and fishing. Both of these were significantly affected by the tsunami. If sea levels rise, many of our islands will be under water. Who will visit us then? Will there still be fish to catch? How will we continue to live our lives?

Social/Cultural Impacts

I am concerned about how our way of life will be affected as sea levels continue to rise. I find it ironic that a people who depend so much on the ocean will ultimately lose their way of life because of that very same ocean. If we move to another land, will our culture follow or will it change as we adopt the customs of our new home? Not only am I worried, but I am also angered by this. My family has never abused the Earth they way I know that people in other countries do, yet my family will be forced to pay for the actions of others. Do they even know what they are doing to me?

Ecological Impacts

The ocean around my country is home to so many unique animals. For example, we are known for the whale shark that frequents our waters. It is now endangered. Will it survive as the climate continues to change? What will become of our famous coral reefs as glaciers melt and salt water and fresh water mix?



Catherine Freeman – 48 years old

I own and operate A Day Without Sunshine Orchards, a family-owned 1250-acre orange and grapefruit operation near the Gulf Coast of Florida. By commercial citrus standards, our family’s orchards are considered small; most are owned by large corporations and are in excess of 4000 acres. The last several years have been tough on us. My orange groves have been hit by severe summer storms, we’ve had hard frosts in the winter, and rising sea levels are causing fresh water aquifers, which are our only source for irrigation water, to become salinated. The every-few-year-hurricanes were bad enough, but now they are becoming more frequent and more severe. Our profits are way down, and it’s getting harder and harder to make ends meet. I don’t know how many more years we’ll be able to absorb these financial losses and still stay in business.

Physical Impacts

Global - We all hear so much about global warming, but I’m not completely convinced that it is really happening. Parts of the world seem to be getting cooler, not warmer. And some regions are getting more rain than usual and others less...it just doesn’t make sense to me.

Regional - Here along the Gulf Coast, the biggest issue is water; too much, too little, and in the wrong place at the wrong time. This area’s economy is based on agriculture, and having reliable fresh water sources is essential to grow produce of any kind.

Economic Impacts

Florida produces more than \$7.5 billion worth of agricultural commodities annually, with citrus production totaling more than \$1.5 billion. If Florida’s weather and climate continue to change like it has over the last 10 years or so, we’re going to lose so much money, both in actual values of the crops we produce, and in lost jobs and tax revenues as a result of these agricultural losses. *I wonder if farmers in other countries are experiencing the same problems?*

Social/Cultural Impacts

It’s getting harder and harder to make the kind of living we’ve become accustomed to. There are times when I think about selling our land to developers and just getting out of the business altogether. My family has been growing citrus in Florida for more than 100 years, and we’ve provided good-paying, stable jobs to generations of workers. If we get out of the business, what will they all do to make a living?

Ecological Impacts

As small, family-owned orchard operation, we pride ourselves on being good stewards of the land, and we’ve been able to do that and make a very comfortable living in the process. A portion of our land is kept undeveloped to provide habitats for many native species of plants and animals. But if we go...they’ll go as well.



Paul Sachs - 29 years old

I am a political activist from Boulder, Colorado. I get my social conscience from my dad, who was politically active in the 70s. I've most recently been active in organizing student groups and other young people to rally and protest against governmental responses to the problem of climate change. Global warming is not a problem for tomorrow, it is a problem of today, and it jeopardizes all life on this planet. There is a conflict between living a green life and continuing to live the old way. And what is at the heart of this conflict? Corporate greed and profits.

Global Physical Impacts

Global - How can the politicians and CEOs of this world ignore the evidence that we are changing the world's climate, and that it is caused by "Western-style" consumerism. Government and corporations have been in a partnership based on their own survival, and have mortgaged the world's future in exchange for short-term greed and profits.

Regional - Young people are the key to changing the status quo. The threat of climate change just might be the thing the rallies our community and state to start the process of changing the way we live.

Economic Impacts

When people realize how the corporations have exploited them, they'll stop buying their products. This will open up huge opportunities for companies that have a social conscience and are less concerned about profits and more concerned with developing green products that people need.

Social/Cultural Impacts

If you are not part of the solution, you are part of the problem. Climate change is the most important challenge we face as a planet. Finding solutions requires a completely new way of thinking about the choices we make, from our elected leaders to our cars, to the foods we eat every day. *My next project is going to take me up to Big Sky Country...I'm going to organize a group to increase awareness of the threat to Glacier National Park's namesake. I'm sure the rangers up there have noticed these changes.*

Ecological Impacts

If we don't make big changes and soon, we're going to let the people who run the corporations and the political system to destroy our planet. The people motivated by greed and power may think that a few less polar bears is not a big deal...they forget that we humans are part of this biosphere. First it's the polar bears that will be gone. One day, will it be humans as well? I'd like to have 30 minutes to sit down with one of these overpaid CEOs and explain to them about the choices they are making...but I doubt they'd listen.



<p>Thea Zorbas - 62 years old I'm a third grade teacher in Key West, Florida, and I have lived and taught school here for 28 years. Key West is a beautiful place to live and grow up, but there are reasons to be concerned for the future. Our school is located right across the road from the beach, which used to be very wide. All of us who've lived here for a while have seen the beach get narrower and narrower over the years, and I wonder if I will outlive my school. Will our playground and classrooms, and Key West itself be under water someday?</p>	
<p>Physical Impacts Global - I was watching a program on TV last night that talked about melting glaciers and polar ice caps, which makes the ocean levels rise. If that happens, it will completely change the map of the world. Regional - The mean elevation above sea level in Key West is only about 5 feet, and the mean for all of Florida is only 100 feet above sea level. If the oceans keep rising, a lot of Florida is going to disappear.</p>	<p>Economic Impacts Most of Florida's coast is involved in tourism and outdoor recreation of some kind. Climate change is going to cost a lot of people a great deal of money when they lose their businesses and multimillion dollar hotel lobbies are underwater.</p>
<p>Social/Cultural Impacts As ocean levels rise, it's going to have a huge impact on people, especially the ones living along the coast and beaches here. They are going to lose their homes, but where are they going to go? I hope I'm long gone before it happens, because it's not going to be a pretty sight.</p>	<p>Ecological Impacts I'm not really sure how the reefs and other marine life would be affected, but it can't be very good for them. I would think the coastal habitats and places like the Everglades would really be affected the most, and once they're gone, they are gone forever. That makes me sad for the next generations of third graders who won't ever get to see it. <i>I'd like to get my kids involved in helping to make sense of all this. I wonder what resources are out there?</i></p>



Debbie Freeland - 38 years old

I live about 5 miles from a newly built coal-fired power plant in a medium-sized town in central Wyoming. I was against building it in the first place, but the power company officials and our local county board told us it would be a “clean coal” plant, and would generate plenty of cheap electricity with hardly any pollution. The reality is, since it’s been active, my fourth grader’s asthma has really gotten a lot worse. Anyone who thinks that we can use “clean coal” technology has never had a coal plant as their next-door neighbor!

Physical Impacts

Global - I saw a commercial that said that CO₂ emissions from U.S. coal-based electricity are greater than emissions from all the cars and trucks in America. That has to have some impact on climate change and global warming.

Regional - My son isn’t the only one to have health problems...two of my neighbors have kids that were just diagnosed with asthma, and I read online that coal emissions might have something to do with cancer.

Economic

What will we do for jobs when they finally say you can’t burn any more coal? What will we do for jobs around here then? We should be putting a lot more money and effort into solar and wind energy...you know how sunny and windy it is in Wyoming. Those are jobs that would be good for the economy and good for the planet.

Social/Cultural Impacts

People in this town were so divided over building the plant. People who mine coal around here need to take care of their family and have decent jobs and I understand that. But what about the future of their children and my two little boys? It’s trading the short-term comfort for long-term solutions. This whole climate-change thing and burning coal could rip this town apart.

Ecological Impacts

Well, I know that putting more and more CO₂ into the air isn’t a good thing, and it is going to change our climate here. It’s been dry here for the last couple of years and this year has been really dry. If it keeps up, it’s going to be real hard on the trout streams in the summer, and the elk and moose are going to have a harder time finding food. That’s going to make it harder for the young calves to make it through their first year.



<p>Dante Randal – 45 years old I own a small business in the town of Wilkes-Barre, Pennsylvania, where I live with my wife and three kids. I’ve heard a lot about climate change on the news and while searching the Internet, but I just don’t see the effects yet. This past winter there was so much snow that we couldn’t make deliveries for three straight days! I would actually welcome warmer temperatures if it would help my drivers get around town.</p>	
<p>Physical Impacts Global – I read online that some areas around the world could actually see more snow if temperatures continue to rise because more water will evaporate and form storm clouds. It is predicted that more rain and snow will fall during the spring and winter, but less will fall during the summer. Regional – These past few years, the folks down in New York City sure did get hit with larger than normal amounts of snowfall. Does this mean climate change IS happening?</p>	<p>Economic Impacts If climate change leads to harsher winters, then I am going to have to raise prices. My drivers are going to spend more time on the road and make fewer deliveries per day. Also, gas prices will go up too. I wonder where the city will find the money to keep the roads maintained.</p>
<p>Social/Cultural Impacts I’m not really sure what climate change will do to the people in my neighborhood. I’ve lived here for 23 years and it has always been a stable middle-class community despite whatever troubles happened in the rest of the country. Will we be able to overcome the challenges that climate change will bring us? <i>I wonder what might happen to my brother in Louisiana.</i></p>	<p>Ecological Impacts I was never one for science, but even I know that if the weather is going to change, that means that all of the plants and animals might not be able to survive. I guess they will have to move to a different place to try and find weather that they are more used to.</p>



<p>Duane Randal – 41 years old I own Mr. R’s Po’ Boys Restaurant in the beautiful city of New Orleans. We’ve been making the best po’ boy sandwiches in town for the past 15 years! We also make a mean gumbo and have the freshest fish you will ever taste! Just about everything we serve comes right out of Lake Pontchartrain, which is fed by the Gulf of Mexico. We live pretty simply down here, but many of the residents are worried about how climate change will affect our way of life.</p>	
<p>Physical Impacts Global – As glaciers and sea ice continue to melt, sea levels are expected to rise. Also, the salinity (concentration of salt) in the ocean will be affected by all of the melted freshwater. Regional – We don’t need another Katrina-level disaster down here! This whole area was underwater for quite some time and some spots still haven’t recovered from the damage.</p>	<p>Economic Impacts Hurricane Katrina caused an estimated 200 billion dollars in damage! I don’t even want to think about what will happen to this area if sea levels rise. I’ve also heard we could get more severe storms. That will only make things worse. We pride ourselves on serving the working-class people who live in this area and I know they were hit really hard by the hurricane. I don’t know how much more they can take.</p>
<p>Social/Cultural Impacts Is it just me, or does it seem like the working-class people of our country are always the hardest hit when it comes to natural disasters? What did we do to deserve it? People say it’s our fault for living so close to the ocean, but we depend on it! We’ve lived this way in New Orleans for as long as I can remember. Why should we change? Why can’t someone else change the way they live?</p>	<p>Ecological Impacts I have already seen the impact of flooding on the environment within the lake. Some fish that we used to see every so often before Katrina haven’t returned. The lake has become cloudier because the extra water is carrying pieces of soil from the surrounding lands. I think our way of life is going to have to change.</p>



<p>Maria Agaba – 24 years old I live in Uganda, Africa, in the small village of Mubuku. We don't have much, but we don't need much. My family and I are very happy with our small garden and our livestock. It used to be that we were able to get all that we needed from our land, but things have started to change.</p>	
<p>Physical Impacts Global – As temperatures rise and ocean currents change, weather systems around the world will change as well. Regional – We depend on the crops that we grow in our village. We used to be able to predict when it would rain and would prepare our gardens. But ever since the 1990s, we can't predict anything. We think it will rain, but instead it is so dry and hot. Then, we think it will be sunny and it rains so much that our gardens wash away!</p>	<p>Economic Impacts Since it is difficult to rely on the weather to plant our gardens, we have started to farm livestock as well. My family owns 16 goats. We have been able to make money selling them to other families, even those in other villages. If we did not make these changes, we would have nothing.</p>
<p>Social/Cultural Impacts Some volunteers who have traveled here from other countries speak of climate change and how it will affect me and my village. They say that it is not right for us to suffer because of the actions of people back in their home countries. <i>They mentioned a company called Exxon-Mobil. What have they done to harm my village?</i></p>	<p>Ecological Impacts I like to think of my garden as a small forest and even it has changed in order to survive. I now plant crops that do not need as much water and can survive more heat. I wonder what will happen to the plants outside my village. Also, my friend recently lost her son to cholera. We think it was caused by the flood. Will anyone in my family get sick?</p>



Erin Bernard – 36 years old

I am a United States Senator and I am proud to represent the great state of Illinois. I come from the more liberal urban part of the state, while my counterpart in the Senate comes from the more conservative rural part of the state. He is a great guy who has a story for everything, but we just don't see eye to eye on many issues including climate change.

Physical Impacts

Global – CO₂ concentrations in the atmosphere have been increasing for years and show no sign of slowing down. Many people believe that this is directly responsible for climate change because CO₂ traps heat.

Regional – We have a lot of coal in Illinois and we're not afraid to use it. The only problem is that burning fossil fuels such as coal releases CO₂ into the atmosphere. It also releases many other pollutants such as sulfur and mercury, which have affected the fish in Lake Michigan.

Economic Impacts

The people who live in my part of the state want to equip our existing coal-fired power plants with modern scrubbers to clean them up. They also want to invest in clean, renewable energy such as wind power. However, lobbyists who represent coal companies continue to say that these changes will force companies to charge more for electricity. We need to reduce our emissions, but who should have to pay for it? If we don't change now, we might be paying for it later as our planet continues to warm and our air becomes more polluted. *I wonder what someone who lives by a coal power plant thinks about all of this.*

Social/Cultural Impacts

It seems that every day is the same old thing here in Washington. We try to make a change for clean energy and we've met with the same argument that it will cost too many jobs and it will force everyone to pay more for their energy. The rural part of the state wants legislation that increases funding for coal and provides more jobs for the region and I understand that. However, my part of the state thinks we should invest money in renewable energy and the jobs that it will create. How do we find that balance between all interested parties?

Ecological Impacts

Coal power plants are the single biggest polluter in our country. They release 3.7 million tons of planet-warming CO₂ gas every year. This is equal to cutting down 161 million trees. They also release sulfur dioxide, which causes acid rain that can damage both natural and man-made environments. Most people don't realize this, but they also release a lot of waste into our water supply such as chemical sludge and mercury, which concentrates in fish and can make them dangerous for humans to eat.