Smithsonian

SCIENCE
for Global Goals

CLIMATE ACTION!

Part 2:

Human Relationships to Climate Science

SUSTAINABLE DEVELOPMENT GOALS

developed by

Smithsonian
Science Education Center

in collaboration with

iap SCIENCE HEALTH POLICY
the interacademy partnership

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PART 2: HUMAN RELATIONSHIPS TO CLIMATE SCIENCE

Find out More!

For additional resources and activities, please visit the *Climate Action!* StoryMap at bit.ly/CLIMATEACTION2030.

Planner

Activity	Description	Materials and Technology	Additional Materials	Approximate Timing	Page Number
Task 1: How do humans build relationships with weather and climate?					
Discover	Identify the differences between weather and climate across the planet.	• Paper • Pen or pencil		30 minutes	36
Understand	Explore how we know the climate is changing over time.	• Paper • Pen or pencil • Computer (optional) or access to information sources such as a library		40 minutes	39
Act	Express your relationship with changes to the climate.	• Paper • Pen or pencil • Camera or computer (optional)		40 minutes	46
Task 2: What relationships does my community have with climate?					
Discover	Identify which climate elements are important to people in my community.	• Pen or pencil • Paper • Recording device (optional)		60 minutes	54
Understand	Explore how people receive and express information about climate in the community.	• Pen or pencil • Paper • Access to print or online resources	Survey data from Discover	40 minutes	58
Act	Conduct research on how people in the community relate to different forms of climate information.	• Pen or pencil • Paper • Access to print or online resources • Recording device (optional)		60 minutes	64

Meet Your Research Mentor, Özge Gürcanlı Fischer-Baum, PhD

Meet Dr. Özge Gürcanlı Fischer-Baum. Özge (pronounced oh-z-gai) will be your research mentor to help you learn more about how humans relate to **climate science**.

Özge is a psychologist working for the Association for Psychological Science. She is currently examining how psychologists interact with different climate change realities. Her job is to communicate the work of the field of psychology, especially **environmental psychology**, to the public. Environmental psychology is a relatively new branch of psychology that examines the relationships between human beings and our surroundings. Since Özge is now working with you, it is important to understand who she is.

Özge's Identity Map

Enjoys educating the public about environmental psychology

Is interested in jazz, history, and women in history

Middle Eastern, Turkish

Lives in Washington, D.C.

44-year-old female

Turkey is an important place for her

Is short

Has blond hair

Is a PhD scientist

Has big eyes

Is the director of scientific and public affairs

Works at the Association for Psychological Science

Is loud, warm, funny, and kind

Enjoys photography and mixed media art for hobbies

Task 1: How do humans build relationships with weather and climate?

Human systems are complex. As you learned in Part 1, people relate to the elements of the atmospheric system in many ways. But a sustainable future will require all of us to work together.

Different people can have different ideas about the system, and that includes human impacts on the atmosphere. Think of it as a big puzzle where everyone notices different pieces. Some people might think human actions do not really change the atmosphere. Others believe our actions have a big impact. Our beliefs may depend on cultural, social, environmental, and personal factors. These different beliefs shape how we perceive and respond to climate change.

In this part, you will explore the different human relationships to climate. Then you will think about the diversity of ways people express and communicate these relationships to others within the system.

Before you begin the rest of Part 2, think quietly to yourself about Özge's identity map and compare it to your *Identity Map*.

- Are there things you have in common with Özge?
- Are there ways in which you are different from Özge?
- Can you see anything about Özge's identity that relates to understanding climate action?

Throughout Part 2 you will notice Özge sharing ideas and experiences with you. She may help you understand better ways to do your research or share some of the research she has done.

In this task you will first ***discover*** more about how **weather** and **climate** changes across the planet. You will then investigate different data sources people use to ***understand*** changes in the climate. Finally, you will ***act*** by sharing relationships you have with climate with your community.

Discover: *How is weather and climate different across the planet?*

1. Ask yourself, What is the difference between weather and climate?
2. By yourself or with your team, consider each of the following statements and decide if you think they are related to weather or climate.
   a. It rained today.
   b. It rains during the **monsoon** season.
   c. This region experiences hot and dry summers.
   d. The wind speed today is 15 kilometers per hour, creating a cool breeze.
   e. A cold front is moving through, causing a sudden drop in temperature today.
   f. Over the past 10 years, the winters in this region have become milder.
3. Read *Weather vs. Climate*.

Weather vs. Climate

Weather and climate are related, but they refer to different aspects of Earth's atmosphere. Weather refers to the short-term conditions in the atmosphere, like what's happening today or tomorrow. It includes things like temperature, precipitation (rain or snow), wind speed, and cloudiness. So when we talk about a sunny day or a rainy afternoon, we're talking about the weather.

Climate is about the long-term patterns of weather in a specific place over a more extended period, like decades or centuries. It is the expected weather, on average. For instance, a place with hot and humid summers and cold winters has a different climate than a place that is warm all year round.

You will want to remember that weather is what we experience day to day, while climate is the long-term average of weather patterns in a particular area.

4. Examine your decisions for each of the statements in step 2. Are there any you would change, now that you are more familiar with the differences between weather and climate?
5. Think about where you live. With a partner or as a team, discuss:
    a. Does your weather change throughout the year? If so, what seasons do you have?
    b. How does the weather affect the clothes you wear?
    c. What is the weather like today? Do you think it will be the same tomorrow, next week, next month, next year? What do you do to plan or prepare for any changes?
    d. How can weather and climate influence how things like buildings and homes are constructed where you live?
6. Read *Climate Regions* and pay close attention to the different climate regions. You will need this information for the next activity.

Climate Regions

The world can be divided into different climate regions, as shown in Figure 2.1.

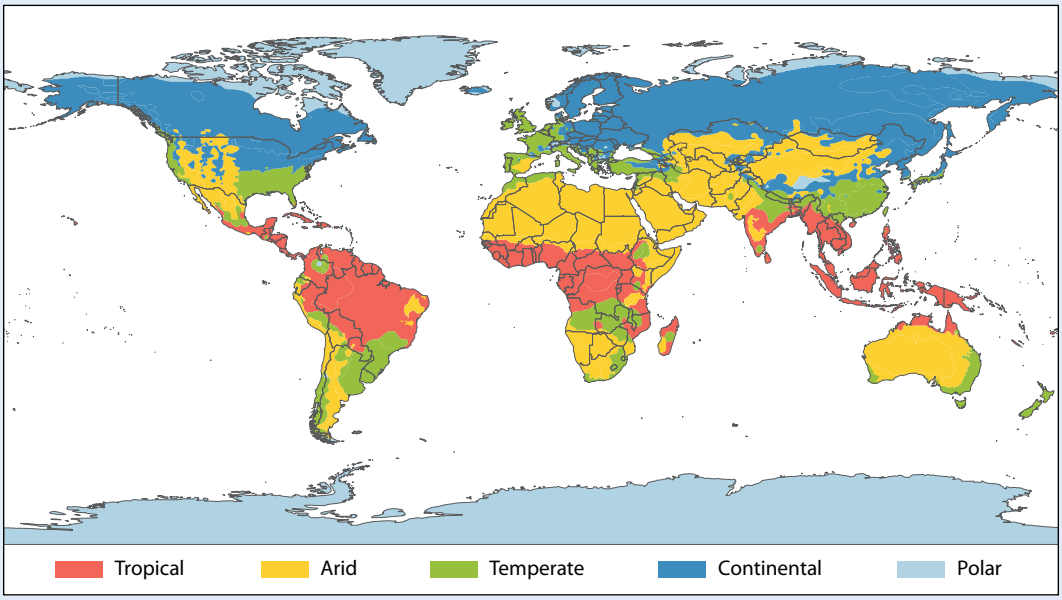

Figure 2.1: World map showing different climate regions.

Polar climates are found near Earth's poles, like in Antarctica and the Arctic. These areas are very cold most of the time, with icy landscapes and very little vegetation. Winters are harsh, and even summers can be chilly. It's like a frozen world where the temperatures stay cold throughout the year.

Continental climates are often found between temperate and polar regions, away from the moderating influence of oceans. These areas can have a wide temperature range. Summers can be warm, and winters can be quite cold with snow. Think of places like the northern parts of North America, Europe, and Asia.

Temperate climates are usually found in the middle latitudes, between the hot tropics and the continental regions. These areas have four distinct seasons: spring, summer, fall, and winter. The temperatures are moderate—not too hot and not too cold. Think of places where you might see changing leaves in the fall and maybe some snow in the winter.

Arid or Dry climates are characterized by a lack of rainfall. Places with deserts or semi-arid regions fall into this category. It can be really hot during the day, and there isn't much rainfall. The land is dry and sometimes sandy. Plants and animals in these areas have adapted to survive with very little water.

Tropical climates are found near the equator, where it's warm or hot all year round. These areas have high temperatures and high humidity. Tropical regions often have lush rain forests with a variety of plants and animals. Some tropical areas experience a wet season and a dry season, but it's generally warm throughout.

7. With a partner, examine the photos in Figure 2.2 and use the information from the *Climate Regions* box to identify the climate region shown in each photograph. Don't worry if you are not sure. Just do your best.

Figure 2.2: Climate region photos.

8. Now, discuss with your partner, which climate region do you think you are in?

Understand: *How do we know the climate is changing over time?*

Climate is like a giant puzzle. Scientists use data and information from many different areas to put the pieces together. Imagine scientists as detectives, gathering clues from places like the sky, the ocean, and even deep in the Earth. They use special tools like **thermometers**, **satellites**, and **ice drills** to collect data. This information comes from everywhere—weather stations on land, buoys in the ocean, and even ancient ice that holds secrets about the past. By bringing together all these pieces of the puzzle, scientists work as a team to understand how Earth's climate works and how it might be changing.

1. Read Özge's thoughts about why she thinks it is important to create connections between different areas of research when working on climate science.

Özge says . . .

Right now, I am advocating the work of other scientists. I'm a psychologist working for a psychology organization. That's why I'm aware of all these different studies. If I want to look at how psychologists interpret climate change reality, I want to know what type of research they do, what type of groups they get involved in, and what I see is a lot of teamwork.

Connecting people who are experts in different areas of research with environmental psychologists so they can do their research together is important. I create connections so people can meet and discuss, and then they can go from there. I can host someone doing environmental psychology work, which is a new field. Other researchers can be like, okay, there is this new field called environmental psychology. What is that? So people are becoming aware that it even exists, which then supports them working together to address climate change together.

2. Take out a piece of paper or use a class board to create a table with three columns. Titled them "Field," "Type of Data," and "Evidence of a Changing Climate." Draw seven rows and label them "Climatologists," "Oceanographers," "Glaciologists," "Meteorologists," "Botanists," "Firefighters," and "Economists." Figure 2.3 shows an example.

Field	Type of Data	Evidence of a Changing Climate
Climatologists		
Oceanographers		
Glaciologists		
Meteorologists		
Botanists		
Firefighters		
Economists		

Figure 2.3: Data table example.

3. As a team, read *Climatologist Data* and fill out the following information in the *Climatologist* row of your data table.
   a. What type of data is this? For example, is it data about specific types of temperature? Add this information to the *Type of Data* column.
   b. Does the data provide evidence that the climate is changing over time or remaining the same? List any evidence of change you notice in the *Evidence of a Changing Climate* column.

Climatologist Data

Climatologists are interested in knowing about climate changes on Earth over long periods of time. Figure 2.4 was created using data from different weather stations across the globe. It shows **anomalies** in Earth's temperature above land and over the ocean since 1880. An anomaly is something that is different than expected. For example, if the global average yearly temperature in a place was 20°C, but one year the average was 21°C, that would be an anomaly of 1°C. An anomaly of zero would show that the data is what you would expect. In Figure 2.4 the red line indicates changes in the global temperature of the air over land. The blue line indicates changes in the global temperature of the air over the ocean.

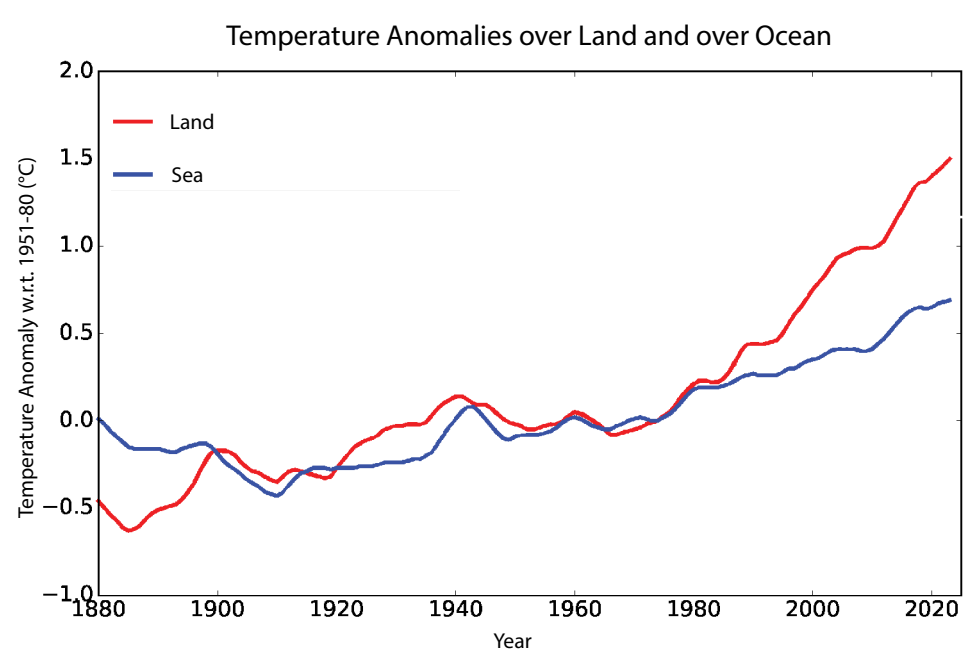

Figure 2.4: Temperature anomalies over land and sea from 1880 to 2020.[1]

4. Examine the data you just entered into your data table and discuss as a team: If you were a climatologist, are there other types of data you would also want to analyze before concluding the global climate is changing?

5. Divide your team into six groups and assign each group a role.
    a. Group 1: Oceanographers
    b. Group 2: Glaciologists
    c. Group 3: Meteorologists
    d. Group 4: Botanists
    e. Group 5: Firefighters
    f. Group 6: Economists
6. Use the blue boxes that follow for your group to explore the data people in your role might use. Use what you learn to fill out the *Type of Data* and *Evidence of a Changing Climate* for your group on the data table.

Group 1: Oceanographers

Oceanographers are scientists who study the ocean. Figure 2.5 is a graph that shows changes in the temperature of the surface of ocean water since 1901. Oceanographers are interested in knowing how the temperature of the water around the world has changed over time. Examine the map. Blue shows places that were cooler in 2020 than in 1901. Yellow, orange, red, brown, and purple show places that are warmer. What do you notice about the change in sea surface temperature?

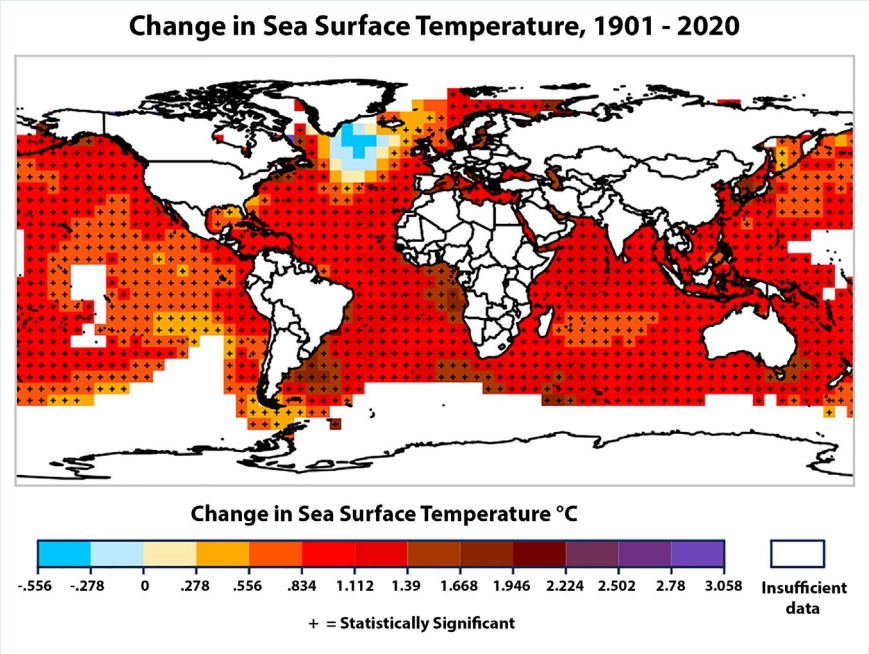

Figure 2.5: Map showing changes to sea surface temperature between 1901 and 2020.[2]

Group 2: Glaciologists

Glaciologists are scientists who study snow and ice on the planet.

Figures 2.6 and 2.7 show sets of images that were taken many years apart at the same locations and the same time of year. Glaciologists use image data such as this to analyze how glaciers, ice, and snow change over time. What evidence of change do you notice?

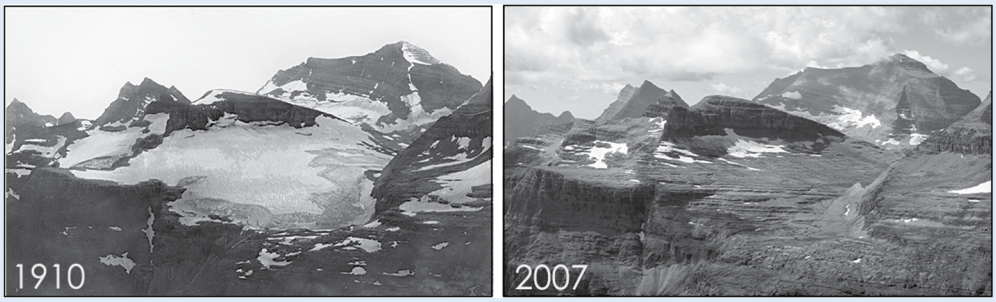

Figure 2.6: Boulder Glacier in 1910 (left); Boulder Glacier in 2007 (right).[3]

Figure 2.7: Grinnell Glacier in 1910 (left); Grinnell Glacier in 2016 (right).[4]

Group 3: Meteorologists

Meteorologists are scientists who study and predict changes to Earth's atmosphere, including forecasting the weather. Meteorologists pay attention to precipitation patterns, wind, and temperature, among other things. Examine the graph in Figure 2.8. It shows the anomalies in annual global precipitation. Remember, an anomaly is the difference between what you expected and what happened. Every year there are variations in precipitation levels. But if you notice increasing anomalies, either higher than the average global precipitation or lower, what do you think that means?

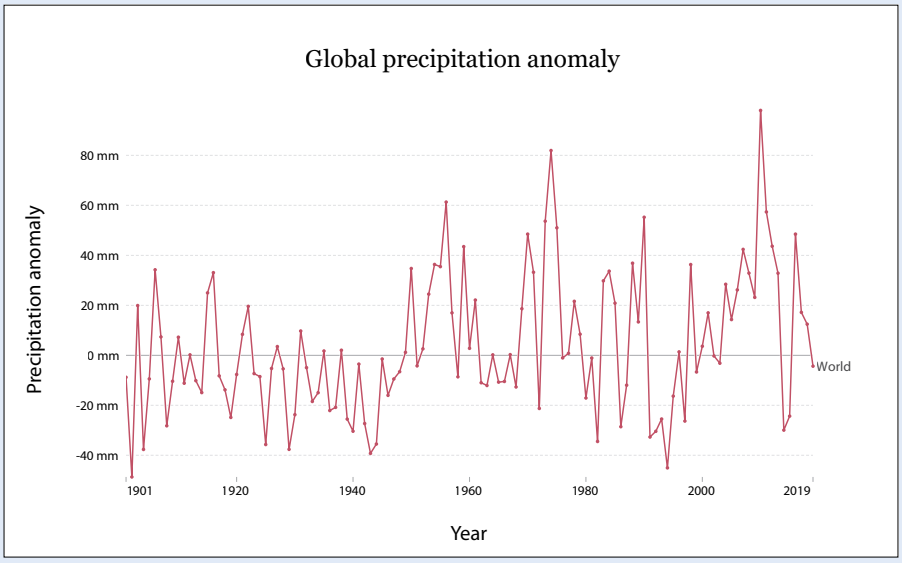

Figure 2.8: Anomalies in average annual precipitation from 1901 to 2019.[5]

Group 4: Botanists

Botanists are scientists who study plants. Botanists might gather data about when specific plants bloom. Changes in climate might affect when a plant blooms. For example, in seasonal climate regions, if it is a warmer year, plants tend to bloom earlier. In Kyoto, Japan, since the year 812 people have been gathering data about when their famous cherry trees are at their peak bloom. Figure 2.9 shows the day of the year of the peak bloom. What do you notice about the 20-year average of the peak bloom day? What do you think that means about the climate?

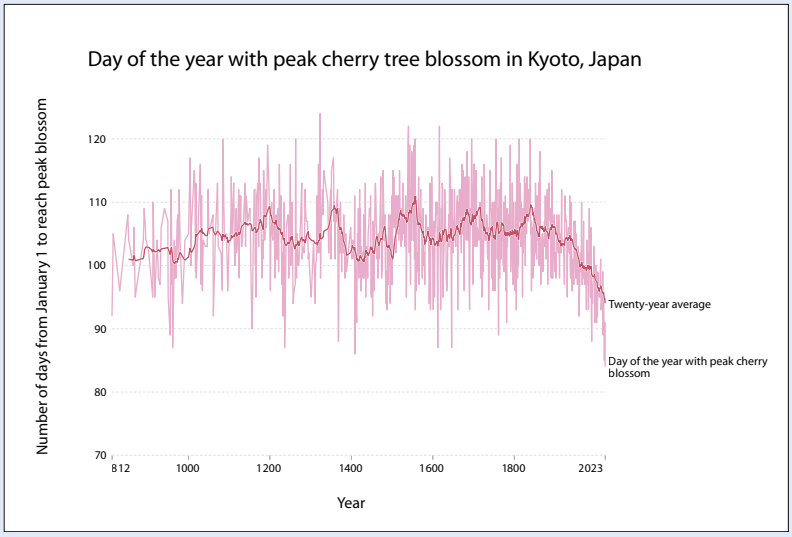

Figure 2.9: Day of the year when the cherry trees were at peak bloom in Kyoto, Japan.[6]

Group 5: Firefighters

Firefighters are people who try to put out fires. Some firefighters focus on extinguishing **wildfires**. Warmer and drier climates can lead to longer and more active seasons when wildfires tend to be a problem. Figure 2.10 shows the number of acres burned by wildfires each year in the United States between 1983 and 2020. (An **acre** is a unit measurement for an area of land.) What do you notice about the changes to the area burned by wildfires over the years shown?

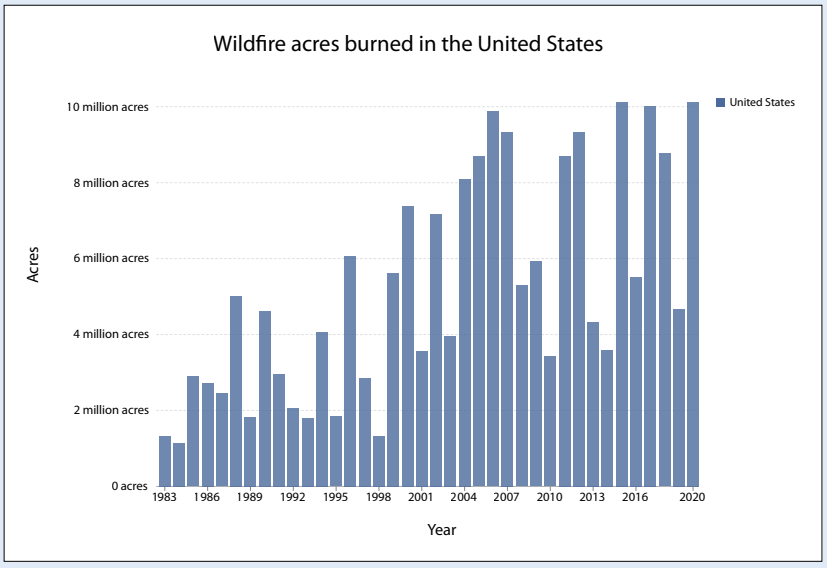

Figure 2.10: Acres burned by wildfires in the United States between 1983 and 2020.[7]

Group 6: Economists

Economists are researchers who study economies. The **economy** is the financial system of a place, and includes money, income, and how wealth is used. One of the things economists study is the financial **damages** caused by a disaster. Financial damages might include the amount of money lost through the destruction of property, crops, or livestock. Certain types of disasters, such as wildfires, **drought**, and extreme weather, are related to a changing climate. Figure 2.11 shows the economic damages caused by natural disasters that can be related to climate change between 1900 and 2023. What do you notice about the economic damages? What might that tell you about how frequent and severe natural disasters are in different years?

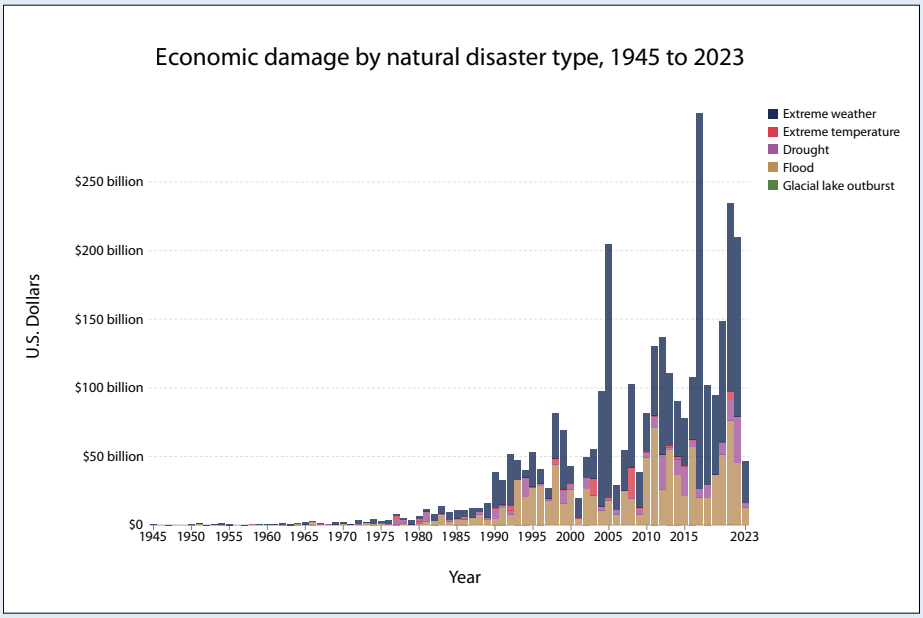

Figure 2.11: Economic damages caused by natural disasters associated with a changing climate between 1945 and 2023, in US dollars.[8]

7. As a group, share your type of data and what you learned from it with the rest of your team.
8. As a team, examine your data table. Discuss:
   a. Is the evidence from the different groups telling a similar story about changes to the climate? What is the trend you notice?
   b. Are there any questions or concerns you still have?
   c. Are there other pieces of data you would like to have access to before drawing a conclusion about changes to the climate?
9. If you want additional data, you can use an online search to see if it is available. The *Climate Action!* StoryMap also has links to other data sources researchers use to think about the changing climate.

Act: *What is your relationship with changes to the climate?*

Why might a changing climate be important to you personally? When people think about a changing climate, they often think about risks or changes to their lives. Changes or risks can include things like big storms and wildfires happening more

often, extreme heat, rising sea levels, drought, the cost of food, and arguments among people about the risks climate change poses. In this activity you will act by expressing what the risks of climate change mean to you.

1. Read *PhotoVoice Activity—Part 1* and follow the directions.

PhotoVoice Activity—Part 1

a. Think carefully: Where do you notice changes to the climate in your life, or what worries you most about a changing climate?
b. Use one or more photos or draw pictures about something in your community that captures where or how you see changes in the climate in your life. You can use a photo you take, one you took previously, or a photo someone else took. If you have a small team, consider using more photos or drawings per person.
c. Take out a small piece of paper and write a sentence or two to explain your photo or drawing.
d. Under your explanation, write one word to describe the one emotion or feeling you associate with the photo or drawing.
e. Display your team's photos or drawings, without the explanation papers, on a table or wall.
f. Move around the display and observe the photos or drawings without any talking.

2. Discuss with your team:
   a. What themes do you see represented in the photos or drawings you displayed?
   b. Why might photos or drawing be a useful way to understand people's thoughts and feelings about climate change?
3. Read *At the Smithsonian*. How did the artist use photos and videos to share his message?

At the Smithsonian

Smithsonian **curators** plan exhibitions so that visitors can see and learn about the most interesting art being made today. Marina Isgro is the associate curator of media and performance art at the Hirshhorn Museum and Sculpture Garden.

Marina recently organized a show called John Akomfrah: Purple. John Akomfrah is a British artist who was born in Ghana. He is a video artist, which means he works with moving images and sound rather than more common art forms like painting or sculpture. Purple is an hour-long video shown on six large screens that explores the topic of climate change.

Figure 2.12: The exhibition Purple—six large screens arranged in an arc at the Hirshhorn Museum from November 2022 to January 2024.

John chose this topic because he grew up near a coal-burning power plant and remembers noticing the pollution around him as a young boy. He found video clips from the 1950s and 1960s showing things like factories releasing smoke into the air and chemicals being dumped in lakes. He edited them together with new videos he recorded in parts of the world whose landscapes are changing as temperatures get warmer. He added a soundtrack of music and sounds from the natural world to finish the video.

Artists and curators like John and Marina want to encourage viewers to think about topics that are relevant to all our lives, such as climate change. Unlike scientists or politicians, many artists are not interested in gathering data or encouraging us to vote a certain way. Instead, they communicate ideas and emotions in creative ways. Their work can spark new perspectives and help viewers think differently about the world around them.

4. Read System Perspectives.

System Perspectives

When thinking about the different risks that result from human impacts on the atmosphere, it is important to think about the system from different **perspectives**. Perspectives mean the different ways people think about the elements and relationships in the systems around us. In this guide we will focus on four perspectives when thinking about the system we live within.

- **Social** is about the interaction of people in a system, such as your community. The health, education, cultural, and community ties, and well-being of people are the most important things from this perspective.
- **Economic** is about money, income, and the use of wealth in a system. Economic growth, including making sure people have jobs and enough money, is the most important thing from this perspective.
- **Environmental** is about the natural world in the system. Protecting living things, natural systems, and Earth itself are the most important things from this perspective.
- **Ethical** means that something is fair in the system. Doing what is right and having a just community where everyone and everything is treated fairly are the most important things from this perspective.

Individual elements and connections in the atmospheric system can be considered from these different perspectives. For example, think of yourself as an element in the atmospheric system from different human perspectives.

- Social: When and how do you (as an element) interact with other people within or about the atmospheric system?
- Economic: How are you (as an element) connected to money, income, financial damages, or wealth in the atmospheric system?
- Environmental: When and how do you (as an element) interact, depend on, or impact natural elements like plants, animals, rivers, and other parts of Earth in the atmospheric system?
- Ethical: How do you (as an element) decide what is fair or not fair about other elements or connections in the atmospheric system?

5. Make a new data table with four columns titled "Photo or Drawing," "Risks," "Emotion," and "Perspectives." Figure 2.13 shows an example. Complete this table individually or as a team.

Photo or Drawing	Risks	Emotion	Perspectives

Figure 2.13: Example of a data table for PhotoVoice Activity—Part 2.

6. Read *PhotoVoice Activity—Part 2* and follow the directions.

PhotoVoice Activity—Part 2

a. Return to the images you looked at in *PhotoVoice Activity—Part 1*.
b. Have each team member read their short explanation and emotion for their image. Then place the explanation next to the photo or drawing.
c. For each photo or drawing, write a description of the image in the *Photo or Drawing* column.

d. Think about any risks the photo or drawing shows, and write those down in the *Risks* column, such as destruction of nature, rising sea levels, or extreme weather. (See the box *Perspectives on Risks* for more examples.)
e. Write down the emotion listed in the *Emotion* column.
f. Think carefully about the risks. Which perspective or perspectives do they show? Use the information from the *Systems Perspectives* box to help you remember about the four different perspectives. Which perspective(s) do these risks fall into? Write your ideas in the *Perspectives* column.
g. What is some new data you gathered during this analysis?

7. Using the data table with your team, identify the following:
   a. Common climate concerns, risks, or changes on your team
   b. Common emotions people on your team feel about the changing climate
   c. Common perspectives people on your team relate to
8. Read Özge's ideas. Why might it be important to remember that each person is different and has a unique perspective?

Özge says . . .

Is your mind the same as mine? Absolutely not. There is no one-size-fits-all way of thinking, perceiving, or behaving. Even though we share a blueprint of a brain structure, our genetic makeup and our experiences shape our brain connections and alter our brain functions. The result is **neurodiversity**, a term coined by scientists that is defined as "the idea that people with brains that work differently are part of the normal range in humans."

9. Consider the *Risks*, *Emotions*, and *Perspectives* on your data table and compare them to the information in the *Perspectives on Risks* box. Are there any risks you would want added to your class data table? If so, add those now.

Perspectives on Risks

Social Risks

- People having to move: Changes in the atmosphere, such as rising sea levels or droughts, might force some people to leave their homes and find new places to live.
- Arguments and fights: People might disagree and get into arguments because they have different opinions about how to solve the problems caused by human impacts on the atmosphere. They also may fight over resources such as fresh water, land to grow food, and safe housing.

Environmental Risks

- Climate change: Changes in the atmosphere caused by human activities can change Earth's climate, which means it gets hotter and can cause more storms and other extreme weather events.
- Destroying nature: When we cut down too many trees or throw garbage in the wrong places, it can destroy the homes of many living things, changing the amount of carbon in the atmosphere and disrupting the natural balance.

Economic Risks

- Expensive repairs: Extreme weather events caused by changes in the atmosphere can damage buildings and roads, which costs a lot of money to fix.
- Trouble for jobs: Changes in industries and the economy due to impacts on the atmosphere can lead to some people losing their jobs or having a hard time finding work.

Ethical Risks

- Unfairness: Some communities may be more affected by changes in the atmosphere than others, which isn't fair to those people.
- Thinking about the future: We need to think about the needs of future generations and make sure we don't make things harder for them because of what we do now.

10. If you are comfortable, think about how you could share your PhotoVoice activity with in your community. For example, you could share it with classmates, with your family, friends, or other community members.
11. If you can, share your PhotoVoice and ask the people you share it with what they would include in their PhotoVoice, if they did one. Add any data you gather from community members to your data table.

Task 2: What relationships does my community have with climate?

In this task you will first ***discover*** which climate elements are important to people in your community. You will then ***understand*** more about where people get their information about climate. Finally, you will ***act*** by exploring how people respond to different forms of expression about climate.

Discover: *Which climate elements are important to people in my community?*

In Task 1, Act, you learned more about system risks and perspectives on your team. As you learned, people relate differently to different risks. These relationships influence how people think and prioritize risks. When working within your community system, it is important to understand which risks people already have a relationship with. An important action is to listen and gather data to understand these elements of your system. Discovering these relationships can help you work together better when taking action in the future system.

1. Read Özge's thoughts on understanding different people's interests to create a common language to support conversations about climate.

Özge says . . .

What's the best way to connect scientific research with interested parties? Well, this question comes with a hidden assumption that interest exists within a diverse set of audiences in the first place. What is often overlooked is the need to create a common language between specialists and non-specialists.

Defining common language is not a one-size-fits-all task, but it is critical for ensuring two-way conversations. It's also important to acknowledge that communication goes beyond words. Other essential pieces of the puzzle are knowing the target audience and meeting them on their level: understanding how they use scientific knowledge on a daily basis, what tools they use, and what their creative processes and typical communication methods are.

2. Read *Survey Instructions* and use the information to design and carry out a survey about concerns and sources in your community related to climate.

Survey Instructions

Choosing People to Survey

a. It is normal to want to survey only the people you know well and feel comfortable with. But try to include people you may not know as well or people who live in other parts of your community. This will help you get a more accurate picture of your community.
b. Think about the categories on your *Identity Map*. Use those categories to try to pick a diverse group of people to survey. For example, ask people of all different ages or of more than one gender.

Ways to Give a Survey

a. Talk to people in person.
b. Talk to people over the phone or the Internet.
c. Write down your questions on paper and give it to people.
d. **Design** a survey on the Internet and send it to people.

Tips for Giving a Survey

a. Divide your survey into two parts.
   - Part 1: Climate concerns that are important to people
   - Part 2: Sources of climate information
b. Make sure your questions are easy to understand.
c. Think back to Part 1, task 1 when you made individual and team identity maps. Use these identity maps to help you think of what questions to ask.
d. Ask questions that have definite answers, such as, "What things do you like to do for fun?" instead of, "What do you like?" For example:
   - Part 1 (Climate concerns) questions could include:
     - How concerned are you about the effects of human impacts on the atmosphere?

- What risks from human impacts on the atmosphere are you most concerned about? (You may want to include a short list of options.)
- In your opinion, how likely are the risks associated with human impacts on the atmosphere to occur in the future?

- Part 2 (Sources of climate information) questions could include:
  - Where do you get information about what is going on in the world? For example, someone in your household, a friend, your doctor, social media, videos, podcasts, television, newspaper articles, radio, pamphlets or posters, or other sources.
  - Where do you get information to learn about topics related to risks from human impacts on the atmosphere, such as rising sea levels or climate change?

e. Some people may feel more comfortable answering surveys if their answers are **anonymous**. Anonymous means people do not give their name.

f. Think about where you should give the survey. Is there a place in your community, either in person or online, where people gather and might be willing to answer your questions? Could you go from home to home? Would that be safe at this time?

g. Remember that you and your team members are part of your community. Think about what you already know about your community to help you choose the best way to get information. For example:

- Will people in your community feel comfortable talking to a student?
- Does everyone have **access** to the Internet if you want to do an online survey?

Safety Tips for Giving a Survey

Talk to your teacher for guidelines. They will know what is safest in your community.

⚠ Physical Safety Tip

Never go alone and always be aware of your surroundings. Pay attention to local guidance on whether it is safe to interact with people outside of your home.

⚠ Emotional Safety Tip

It can be hard to talk to other people in the community. You may feel shy or nervous. Someone may tell you they don't want to talk. That's okay! It doesn't have anything to do with you. It just means they don't want to share. You can show them respect by thanking them and moving on to another community member.

3. Combine the data from all the surveys your class conducted.
4. Read Özge's thoughts on the importance of using knowledge from science, such as surveys, to create a common language to talk about science.

Özge says . . .

As successful users of scientific knowledge, people must focus on two main questions: What's the expected outcome? What's the make-up of the audience?

With a critically established common language and carefully planned communication efforts, youth can use scientific information as a tool to solve a problem and filter it as necessary throughout the project. The use of language to communicate ideas always comes with the risk of the message getting lost in translation. Creating a common language is instrumental in helping us talk about science.

5. Analyze the data from Part 1 of the survey. Identify the level of concern and which risks people in your community relate to the most.
6. Discuss:
   a. What does the data you collected from the survey tell you about the different relationships people in your community already have with climate and human impacts on the atmosphere?
   b. How does your community data compare to your team data?
   c. How could this survey data be useful when having conversations about human impacts on the atmosphere in your community?

7. Keep the surveys and data in a safe place. You will use the Part 2 data about sources of climate information in the Understand section.

Understand: *How do people receive and express information about climate in the community?*

In human systems, people receive and express information in many ways. Each person has their own unique perspectives and **biases**. People get information from traditional media outlets, social media platforms, scientific studies, and personal interactions and thoughts. A place where you get information is a **source**. There are many types of sources people use and create.

1. Read *Different Ways Humans Express Information*.

Different Ways Humans Express Information

There are many ways humans express information about the atmosphere. Here are just a few to consider.

- Talking and sharing: Humans talk to each other and share information to explain how things we do can affect the air we breathe.
- Writing and drawing: Humans write stories and poems, and create images to show how human actions can change the atmosphere. They use words and art to explain how things like cars, factories, and burning **fossil fuels** can make the air dirty and cause climate change.
- Singing and dancing: Some humans use music and dance to express their concerns about human impacts on the atmosphere. They create songs and dances to spread the message about taking care of parts of the community, such as the people and environment.
- Scientific research: Humans conduct and share scientific research to help us understand how human activities affect the atmosphere. They might show us how burning different things, like wood or paper, can create smoke and pollution.
- Public demonstrations: Activists and concerned humans organize protests, marches, and rallies to raise awareness about climate change and demand action from governments and institutions.

- Social media and online activism: Many humans use social media platforms to express their opinions, share information, and engage in discussions about climate change. Hashtags, online campaigns, and shared videos amplify the voices of individuals and communities concerned about the environment.
- Personal narratives and testimonials: Humans affected by climate change, such as farmers, Indigenous communities, and coastal dwellers, share their personal stories and experiences. These narratives humanize the issue and convey the real-world impacts of climate change, fostering empathy and understanding.

8. Read the *At the Smithsonian* to learn how musicians and curators express human connections to climate.

At the Smithsonian

Smithsonian Folkways Recordings is the nonprofit record label within the Smithsonian Center for Folklife and Cultural Heritage. It is dedicated to supporting cultural diversity and increased understanding among peoples by documenting, preserving, and disseminating sound.

Figure 2.14: Cover art of a Smithsonian Folkways recording.

In 2022, Folkways Recordings released the album *The New Faith* by musician and scholar Jake Blount. Jake was 26 when he made this album, and was living in Providence, Rhode Island in the United States. He specializes in the folk traditions of Black and Indigenous Americans.

In *The New Faith,* listeners enter a futuristic world where climate change has caused great damage to the world. They follow Jake and his friends, who are Black refugees from the effects of devastation from climate change. They come together to perform a special religious service, singing spiritual songs that have been passed down through generations. These songs, born from the struggles of Black Americans, connect them to their shared history and give them strength.

The New Faith is a powerful exploration of what Black religious music might sound like in a future shaped by climate change. It's a testament to the resilience and creativity of communities facing adversity.

9. Gather the survey data you collected in the Discover step.
10. Look specifically at the survey data from Part 2, about sources of information. If you have not completed Part 2 of the survey, do it now, following the instructions in the Discover step.
11. Using the data, identify two or more sources people use the most in your community to get information or learn about the atmosphere or climate.
12. Go to these specific sources and find several pieces of information about risks from human impacts on the atmosphere, such as climate change. These pieces of information could be in the form of articles, conversations with people, podcasts, videos, photos, or any other format.
13. Read ***How to Evaluate a Source of Expression*** and use it to help you or your team evaluate the pieces of information you found.

How to Evaluate a Source of Expression

Consider one piece of information at a time. You and everyone on the team should read, listen to, or view the piece of information you are evaluating. Answer the following questions on your own or with your team.

Age

- Does this information list the date it was created?
- Was this information created recently?

Style

- Does the information seem neat and organized?
- Is the spelling and grammar correct?
- What audience do you think this was made for? A general audience or specialized group?

Author

- Who created this information?
- Is the author's name in a place where you can easily find it?
- Is there information about the author?
- Does the author know a lot about this subject, or did they include information from people who do?

Data

- Does this piece of information include data?
- Where does the data come from? Is that source listed?
- Can you check the data yourself?

How Does the Information Make You Feel?

- Does this information have words, images, or sounds that make you feel intense emotions, such as angry, scared, or upset?
- Does it use loud voices, capital letters, or exclamation points?
- Does it feel like the information is trying to get you to take a side?

14. Read Özge's ideas about different types of thinking. Which type do you believe is better for thinking about changes to the climate? What types of sources might help you think this way?

Özge says . . .

All people have two thinking systems: system one and system two thinking. **System one thinking** uses shortcuts and biases. So, for example, if you ask anyone a question about shark attacks or sharks killing people, they might guess that the actual number is high. But if we look at the data, sharks killing people is not very high. But why do we all jump to that conclusion? Because there is the famous movie, *Jaws*. When there's a shark attack, it makes the news right away and everyone talks about it. We can think about and imagine it very easily. This plays into system one thinking.

System two thinking is more detailed, more careful. It is time-consuming. It is more like reading an article carefully, looking at a series of musical notes for the first time to understand how we are going to play it, or solving a math problem.

There's a reason that we have both system one and system two thinking. We cannot be very focused all the time and think in detail about everything. So it is human nature to use shortcuts. But when we need serious thinking, we need to use system two.

15. Consider the survey answers you recorded. Use the information here to help you evaluate your sources.
    a. Date: A good piece of information clearly states when it was created. Our information about the atmosphere changes each day, so you may want to use information that was created recently. It is okay if the source you are using has been around a long time (such as archival data, an oral history, or a newspaper or magazine that has been in business for many years). You just want to make sure you are using the most recent information from that source.
    b. Style: A good piece of information has correct grammar and spelling. It is neat and organized. It seems professional.
        - For example, a website with spelling errors, broken links to other websites, and a poor design may not be a good source.

c. Author: You should be able to tell who created a piece of information. They should be experts in the topic. Or the author should use information from other people who have more knowledge than they do.
   - For example, the host of a podcast should tell you their name. You should be able to contact them or their company to ask questions about the information they discuss.
   - If the host is talking about the atmosphere, they should be an expert on the atmosphere or have education related to the atmosphere. Or they should include guests who know about the atmosphere.

d. Data: A good piece of information has data that comes from a trusted source, such as an institution or university.
   - For example, an article should tell you where any data they include came from. You should be able to go to that same place and find the same data.

e. How does the information make you feel? A good source gives you facts. It delivers information in a calm and clear way. It does not try to make you angry or scared, try to convince you it is the only source that is right, or use photos, type styles, or voices that try to make you upset.
   - For example, a post on social media that reads, "The climate has never been better! Don't be a SHEEP!!! Climate change is a HOAX created by scientists. They can't even agree it is real!" is using certain words to make you feel scared and angry. It uses capital letters and exclamation points. It is not delivering information in a calm and clear way. This is not an accurate source of information.

16. Think to yourself or talk to your team about the following questions.
    a. Do you think the sources you considered are accurate?
    b. Do you want to change where you get information?
    c. Did you notice that people in your community are using sources that you think are not accurate?

17. What can you do if someone in your community is sharing misinformation? Here are some suggestions from experts. (You can read other suggestions in the *Climate Action!* StoryMap at https://bit.ly/CLIMATEACTION2030.)
    a. Show **empathy** and respect. Show people that you are listening. That will help them stay open to a conversation with you.
    b. Do not repeat their misinformation. Present accurate information instead.

18. Read Özge 's ideas. What do you want to remember about the way different people might think and how their sources might affect that?

Özge says . . .

When thinking about system one versus system two thinking, think about all these scamming strategies. You know, there are all these scams to try and get your digital passwords, bank information, credit card numbers, or money scams. They target our system one thinking. They don't give us enough time to engage our system two thinking. They just try to get people to do something really quickly. They throw the information at us quickly with so many details; they play to our fear. So when we are thinking with system one, we don't have time to sit down and think about something.

This is similar to the climate conversation. That's why there are cultural and political differences in what people think about climate change. Because the data is there. But the media methods of current public conversation can affect how people think about it, even if what they are saying is not true. If we hear a lot of people talking about the idea that climate change is not real or the world is flat, even though we don't believe in that, it becomes a part of our habitual thinking because of the way we are exposed to it by people who are targeting our system one thinking.

Act: *How do people in my community relate to different forms of climate information?*

In the Understand activity, you gathered different sources of expression humans in your community interact with when they talk about human impacts on the atmosphere. Understanding how different people react to these different forms of expression can be useful when taking actions in the future.

1. Read *Investigating Reactions in the Human System* and follow the directions.

Investigating Reactions in the Human System

Now you will observe and analyze how people respond to various forms of expression and their effectiveness in capturing attention and conveying messages.

Materials

- You'll need various examples of information related to risks or meanings about the atmosphere or climate. Use examples from the sources you collected in the Understand step.
    - Print (magazines, newspapers, flyers, visual art)
    - Digital (online banners, social media posts, digital art)
    - Audio (radio commercials, jingles, songs, podcasts)
    - Video (TV commercials, online and public videos)
- *System Perspectives*
- Device with Internet access (if you're using online examples)
- Video recording devices (optional)
- Paper and pens or pencils

Procedure

a. Divide your team into small groups of three to four people.
b. Have each group select different examples from the various examples of information you collected (print, digital, or a combination).
c. Have each group analyze their examples and identify the following:
    - Who do you think the intended target audience is?
    - Is the example using persuasive techniques? For example:
        - Bandwagon: Imagine an ad that says, "All your friends are using this app, so you should too!" This is the bandwagon technique. It's like when everyone at school starts wearing a certain brand of clothes, and you feel like you need to as well to fit in. The ad is trying to make you feel left out if you don't join in.
        - Celebrity endorsement: This is when you see a famous person, like your favorite singer or athlete, using or talking about a product. The idea is that if someone you look up to thinks this product is great, then it must be cool, and you might want it too.
        - Emotional appeal: Some information makes you feel really happy, sad, or even scared, hoping that these feelings will make you want to buy

something or support a cause. For example, a commercial for a charity might show very sad pictures to make you feel compassionate and want to donate money. Or an ad for a vacation might show super happy families having the time of their lives, making you want to go to the same place.

d. As a group or team, discuss:

- What are some physical reactions people might display when they're exposed to different forms of expression, such as a song, poem, or advertisements?
- What might physical or emotional reactions, such as smiling, laughing, raising eyebrows, leaning forward, nodding, or other gestures, indicate?

Observation

Groups will observe other groups' reactions to different elements.

a. Arrange a space where groups can sit across from each other.
b. Each group should take turns showing one of their group's selected examples to the other group across from them. The group presenting their example is the presentation group and the group receiving the information is the reaction group.
c. The presentation group should make observations and take notes on the physical reactions they observe from the reaction group.
d. If possible, record the presentation and reactions using a video recording device for later analysis.

Discuss

a. After each example, the presentation group should lead a discussion or provide response sheets or surveys to collect feedback from the reaction group. The questions can include:

- How would you describe what you were feeling when you were experiencing the example? What emotions did you feel?
- Was the example effective in capturing and keeping your attention?
- Was the message clear and memorable?
- Did anything positive or negative stand out about the example?

2. Have a discussion as a team about the different types of reactions to different examples of climate information. Include:
    a. Were there any specific persuasive techniques in the examples that seemed to have more impact on people's reactions?
    b. Do team members think these techniques influenced their decision-making?
3. Discuss how this information could be useful to your team when choosing ways to communicate about humans and the atmosphere with different audiences in your community.
4. Read Özge's thoughts on why it is important to think about your audience when making decisions about how to communicate with them.

Özge says . . .

My current group is part of a global psychological science community. We have a membership base, but we know that the public is following us on social media and our website. So, looking at the data we have, I get to understand what our audience is like.

When we write a piece, when there's a webinar, there is a whole process about finding the critical information, making sure we have information from **peer-reviewed resources**. For people who don't know what that is, it is the work of scientists, which is checked by other scientists. That is what peer review is.

Then, different things are created for webinars, podcasts, social media, and other forms of communication. But I want to make sure that we communicate the same information using different methods.

And going back to education basics, some people prefer listening to information. Some people prefer to read about it. I want to make sure that, depending on what topic we are working on or what my colleagues are working on, I pick a topic and figure out how to communicate this in different ways to different audiences.

5. Write down some ways you might communicate what you learned to your community. How do they relate to different forms of climate information?

6. Acknowledge: Take a moment and recognize that you took more actions in this guide. Understanding human relationships to climate science is an essential first action. You are part of a human system. Humans are complex social animals. To effectively act on human impacts on the atmosphere, such as climate change, you must understand and respect the system.

Congratulations!

You have finished Part 2.

Find out More!

For additional resources and activities, please visit the *Climate Action!* StoryMap at https://bit.ly/CLIMATEACTION2030.

References

1. "GISS Surface Temperature Analysis (GISTEMP v4) Temperature Anomalies over Land and Over Ocean reference," NASA, 2020, https://data.giss.nasa.gov/gistemp/
2. "Climate Change Indicators: Sea Surface Temperature," United States Environmental Protection Agency, April 2021, https://www.epa.gov/climate-indicators/climate-change-indicators-sea-surface-temperature
3. "Repeat Photography Project," United States Geological Society, April 6, 2016, https://www.usgs.gov/centers/norock/science/repeat-photography-project?qt-science_center_objects=1#qt-science_center_objects/
4. "Repeat Photography Project," Our World in Data, 2020, https://www.usgs.gov/centers/norock/science/repeat-photography-project?qt-science_center_objects=1#qt-science_center_objects/
5. "Day of the year with peak cherry tree blossom in Kyoto, Japan," Our World in Data, 2024, https://ourworldindata.org/grapher/global-precipitation-anomaly
6. "Global Precipitation Anomaly," Our World in Data, 2020, https://ourworldindata.org/grapher/date-of-the-peak-cherry-tree-blossom-in-kyoto
7. "Wildfire acres burned in the United States," Our World in Data, 2021, https://ourworldindata.org/grapher/acres-burned-usa
8. "Economic damage by natural disaster type," Our World in Data, September 2023, https://ourworldindata.org/grapher/economic-damage-from-natural-disasters

Glossary

This glossary can help you understand words you may not know. You can add drawings, your own definitions, or anything else that will help. Add other words to the glossary if you would like.

Access: Able to reach a place, thing, or idea

Acre: A unit of measurement for an area of land

Anomaly: Something that is different than expected

Anonymous: People do not give their name

Biases: A situation where different groups or ideas are not considered equally

Botanists: Scientists who study plants

Climate: Long-term patterns of weather in a specific place over an extended period, such as decades or centuries

Climate science: Efforts by humans to understand the forces that control the climate system

Climatologists: Scientists who study climate

Curator: a person who oversees or manages a place (such as a museum or zoo) that offers exhibits

Damages: The amount of money lost through the destruction of property, crops, or livestock

Design: To decide on the look and function of a building, space, process, or object

Drought: a period of dryness especially when prolonged

Economic: Concerned with money, income, or the use of wealth

Economists: Researchers who study economies

Economy: The financial system of a place, which includes money, income, and how wealth is used

Empathy: Trying to understand the perspective of another

Environmental: About the natural world

Environmental psychology: The branch of psychology that explores the relationship between humans and the external world

Ethical: Something that is fair

Firefighters: People who try to put out fires

Fossil Fuels: Substances such as oil and natural gas that are taken out of the Earth

Glaciologists: Scientists who study snow and ice on the planet

Ice drill: A tool used to drill down into an ice sheet or glacier to recover ice created in the past

Oceanographers: Scientists who study the ocean

Meteorologists: Scientists who study and predict changes to Earth's atmosphere, including forecasting the weather

Monsoon: A shift in winds that often causes a very rainy season or a very dry season.

Neurodiversity: The range of differences in individual brain function and behavior traits that are regarded as part of normal variation in the human population

Peer-reviewed resources: Work that has been evaluated by one or more people with similar knowledge as those who produced the work

Perspectives: The different ways people think about the elements and relationships in systems around us

Satellite: An object, typically a spacecraft, placed into orbit around a celestial body, such as the Earth, moon, or another planet

Social: Related to the interaction of people in the community and their education, health, and well-being

Source: A place where you get information

System one thinking: A mode of thinking that operates automatically and quickly, with little or no effort and no sense of voluntary control

System two thinking: A mode of thinking that requires concentration and mental activities that demand effort, such as complex computations

Thermometer: An instrument used to measure and indicate temperature

Weather: Short-term conditions in the atmosphere, including things like temperature, precipitation, wind speed, and cloudiness

Wildfires: uncontrolled fire in a forest, grassland, brushland, or land sown to crops.

