

CLIMATE RESILIENCE!

How can communities adapt to a changing climate?



**SUSTAINABLE
DEVELOPMENT GOALS**

developed by



Smithsonian
Science Education Center

in collaboration with

iap **SCIENCE
HEALTH
POLICY**
the interacademy partnership

Copyright Notice

© 2024 Smithsonian Institution
All rights reserved. First Edition 2024.

Copyright Notice

No part of this module, or derivative works of this module, may be used or reproduced for any purpose except fair use without permission in writing from the Smithsonian Science Education Center.

Smithsonian Science Education Center greatly appreciates the efforts of all the individuals listed below and in the acknowledgments section in the development of *Climate Resilience! How can communities adapt to a changing climate?* Each contributed his or her expertise to ensure this project is of the highest quality.

Smithsonian Science Education Center Module Development Staff

Director—Dr. Carol O'Donnell

Division Director for Curriculum, Digital Media, and
Communications—Dr. Brian Mandell

Manager of Global Sustainability Series—Heidi Gibson

Science Curriculum Developer—Khadijah Thibodeaux

Science Curriculum Developer—Andre Radloff

Project Manager—Hannah Osborn

Division Director of Professional Services—Dr. Amy D'Amico

Assistant Division Director of Professional Services—
Katherine Blanchard

Program Specialist—Jacqueline Kolb

Program Assistant—Layla Sastry

Smithsonian Tropical Research Institute Module Development Staff

Ira Rubinoff Director—Dr. Joshua Tewksbury

Director, Adrienne Arsht Community-Based Resilience
Solutions Initiative—Dr. Ana K. Spalding

Program Manager, Adrienne Arsht Community-Based
Resilience Solutions Initiative —Dayana Agudo Atencio

Public Programs Manager—Jimena Pitty

Science Education Specialist—Karina Hassell

Public Program Educator Coordinator—Eileen Haskett

Program Coordinator—Sol Diaz

The contributions of the Smithsonian Science Education Center Module Support Staff, Technical Reviewers, and Project Advisors are found in the acknowledgments section.



Thank You for Your Assistance



Thank You for Your Support

This project was supported by the Adrienne Arsht Community-Based Resilience Solutions Initiative to the Smithsonian Institution.

Adrienne Arsht Community-Based Resilience Solutions Initiative



Smithsonian
Science Education Center



Smithsonian
Tropical Research Institute

LIFE ON A
SUSTAINABLE
PLANET



Smithsonian





Smithsonian

Science Education Center

Dear Parents, Caregivers, and Educators,

As a global community we face many challenges. At times, these worldwide problems can seem overwhelming. We may ask ourselves questions about how to understand these complex problems and whether there's anything we can do to make them better. This community response guide encourages young people to discover, understand, and act on the answers to these questions.

In the years leading up to 2015, people around the world worked together to share their ideas about how our world should be. These ideas became a list of goals, the United Nations Sustainable Development Goals. The goals represent a plan for a sustainable world: a world where peaceful societies collaborate; a world where we live in balance with the environment of our planet; a world in which our economies fulfill our needs; a world that is fair to all.

As youth around the globe engage with the activities in this guide, they will gain an understanding of the science that underlies the Sustainable Development Goals. They will be able to share their knowledge with their community, create tangible ways to help their community make informed decisions, and understand the best places to find additional information on these topics.

Throughout the guide, young people may find themselves asking many questions about pathways to a sustainable future. You do not need to have the answers to any of these questions. The most important thing you can offer young people is the opportunity to question, investigate, think critically and systemically, synthesize, and act. Ask the young people around you how they are feeling and what they are thinking about as they learn this content.

I am immensely grateful to the experts who helped to develop this guide—the InterAcademy Partnership, a collaboration of 140 national academies of sciences, engineering, and medicine; our colleagues across the Smithsonian Institution; and the external subject matter experts who contributed to this guide—for their perspectives and technical support in ensuring the science in this guide is accurate. I also want to say a special thank you to the developer of this guide, Khadijah Thibodeaux, for her thoughtful contributions to the *Smithsonian Science for Global Goals* project.

Working together—scientists, researchers, parents, caregivers, educators, youth—we can make a better world for all. This guide is a step toward that grand collaboration.

Thank you for partnering with us to inspire our youth to build a better world.

Best,

Dr. Carol O'Donnell, Director
Smithsonian Science Education Center



Student Letter

Dear Student,

This is the last time you will be called a student in this Community Response Guide. Instead, you will take on a new role as an action researcher. Action researchers are interested in figuring out what to do to make their communities better. They use scientific investigations to help understand the natural world around them. They use social science investigations to help understand the people, cultures, and history of their communities. Then they use the information they gather to help solve problems in their own communities. This guide will help you learn more about this process. The most important thing to know is that you will control your own research and make your own decisions.

Think back to a time when you solved a problem. You first needed to know what you wanted, your goal. Then you had to figure out what you needed to do to achieve your goal. This guide is similar. You will think about goals you have for your local community, then figure out what you need to take action to help reach those goals.

You and your classmates will work as a team to think about information you already have about the place where you live. Then you will investigate your local community and how things work. Finally, your team will decide how to make things better. Together you will put your decision into action. Sometimes, making decisions about what to do is difficult. Don't worry, this guide will give you lots of support.

How to Use this Guide

This guide is designed to help you explore and think about problems in your community. The guide is here to help you. That means you can always change it.

Adapting the Guide

You will notice that in this guide there are often suggestions of different ways to share your ideas or do investigations. This is because different people think and work best in different ways. For example, some people like to draw, some people like to talk out loud, and some people prefer to write to express their ideas. This guide has suggestions, but you can always change the method suggested. You can share your ideas using discussions, acting, signing, telling stories, recording your voice, writing by



hand, typing on a computer, drawing, or another way you choose. Think about the way you and your team learn best together. Including everyone on the team is important.

Safety Tips

This guide asks you to do and think about things that may seem unfamiliar. You will notice physical and emotional safety tips in the guide. These will help you stay safe and supported during the activities. Make sure you follow your teacher's directions about staying safe.

Guide Structure

There are eight tasks in this guide. Each task has three activities. The activities are called **Discover**, **Understand**, and **Act**. In the **Discover** activities you will focus on thinking about information that you and your team already know. In the **Understand** activities you will investigate to find out new information. In the **Act** activities you will put your existing and new knowledge into action by applying it and making decisions. Words that may be unfamiliar will be in **bold** the first time they are used. Then at the end of the guide a glossary lists the definitions of these words.

Investigations

You are the one doing the research in this guide. This means often you will develop your own questions and determine the best way to answer them. Developing and answering questions is how scientists find out new information about the world around them. As an action researcher, you need to think like a scientist to discover what you need to know, investigate to find out more information, and think about the meaning of what you found out. In many activities there are resources to give you more information and help you investigate in the *Climate Resilience!* StoryMap website found at <https://bit.ly/ClimateResilience2030>.

Keeping Organized

In this guide you will have some papers you will need to keep so you can look at them later. You may want to have a folder, notebook, or science journal to help you stay organized. To make sure this isn't confusing, here is a list of papers you will create and refer back to as you work through the guide.



Identity Map (Task 1, Discover activity)

Personal Resilience Diagram (Task 1, Understand)

My Resilient Community (Task 2, Discover activity)

Community Map (Task 2, Understand activity)

Climate Resilience Planner (Task 2, Act activity)

Climate Challenge Research Organizer (Task 3, Understand activity)

Food System Resilience Planner (Task 4, Discover activity)

Water Resilience Planner (Task 5, Discover activity)

Built Environment Resilience Planner (Task 6, Discover activity)

Structure Assessment Rubric (Task 6, Discover activity)

Cultural Resilience Planner (Task 7, Discover activity)

Teams

You will be working with other classmates as part of a research team. Your team will conduct investigations and make decisions together. When conducting research, there may be many things to figure out as a team. You will need to be creative. There will not always be a clear right and wrong answer. Sometimes the team might not agree. This is okay. Just make sure to respect your teammates. There is no one right answer to the problems faced by your community. There is just the right answer for you and your team.

Getting Started

You will be thinking about complex problems. Sometimes this can feel difficult. Be patient. You will be guided to consider different parts of the problem. By the time you are making big decisions, you should have lots of information. Always remember, your work is important. Decisions you make can change your community. You are an important part of making your local and global communities better.

Thank you for working to make your community better.

The Smithsonian Science for Global Goals team



Planners	vii
Task 1: How does climate resilience relate to me?	1
Discover: How am I resilient?	2
Understand: What is climate resilience?	9
Act: What is my role in building climate resilience?	13
Task 2: What does my community need for a resilient future?	17
Discover: How is my community already resilient?	17
Understand: How do members of my community feel about our climate future?	22
Act: How can I plan for a resilient future?	25
Task 3: How might my community be challenged in the future?	31
Discover: How can the climate challenge communities?	31
Understand: How has the climate challenged my local community in the past?	36
Act: How can data help us predict the future?	41
Task 4: How can we strengthen our community's food system?	48
Discover: What is my community's food system?	48
Understand: Can we add redundancy to our food system?	58
Act: How can we make our food system more resilient?	64
Task 5: How can our community effectively manage water?	67
Discover: What are the concerns with water in my community?	67
Understand: How can communities collaborate to manage water?	72
Act: How can we make our water system more resilient?	81



Task 6: How can we innovate to improve the built environment?	84
Discover: How can we assess the built environment?	84
Understand: How can we adapt buildings in our built environment?	90
Act: How can we make our built environment more resilient?	95
Task 7: How can culture help us become more climate resilient?	98
Discover: How can cultures help us adapt to change?	98
Understand: How can our cultures be more climate resilient?	105
Act: How can we make our culture more climate resilient?	110
Task 8: How can we act to ensure a resilient future?	114
Discover: What are possible future outcomes?	114
Understand: What will my role be?	117
Act: How will I put my ideas into action?	119
End Notes	121
Glossary	122

Find out More!

For additional resources and activities, please visit the *Climate Resilience!* StoryMap at bit.ly/ClimateResilience2030.



Climate Resilience Guide Planner

Activity	Description	Materials and Technology	Additional Materials	Approximate Timing	Page Number
Task 1: How does climate resilience relate to me?					
Discover	Develop an <u>Identity Map</u> showing the different parts of who you are. Create a <u>Personal Resilience Diagram</u> showing examples of how you are resilient.	- Paper - Pens or pencils - Arts and crafts materials (optional)		60 minutes	2
Understand	Use various forms of storytelling to share stories of resilience and stories of climate resilience.	- Paper (optional) - Pens or pencils (optional)	<u>Personal Resilience Diagram</u>	30 minutes	9
Act	Create a collaborative art piece that represents the role your team can play in building climate resilience.	- Class board or poster paper - Paper - Markers, pens, or pencils - Arts and crafts materials (optional)	<u>Personal Resilience Diagram</u> <u>Identity Map</u>	25 minutes	13
Task 2: What does my community need for a resilient future?					
Discover	Develop an idea of what makes a community resilient, then apply that to a map of your local community.	- Paper - Pens or pencils - Local map (optional)	<u>Identity Map</u>	45 minutes	17
Understand	Interview members of your local community and add community input to your <u>Community Map</u> .	- Paper - Pens or pencils - Audio or video recording device (optional)	<u>Community Map</u>	15 minutes + Interview time	22
Act	Create a <u>Climate Resilience Planner</u> and describe the context of your local community.	- Class board or poster paper - Paper - Markers, pens, or pencils	<u>Community Map</u>	35 minutes	25



Activity	Description	Materials and Technology	Additional Materials	Approximate Timing	Page Number
Task 3: How might my community be challenged in the future?					
Discover	Develop a list of local and global climate-related challenges, then use data to think about future risks.	• Paper • Pens or pencils	<u>Personal Resilience Diagram</u> <u>Climate Resilience Planner</u>	45 minutes	31
Understand	Research the impact past climate challenges have had on your community.	• Paper • Pens or pencils • Arts and crafts materials (optional) • Internet access (optional)	<u>Identity Map</u>	60 minutes + Presentation creation and delivery time	36
Act	Analyze the data you've collected and predict how your community may be vulnerable to future climate challenges.	• Paper • Markers, pens, or pencils • Scissors • Arts and crafts materials (optional)	<u>Climate Resilience Planner</u> <u>Climate Challenge Research Organizer</u>	25 minutes	41
Task 4: How can we strengthen our community's food system?					
Discover	Map and model parts of your community's food system. Create a <u>Food System Resilience Planner</u> .	• Paper • Pens or pencils • Small items, such as rocks or paper clips • Computer (optional)	<u>Community Map</u> <u>Climate Resilience Planner</u>	45 minutes	48
Understand	Use a game to build a resilient food system then test it against different climate-related challenges.	• Paper, white and another color • Scissors • Pens or pencils	<u>Food System Resilience Planner</u> <u>Building a Resilient Food System Game cards</u>	45 minutes	58
Act	Brainstorm actions that can strengthen your community's food system, then complete your <u>Food System Resilience Planner</u> .	• Paper • Markers, pens, or pencils • Arts and crafts materials (optional)	<u>Food System Resilience Planner</u>	25 minutes	64



Activity	Description	Materials and Technology	Additional Materials	Approximate Timing	Page Number
Task 5: How can our community effectively manage water?					
Discover	Create a model that represents sources of fresh water in a community, then make a <u>Water Resilience Planner</u> .	• Paper • Pens or pencils • Container • Small rocks • Cloth or paper towels • Dirt or soil • A small cup • Water • A spray bottle (optional)	<u>Community Map</u> <u>Climate Resilience Planner</u>	45 minutes	67
Understand	Complete a collaborative water management challenge.	• Paper • Pens or pencils • A way to measure liquid volume • 3 large bottles • 4 large cups • Water	<u>Water Resilience Planner</u> <u>Collaborative Water Management Challenge</u> role cards	25 minutes + Oral history gathering time	72
Act	Brainstorm actions you can take to help your community better manage water, then complete your <u>Water Resilience Planner</u> .	• Paper • Markers, pens, or pencils	<u>Water Resilience Planner</u>	25 minutes	81
Task 6: How can we innovate to improve the built environment?					
Discover	Create a <u>Built Environment Resilience Planner</u> . Design a <u>Structure Assessment Rubric</u> , then use it to assess structures in your community.	• Paper • Pens or pencils • Computer (optional)	<u>Climate Resilience Planner</u>	30 minutes + Assessment time	84



Activity	Description	Materials and Technology	Additional Materials	Approximate Timing	Page Number
Understand	Design a building model that is adapted for passive heating and cooling.	• Model-building materials, such as sponges, aluminum foil, clay, leaves, colored paper, tape, and plastic wrap • Paper • Pens or pencils		60 minutes	90
Act	Brainstorm actions you can take to improve structures in your community, then complete your <u>Built Environment Resilience Planner</u> .	• Paper • Markers, pens, or pencils • Arts and crafts materials (optional)	<u>Structure Assessment Rubric</u> <u>Built Environment Resilience Planner</u>	25 minutes	95
Task 7: How can culture help us become more climate resilient?					
Discover	Identify cultural assets that define modern youth culture in your community. Create a <u>Cultural Resilience Planner</u> .	• Class board or poster paper • Paper • Pens or pencils • Sticky notes or index cards (optional) • Arts and crafts materials (optional) • Internet access (optional)	<u>Identity Map</u> <u>Climate Resilience Planner</u>	45 minutes	98
Understand	Create a resilience triptych related to culture and climate resilience.	• Paper • Pens or pencils • Pictures for a collage • Arts and crafts materials (optional)	<u>Cultural Resilience Planner</u>	60 minutes	105



Activity	Description	Materials and Technology	Additional Materials	Approximate Timing	Page Number
Act	Brainstorm actions you can take to make cultures in your community more resilient, then complete your <u>Cultural Resilience Planner</u> .	• Paper • Markers, pens, or pencils • Arts and crafts materials (optional)	<u>Identity Map</u> <u>Cultural Resilience Planner</u>	25 minutes	110
Task 8: How can we act to ensure a resilient future?					
Discover	Brainstorm actions you can take to make your community more resilient, then complete your <u>Climate Resilience Planner</u> .	• Paper • Pens or pencils	<u>All Resilience Planners</u> <u>My Resilient Community</u>	45 minutes + Presentation time	114
Understand	Decide what role you will take in building climate resilience, then develop an inclusive action plan.	• Paper • Pens or pencils	<u>Personal Resilience Diagram</u> <u>Climate Resilience Planner</u>	30 minutes	117
Act	Implement your action and reflect on what went well and what could have gone better.	• Paper • Pens or pencils	<u>Action Plan</u> <u>My Resilient Community</u>	15 minutes + Action time	119



Climate Resilience! How can communities adapt to a changing climate?

People respond to changes in the **weather** every day. The weather is the pattern of temperature, precipitation, wind, and humidity in a place over a short period of time. When someone experiences rainy weather, they may respond by staying indoors. When the sun sets at night and temperatures get lower, people often respond by wearing a jacket.

The **climate** is the weather conditions in a place over a long period of time. Earth's climate is changing rapidly. **Climate change** often affects people by changing the weather they experience. Responding to climate change is not always as simple as staying indoors or changing your clothes. In this guide, you will explore ways to manage the effects of climate change in your local area.

While using this guide you will become an **action researcher**. As an action researcher you will work with a team to help solve problems in your **community**. A community is a group of people who have something in common, such as sharing the same local area. Action researchers first **discover** their own existing knowledge. Then they investigate to **understand** problems. Finally, they **act** on what they have learned to make local and global communities better.

Your team is not alone on this learning journey. Throughout this guide, **research mentors**, or professional researchers, will help guide you by sharing ideas or information. Pay close attention to orange boxes for information shared by research mentors. You will also create and keep several sheets of paper or digital documents to help you record and remember information. You may want to use a notebook or folder to help organize the sheets you will use in the guide.

Remember: *In this guide you and your team are in charge. You can always change the instructions in the steps to make them work better for you and your team.*

Task 1: How does climate resilience relate to me?



People have always faced **challenges**, or problems they've had to solve. For example, early humans were challenged by cold temperatures. They overcame this challenge by learning to build fires. One way people manage challenges is by having resilience.



Resilience is the ability to respond and **adapt** to changes and challenges. Adapt means to change in a way that helps you adjust to something new. All people have strengths that can make them resilient and help them respond and adapt. But everyone's resilience is unique. In this task you will first **discover** more about your own resilience. Then you'll analyze stories to **understand** how people can share their resilience with others. Finally, you will **act** by sharing your team's role in building resilience to climate change.



Discover: *How am I resilient?*

Our different experiences, backgrounds, and ideas give each of us a unique **identity**. Your identity is what makes you you. This activity will help you think about how your identity and experiences make you resilient. Thinking about your personal resilience is important. Recognizing your own resilience can inspire you and others as you work to manage new challenges.

1. Take out a piece of paper and title it "Identity Map."
2. On the paper, write your name in the center of the page or draw a small picture of yourself.
3. Draw a circle around your name or picture.
4. Think about your answer to the question, Who am I? The list below can give you some ideas to consider, but you choose what you want to include. You can also include things that are not on the list.
 - Age
 - School or class
 - Race and/or ethnicity
 - Gender
 - Country or place where you live
 - Climate you live in (such as rainy, dry, hot, cold)
 - Country or place that is important to you or your family
 - Values or beliefs that are important to you
 - Topics or subjects that interest you
 - Goals that are important to you



- Hobbies or things you like to do for fun
 - Physical traits (such as tall, black hair, brown eyes, wears glasses)
 - Personality traits (such as loud, funny, sad, kind)
 - Roles you have in your household (such as big sister, helper, cousin)
 - Languages you speak or cultures that are important to you
 - Groups you belong to
5. Write each answer on the page around your name. Draw a line between your name and each answer. Figure 1 is an example of a written Identity Map. You can put your answers at the end of each line.

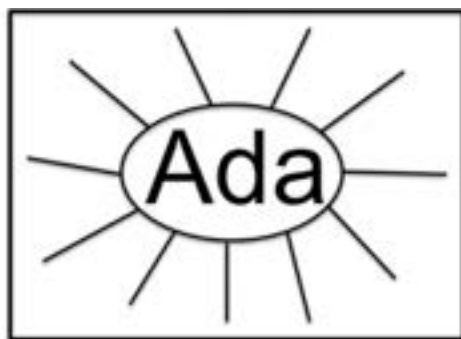


Figure 1: Example of written Identity Map.

6. If you prefer, you can use objects around your home or classroom to create your map. To keep your map, you can take a picture or just remember it. Figure 2 is an example of an Identity Map using objects. You could also make a digital map using recordings or photos.



Figure 2: Example of an Identity Map using objects.



7. Now form a team. As action researchers you will work together with your team, made up of your classmates, for the rest of this guide. Your team may be your whole class, or it may be a smaller group. Either is fine.
8. Share your Identity Map with the members of your team to find out what you have in common. Try to find matching identities with your teammates. For example, if you like to read for fun, see if you can find someone else who likes to read for fun. Find a few matching identities. Then move on to the next step.



Emotional Safety Tip

Sharing your identity with someone else can help build trust between you and that person. But it can be hard to share your personal identity with someone else. Only share parts of your Identity Map that you feel comfortable talking about.

9. Now try to find teammates who have different identities from you. Then return to your place.
10. Think quietly to yourself about the different identities you found in your team. Everyone is unique. It is good to have different identities as part of your team. This means you have different information to share. As action researchers, you will work together as a team to find the best way to take action on the problems you identify. The different identities and experiences of each member of your team will help you make better decisions. For example, if you were born in the place where you live but your teammate was born somewhere else, you each may know different things.
11. Read what research mentor Dr. Ana Spalding says about resilience. Ana is one of the eight research mentors who will give your team important information throughout the guide. Why is it important to understand how different people demonstrate resilience?





Resilience is the ability of people and nature to respond and adapt to external **stressors**. Changes in the climate often cause stresses that people must respond and adapt to. A lot of how the climate is impacting people is **unprecedented**, or new. We must find ways to respond and adapt to the changing climate.

There's not just one solution to the climate issues people are facing.

Examples of resilience help us understand various paths we can take to manage changes and challenges. Exploring examples of your own resilience and the resilience of others can help inspire people as we work to build resilience.

—Dr. Ana Spalding

Ana is a staff scientist at the Smithsonian Tropical Research Institute located in Panama, and the director of the Adrienne Arsht Community-Based Resilience Solutions Initiative. Ana's work focuses on how coastal communities can be resilient and create a better future for people and the ocean.

Visit the *Climate Resilience!* StoryMap to learn more about Ana and the other research mentors you will learn from throughout the guide.

12. Read *Personal Examples of Resilience* to understand more about the things that already make you resilient.

Personal Examples of Resilience

What makes you resilient? Throughout life people gain knowledge and skills that help them solve problems and manage challenges. Everyone has knowledge and skills that support their resilience, but our personal sources of resilience are often different.

Your identity can be a source of resilience. Everyone's identity is made up of many parts. Each part of your identity can give you knowledge and skills that help you respond to changes and challenges. For example, if "loves science" is a part of your identity, you might know about investigating issues and problem-solving. If your identity includes "older sibling," you might know about teaching others or have leadership skills. The knowledge and skills you get from parts of your identity help make you resilient.



Personal experiences can also be a source of resilience. Your personal experiences are events that have happened in your life. Some experiences are **achievements**, or things you have accomplished. Some experiences are changes or challenges you have had to manage. As people manage challenges and work toward achievements, they often gain new skills and knowledge. For example, preparing for a test could give you new knowledge on a subject or critical thinking skills. The skills and knowledge you gain from your experiences also help make you resilient.

13. Take out a piece of paper and title it "Personal Resilience Diagram." This diagram will help you understand examples of your personal resilience.
14. Draw two boxes next to each other on the page. Label one box "Identities" and the other "Experiences."
15. Draw a third box below the "Identities" and "Experiences" boxes and label it "Strengths and Resilience" Figure 3 shows an example.



Figure 3: Example of a Personal Resilience Diagram.

16. Examine your Identity Map. Search for parts of your identity that you think might make you resilient. These are parts of your identity that give you knowledge and skills. List anything you find in the *Identities* box on your Personal Resilience Diagram.
17. Think of knowledge, skills, or other resources that parts of your identity may have given you. For example, if part of your identity includes playing a sport, you might think of skills like working well with others. List anything you think of in the *Strengths and Resilience* box on your Personal Resilience Diagram.
18. Think of times you've been challenged. Challenges can be experiences that end in a few hours, days, or months, such as a competition or a bad storm. Challenges



can also be experiences that last a long time or forever, such as a subject that you struggle with in school or a major change in your family.

 Emotional Safety Tip

It can be difficult to think about challenges you have experienced, especially if you do not like the outcome. Resilience can mean trying to move forward even when bad things happen, but it can be very difficult. Be kind to yourself as you think about how you have responded to challenges in the past. No one is perfect, but this guide is a chance to think about how you want to respond in the future.

19. Write or draw the major challenges you've experienced in the *Experiences* box of your Personal Resilience Diagram. Be sure to think about:
 - a. Challenges you have faced at school or while learning
 - b. Challenges you have faced at home or with your friends
 - c. Challenges you have experienced related to groups you might be part of, such as your **local community** or religious, racial, ethnic, or other groups that are part of your identity
 - d. Challenges that are related to the natural or physical world around you; this could include **natural disasters** (natural events that cause harm to people and the environment)
20. Now think about your achievements. What are some experiences in which you felt successful? Like challenges, achievements also can happen quickly or over a very long time.
21. Add the major achievements you have experienced in the *Experiences* box of your Personal Resilience Diagram. Be sure to think about:
 - a. What achievements have you experienced at school or while learning?
 - b. What achievements have you experienced at home or with your friends?
 - c. What achievements have you experienced related to groups you might be part of, such as your local community or religious, racial, ethnic, or other groups that are part of your identity?
 - d. What achievements have you experienced that are related to the world around you, like picking up litter or successfully planning for bad weather?



 Emotional Safety Tip

Everyone has had challenges and achievements, both big and small. Thinking of past experiences can be hard and can create both positive and negative feelings. As a team member, sharing your experiences is important, but you can choose not to share any experiences you are not ready to think about or reflect on. It is also okay if you can't think of a challenge or achievement right away.

22. Examine your experiences. Search for anything you think may have made you more resilient or able to manage change or challenges.
23. Think of the skills, knowledge, or other resources these experiences have given you. List any skills or knowledge you used or gained during these experiences in the *Strengths and Resilience* box on your Personal Resilience Diagram.
24. Examine your *Identities* and *Experiences* boxes. Are any parts of your identity related to your experiences? For example, if you have experienced a health problem, it might be related to the idea of patience as part of your identity.
25. Draw lines to show the connections between parts of your identity and things listed in your *Experiences* box. One item in your *Identities* box might connect to more than one in your *Experiences* box. And one of your *Experiences* might connect to more than one of your *Identities*.
26. Are there any of those connections between your *Identities* and *Experiences* that make you think of other strengths you have shown? If so, add those to your *Strengths and Resilience* box now.
27. Examine your *Strengths and Resilience* box and think quietly to yourself:
 - a. Are there strengths listed that you hadn't thought about before?
 - b. How can knowing about your past resilience support you when thinking about future challenges?
 - c. Are there strengths that could be used to help others?
28. As a team, discuss personal resilience. How can understanding your own resilience help you manage challenges in the future?
29. Keep your Personal Resilience Diagram close by. You will need it again while using this guide.





Understand: What is climate resilience?

Your Personal Resilience Diagram is an example of your **individual resilience**. Individual resilience is a single person's ability to respond and adapt to changes and challenges. Some problems, such as climate change, are too big for just one person to solve. People often take on major problems by working together and building a shared **social resilience**. Social resilience is the ability of a group of people to respond and adapt to changes and challenges together. Communities of people often rely on their social resilience to remain happy and healthy after challenges.

Groups can build social resilience by sharing information and learning from others. Climate change challenges many people around the world. Sharing examples of resilience with others can help everyone identify knowledge and skills they could use to manage the challenges they face. For example, if someone shares how they managed a challenge such as flooding, it can give others ideas for better ways to manage floods in the future. In this activity, you will use storytelling to understand how people can share knowledge, skills, and resilience related to climate.

1. Read Stories of Resilience and think of stories that you know.

Stories of Resilience

Groups of people have shared knowledge, skills, and resilience through stories for thousands of years. Think of a story you found exciting or inspiring. Often the stories we tell involve a challenge a person must overcome. They can also involve someone adapting to changes. Stories about how people manage changes and challenges are often stories of resilience.

Storytelling can pass on knowledge that helps us imagine a way through the many challenges people face. Some stories pass on knowledge that builds **physical resilience**. Physical resilience is the ability to manage challenges that could do physical harm to people, places, or the natural world. Some stories pass on knowledge that builds **mental resilience**. Mental resilience is the ability to stay calm, confident, and motivated to solve problems when experiencing challenges.



Forms of Communication and Storytelling

There are many forms of communication or ways to tell a story about resilience. Here are some examples:

- Spoken stories: verbal storytelling, oral histories, and speeches
- Written stories: essays, short stories, books, and poems
- Visual stories: paintings, drawings, photographs, sculpture, and videos
- Performances: songs, plays, and dances
- Media: news reports, social media posts, television, film, and radio

If possible, visit the *Climate Resilience!* StoryMap to explore global examples of stories of resilience.

2. Think of a story of resilience that you know. It can be a story about you or about other people. It can be historical or about a real challenge people have faced. It can also be fictional and about imaginary people or challenges.
3. Answer these questions to analyze the story you chose and think about how it shows resilience.
 - a. What is the challenge in this story? Does this challenge exist in the world today?
 - b. How did people manage this challenge? What knowledge, skills, or resources did people use to face the challenge in your story?
4. Find a partner and prepare to share your story. Stories are often spoken, but you can share your story through any form of communication. If the story you chose has been told before by others, you can use writing, visuals, media, or performances that already exist to share your story.
5. Share the story of resilience with your partner.



Emotional Safety Tip

Stories about resilience can bring up challenges that are scary or have a negative impact on people's lives. It is okay if a story makes you feel sad or angry. Learning how others have shown resilience by overcoming challenges can help you think about ways to prevent negative impacts in the future.



6. Now discuss your story with your partner. Be sure to think about:
 - a. What type of resilience is this story about? Does this story show physical, mental, or both types of resilience?
 - b. How could this story help others? Does this story teach a lesson? What knowledge could this story pass on between people?
7. Read *What Is Climate Resilience?* to learn about how people are building resilience to manage climate-related challenges.

What Is Climate Resilience?

The climate affects everyone on Earth. Many communities around the world are experiencing extreme temperatures, flooding, wildfires, severe storms, rising sea levels, droughts, and other climate-related challenges. Challenges caused by the climate can make it hard for people to be happy and healthy.

To manage these challenges, people around the world are working to build **climate resilience**. Climate resilience is the ability to respond and adapt to climate challenges and changes. To build climate resilience, people first work together to understand how the climate challenges communities. Then they create plans for taking action. Finally, they ensure the actions they take lead to a happy and healthy future for all. Figure 4 shows these steps to climate resilience.



Figure 4: Steps to build climate resilience.

If possible, visit the *Climate Resilience!* StoryMap to see examples of how people around the world are building climate resilience.



8. Think of a story about climate resilience. This can be any story about a time someone was challenged by the climate. Your story can be personal to you or a story that was shared with you.
9. Answer these questions about the story.
 - a. What was the challenge in this story? Does this challenge exist in the world today?
 - b. How did people manage this challenge? What knowledge, skills, or resources did people use to face this challenge?
10. Find a partner and prepare to share this story of climate resilience. Then discuss:
 - a. What type of resilience is this story about? Does this story show physical, mental, or both types of resilience?
 - b. How could this story help others? Does this story teach a lesson? What knowledge could this story pass between people?
11. As a team, discuss climate-related challenges and the need for climate resilience. It may be helpful to write down these challenges so you can refer back to them in the future.
 - a. How can the climate create problems or challenges for people? Has your community ever been challenged by a problem related to the climate?
 - b. Why is it important to be resilient? How could climate resilience benefit communities?



Emotional Safety Tip

Sometimes it can be hard to think about and discuss worries you have about the future. It is okay to feel sad or angry when thinking about the problems of climate change. If you need to, take a break to help you feel calmer. Remember, you are not alone. Many people around the world are working together to create the best future possible.





Act: *What is my role in building climate resilience?*

There isn't only one solution for managing climate-related challenges. Building climate resilience requires many people taking action in different ways. There are many actions your team could take to plan and prepare for climate challenges. As your team chooses the actions you'll take to build climate resilience, it is important to consider the challenges you might face and the knowledge and skills your team can use to manage these challenges. In this activity you will think about the roles you and your team could have in helping your community become more resilient.

1. Read *At the Smithsonian* to learn about the Smithsonian's role in building resilience.



At the Smithsonian

How can people and groups adapt to a changing climate? The Adrienne Arsht Community-Based Resilience Solutions Initiative at the Smithsonian Institution is conducting **interdisciplinary** research and working with communities to answer this question.

Building climate resilience requires many action-takers. Similar to your team, the Resilience Initiative brings together a team of people from across the Smithsonian to support efforts toward resilience through research, training, and engagement. The Resilience Initiative uses Smithsonian art, science, culture, and history to connect Smithsonian researchers, educators, and community solution implementers. Together they work to understand what resilience looks like in different **contexts** and provide examples of adaptation strategies necessary to achieve resilience.



Figure 5: A project supported by the Adrienne Arsht Community-Based Resilience Solutions Initiative aiming to integrate traditional ecological knowledge into future conservation strategies.

Climate resilience means we need to use many different ways of thinking about how our communities will need to adapt. Art and history can provide some information and ideas. Science can provide other information and ideas. Bringing together many different ways of understanding the world and the problem can help to **transform** potential actions. The Resilience Initiative is helping people **collaborate** to consider how nature and people can work together to build a resilient future.

2. Find a large sheet of paper, whiteboard, chalkboard, or any other materials your team can use to create a **collaborative** or shared art piece. This piece of art will be about the climate challenges you may face in the future and the role your team could take in building climate resilience.
3. Think about challenges that are related to the climate that motivate you to build resilience in your community. If you are having trouble thinking of challenges, reflecting on the stories your team shared about climate resilience can help you identify challenges that inspire your team to take action. If you recorded the challenges you discussed in your stories of climate resilience, it might also be helpful to examine those challenges.
4. Represent one or more of these challenges on the collaborative art piece by using words, pictures, or another method to express your ideas. Part of having a role in building climate resilience is understanding and expressing why you and others need to act.



5. Take out your *Personal Resilience Diagram* and reflect on your strengths and resilience. The knowledge and skills you have or gain while using this guide can be used to contribute or play a role in building climate resilience.
6. Represent one or more of your strengths on the collaborative art piece by using words, pictures, or another method to express your ideas. Understanding and expressing how you can help your community or support others when taking action is another important part of understanding your role in building climate resilience.
7. Discuss the art you've created as a group.
 - a. What challenges are represented most often in your group's art? Why does your group feel like these challenges are important?
 - b. What strengths does your team have **collectively** or as a group? How does this compare to your strengths as an individual?
8. Read what research mentor Dr. Keith Phiri says about the importance of sharing your climate knowledge with others in your community. Why do you think it might be important to share your thoughts about the climate with others?



Climate communication is a part of adaptation and resilience.

Communities are often aware that the climate is changing but don't always understand the effects of climate change. At our university, we formed a group called Climate Youth Advocates where our undergraduate students could contribute and help combat the **impacts** of climate change. The Climate Youth

Advocates studied climate change and found ways to share climate information with communities. Instead of using complicated language, they used drama, poetry, and comedy to explain its effects to rural and urban communities. They played out what people saw every day in their villages, to communicate about the climate in ways the communities could relate to and understand.

—Dr. Keith Phiri

Keith is a researcher and climate change specialist at Lupane State University in Lupane, Zimbabwe. Keith's research focuses on climate change and its impact on **marginalized** communities.



9. Think about the groups you belong to. You could think about groups you listed on your *Identity Map*, groups that are in your school, or groups outside of school. These groups are people in your community you can share knowledge with to help build climate resilience.
10. Use your art piece to share knowledge about climate resilience with someone outside your team. You could share this artwork by taking a picture of it, telling a story about how it was made, recreating your own version of it, or use another method that works for you. You may want to share it with people in groups you are a part of. These people can be important sources of knowledge that will help you build resilience as you use this guide. Be sure to share:
 - a. The climate-related challenges your team's art represents
 - b. The shared strengths your team will use to build climate resilience in your community



Emotional Safety Tip

Speaking to others about the climate can be hard. Sometimes this topic can be very sensitive or scary. It is important when discussing the climate with others that you listen closely to their feelings and respect everyone's opinion, even if it is different from your own. Treat others with respect and expect to be treated with respect yourself.



Task 2: What does my community need for a resilient future?

Different communities often have different climate-related needs. For example, some communities may need to prevent flooding while others may need to manage drought. Before taking action, action researchers often collect information about the **context** or background of an area. Understanding your community's context can help you plan to take the actions your community needs most. In this task you will **discover** the parts of your community that already support climate resilience. You will work to **understand** what people around you feel is important for your community. Then you will **act** by beginning to plan for a more resilient future.



Discover: *How is my community already resilient?*

When working to build climate resilience in your community, you can start by thinking about how your community is already resilient. Then you can consider what your community needs for a resilient future. The difference between what is happening now and what you want for the future is where you can help when you take action. In this activity you will use a map of your community to think about what your community needs for a resilient future.

1. Think to yourself about different communities you are a part of. You can use your Identity Map to help you. Remember, a community is a group of people who have something in common. You may be part of many communities. For example, you may be part of a community that shares a religious or ethnic identity.
2. As a team, discuss the importance of having a community.
 - a. What do you depend on others for? How do people in the communities you are familiar with support one another?
 - b. What kinds of issues do groups of people come together to solve? For example, after natural disasters communities often work together to **recover**, or return to normal.



3. Read Resilient Communities to explore what makes communities resilient.

Resilient Communities

What do you need to be happy and healthy? All people have needs such as food, water, shelter, health care, and education. Challenges can harm communities by limiting people's abilities to meet their needs. For example, a severe drought can harm a community by making it difficult for people to grow food. In Task 1 you learned that individuals cannot recover from climate-related challenges alone. To manage major challenges, individuals often must come together and rely on social or group resilience. Responding and adapting together to meet people's needs helps communities of people stay happy and healthy.

A **resilient community** is a community that works together to respond and adapt to challenges and meet people's needs. When groups of people work together, they can build both physical and mental resilience for their entire community. In the case of climate resilience, working with others in your local area is often important. For example, when a group of people in a coastal community work together to prevent flooding, they increase the physical resilience of their entire community. When community members work together to create art that inspires others, they can increase the mental resilience of their entire community.

4. With your team, take out a piece of paper and title it "My Resilient Community." You will use this paper to think about your idea of a resilient community.
5. Start to imagine how you think a community should be. Don't worry, we know life is not always perfect. Right now, it is time to dream.
6. Write or draw some ideas about your resilient community. If you would like to record this information a different way, you can do that. Just make sure you can save it and use it later. You can use some or all of these questions to help you think.
 - a. What needs do you have that would always be met in a resilient community?
 - b. What wants do you have that would always be met in a resilient community?
 - c. What challenges would you be protected from in a resilient community?
 - d. How would you expect to feel in a resilient community?
7. Set your My Resilient Community paper to the side. Your team will return to it later.



8. As a team, decide what you will consider to be your local community, which is the community of people in your local area. In this guide your local community will be your research area and where you take action. Discuss the following ideas when you consider which area to choose to be your local community.
 - a. Try to choose a space that is not too big, so you can get to know the area well.
 - b. Choose an area that has a variety of places in it. For example, it probably would be a good idea to choose an area with some housing, some shops, and some public spaces.
 - c. Think about a place in your community you would like to know more about.
 - d. Consider **access**. Make sure all your team members will be able to reach your research area. Be sure they can all work there comfortably and safely. It may be best to have your research area near your school or near the places where team members live.
 - e. You can choose to have more than one research area, if that works best for your team.
 - f. These decisions are all up to your team. It is also okay to change the size and number of research areas later, as you collect more information.
9. Take out a sheet of paper and label it "Community Map."
10. Read *Mapping Your Local Community* and follow the instructions to complete your *Community Map*.

Mapping Your Local Community

As action researchers, you will be conducting investigations to help you plan to take action in your local community. Before you can do this, you need to decide as a team what local community area you will be using as your research area. In this activity, you will map the boundaries of your local community.

Using an Existing Map

To get you started, it may be useful to obtain a map of the community around where your team meets. Then, mark the edges of your local community on the map. Figure 6 shows an example.





Figure 6: Example of an online community map.

Maps can be found online, in local libraries, government planning offices, tourist centers, and with elders or community leaders. If your team uses an existing map, make sure it is **accessible**, or able to be used by everyone on your team. People who are blind or have low vision sometimes use tactile or Braille maps. These maps use raised surfaces to describe where things are.

Creating a New Map

Your team can also create your own map. If you are going to create your own map, here are some instructions that can help.

- a. Use a blank piece of plain paper or grid paper. If you can examine or print an online map to help you draw, that might be useful.
- b. If you don't want to use paper, you can make your map on a computer. Or you can draw your map outside in dirt, sand, or other material. You can also describe your map out loud with your team.
- c. Start by marking on your map the location where your team meets. You will work outward from this location to determine your research area boundaries.
- d. Your map should include:
 - Places people in your community go for shelter or safety
 - Places people in your community get food, drinking water, and other essentials



- Places people share in the community, such as schools, hospitals, and parks
- Places people go to share beliefs or traditions
- Major roads, bridges, and railways in your community
- Natural spaces in your community, such as bodies of water like lakes or rivers

e. Next, draw the edges of your research area on the map.

f. Your map does not need to be perfect; it just needs to make sense to you and your team. You can always add to it or fix it later

11. Compare your community to your team's idea of a resilient community and think about the future you want for your local area. The information written on your team's *My Resilient Community* paper and your *Community Map* might be useful when thinking about the future. As a team, discuss your hopes for your community's future.
 - a. Are there parts of your community you hope will continue helping people meet their needs in the future?
 - b. Are there things listed on your *My Resilient Community* paper that already exist in your community and give you hope for the future?
 - c. Are there things listed on your *My Resilient Community* paper that you hope will exist in your community one day?
12. Represent your hopes for the future on your *Community Map*. You can use a symbol such as a heart to mark the parts of your community that make you hopeful for the future. If your hopes for your community don't already exist, add them to your map. You can add hopes to your map by writing them or drawing pictures that represent your hopes.
13. Think of the parts of your community that make you worried or feel concerned about the future. As a team, discuss your concerns about your community's future.
 - a. Are there parts of your community that could be affected by the climate or weather?
 - b. Are there other challenges that make it difficult for people in your community to meet their needs?
14. Represent your concerns for the future on your *Community Map*. You can use another symbol, such as a diamond or triangle, to mark the parts of your community you are concerned about. You can also write or draw your concerns directly on



your *Community Map*. Some parts of your community may be marked with both your symbol for hope and for concern. That is okay. People often have both hopes and concerns for important parts of their community.

Emotional Safety Tip

Different members of your team may have different opinions about your community. Each person has their own experiences and challenges. Some team members might benefit from parts of your community, while others do not. It is important to listen to and respect the opinions of each team member.



Understand: *How do members of my community feel about our climate future?*

Examining a map of your community is only one way to understand its resilience. To better understand your community, your team should learn from the thoughts and feelings of community members. Members of a community often have different hopes and concerns about a community's future. Understanding the unique thoughts and feelings of community members can help you take actions that benefit everyone.

In this activity, your team will gather information from different members of your community. You will use this information expand your knowledge of what your community needs for a climate resilient future.

1. Read what research mentor Dr. Anne Fitchett says about the importance of local knowledge. What do you think you could learn from others in your community?



Local knowledge is something that is quite profound. I think particularly when you're talking about things like climate change, the people that actually live in an area know all the nuances around climate pressure and climate challenges. They really bring a wealth of knowledge. There's also always an opportunity when you are speaking with a community to inform others. As you speak with others, you can increase their knowledge of



problems or risks they don't know about that could have a very serious impact on your community. I would say when you go into a community, go in with a very open mind about what the important things are.

—Dr. Anne Fitchett

Anne is a recently retired environmental engineering professor at the University of Witwatersrand in Johannesburg, South Africa. Throughout her career she has worked intensively with communities in informal settlements to understand how people can best manage water.

2. Read *Interview Instructions* and follow the instructions to gather community knowledge through interviews.

Interview Instructions

In this activity, each member of your team will interview a different person in your community. Conducting interviews can help you understand how members of your community think and feel. Every person in your community has a valuable **perspective**, or way of thinking. These interviews can help your team consider many different perspectives in your community as you plan for climate resilience.

Questions

With your team, think about some questions you would like to ask people to learn more about climate resilience in your community. For example:

- a. What are some things that make our community strong or resilient?
- b. What are some problems or challenges related to the climate or weather you have experienced while living here?
- c. What are some ways people in our community are preparing for the future?
- d. What are your hopes and concerns for our community's future?

Choosing People to Interview

As a team, try to talk to people who live in all parts of your community. If that is not possible, do not worry. You can also learn by talking to people who are easier for you to reach, such as others in your school.



You can visit the *Climate Resilience!* StoryMap to explore video interviews about community resilience, if you are not able to interview people in your local community.

Tips for Conducting an Interview

- You can interview people in many different ways. You can talk to people in person, over the phone, or using the Internet.
- You can record the ideas shared in your interview using audio, video, writing, or drawings.
- Make sure to ask permission to record and share a person's answers.
- If it feels as if someone didn't answer your question, don't be afraid to ask the question again in a different way.
- Let the person you are interviewing answer the questions the way they want. Be patient. Listen carefully. Understand that they might give answers you didn't ask for or expect.

Safety Tips for Interviewing People

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



Physical Safety Tip

Never conduct an interview with an unknown person alone and always be aware of your surroundings. You might want to suggest recording the interview in a quiet public place.



Emotional Safety Tip

It can be hard to communicate with 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. By yourself, examine the record of your community interview. Identify new information that can be added to the hopes and concerns represented on your team's Community Map.
4. Represent the community strengths and hopes mentioned in your interview on your team's Community Map. Mark their hopes using the same symbol you used to show your hopes in the Discover activity.
5. Represent the climate-related challenges and concerns mentioned in your interview on your team's Community Map. Mark their concerns using the same symbol you used to show your concerns in the Discover activity.



Act: *How can I plan for a resilient future?*

Similar to your local community, you are also a member of the **global community**. The global community is the community of all the people around the world. The global community is also a group that works together and relies on social resilience. When you take actions to build resilience, you can benefit both your local and global community.

People often set goals to motivate themselves to achieve something in the future. For example, you may have a goal for the type of career you want. Identifying the goals people in your community have for their local and global future can help you plan actions that fit your community's needs. In this activity, you will use the information from the Discover and Understand activities, as well as the UN **Sustainable Development Goals**, to define your community's resilience goals.

1. Read what research mentor Dr. Hussam Mahmoud says about planning for a resilient future. Why might it be important to create plans for the future?



Before a community faces an extreme event, we want to make sure that community is as resilient as possible. Communities can become more resilient by planning and preparing for future challenges. Communities can plan to **mitigate**, or lessen the impact, extreme events might have in the future. Communities can also plan how they will respond to future challenges, to ensure they recover back to how they were before the event, if not better.



When planning for the future, it is important to think about how your community will meet its needs before, during, and after it faces challenges. How should your community share resources to mitigate the impact of events? Where should supplies for recovery be stored? How will you prepare hospitals before events? How will you ensure students have access to schooling? Thinking about questions like these in advance and creating a plan can lessen the impact of climate challenges on your community and speed up its recovery.

—Dr. Hussam Mahmoud

Hussam is a researcher and professor at Colorado State University in Fort Collins, Colorado. His research focuses on sustainable and resilient infrastructure in communities. He serves as an advisor on community resilience to the World Bank, insurance companies, and other agencies.

2. Read *Possible Futures* and think about what you want for the future of your community.

Possible Futures

Major changes and challenges can limit a community's ability to **function**, or meet everyone's needs. For example, a severe storm could harm how a community functions by damaging hospitals, schools, homes, and stores people rely on. Though communities cannot always control the challenges they face, they can control how they respond and adapt to challenges. Working together to respond and adapt to the challenges they face helps communities have the best possible **outcomes**, or possible futures.

Those outcomes include:

- **Transform:** Communities respond and adapt to transform the way they meet people's needs after challenges and into the future. To transform, communities learn from past challenges to plan and prepare to better manage future challenges.
- **Recover better:** Communities respond and adapt to meet more needs after a challenge than they were able to meet before they were challenged.



- **Recover:** Communities respond and adapt to return to normal after a challenge. Communities that recover meet the same needs before and after being challenged.
- **Recover worse:** Communities respond and adapt but meet fewer needs after a challenge than they were able to meet before they were challenged.
- **Collapse:** Communities try to respond and adapt but are not able to meet needs everyone's needs after a challenge. Communities that collapse are no longer able to function.



Figure 7: Range of possible outcomes.

3. As a team, discuss what outcome you want for your community if it experiences challenges in the future. Try to come to a **consensus** for the possible outcome that you want to set as a goal for your team as you work to build resilience. A consensus is a balanced decision that works for everyone.
4. Read *Planning for the Future* to find out more about taking planned actions to reach your goals.

Planning for the Future

Reaching goals, such as creating a resilient community, often requires **strategic planning**. Strategic planning is when you make a long-term plan that considers the best way to achieve your goals with the resources you have available. Creating a strategic plan can help people ensure they have the best potential outcome after they face a challenge.

There are many ways to create a plan for building resilience. This guide will help you plan for building climate resilience, using the chart in Figure 8. As you use this guide, you will create several versions of this *Resilience Planner* to think about different ways your community can build climate resilience.

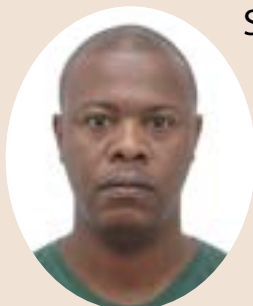


Context	Challenges	Vulnerabilities	Responses	Potential Outcomes
				Transform
				Recover Better
				Recover
				Recover Worse
				Collapse

Figure 8: A blank *Resilience Planner*.¹

If possible, visit the *Climate Resilience!* StoryMap to see examples of how this planner can be used in each task in this guide.

5. Create your own version of the chart in Figure 8 and title it “Climate Resilience Planner.” This planner will help you think about resilience in all parts of your community. You will use it now and throughout the guide. In later tasks you will make resilience planners that focus only on certain parts of your community. You can create a physical version of this planner on a piece of paper or a digital version of this planner. Do not fill out your planner yet. You will write in different parts of this planner as you complete tasks in the guide.
6. Read what research mentor Keith says about solutions for building resilience. Why is it important to think about your community’s context as you plan actions to build resilience?



Solutions for building resilience are not **homogenous**, or the same for everyone. They are context-specific. They are area-specific. The best solutions consider both the needs and resources in a particular area.

—Dr. Keith Phiri



7. In the *Context* column of your *Climate Resilience Planner* write the words “**Assets**” “**Needs**,” and “**Goals**.” Leave yourself space to write under each of these words. An asset is something useful or valuable. The assets in your community are a part of what makes it resilient.
8. If you have time, visit the *Climate Resilience!* StoryMap for an example of how to fill in the *Context* column of your *Climate Resilience Planner*.
9. With your team, discuss your *Community Map* and think about what your community needs for a resilient future. Discuss:
 - a. Which parts of your *Community Map* are marked with your symbols for hope? Which parts of your community already contribute to its resilience? Add what you discuss under *Assets* in the *Context* column.
 - b. Which parts of your community are you concerned could be negatively affected by the climate? Which are essential and need to be protected? Add what you discuss under *Assets* in the *Context* column.
 - c. Which hopes did you add to your map because they do not already exist in your community? What does your community need to reach your team’s idea of a resilient community? Add your ideas under *Needs* in the *Context* column.
 - d. Which concerns did you add to your map? What kinds of challenges does your community need to build resilience for? Add what you discuss under *Needs* in the *Context* column.
10. Think of goals your team has for the future of your community. You might have marked locations such as natural areas that you hope remain in the future. This could help you identify a goal of making sure your community’s future includes access to these types of places.
 - a. What are some goals you and others have for your community, based on your hopes and concerns on your *Community Map*? How could your community become more resilient? Add what you discuss under *Goals* in the *Context* column.
 - b. What goals in your local community do you think other communities share? Do you think any of your local goals may also be global goals?
11. Read *The Sustainable Development Goals*.



The Sustainable Development Goals

Many people have goals to improve their local community. There are also goals for improving the global community. The **United Nations**, also called the UN, is a global organization designed to help governments and people around the world collaborate and use their shared knowledge and skills to solve problems faced by many communities around the world.

As the year 2015 approached, the UN asked countries and people around the world to imagine a better world and a better future. They worked together to determine a list of goals based on many different hopes and concerns for the future. These goals for the global community are called the UN Sustainable Development Goals, or SDGs. Many of the SDGs are related to the climate or the impacts of climate change. When you and others around the world work toward goals in your own local communities, you may also be working toward improving the global community through the SDGs.



Figure 9: United Nations Sustainable Development Goals (SDGs).

12. Examine the goals you wrote, based on your community's hopes and concerns. Do any of the SDGs shown in Figure 9 relate to anything in your community goals? If so, write the SDG number or numbers next to each idea on the list.
13. Are there SDGs that make you think of a new goal for your community's future? If so, add that goal in the *Context* column of your Climate Resilience Planner.
14. Store your planner somewhere safe. You team will continue to fill out columns in this planner as you complete this guide.



Task 3: How might my community be challenged in the future?

Every community has unique experiences with the climate and the weather. For example, many communities experience severe storms, but storms affect different places in different ways. Some communities flood when it storms. Other communities lose power when it storms. Some communities must manage both challenges. Because of these unique experiences, climate resilience develops differently in different places. To understand how your community should work to build climate resilience, it is important to understand the ways the climate might challenge you in the future.

Understanding past and current climate challenges can help your community predict your needs for the future. Predictions about the future can help you prioritize building resilience to the greatest climate threats in your community. In this task you will first **discover** ways the climate often challenges communities. You will then work to **understand** how the climate has challenged your community in the past. Finally, you will **act** by making predictions that can help prepare your community for the future.



Discover: *How can the climate challenge communities?*

The climate can affect the weather, bodies of water, and the land in a community. As the climate on Earth changes, many communities are challenged by severe storms, wildfires, changes in water availability, and worsening land quality. In this activity, you will start to identify different ways the changing climate challenges people in your local and global community. You will use this information to plan for adapting your community to the unique challenges you may face in the future.

1. Take a moment to think about what it means to be challenged. If possible, find a quiet place where you can close your eyes and reflect alone. Examining the *Experiences* boxes in your *Personal Resilience Diagram* from Task 1 could help you with this reflection.



 Emotional Safety Tip

Reflecting on challenges can bring up negative feelings. This is okay. Identifying challenges through reflection is often the first step to solving these challenges. If you feel this reflection brings up too many negative feelings, it is okay to stop and take a moment to take care of yourself.

2. Reflect on a time you've been shocked by something. A **shock** is a change or challenge that happens quickly or unexpectedly.
3. Think of ways the climate could shock or quickly challenge your local community or other places around the world. What climate or weather-related experiences could disturb a community quickly?
4. Now think of a time when you've been stressed. A **stress** is a challenge that builds slowly overtime.
5. Think of ways the climate could stress or slowly challenge a community over time. What climate or weather-related experiences could disturb a community over a year or more?
6. Return to your team and share the climate challenges you thought of during your reflection. Add the challenges you shared to the *Challenges* column of your *Climate Resilience Planner* from Task 2.
7. Read *Global Climate Challenges* and follow the instructions.

Global Climate Challenges

Communities across the globe are often challenged by climate-related events, or **climate challenges**. **Climate shocks** are climate events that can quickly cause a major challenge in a community. Some examples of major climate shocks are typhoons (also called hurricanes, or cyclones), tornados, severe storms, floods, wildfires, and **landslides**, which are sudden downhill movements of rock and dirt.

Climate stressors are climate events that slowly challenge a community over time. Some examples of major climate stressors are heatwaves, cold waves or cold snaps, droughts, melting **glaciers**, and sea level rise. Even though climate stressors may not cause harm immediately, they can still have a big impact



on a community. For example, during major droughts some communities are challenged by water or food shortages and **land degradation**, which means worsening land quality.

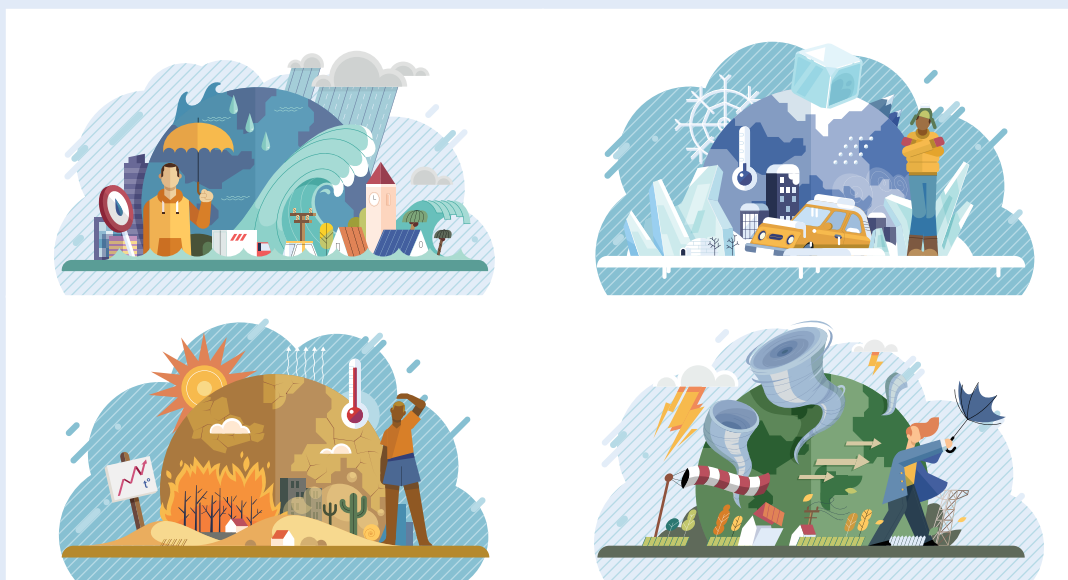


Figure 10: Examples of climate shocks and stressors.

Discuss global climate challenges with your team:

- Are there challenges that affect the global community that are not currently listed in the *Challenges* column of your *Climate Resilience Planner*? If so, add those challenges to your list.
- Analyze Figure 10. Which climate challenges do you think might be related? For example, rising sea levels often make flooding worse.
- Share examples of challenges in these images that could be **sequential**. Sequential means they happen one right after another.
- Share examples of challenges in these images that could be **compounding**. Compounding means they make one another more severe.

If possible, visit the *Climate Resilience!* StoryMap to learn more about how climate challenges are connected.

- Pick a symbol, such as a star or plus, to represent your community.



9. As a team, discuss how global challenges relate to your local community.
 - a. Are there climate challenges listed in the *Challenges* column of your *Climate resilience planner* your community has experienced in the past? If so, mark these shocks with the symbol your team chose to represent your community.
 - b. Climate does not just happen in one place; it connects locations around the world. How could your community benefit from understanding how other communities manage challenges?
10. Read *Using Data to Assess Risk* and follow the instructions.

Using Data to Assess Risk

Climate challenges, such as natural disasters, have always affected people. Climate change is increasing the challenges many communities are facing. Around the world, challenges related to the climate are becoming more intense, more frequent, and occurring in new locations.

Researchers use **data**, which are pieces of factual information, to help them think about the **risk** of future climate challenges. Risk is the likelihood of experiencing something that is negative. As your team plans to build resilience, it is important to think about the challenges that are a risk to your community now and into the future.

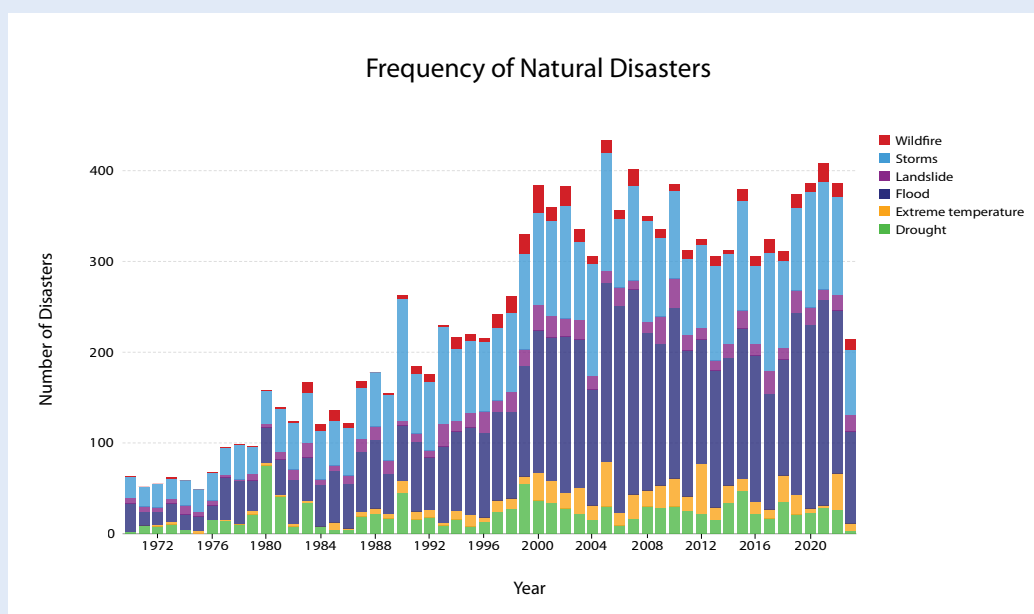


Figure 11: Graph of frequency of natural disasters.²



Examine the data in Figure 11 and think about how the frequency of natural disasters has changed over time. As a team, discuss:

- How does the frequency of natural disasters since the year 2000 compare to the frequency before 2000? If this chart extended to the year 2050, what frequency might you expect?
- How does data collected over a short period of time compare to data collected over a much longer period? Why might it be important to examine at long periods of climate data when considering resilience?
- Are there people in your community who may have experienced changing climate challenges? Speak with an older member of your community and ask if they have noticed an increase in climate challenges over their lifetime.

- Now, draw a line on a class board or on a sheet of paper, as in Figure 12, and label one end of the line “Not Worried” and the other “Very Worried.” Or imagine a line running across your classroom and choose one side of the room to be “Not Worried” and the other to be “Very Worried.”

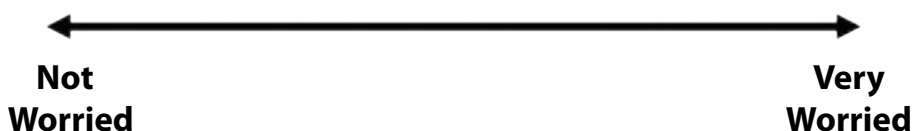


Figure 12: Example of a Not Worried to Very Worried Line.

- With your teammates, examine the *Challenges* column in your *Climate Resilience Planner* and think about the risk of future climate challenges. Do any of these shocks or stressors ever make you worry about your community's future?
- Write the name of each challenge on the Not Worried to Very Worried Line, or choose teammates to represent these challenges and physically place yourself along the line.
- For each challenge, have a few teammates share why they worry or do not worry about that challenge.





Understand: How has the climate challenged my local community in the past?

Exploring data on past climate challenges in your community can help you understand what your community might need for a resilient future. There are many ways your team could help prepare your community for climate events, but it is important to prioritize preparing for the most impactful or harmful events. In this activity, you will research a past climate shock or stressor your community has experienced, to identify possible needs for a resilient future.

1. Read *The Four Perspectives*

The Four Perspectives

Climate challenges can affect or harm communities in different ways. How people think about the impact climate has on their community may depend on their perspective. People with different perspectives often value different parts of a community. For example, after a natural disaster a store owner might worry about the cost of **damages** to their business. Alternatively, a **conservationist** or someone who works to protect nature might worry about the damage to plants and animals in the community.

To understand which climate shocks and stressors have the greatest impact on your community, it's important to consider four types of community perspectives: social, economic, environmental, and ethical.

- **Social** is about the interaction of people in a community. The health, education, and well-being of people are the most important things.
- **Environmental** is about the natural world. Protecting Earth and its natural systems is the most important thing.
- **Economic** is about money, income, and use of wealth. Economic growth, including making sure people have jobs and enough money, is the most important thing.
- **Ethical** means the fairness of something. Doing what is right and having a just community where everyone is treated fairly is the most important thing.



2. Divide your team into groups of two to six people to research the impact different challenges have had on your community in the past.
3. Read what research mentor Alexandra Guzman says about challenges related to the climate. Why is it important to learn from many perspectives on past challenges?



Challenges are inevitable. Resilience involves embracing challenges and using those experiences to learn, transform, and persevere. To prepare for climate challenges, you need to consider how they will impact you directly, your community, and future generations. While we cannot control natural disasters, we can control our responses and share knowledge about them with others.

—Alexandra Guzman

Alexandra is a marine biologist at the Smithsonian Tropical Research Institute in Panama City, Panama. She works on long-term oceanography **monitoring** to understand the impacts of climate change. As part of the Physical monitoring program, she collects data that helps scientists understand the impacts of climate change.

4. Take out a sheet of paper or a digital document your small group can share and title it “Climate Challenge Research Organizer.”
5. Divide your *Climate Challenge Research Organizer* into five sections. Label one section “Background,” then label each of the remaining sections with one of the four perspectives. Figure 13 shows an example.

Background	Social	Environmental
	Economic	Ethical

Figure 13: Example of a *Climate Challenge Research Organizer*.



6. As a small group, choose a climate challenge listed on your team's Not Worried to Very Worried Line to research. It may be helpful to choose the challenges your team is the most worried about.
7. Write information about your chosen climate challenge in the *Background* section of your group's Climate Challenge Research Organizer. If there is background information you don't know, begin to think about how you could find it.
 - a. What type of climate challenge are you researching? For example, some groups may focus their research on wildfires, while others research sea level rise.
 - b. Has your community experienced this climate challenge in the past? List specific times your community has experienced this challenge.
 - c. How does the challenge you are researching relate to other climate challenges? Are there climate shocks or stressors that may be sequential or compounding the challenge you are researching? For example, sometimes a shock such as a wildfire comes as a result of a severe drought.
8. Read Gathering Information to understand more about sources of climate data.

Gathering Information

Types of Data

There are different types of data you can collect to understand the impact of a climate event. Some data is **quantitative**. Quantitative data are numbers and measurements that describe an event. Some data is **qualitative**. Qualitative data describes an event using words. Data can describe the physical impact of an event or how an event made people in your community feel. It's important to collect both types of data to understand the impact of climate challenges.

Sources of Information

Personal reflection: Start with what you already know. You are an important member of your local community. Reflecting on your own memories of a climate event is a great source of qualitative data.

Community members: Community members often have experienced many climate challenges throughout their lives. Older community members can be a great source of qualitative data on climate events that you did not experience or cannot remember.



News reports: People often write news reports about major climate events. Searching online, visiting a library, or locating an **archive** or place where historical documents are stored are some ways to find news reports about a past climate event. News reports can often provide quantitative and qualitative data.

Online or digital resources: People often share information about climate events online or digitally. Online articles and **databases** (large sets of information stored digitally) are a great source of quantitative data. Blog posts, videos, and social media posts are some online sources for both quantitative and qualitative data.

Visit the *Climate Resilience!* StoryMap for sources of online data on the climate.

9. Discuss the kinds of data your group can access.
 - a. What sources of information can you access? How can members of your group help each other access information? For example, some groups members may be able to easily access data shared on social media posts, while others can easily access data from an older member of your community.
 - b. Why might it be important to gather both quantitative and qualitative data on the climate?
10. Use at least two sources of information to complete the *Background* section of your *Climate Challenge Research Organizer*. Make sure to include both quantitative and qualitative data on the background of the climate challenge you are researching.
11. Read *Using Data to Assess Vulnerabilities*.

Using Data to Assess Vulnerabilities

Communities often repeatedly experience the same types of climate challenges. For example, some communities have a season every year when they experience hurricanes. Researchers often use data on repeated past challenges to identify a community's vulnerabilities. A **vulnerability** is something's risk of future harm.

Your team can build climate resilience by taking action to protect the vulnerable parts of your community. In this activity, you will collect data on the impact of a past climate event. This data will help your team think about how your community



might be vulnerable to future challenges. The four perspectives can help you think of many ways a community is affected by a climate event. As you investigate, try to find data to answer the following questions about the climate challenge listed in your *Climate Challenge Research Organizer*.

a. Social:

- Has this climate challenge harmed people in your community?
- Has this climate challenge affected shared spaces in your community, such as schools or hospitals?
- Has this climate challenge changed the way people in your community interacted with one another?

b. Environmental:

- How has this climate challenge affected natural spaces in your community?
- Has this climate challenge affected **natural resources**, such as land or water in your community? Natural resources are the resources people get from natural spaces on Earth.
- Have plants or animals in your community been affected by this climate challenge?

c. Economic:

- How much money has this climate challenge cost your community in damages? Damages are the cost to improve parts of the community that were harmed.
- Have community members lost jobs, money, or property because of this climate challenge?
- Has this climate challenge harmed businesses in your community?

d. Ethical:

- Was the harm caused by this challenge **inequitable** or unfair? Are there people or groups that were more affected by this challenge than others?
- Were the solutions for this challenge inequitable? Were some people or groups given more resources or assistance to recover than others?



Emotional Safety Tip

Sometimes climate challenges can be very difficult to think about. It is okay if researching impacts makes you feel worried or concerned. If you begin to feel overwhelmed by what you are learning, it is okay to take a break. Though learning about the impacts of climate challenges can be difficult, this information can help you change your community and prevent future harm.

12. As a small group, use multiple sources of information to add quantitative and qualitative data to your Climate Challenge Research Organizer. Try to find data to answer as many of the questions as possible from the box Using Data to Assess Vulnerabilities. Be sure to add information to each box in your Climate Challenge Research Organizer to ensure you are considering all four perspectives.
13. Have each group present their climate event impact research to the rest of the team. You can present by creating posters, giving a digital presentation, or trading Climate Challenge Research Organizers.
14. As a team, discuss climate challenges and the impact they have had on your community.
 - a. Which climate challenges happen the most frequently in your community?
 - b. Which climate challenges have had the largest impact on your community?
 - c. Do you think climate challenges have affected your community the most socially, environmentally, economically, or ethically?
15. Examine your team's Not Worried to Very Worried Line. Now that you have collected data on the impact of past climate challenges, are there challenges you are more worried about or less worried about than before? If so, move the position of those challenges on the line.



Act: How can data help us predict the future?

Monitoring, or collecting data over long periods of time, allows researchers to make **projections**. Projections are predictions of what conditions might be in the future. Projecting what challenges may arise and how your community may be affected



can help people plan and prepare for the future. In this activity you will explore how you can use the data you collected about your community's past challenges to make projections and plan for future possibilities.

1. Read *At the Smithsonian* to find out about how climate data is collected and used at the Smithsonian.



At the Smithsonian

Smithsonian scientists have been monitoring the natural world and the climate for many years. In 1972, the Smithsonian Tropical Research Institute (STRI) created the Physical Monitoring Program. Today, this program consists of nine weather stations and two **weirs** (special concrete dams that measure water flow). These weather stations and weirs are located at STRI's seven primary research facilities in the Republic of Panama. This program also maintains more than 20 underwater temperature sensors located along both the Pacific and Atlantic coasts, as well as in the Bay of Panama. The Physical Monitoring Program collects a wide range of environmental data, including climate (rainfall, air temperature, humidity, wind, and other measures), ocean temperature and water quality, sea level, and much more.

Alexandra Guzman, a researcher with the program, says, "You cannot take care of something that you don't understand." Long-term monitoring can reveal **trends** or patterns that help people understand Earth's climate past, present, and future. The data collected by STRI's Physical Monitoring Program supports scientists as they think about questions like how severe an upcoming drought will be or how much sea temperatures will warm.

The impact of this program is not limited to Panama. The Physical Monitoring Program provides a vital source of climate data that is used by people around the world. The data collected by this program is stored in an online database that is free to use. Scientists use this data as a base for a wide range of research projects. Reporters use it to help communicate about climate change. Decision-makers and



government and non-governmental programs also benefit from having detailed data that helps them plan for the future needs of a community.



Figure 14: Alexandra Guzman uses a probe to collect data on water.

2. Cut each group's Climate Challenge Research Organizer into sections and group the background information and information from each perspective into five separate piles. Figure 15 shows an example of how you can do this. You will use this information to think about different ways your community might be vulnerable to climate challenges.

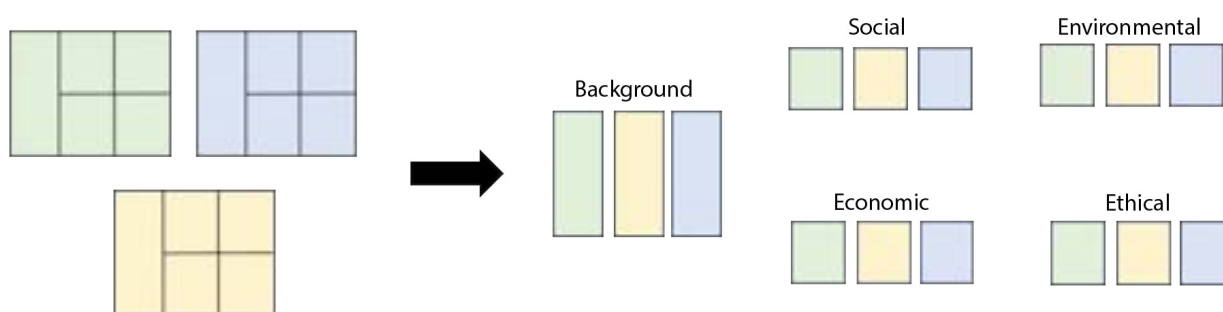


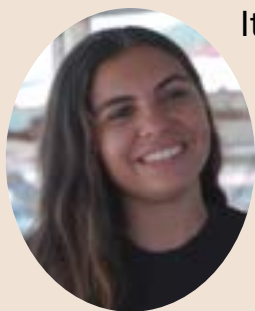
Figure 15: Example of how to reorganize your Climate Challenge Research Organizer.

3. Examine the data on the impacts of climate challenges from each perspective. Try to identify trends or patterns in how climate challenges affect your community. For example, wildfires and hurricanes are different types of challenges but may have similar economic or social effects on communities.



4. Based on trends you noticed in the *Background* boxes, work with your team to make projections about the risk of future climate challenges. As a team, discuss:
 - a. What past challenges is your community most likely to experience again in the future? For example, there may be a challenge that has happened more often in the past than others.
 - b. What challenges are likely to occur regularly in the future? For example, some communities have a yearly dry season when they are likely to experience drought.
5. Return to the *Challenge* column of your *Climate Resilience Planner* and add an additional star to the climate challenges you feel are the biggest risks or most likely to happen again in the future.
6. Write the words “Social,” “Environmental,” “Economic,” and “Ethical” in the *Vulnerabilities* column of your *Climate Resilience Planner*. Leave space to write under each word.
7. Based on the trends you noticed, make projections about how your community could be vulnerable to future climate challenges. As a team, discuss:
 - a. What are your community’s social vulnerabilities? Are there trends in the ways challenges affect your community’s health, education, or well-being?
 - b. What are your community’s environmental vulnerabilities? Are there trends in the ways challenges affect natural systems in your community?
 - c. What are your community’s economic vulnerabilities? Are there trends in the ways challenges affect your community financially?
 - d. What are your community’s ethical vulnerabilities? Are there trends in who is unfairly affected by challenges?
8. Write what your team discussed in the *Vulnerabilities* column of your *Climate Resilience Planner* under the corresponding perspective.
9. Read what research mentor Alexandra says about creating resilient communities. Why is it important to share what you learn about the climate with others in your community?





It is necessary for all of us to take action to create resilient communities. For me, action-taking is about first educating myself, then transferring that knowledge into communities. You can act by learning more about how the climate is impacting the environment, raising your community's awareness of climate issues, and planning to mitigate or lessen the impact of climate challenges.

—Alexandra Guzman

10. As a team, discuss who else in your community could benefit from your climate research and projections. For each perspective, try to identify a representative person or group from your community.
11. Think about how people in your community share information. Think about forms of communication you learned about in *Stories of Resilience* in Task 1. As a team, pick one communication method that you feel is best for sharing information with others in your community.
12. Create your communication to share your projections about your community's vulnerability to future challenges. Make sure to include information on how your community is socially, environmentally, economically, and ethically vulnerable to future challenges.
13. Act by sharing your communication with others in your community. It is okay if your small group can't share the information you've gained with people in your community right away. You can start by sharing this information with your family or friends.
14. Read *Building Adaptive Capacity* to understand more about what your community can do to adapt and become less vulnerable to future challenges.



Building Adaptive Capacity

What do communities need to adapt? To build climate resilience in your community, you must increase your community's ability to respond and adapt to climate changes and challenges. The rest of this guide will help you understand strategies your team can use to build your community's **adaptive capacity**. Adaptive capacity is the ability to adapt to changes or challenges. When you increase your adaptive capacity, you build your individual and social resilience.

There are many ways to think about adaptive capacity. Figure 16 is one example of how we can describe adaptive capacity.

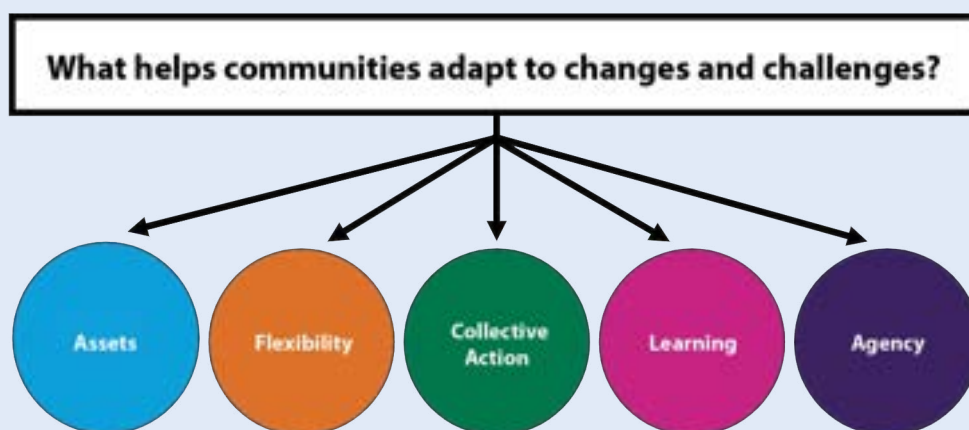


Figure 16: Five areas of adaptive capacity.³

Individuals and communities can increase their ability to adapt in different areas.

- Assets: Identifying the assets you and your community can rely on in times of need; assets are things that are useful or have value
- Flexibility: Creating flexibility to change strategies for meeting your needs; this means having many different ways to meet one specific need
- Collective action: Collaborating with others to take collective or shared actions
- Learning: Learning about the challenges people face and ways to respond
- Agency: Understanding your **agency**, or the power to decide whether or not you will respond and adapt



15. As a team, identify which areas of adaptive capacity you are most interested in learning more about.
16. Read *Picking a Path* and think about how your team will complete the rest of this guide.

Picking a Path

You have the power to chart your own path toward climate resilience! You have already increased your adaptive capacity by learning about your community and its resilience and taking action as a team. By increasing your adaptive capacity, you have already begun to build climate resilience in your community.

Tasks 4, 5, 6, and 7 will help your team continue to build resilience by increasing your adaptive capacity in different ways. Your team should complete whichever tasks you feel would be most helpful. You will need to create a new resilience planner for each of these tasks. If time permits, you should try to complete all the tasks. Here is a description the tasks you can choose to complete:

- Task 4: Reevaluating food systems (flexibility)
- Task 5: Managing water resources (collective action)
- Task 6: Adapting structures in your community (learning)
- Task 7: Developing resilient cultures (assets)

After completing one or more of these tasks, your entire team should complete Task 8 to plan your final action. This will help you pull together everything you have learned and better understand your agency.

17. As a team, discuss how you will complete this guide You can complete Tasks 4 through 7 in whatever way works best for you. You may decide that your entire team should complete all four tasks. You may decide to split your team into groups and divide up the tasks. If you decide to divide the tasks, remember all team members should come back together to complete Task 8.



Task 4: How can we strengthen our community's food system?

One of people's most important needs is food. In this task, you will be thinking about the **system** of food in your community. A system is a group of things that interact with one another as part of a common network. For example, in a **food system**, the food itself is part of the system, but so are the shops, transportation, and places where the food is produced or stored. The way all these different parts work together creates the food system.

When systems are resilient, they can still function even when there are shocks and stressors. For example, in a resilient food system people would still have enough to eat even if there was a drought or a hurricane.

In this task you will **discover** more about the food system in your community. Then you will build and test a potential food system to **understand** what makes it resilient. Finally, you will **act** on what you have learned by identifying things you can do to make your community's food system more resilient.



Discover: *What is my community's food system?*

Finding, preparing, and eating food is a daily occurrence for most people. But where does that food come from? In this activity, you will be exploring the system that is behind the food you eat.

1. Turn to a partner and discuss your favorite meal or a meal you enjoy.
 - a. What are the ingredients in your favorite meal?
 - b. Where do these ingredients come from?
 - c. What are some different ways that people produce or get food—for example, farming, raising animals, or hunting.
 - d. Do you think how people get the food they eat has changed over time?
2. Read *At the Smithsonian* to learn more about how the Smithsonian is using traditional techniques to produce the foods that are meaningful to people and communities.





At the Smithsonian

The Native Landscape surrounding the Smithsonian's National Museum of the American Indian showcases plants and planting methods used by Indigenous Peoples of the Americas. The Traditional Croplands portion of the Native Landscape includes Native American crops and food plants such as corn, beans, squash, chili, peppers, and sorghum.

The garden is planted using many **heirloom varieties** of plants. Heirloom varieties are a diverse set of plants passed down through generations that are often well-suited to specific locations and climates. The **horticulturists** who maintain this space also incorporate traditional gardening techniques such as planting the Three Sisters (corns, beans, and squash) together so they can support each other and by creating a “waffle garden” where sections bounded by raised grids of soil help trap and conserve water. The garden itself becomes more resilient by using a wide variety of plants and techniques. Communities can use the traditions and heritage of plants to make their own food systems more resilient.



Figure 17: Part of the Native Landscape at the Smithsonian National Museum of the American Indian.



Smithsonian Gardens hopes that visitors are inspired to plant their own gardens with native plants. Lead horticulturist Christine Price-Abelow explains, “There is so much value in growing your own food. You can control what goes on it. You can harvest it fresh and do not need to transport it. You can really watch the entire cycle and feel connected to the Earth.”

Growing your own food can be an important part of a resilient food system. If you want to learn more, visit the *Climate Resilience!* StoryMap for more resources and information.

3. Take out a piece of paper or use a class board. Your team will use this to design your own community garden.
4. Draw some beds in the garden. These can just be squares, rectangles, or other shapes to show the area of your garden.
5. Think about what plants you would want to have if you were creating a garden. You might consider:
 - a. Your favorite foods
 - b. Foods you eat often
6. Draw or add a picture of the plants you chose for your team’s garden. If you do not know the appearance of a plant, you could search online, find a person you know who gardens, or consult a gardening book.
7. After all team members have added their plant pictures or drawings to your community garden, examine the entire garden together.
 - a. Are there any plants you think might be difficult to grow in your climate? For example, if you live in a colder area, you might not be able to grow mangoes. If you live in a warm area, you might not be able to grow apples. If there are plants you couldn’t grow, remove them from your garden.
 - b. What would you need to build a garden—for example, space, water, and soil. Write those ideas down next to your garden.
 - c. Who in your community could you ask to learn more about how to grow plants? For example, are there people who love to garden or keep your community’s traditions of how to grow things? Write those ideas down on the other side of your garden.



8. Examine your garden design and think about the plants you had to remove. As a team, discuss why it might be important for a community to have many different ways to get the foods they need.
 - a. Were there foods you couldn't grow in your climate?
 - b. Is there enough room in your community to plant a garden that is large enough to feed everyone?
 - c. What are some ways people access food through your community's food system? Access means to reach or interact with.
9. Keep this design close. You will use it again to plan for food resilience later in this task.
10. Read *Mapping Your Local Food System* and work with your team to carry out the instructions.

Mapping Your Local Food System

The food that is available for people to eat is called the **food supply**. People can access the food supply in different ways. You learned about one way when you designed your own garden, but there are many other ways we get food. For example, sometimes other people prepare food and you access it at a restaurant or their home. Other times you may access food at a grocery store or farmer's market and take it home to prepare.

Food access points are places where people can get food. Food access points in a community are often connected and form a local food system. In this activity, you will map the connections between food access points in your community to think about your local food system. Figure 18 is an example of this kind of *Food System Map*.



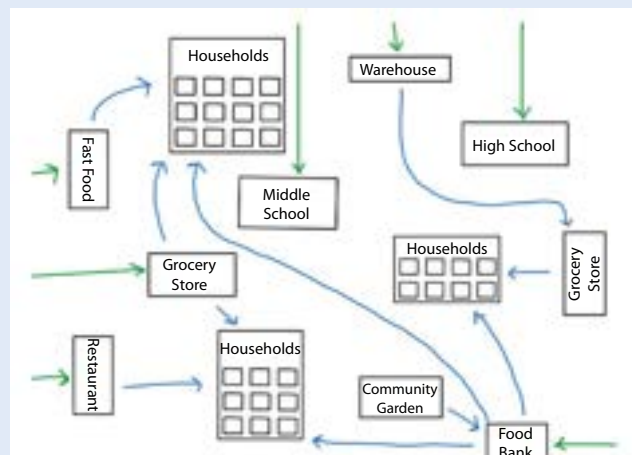


Figure 18: Examples of a Food System Map.

Create a Food System Map

- With your team, get out your Community Map from Task 2 and remember the places you just thought about where you access food.
- You can use this Community Map, open a new digital map, find a paper map, or use a blank sheet of paper you can mark to create your Food System Map. This Food System Map will give you a space to think about the parts of your community that help form your local food system.
- Use an online drawing tool, a pen, or a pencil to circle food access points. Make sure each team member adds their knowledge and experience about accessing food to the map. Be sure to circle places where you:
 - Access food every day, like your home or school
 - Access unprepared food, like a grocery store, farmer's market, or a food donation center
 - Access prepared foods, like a restaurant or a relative or friend's home
 - Grow your own food or get food that someone you know has grown
- Draw arrows between food access points in your community that are connected. These arrows represent how the food supply is transported or moved in your local food system. For example, perhaps the food you access at home comes from a grocery store. Draw an arrow from the grocery store to your home.



- e. Examine your map of your community's food system. Do you notice any food access points that supply other access points with food? These are the access points that have arrows pointing away from them, such as grocery stores, restaurants, or markets.
- f. Think about where the food supply at these access points comes from. If you know where these access points get food, make sure to add this information to your map. For example, maybe your grocery store gets its food from a local warehouse. You could write "warehouse" on the edge of your map and draw an arrow from it to your grocery store. You may not know a lot about where food is stored in your community. Just do your best.
- g. If these access points get food that is grown or raised outside of your community, in another color draw an arrow that extends from the edge of your map to these access points. These arrows represent parts of your local food system that are connected to larger food systems.

11. Examine your team's map of your local food system and think about the sources of your community's food supply. As a team, discuss:
 - a. How much of your food supply does your team think comes from local sources for food?
 - b. How much of your food supply does your team think comes from sources outside your community?
12. With your team, create a resilience planner like the one shown in Task 2, Figure 8. Label it "Food System Resilience Planner."
13. In the *Context* column of your Food System Resilience Planner write "Access Points." Then list all the places you circled on your map.
14. In your *Challenges* column write down your community's shocks and stressors you identified in Task 3. These are the shocks and stressors that are starred in the *Challenges* column your Climate Resilience Planner.
15. Read what research mentor Lynda Zambrano says about how climate challenges can affect food access. How do you think emergencies, such as climate disasters, can affect food access?





Climate is starting to change the availability of traditional foods that Indigenous peoples have consumed for thousands of years. In the last several years, there have been prominent wildfires in the Southwest of the United States and up into the Pacific. These fires have completely obliterated all of the fields where tribes are accustomed to gathering berries in the fall. When COVID-19 hit, people couldn't leave their reservations. Tribal communities thought they were going to be able to rely on gathering and hunting. Suddenly, it brought to the forefront that a lot of those foods were no longer available for them to be able to access.

—Lynda Zambrano

Lynda is the director of the National Tribal Emergency Management Council, based in Seattle, Washington. Her work focuses on ensuring food access in communities before and after emergencies such as natural disasters.

16. Compare the access points listed in your *Context* column to your *Challenges* list. Compare each challenge to each access point on the map. Would you be able to access that place during the challenge? For example, if your community had flooding, would you be able to get to a store for food? If you would not be able to access that place, draw a star or make another mark to record that vulnerability.
17. In your *Vulnerabilities* column, write "Access Vulnerabilities." Then list each starred place.
18. Draw a line to connect any *Access Vulnerabilities* with the shock or stressor causing the problem listed in *Challenges*. Some might have lines to more than one thing. Figure 19 shows a *Food System Resilience Planner* with one example filled in.

Context	Challenges	Vulnerabilities	Responses	Potential Outcomes
<u>Access Points</u> Food store	Flooding	<u>Access Vulnerabilities</u> Food store ...		Transform Recover Better Recover Recover Worse Collapse

Figure 19: Example of a *Food System Resilience Planner* with one item filled in.



19. Read *Supply Chain Modeling* and follow the directions to think about more ways your food system could be vulnerable.

Supply Chain Modeling

Examine your food system map. Most of the places you access food probably don't grow or raise that food themselves. Often, they are supplied by someone else. A **supply chain** is the process of moving an item from where it is produced to a place where it can be accessed. For example, a food supply chain might move food from a farm to a shop where you can buy it.

Most food systems have many supply chains moving different types of food. The arrows on your *Food System Map* represent supply chains in your food system. Some arrows on your food system map may represent a local supply chain that moves food from local sources, such as a local farm to a farmer's market. Arrows that extend from the border of your food system map may represent regional or global supply chains that move food from farther-away places to distribution or storage centers, such as warehouses, and then to local access points, like restaurants or grocery stores.

Items in some supply chains make many stops along the way. A **regional food supply** might be grown or raised a few hours away, such as in a neighboring city, state, province, or country. A **global food supply** could come from anywhere around the world.

Local Supply Chain

- Write "Local Supply Chain" under the *Vulnerabilities* column in your *Food System Resilience Planner*.
- Pick four team members to **model** a local supply chain. Models are representations of objects or systems. Have them form a line. Each person on the line is modeling one point on the local supply chain, as shown in Figure 20.

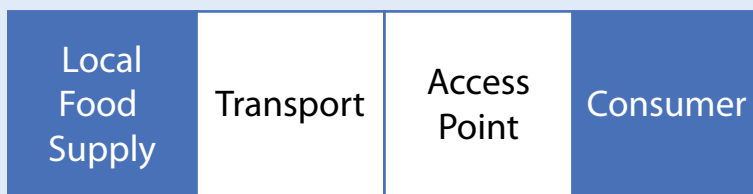


Figure 20: Local supply chain order.



- c. Give the first person a pile of small items. The items might be small rocks, paper clips, or other items that are easy to hold. These items represent the local food supply, such as food grown at a local farm or garden.
- d. The second person in line represents transport, such as someone operating a truck. The third person represents an access point such as a local market. The fourth person represents a **consumer**, or someone buying and using the food.
- e. Have the first person (food supply) pass an item along the line to the second (transport), to the third (market), to the fourth (consumer). You have just shown a local food system that is working, or **functional**.
- f. Now try it with another item, but each time you try to pass the item, have another team member call out a shock or stressor from your *Challenges* column on your *Food System Resilience Planner*.
- g. As a team, discuss each one of the challenges. Might the shock or stressor create a problem for the farmer, transport, or market? If so, have those people move out of the line. Does the item still make it to the consumer? If not, the supply chain has a vulnerability.
- h. If a challenge might create a problem, use a line to connect that *Challenge* to *Local Supply Chain* in your *Vulnerabilities* column.

Regional Supply Chain

- a. Write "Regional Supply Chain" in your *Vulnerabilities* column.
- b. Pick six team members and have them form a line.
- c. Assign the team members the following roles: regional food supply, regional transport, warehouse, local transport, local market, and consumer. The regional food supply can be food grown or raised anywhere in your region. Figure 21 shows an example.

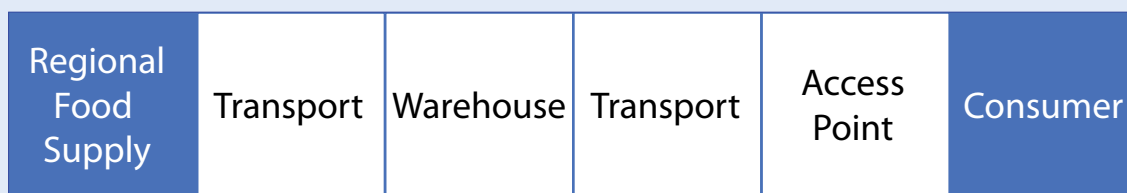


Figure 21: Regional supply chain order.



- d. Give the person holding the items representing the regional food supply and have them pass an item down the line to the consumer.
- e. Just as with the local supply chain, have team members call out a challenge and discuss it. Would the shock or stressor create a problem for any part of the supply chain? If so, have those people step out of the line. Does the item still make it to the consumer? If not, the supply chain has a vulnerability.
- f. If a challenge might create a problem, draw a line to connect it to the *Regional Supply Chain* in your *Vulnerabilities* column.

Global Supply Chain

- a. Write "Global Supply Chain" in your *Vulnerabilities* column.
- b. Follow the same directions as for the Local and Regional Supply Chains, assigning the following eight roles: global food supply, global transport, distributor, regional transport, warehouse, local transport, local market, and consumer. The global food supply can be food grown or raised anywhere around the world.

Global Food Supply	Transport	Distributor	Transport	Warehouse	Transport	Access Point	Consumer
--------------------	-----------	-------------	-----------	-----------	-----------	--------------	----------

Figure 22: Global supply chain order.

- c. Give the person holding the items representing the global food supply and have them pass an item down the line to the consumer.
- d. Just as with the other supply chains, have team members call out a challenge and discuss it. Would the shock or stressor create a problem for any part of the supply chain? If so, have those people step out of the line. Does the item still make it to the consumer? If not, the supply chain has a vulnerability.
- e. If a challenge might create a problem, draw a line to connect it to the *Global Supply Chain* in your *Vulnerabilities* column.

Remember these supply chains; you will use them for a game in the Understand activity.



20. Read what research mentor Lynda says about why it is important to have multiple pathways to food if you want to make a system resilient. Multiple pathways in a system are called **redundancy** in the system. You will be thinking about redundancy now and in the next activity.



Redundancy is critical for access to food in any food system. Otherwise, a natural disaster or climate-related event might completely eliminate a type of food or food access in general. It is more important than ever that we are trying to ensure that foods are accessible in multiple areas and in multiple ways.

—Lynda Zambrano



Understand: *Can we add redundancy to our food system?*

Food systems have always been vulnerable to natural disasters. Weather and climate events such as heat, flooding, drought, and storms affect the ability to grow crops and raise livestock. They also affect transportation networks that move food to access points. As shocks and stressors related to climate change increase, the vulnerabilities increase as well. This means planning for a resilient food system is more important than ever.

1. Read *Building a Resilient Food System Game* and follow the instructions to play the game.

Building a Resilient Food System Game

Prepare

- a. Form a group of three to five people.
- b. Cut two pieces of paper into pieces or use index cards to create small cards for this game. You will want one set of 22 cards to be white and one set of 11 cards to be another color. You can also find a printable version on the *Climate Resilience!* StoryMap.



- c. The 22 white cards are the connecting parts in the food system. Label the white cards this way:
- 5 cards: "1 Access Points" (this represents places you access food, such as grocery stores or food donation centers)
 - 5 cards: "2 Warehouses" (this represents places where food is stored)
 - 2 cards: "3 Distributors" (this represents places where food is temporarily stored before going many different places)
 - 10 cards: "Transport" (this represents cars, trucks, rail, planes, ships, or other transportation that moves food)
- d. The 11 colored cards are the food supplies in the system. Label the colored cards this way:
- 1 card: "Consumer" (this represents you and your community)
 - 1 card: "1 Emergency Food Supply" (this represents a three-day supply of food at your home that you can use in an emergency)
 - 4 cards: "2 Local Food Supply" (this represents food grown locally, indoors or outdoors, such as in an indoor farm, an outdoor farm, or a community garden)
 - 3 cards: "3 Regional Food Supply" (this represents food grown or raised regionally)
 - 2 cards: "4 Global Food Supply" (this represents food grown or raised globally)
- e. Place the *Consumer* card in the middle of the table.
- f. Space out the other colored cards except the *Emergency Food Supply* card.
- g. Place the white cards on the side of the table in piles by type. Place the *Emergency Food Supply* card in its own pile. Figure 23 shows an example of how to set up all the cards.



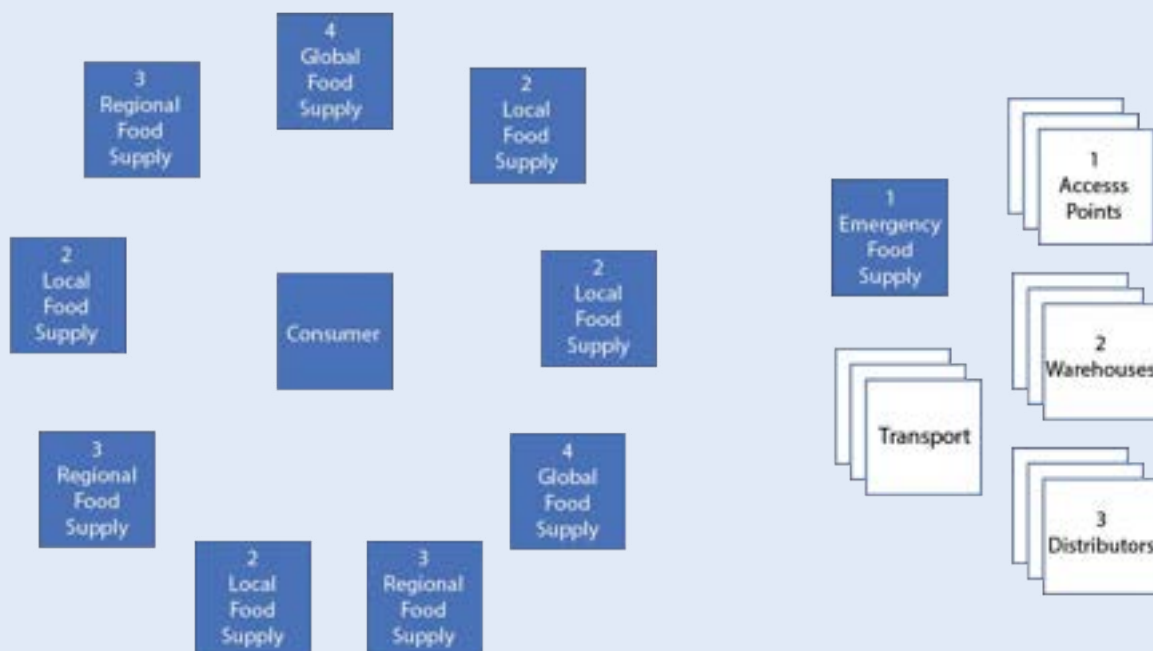


Figure 23: Example of the Food System Game setup.

You will be collaborating with the other people in your group as you play the game. You may remember that collaborating means working together toward a common goal. Your goal is to build a resilient food system. To do this, you need to connect your consumer to a food supply. After you build your food system, you will test it using *Challenges*. In a resilient food system, there will still be a way for the consumer to access food, even when there are *Challenges*.

Game Play

- a. One at a time, have each group member pick a card from any pile and add it to the table to build your food system.
- b. These are the rules for playing cards:
 - Cards are played next to each other and face up. The numbers on the card help remind you of the order of play. Cards with a "1." are played next to the *Consumer* card.
 - The *Emergency Food Supply* card gives you access to food for three days if it is on the board.
 - You must have at least one *1. Access Point* card or one *1. Emergency Food Supply* card on the board for your consumer to access food.



- Numbered cards, such as between 1. *Access Points* and 2. *Warehouses*, are played in numerical order and must have *Transport* cards between them.
 - You can build your chain starting from the *Food Supply* card or starting from the *Consumer* card. But the *Food Supply* and the *Consumer* must be eventually linked to have a pathway to food.
- c. Cards connecting *Consumer* to a *Food Supply* can be played in the order of the supply chain pathways shown in Figure 24. These are the same pathways you modeled in the Discover activity.

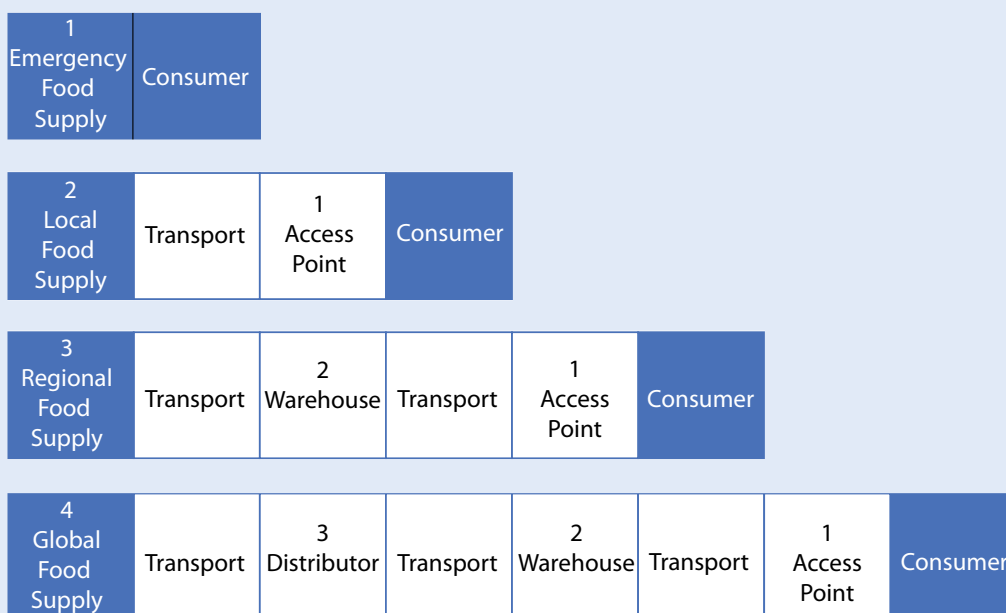


Figure 24: Four pathways linking cards in the game.

- d. Play three rounds, with everyone taking a turn to build your group's food system.
- e. Then follow the *Testing Your System* rules to test the food system you just built for resilience.

Testing Your System

Food systems face many challenges. A resilient food system is redundant. That means if one supply chain or access point has a problem, there is another one available.



 Emotional Safety Tip

It can be difficult to think about problems with your food system, especially if you have personally experienced some of these problems. Planning for a resilient future is one way to make sure these problems don't continue to happen. But it is okay to take a break to take care of yourself if you need to.

Read through the *Challenge* cards in Figure 25, starting with *Challenge 1*. For each *Challenge* card:

- a. Read the challenge and follow the directions.
- b. After each challenge, stop and assess: Do you still have a pathway to food?
 - If you do, make sure you turn back over any cards so they are all facing up, and continue to the next challenge.
 - If not, go back and play an additional round of cards, following the same rules as your first three rounds. Then test your system again using the *Challenge* cards. Keep playing additional rounds until you still have a pathway even when you face each *Challenge* cards. Often it takes several tries to build a resilient food system.

If you still have a pathway to food after completing all the *Challenge* cards, congratulations—you won the game.

Challenge 1: An extreme storm means you cannot leave your house for several days. Turn over all your *Access Point* cards. Do you still have access to a food supply? If so, remove your *Emergency Food Supply* from the game and continue to Challenge 2.

Challenge 2: Flooding means local shops and markets are closed. Turn over two *Access Point* cards.

Challenge 3: Extreme heat destroys all the crops in your area. Turn over all *Local Food Supply* cards.

Challenge 4: A wildfire sweeps through your area. Turn over all *Local Food Supply* cards.

Figure 25: Challenge cards. (Continued)



Challenge 5: Your region experiences a severe drought. Turn over all *Local Food Supply*, and *Regional Food Supply* cards.

Challenge 6: There is a regional storm and no transportation can operate. Turn over any *Transport* cards that are next to a *Regional Food Supply* or *Warehouse* card.

Challenge 7: Global transportation links are stopped because of a new disease. Eliminate any *Transport* cards that are next to a *Global Food Supply* card.

Challenge 8: Global food shortages related to the changing climate mean countries stop exporting food. Turn over the *Global Food Supply* card.

Figure 25: (Continued)

Visit the *Climate Resilience!* StoryMap to explore real-world examples of these food access challenges.

2. Discuss your experience building a resilient food system with your group.
 - a. How many tries did it take to build a food system that was resilient to all the challenges?
 - b. Why was it important to have redundancy in the system by creating multiple pathways to food?
3. Examine your *Food System Map* and discuss with your team:
 - a. What redundancy in the system do you notice?
 - b. If you used the *Challenge* cards to challenge the food system in your community, do you think you would still have a pathway to food?
4. For any vulnerabilities in your food system that you identify, make a mark such as a star or a triangle next to the words such as “access points” under the *Vulnerabilities* column in your *Food System Resilience Planner*. If the vulnerability is not listed, you can add it.





Act: How can we make our food system more resilient?

Building a resilient food system takes time, care, and planning. And you can be a part of this process. In this activity you will use what you learned in the Understand activity about building a resilient food system and find actions you can take to make your own food system more resilient.

1. Read what research mentor Lynda says about one action that can make food systems more resilient. How are Lynda's actions creating redundancy in her food system?



One of the things we're really promoting is going back to old ways of planting and teaching people how to care for the plants. We are also using modern technology to preserve certain foods so that they are available during any type of disaster. We just built a commercial kitchen, and we will start freeze-drying elderberries, blackberries, blueberries, and other foods. Next time a village tribe experiences a big wildfire and all of their berry fields burn, we will have an abundance of foods that we will be able to bring to that community.

—Lynda Zambrano

2. With your team, examine the *Vulnerabilities* column in your *Food System Resilience Planner*. What are the possible things you could do to make your food system less vulnerable? List anything you can think of in your *Responses* column. For example, could you add an emergency food supply or try to support additional access points?
3. Also list "Do Nothing" in your *Responses* column. People often choose not to act, so it is important to consider that as a potential response to a vulnerability.
4. Analyze your potential responses. Would the response lead to transformation, recovering better, recovering, recovering worse, or collapse? Draw a line from each response to where it is on the range of *Potential Outcomes*. Figure 26 shows an example.



Context	Challenges	Vulnerabilities	Responses	Potential Outcomes
Access Points Food store	Flooding	Access Vulnerabilities Food store ...	- Find another food store that doesn't flood - Store an emergency food supply - Grow garden for food access - Do nothing	Transform Recover Better Recover to Recover Worse Collapse

Figure 26: A Food System Resilience Planner with some examples of responses filled in.

5. With your team, use a piece of paper to create a list of actions you could each take to help move toward transformation and become more resilient to future challenges. Consider things you might be able to influence. For example, you might have some influence over:
- Food stored in your home for an emergency
 - Food grown around or near your home, such as a personal or community garden, to provide additional access points
 - Where you go to access food
 - Whether your food is coming from local, regional, or global food supplies

Connecting to Experience

One way to help people understand that they may need to think about their resilience in the future is to help them remember the need for resilience in the past. Many people have had experience with a food system that was not resilient, although they may not realize it. Shocks and stressors can make food inaccessible because of emergencies, supply chain issues, costs, or other challenges. Sometimes food systems will work for some people in a community, but not others.

Since access to food is important for all people, functional food systems need to provide food for everyone. If you have ever had to worry about your access to food, that is an example of a food system that is not working.



As you think about vulnerabilities in your food system and potential responses, it is important to think about responses that will make sure everyone has food. When you evaluate potential responses, it is important to make sure they are **equitable**, which means they lead to the same outcome of food access for people no matter who or where they are.

When thinking about food system challenges related to the climate, it may be helpful to think about another recent challenge to the global food system that was caused by a pandemic.

In early 2020, the COVID-19 pandemic was a massive shock to food system supply chains around the world. Thinking back to that time, many people may remember empty supermarket shelves and closed access points, such as stores and restaurants. Local, regional, and global supply chains faced big challenges. In some cases, transportation links were not working. In some cases, warehouses or processing units were not open. In some cases, workers who help grow or raise the food supply were unable to work. You may have a memory of this time, or you may know someone older who has a memory of this time.

6. Read Connecting to Experience.
7. If you can, ask someone, such as an older family member who has a strong memory of the COVID-19 pandemic, about their experience with the need for food system resilience at that time. Listen attentively to the story they tell you.
8. After listening to the person's story, share with them what you learned about the need for resilience in your food system as the climate changes.
9. Have the person you are talking to examine your list of potential actions. Is there an action they think you could take or that you could take together? If so, put that idea into action.
10. If not, you have still taken action. Helping to educate other people about what you have learned and learning from others is a way of taking action.



Task 5: How can our community effectively manage water?

Water is necessary for everyone in a community. Climate challenges can cause a community to have too much or too little water. When the climate changes the amount of water in a community, it can become difficult to manage everyone's water needs. In this task you will **discover** how climate challenges might affect water in your community. You will then work to **understand** how communities can work together to manage water and meet everyone's needs. Finally, you will **act** by planning for water resilience in your community.



Discover: *What are the concerns with water in my community?*

Water in a community is complex. It often flows or moves and is stored in many different places. In this activity, your team will build a model that represents sources of water in a community. Scientists often build models to help them understand the natural world. The model you build in this activity can help you consider how the climate and weather affect water in your community.

1. Turn to a partner and discuss water in your community.
 - a. What do you rely on water for? How does water help you stay happy and healthy?
 - b. How do you access or reach water most often? Where do you think the water in your community comes from?
2. With your team create a resilience planner like the one shown in Figure 8 in Task 2. Title it "Water Resilience Planner."
3. Read *Sources of Fresh Water*.

Sources of Fresh Water

Most of Earth is covered in water, but less than 3% of water on Earth is **fresh water**. Fresh water is water that has very little salt. This is the water people use for drinking, cooking, cleaning, growing food, and other daily activities. Communities often have several sources of fresh water. In this task we will focus on three sources of fresh water used by many communities.



Surface water, or water held above ground, is a source of fresh water many communities depend on. Rivers, lakes, streams, wetlands such as swaps and marshes, and creeks are all examples of surface water on Earth.

Groundwater, or water stored under the ground, is another source of fresh water. Many communities dig **wells** (holes deep into the earth) to access groundwater. A community can **deplete** or decrease groundwater if they use too much. A community can also **replenish** or increase their store of groundwater. Replenishing groundwater can help make sure a community has access to fresh water in the future.

Storm water is also a common source of fresh water in communities. Storm water comes from storms. It can be rainwater or hail, ice, or snow melt. It can collect on the ground or flow into surface water locations or sewers. If storm water is collected, it can be used to meet a community's fresh water needs.



Figure 27: Fresh water sources.

4. As a team, discuss the sources of fresh water in your local community. The Community Map you created in Task 2 might be helpful when thinking about this.
 - a. How do community members access fresh water in their home? Where does this water come from?
 - b. Is there surface water in your local community? For example, does your community have lakes, rivers, streams, ponds, or wetlands?
 - c. Does your community have access to water in the ground? For example, community members might use a well or pump to access fresh water.



5. In the *Context* column of your *Water Resilience Planner* write “Water Sources.” Then list the sources of fresh water in your local community.
6. Read *Community Water Model* and follow the instructions.

Community Water Model

Water sources on Earth are connected. A raindrop can fall from the sky and become surface water in a lake. Surface water and rain can seep into the ground and become groundwater. Because water sources are connected, a single climate shock or stressor can affect many fresh water sources in a community.

In this activity, you will model how the climate and weather affect water in a community. Modeling different **climate scenarios**, or possible climate events, can help you think about how the climate affects water in your community. Figure 28 shows an example of the model you will build.

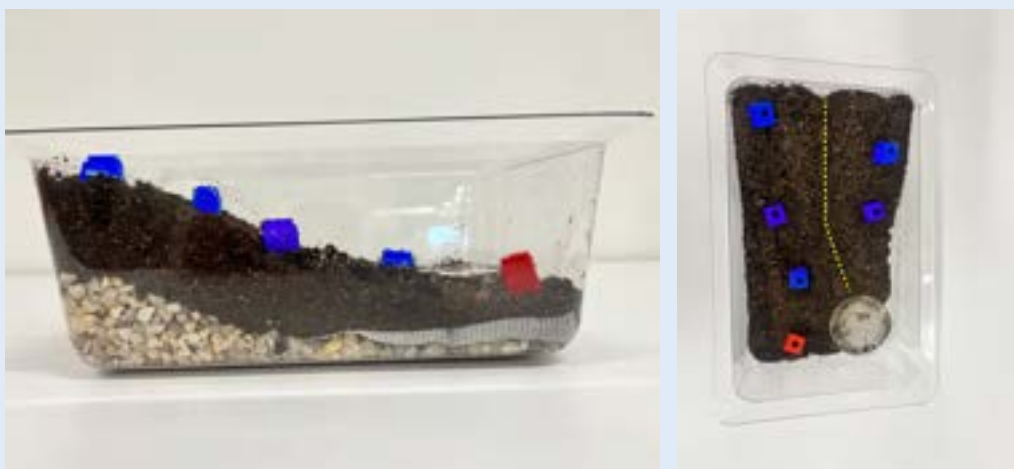


Figure 28: Side and overhead views of the community water model.

Gather Your Materials

You can use many different materials to model water sources in a community. To build the model in Figure 28 you will need:

- A large transparent container
- Small rocks or gravel
- Pieces of thin cloth or paper towels
- Dirt or soil



- A small cup
- Small blocks, cubes, or other materials that can represent buildings in a community
- Enough water to fill at least one-third of your container
- A spray bottle or large cup with holes in the bottom

Build the Model

Follow these steps to build a model of community fresh water sources.

- a. Place a layer of small rocks at the bottom of the container. Pile the rocks higher on one side of the container to create a gradual incline. This layer of rock represents a **groundwater reservoir**—a place where groundwater is stored.
- b. Place a paper towel or cloth on top of the layer of rocks. This paper will help keep the rock layer and dirt layer separate.
- c. Place a layer of moist dirt or soil over the paper towel or cloth. Make sure the soil you add follows the slope of the rock layer below it.
- d. Place a cup or small container at the bottom of the slope and fill it with water. This cup represents a lake filled with surface water.
- e. Use your finger, a pencil, or other materials to press a line in the dirt from the top of the slope to the bottom. Make sure your line leads to the small cup of water. The dotted line in Figure 28 is an example of how you can do this. This line represents a river that flows into the lake at the bottom of your slope.
- f. On either side of the river you've made, place blocks or other small objects that can represent homes in this community.

Model Severe Storms

Model severe storms by using your spray bottle to wet your Community Water Model with water. As your team sprays storm water on your model, be sure to notice what happens to the river, lake, homes, and groundwater reservoir. You can also model severe storms by poking holes in a small cup or bottle and allowing water to slowly fall over your model.

As a team, discuss how severe storms affect a community's water.



- a. How do storms affect surface water in a community? What benefit or harm could this have on community members?
- b. Was groundwater depleted or replenished by storms? What benefit or harm could this have on community members?
- c. Has your community ever had severe storms? Did your community have similar outcomes to your model?

Model a Severe Drought

Model severe drought by leaving your Community Water Model in a dry, sunny place for several days. When your team returns to your model, be sure to notice what has happened to the river, lake, homes, and groundwater reservoir.

As a team, discuss how a severe drought affects a community's water.

- a. How does drought affect surface water in communities? What affect could this have on community members?
- b. Was groundwater depleted or replenished by drought? What benefit or harm could this have on community members?
- c. Has your community ever had a prolonged drought? Did your community have similar outcomes to your model?

6. Read what research mentor Anne says about water in her community. Are people in your local community ever worried about water?



One of the most pressing concerns we have in the southern African region is around water. I live in Johannesburg, a very water-stressed part of the world. In fact, in my city we import most of our water from a neighboring country because we have such a serious undersupply of water. We have very rainy summers and very dry winters. We are vulnerable to both types of climate challenges—on the one hand flooding, and on the other hand **water shortages** or the lack of water supply. We can literally have zero rainfall for six to seven months of the year, then experience a number of cases of very serious flooding that communities are just not adequately prepared for.

—Dr. Anne Fitchett



7. In the *Challenges* column of your Water Resilience Planner, write down your community's shocks and stressors you identified in Task 3. These are the shocks and stressors that are starred in the *Challenges* column of your Climate Resilience Planner.
8. Compare your challenges list to the water sources listed on your Water Resilience Planner. For each challenge, examine the water sources in your community. Could your community's water sources be affected by climate shocks or stressors? For example, if your community has a drought, would lakes or other surface water be affected? If a water source could be affected by a climate challenge, draw a star or make another mark to record that vulnerability.
9. In your *Vulnerability* column, write "Water Source Vulnerabilities." Then list each starred place.
10. Draw a line to connect any water source vulnerabilities with the shock or stressor causing the problem listed in *Challenges*. Some might have lines to more than one thing.



Understand: How can communities collaborate to manage water?

Managing water resources can be difficult. Communities often must manage multiple sources of water and balance many different needs for water at once. It is important that community members work together to make sure everyone's needs are met. In this activity, you will use different methods of collaboration to complete a water management challenge. Identifying effective ways for a community to collaborate can help you plan for collaboration to build climate resilience in your community.

1. Read Setting Up the Collaborative Water Management Challenge and gather your materials.

Setting Up the Collaborative Water Management Challenge

Communities often collaborate, or work together, to solve problems. In this challenge, your team will collaborate to manage water in an imaginary community after a climate challenge. There are many ways people can collaborate. Your team



will attempt this challenge up to three times, using different collaboration styles, to find what works best for you. Understanding how to collaborate can help you plan how your community can work together to build climate resilience.

Materials

For this challenge you will need:

- A tool to measure liquid volume, such as a beaker or graduated cylinder.
- 3 large pitchers or 2-liter bottles labeled “groundwater,” “surface water,” and “storm water”
- 4 large cups or beakers labeled “agriculture,” “households,” “industry,” and “energy”
- 3.5 liters of water

Pick a Scenario

In this challenge you can manage water in one of two different climate scenarios. Pick the scenario you feel best relates to your local environment. If time permits, your team can try to complete both challenge scenarios.

Scenario 1: Severe Storms

In this challenge your team will collaborate to manage water in an imaginary community after a severe storm.

Begin each attempt at the challenge by filling your containers with the following water volumes:

- Households: 0 ml
- Industry: 0 ml
- Agriculture: 0 ml
- Energy: 0 ml
- Storm water: 1,000 ml
- Surface water: 1,250 ml
- Groundwater: 1,250 ml



Scenario 2: Prolonged Drought

In this challenge your team will collaborate to manage water in an imaginary community during a prolonged drought.

Begin each attempt at the challenge by filling your containers with the following water volumes:

- Households: 0 ml
- Industry: 0 ml
- Agriculture: 0 ml
- Energy: 0 ml
- Storm water: 50 ml
- Surface water: 400 ml
- Groundwater: 1,000 ml

If you do not have the time or space to complete this challenge, visit the *Climate Resilience!* StoryMap to explore online water management games.

2. As a team, discuss the challenge scenarios and decide which you will work to complete.
3. Set up your challenge by filling each of the containers you gathered with the appropriate amount of water and placing them in different parts the room.
4. Read *Roles in Water Management* to understand the different roles members of your team will play in the Collaborative Water Management Challenge.

Roles in Water Management

The cards in Figure 29 describe roles in water management. In this challenge, your team will take on these roles to think about how communities can effectively manage water. Some people will manage sources of water such as groundwater, storm water, or surface water. Others will manage **sectors** or parts of the community that need water, such as households, agriculture, energy, and industry.



Each role card has a description of a role in water management. Each card also has a range of possible outcomes that determine whether you win or lose the challenge. Your outcome at the end of each attempt at this challenge is determined by the amount of water you collect or distribute.

If you do not meet the needs on your role card, your potential outcome will be Collapse. If you fully meet the needs on your role card, your potential outcome will be Transform. If the amount of water in your container is in the range between Collapse and Transform, your potential outcome will be Recover.

Visit the *Climate Resilience!* StoryMap for a printable version of the Collaborative Water Management Challenge role cards.

ROLE CARD

Storm water management: Your role is to manage storm water in this community. If you distribute all the storm water, this community can transform and become more resilient by using storm water to meet other needs. If you do not distribute enough storm water, this community will collapse due to flooding, and your team will lose the challenge. To ensure a positive future, distribute enough water to meet your needs.

Possible Outcomes:



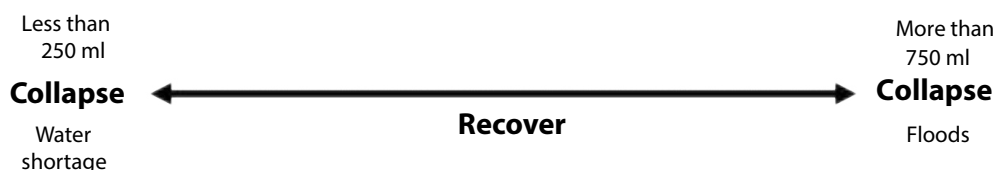
Figure 29: Collaborative Water Management Challenge role cards. (Continued)



ROLE CARD

Surface water management: Your role is to manage surface water in this community. If you collect too much surface water, this community will collapse due to flooding. If you collect too little surface water, this community will collapse due to a water shortage, and your team will lose the challenge. To ensure a positive future, maintain a suitable water level.

Possible Outcomes:



ROLE CARD

Groundwater management: Your role is to manage the groundwater in this community. If you collect enough water, this community can transform and become more resilient by replenishing the store of water they can rely on during future challenges. If you distribute too much water this community will collapse due to a water shortage and your team will lose the challenge. To ensure a positive future, maintain a suitable water level.

Possible Outcomes:



Figure 29: (Continued)



ROLE CARD

Agriculture: Your role is to manage water that goes to farms and ranches in this community. Farmers and ranchers need water to grow crops and raise animals that feed the community. If you collect enough water, the community can transform by growing excess food to store for emergencies. If you collect too little water the community will collapse due to a shortage of food, and your team will lose the challenge. To ensure a positive future, collect enough water to meet farmers' and ranchers' needs.

Possible Outcomes:



ROLE CARD

Industry: Your role is to manage water for industrial activities in a community. Industrial activities are processes that turn raw materials into products such as clothing, soap, technology, and other essentials community members need. These processes often use water. If you collect enough water, the community can transform and have the option to make more products, if needed. If you collect too little water, the community will collapse due to a shortage of essential products, and your team will lose the challenge. To ensure a positive future, collect enough water to meet your community's industry needs.

Possible Outcomes:



Figure 29: (Continued)



ROLE CARD

Households: Your role is to manage water for households in this community. Community members use water in their homes for cooking, bathing, washing their clothes, and taking care of pets. If you collect enough water, this community can transform and become more resilient by giving households enough water to share with neighboring communities. If collect too little water, this community will collapse because people cannot cook, clean, or stay hydrated. If this part of the community collapses, your team will lose this challenge. To ensure a positive future, collect enough water to meet your community's household needs.

Possible Outcomes:



ROLE CARDS

Energy: Your role is to manage water used for energy in a community. Energy plants use water during the process of generating electricity. This electricity lights homes and powers technology in a community. If you collect enough water, the community can transform by generating clean energy for this community and neighboring communities. If you do not collect enough water the community will collapse, and your team will lose the challenge. To ensure a positive future, collect enough water to meet your community's energy needs.

Possible Outcomes:



Figure 29: (Continued)



5. Divide your team into seven groups and assign each group a role card. Do not share the information on your card with people outside your group.
6. Move to the part of the room that has a container labeled with your role card.
7. Discuss your role card with your small group and think about the possible outcomes. The information about transformation and collapse written on the cards can be a great starting place.
 - a. What would it mean if the part of the community you represent collapsed? How would community members be affected? Write what you discuss on the *Collapse* side of your role card.
 - b. What would it mean if the part of the community you represent recovered to normal? Based on your own community, what would you consider normal? Write what you discuss under the *Recovery* range of your role card.
 - c. What would it mean for the part of the community you represent to be transformed? What are some ways this part of the community uses excess water to prepare for future challenges? Write what you discuss on the *Transform* side of your role card.
8. As a small group, choose a desired outcome for your role and determine how much water you will try to collect or distribute throughout the challenge to reach your water goal.
9. Read Challenge Rules to understand how your team should complete the challenge.

Challenge Rules

How to Win

In this challenge your team must collaborate to distribute water between the containers that are labeled with water sources and water uses in a community. To win this Collaborative Water Management Challenge, your team must meet the water needs described on all the role cards and prevent collapse.



Rules

- a. Members of your team must take turns transferring water between containers.
 - b. Your entire team has 10 turns to transfer water during each attempt at the challenge.
 - c. Team members can transfer up to 200 ml of water during each turn.
 - d. Water can be taken from any container and given to any container as you attempt the challenge.
 - e. If any group's container is filled with more water than what is needed to transform, your team will be disqualified and lose the challenge.
 - f. If any group collapses, the team loses the challenge.
10. Begin your first attempt at the Collaborative Water Management Challenge by having members of each of the seven groups take turns transferring water between containers. Groups are not allowed to communicate with each other or share information on their role cards during this attempt.
 11. Measure the volume of water in your group's container at the end of this attempt and use the range of potential outcomes on your role card to determine your group's outcome.
 12. Share your group's role and outcome with the rest of your team. Be sure to share:
 - a. What role your group plays in the community and why you feel your role is important
 - b. How much water your group had at the end of the attempt and your group's outcome for that amount of water
 13. As a team, discuss the result of your first attempt at the challenge.
 - a. Was your team able to effectively collaborate without communicating?
 - b. Why might it be important for people with different roles in water management to communicate?
 14. Make a second attempt at this challenge, but in this attempt choose one person to be your team leader. This person can speak with all seven groups, but the individual groups still cannot communicate or read each other's role cards.
 15. Measure the volume of water in your small group's container at the end of this second attempt, then share your group's outcome with the rest of your team.



16. As a team, discuss the result of your second attempt at the challenge.
 - a. Was your team able to effectively collaborate with just one person communicating?
 - b. Why might it be important for people with different roles in water management to communicate?
17. Think of a way all seven groups can collaborate to manage their water needs. For example, you can discuss your water needs and write a plan for ensuring no part of the community collapses.
18. Make a third attempt at this challenge. During this attempt, ensure all members of the team work together and share information to complete the challenge.
19. As a team, discuss all three attempts at this challenge and decide what collaboration styles worked best for your team. Write how you feel your community could collaborate or work together in the *Potential Responses* column of your Water Resilience Planner.
 - a. Was your team able to effectively collaborate? If so, how?
 - b. How could your technique for collaboration be used in your community?



Act: *How can we make our water system more resilient?*

There are many ways to work together and take action to build resilience. It is important to create a plan for collaboration that benefits everyone in a community. In this activity you will use your understanding of community water sources to plan a collaborative action people in your community can take to protect water.

1. Think quietly to yourself about your community's water needs.
 - a. Do you need to conserve water and limit water use?
 - b. Do you often experience floods and need to manage storm water?
 - c. Is there another issue with water that affects your community?
2. Read the solutions research mentor Anne suggests for managing water in a water-stressed community. Which solution might be helpful in your community?





One possible solution is **water harvesting**. Water harvesting means collecting or storing water instead of letting it flow through a community. Rainwater harvesting can be an interesting engineering problem because of the long dry season. It can take intense engineering analysis to build storage tanks that can store enough water to meet our needs but do not cost too much money.

People can also harvest **gray water**, which is recycled water from bathing, washing clothing, and dishwashing. Gray water harvesting becomes a much more interesting proposition, because you're always going to be generating gray water throughout the year no matter whether it's a rainy season or dry season. Gray water can be used for toilet flushing, which is one of the most major consumptions of water. You can use that gray water without having to process it to a very fine degree or making it drinking water quality.

Another solution is improving infrastructure. Quite a serious challenge in my region is poor maintenance of infrastructure. We find that we've got a very high percentage of unaccounted for water through leaks, through pipe bursts, and just through general lack of appropriate maintenance of the infrastructure we have.

—Dr. Anne Fitchett

3. With your team, examine the *Vulnerabilities* column in your *Water Resilience Planner*. As a team, choose a vulnerable water source in your community that you can take action to protect.
4. Identify actions that could make this water source less vulnerable. List anything you can think of in your *Potential Responses* column.
 - a. Are there ways the community could conserve or recycle water? For example, could people take shorter showers or reuse non-soapy bath water to water plants?
 - b. Are there ways your community can prevent water from being wasted? For example, are there water leaks in the community that could be fixed?
 - c. Are there ways your community can prevent flooding? For example, can your community harvest storm water and divert it to other bodies of fresh water?



5. Also list “Do Nothing” in your *Potential Responses* column. People often choose not to act, so it is important to consider it as a potential response to a vulnerability.
6. Analyze your potential responses. Would the response lead to transformation, recovering better, recovering, recovering worse, or collapse? Draw a line from each response to where it is on the range of potential outcomes.
7. Choose an action your team would like to take and think of how you can make that action collaborative. For example, if you plan to take action by conserving water, you may be able to collaborate with farmers or local business owners to conserve water in multiple places in your community.
8. If you have time, take a shared action to protect a water source in your community. You may need to think about where you have influence, then create a plan for shared action. If you are not able to implement your plan today, share your plan with someone else and think about how you can take action in the future.



Task 6: How can we innovate to improve the built environment?

The climate does not challenge only the natural parts of a community. Climate events can also have an impact on the parts of your community built by people. After major climate challenges, many communities are forced to rebuild damaged structures. Rebuilding can be transformative. It is an opportunity to adapt structures, build resilience, and correct past mistakes.

In this task you will assess community structures to **discover** how these structures could be improved in the future. You will complete an engineering challenge to **understand** how structures can be adapted to be more resilient and sustainable. Finally, you will **act** by creating adaptation plans for important structures in your community.



Discover: *How can we assess the built environment?*

The human-built structures in a community that people interact with make up the **built environment**. Communities often build structures that help everyone live a happy and healthy life. Like the other important parts of a community, the built environment needs to be climate resilient. In this activity you will analyze the built environment in your community. This analysis will help you think about how you can change structures in your community to ensure a positive future.

1. Think about the human-made structures in your community that you and others depend on. The Community Map you created in Task 2 is a great source of information. Discuss the built environment in your community as a team.
 - a. What structures do people use to meet their needs? Where is food and water stored? What types of shelter do people in your community use?
 - b. Are there shared structures that many people in your community rely on? For example, are there schools, hospitals, office buildings, or parks?
 - c. Are there important structures for travel? For example, are there roads, bridges, ports, or railways used by many people in your community?
 - d. Are there structures made to protect people in your community? For example, are there levees, dams, or sea walls?



2. With your team, create a resilience planner like the one shown in Figure 8. Label it “Built Environment Resilience Planner.”
3. In the *Context* column of your *Built Environment Resilience Planner* write “Community Structures.” Then list the parts of the built environment your team discussed.
4. In the *Challenges* column write down your community’s shocks and stressors that you identified in Task 3. These are the shocks and stressors that are starred in the *Challenges* column of your *Climate Resilience Planner*.
5. Read what research mentor Dr. Shiromi Karunanratne says about challenges to the built environment. What might happen if we choose to ignore issues instead of adapting and responding to problems?



Given the climate conditions, we have to look at the resilience of our built environment. You have to adapt to the changing situation and change your built environment rather than try to ignore changing conditions. Adapt means to adjust something to a new condition. Let’s say you have your road built along the coastal line. With sea level rise causing coastal erosion, it becomes difficult to maintain those roads. Maybe it’s time to think of how you can elevate them instead or change the route completely.

—Dr. Shiromi Karunanratne

Shiromi is a professor of civil engineering at the Sri Lanka Institute of Information Technology in Malabe, Sri Lanka. She believes sustainable engineering needs a skill set as well as a shift in thinking, and is committed to inspiring young minds to engineer a better tomorrow.

6. Compare the community structures in your *Context* column to your *Challenges* column list. For each challenge, think about the possible impact on community structures. Could the challenge effect this structure? For example, if your community had a flood, would this structure be harmed? If you think a structure could be affected by a climate challenge, draw a star or make another mark to record that vulnerability.



7. In your *Vulnerabilities* column write “Vulnerable Structures.” Then list each of your starred community structures from the *Context* column.
8. Draw a line to connect any vulnerable structures with the shock or stressor listed in *Challenges* that is causing the problem. Some might have lines to more than one thing.
9. Read *Adapting for a Sustainable Future* to find out what communities should consider when preparing to adapt.

Adapting for a Sustainable Future

Adapting communities to better manage climate challenges is an essential part of building climate resilience. When adapting to build resilience, communities have an opportunity to make changes that also support a **sustainable future**. A sustainable future is a future that balances social, economic, environmental, and ethical concerns and works well for people and the planet. Climate adaptations that support a sustainable future can help a community build resilience that lasts for a very long time.

Before adapting the built environment, communities must assess the current state of their structures. **Assessments** can help communities evaluate the need for adaptation to meet their needs for the future. In this activity, you will create a **rubric** that can be used to assess or score the structures in your community’s built environment. A rubric is a guide for rating or grading something. The rubric you create will help you think about the resilience and sustainability of structures in your community.

10. Create a table with four columns and six rows. Figure 30 shows an example. Title the table “Structure Assessment Rubric.”
11. Label the columns “0 points,” “1 point,” and “2 points.” Label the second row “Climate Resilience.”



	0 points	1 point	2 points
Climate Resilience	Future climate events could greatly affect this structure	Future climate events would have little impact on this structure	This structure is already prepared for future climate challenges
Social			
Environmental			
Economic			
Ethical			

Figure 30: *Structure Assessment Rubric example.*

12. In the *Climate Resilience* row and *0 points* column, write what you think would be a very bad outcome for the climate resilience of a built structure. For example, you might write, "Future climate challenges could greatly affect this structure."
13. In the *Climate Resilience* row and *1 point* column, write what you think would be a neutral, or not good or bad, outcome for the climate resilience of a built structure. For example, you might write, "Future climate challenges would have little impact on this structure."
14. In the *Climate Resilience* row and *2 points* column, write what you think would be a very good outcome for the climate resilience of a built structure. For example, you might write, "This structure is already prepared and protected from future climate challenges."
15. Read *Perspectives on a Sustainable Built Environment* and then fill in the remaining rows to create a rubric to assess buildings in your community. Your team can also visit the *Climate Resilience!* StoryMap for an example of a completed rubric.

Perspectives on a Sustainable Built Environment

Follow these instructions to complete your *Structure Assessment Rubric*.

- a. In the remaining four rows, write in each of the four perspectives you learned about in Task 3. Figure 30 shows an example.



- b. Then fill in the rubric for each perspective. For example, in the *Social* row, under *0 points*, write a very bad outcome from a social perspective for the structure. Under *1 point* write a neutral outcome, and under *2 points* write a good outcome.
- c. Repeat for each of the four perspectives.

Considering these questions might be helpful as you think about what would be a bad, neutral, or good outcome from each perspective.

Social

- Does using this structure affect people's well-being? For example, a road can benefit some people by making travel easier. It can challenge others by dividing or disrupting a neighborhood.
- Does this structure help people access social systems, such as health care or education?

Environmental

- Did building the structure disrupt air, water, land, or living things?
- Does using this structure affect the air, water, land, or living things in your community? For example, when birds travel, are they often harmed by flying into large buildings or closed windows?

Economic

- Can the community afford to use and make improvements to this structure?
- Does this structure benefit community members financially? For example, a shopping mall might employ many people in a community.

Ethical

- Is access to this structure equitable? For example, structures without ramps can be difficult for community members in wheelchairs to access.
- Are there groups in your community that are harmed by this structure?

After reading these questions, you might think *0 points* in the *Social* category might be a structure that harms people's well-being; *1 point* in the *Social* category might be a structure that both helps and harms people's well-being; *2 points* in the *Social* category might be a structure that improves people's well-being.



16. Divide your team into groups of two and assign each pair a structure listed in the *Vulnerabilities* column of your *Built Environment Resilience Planner*.
17. Go out into your community with your partner and examine your assigned structure. If you cannot travel around your community, you can examine images of the structure or reflect on personal memories of the structure. Online maps, such as Google Maps, can also allow you to explore structures in your community virtually.

 Physical Safety Tip

Be careful when moving around your community. Pay attention to your surroundings and follow guidance from an adult about safe places to conduct this investigation.

 Emotional Safety Tip

As you assess your community, you may worry about the future of structures that are important. This is okay. Building climate resilience is a process. By taking action, you and others can improve the structures in your community.

18. Use your *Structure Assessment Rubric* to assess your assigned *Community Structure*. If you need more information to assess this structure, you can go online or talk to community members to help you.
19. Add up the points scored for the four perspectives and write the total on your *Structure Assessment Rubric*. This total is your sustainability score.
20. Write down the points scored for climate resilience on your *Structure Assessment Rubric*. This is your climate resilience score.
21. Return to your team and report the results of your assessment. As a team, discuss:
 - a. Which structures in your community have the lowest climate resilience scores and are most vulnerable to climate challenges? Is there something, such as location, use, or age, that makes these structures more vulnerable?
 - b. Which structures in your community had the lowest sustainability scores? Are these important structures your community should work to adapt?



22. Put your *Structure Assessment Rubric* somewhere safe. You will use it again later in this task.



Understand: *How can we adapt buildings in our built environment?*

After assessing the structures in a community to understand its needs, people can begin to change some structures to make them more resilient and more sustainable. One type of structure that communities commonly need to adapt is buildings. Whether they're homes, businesses, schools, stores, or hospitals, all the buildings in a community can be affected by climate change. In this task you will complete a sustainable engineering design challenge that can help you think about how buildings in your community could be adapted.

1. Read what research mentor Hussam says about the difference between resilience and sustainability. Why is it important to consider both sustainability and resilience when helping your community to adapt?



People often think of sustainability and resilience as being the same.

When planning adaptations, we should consider both sustainability and resilience separately. Adaptations that improve resilience help people recover after a challenge. Sustainable adaptations reduce social, economic, and environmental strain on a community.

Sustainable adaptations do not always improve resilience. For example, for sustainability you could make a building out of mud bricks because it is better for the environment. However, your building will not be resilient if the bricks cannot withstand large forces from a hurricane event. Adaptations that improve resilience are not always sustainable. For example, some communities build huge dams or structures that hold water to stop flooding. Yes, this solution improves resilience, but the economic impact is high because it costs a lot of money to build a huge dam. Dams can also have a negative environmental impact.

—Dr. Hussam Mahmoud



2. Read *Adapting to Extreme Temperatures*. You will use this information to help you in an engineering design challenge.

Adapting to Extreme Temperatures

Many communities around the world are being challenged by extreme temperatures. Extremely high and extremely low temperatures can be very uncomfortable and harmful for human health. Buildings can be a source of resilience and are used to protect people from extreme temperatures. For example, communities challenged by extreme heat often build resilience by adding air conditioning or fans to buildings. Communities challenged by extreme cold often add furnaces or fireplaces to buildings.

Some methods for managing temperature build resilience, but they are not sustainable. If overused, air conditioning and furnaces can have negative social, economic, environmental, and ethical impacts on a community. For example, using air conditioning requires energy, which can have an environmental impact. The energy required for air conditioning often costs money, which affects the community economically. Some people can afford air conditioning and others cannot, which raises questions of fairness and ethics.

To prevent overuse of unsustainable methods to manage temperature, buildings can be designed for passive heating and passive cooling. To passively heat and cool, this is what buildings need.

Cold Climate: Strategies for Passive Heating in Buildings

- Increase the amount of sunlight that enters a building
- Decrease the flow of air into a building
- Insulate walls and windows to trap heat in a building

Warm Climate: Strategies for Passive Cooling in Buildings

- Decrease the amount of sunlight that enters a building
- Increase the flow of air into a building
- Reflect sunlight off a building
- Use building materials that absorb heat



3. As a team, discuss temperature in your community. Are there ever times when it is very hot or very cold?
4. Divide your team into groups of two to four people. Each small group will work together for the sustainable engineering design challenge.
5. As a small group, create a box to model a building in your community. You can use paper or cardboard to make this box. Figure 31 demonstrates this process. Your team can visit the *Climate Resilience!* StoryMap for a printable template you can use to create this box.

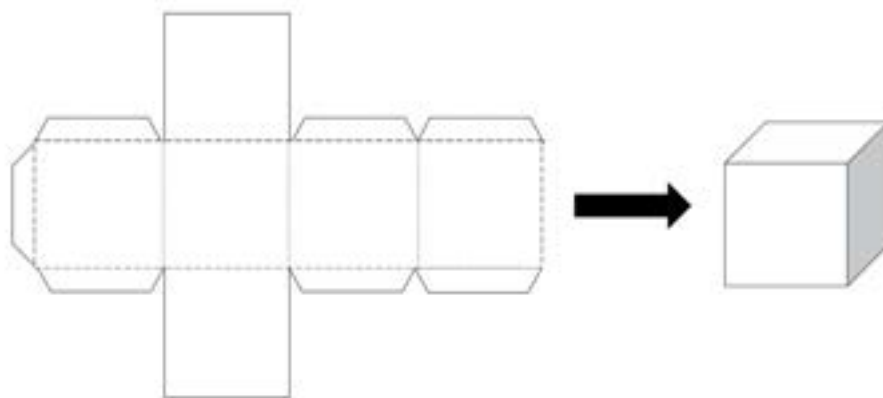


Figure 31: Example of how to cut and fold paper to create a building model.

6. Gather materials you can use to modify your building models. You can use whatever you have available. For example, colorful paper, clay, leaves, plastic wrap, sponges, cloth, cotton, and aluminum can all be used to adapt your model buildings.
7. Read *Sustainable Engineering Design Challenge* to learn how to adapt your building model to extreme temperatures.

Sustainable Engineering Design Challenge

This engineering design challenge will help you think about how people can adapt buildings to manage extreme temperature. The choices made when adapting a building can affect its use, resilience, and sustainability. Your goal in this challenge is to adapt your building model for passive heating or passive cooling. For an additional challenge, you can try to adapt your building model so that it works for a climate that is hot and cold at different times.



Possible Wall Adaptations

Adapting the walls of a building can change the temperature inside a building. Walls filled with **insulation** (materials that prevent heat loss) can passively heat a building. Foam, cotton, fiberglass, and wool are some examples of materials that insulate buildings. Walls painted dark colors can passively heat buildings by capturing and holding heat from sunlight.

Walls built with materials that have a high **thermal mass** can passively cool a building. A material with a high thermal mass can absorb heat without its temperature changing. Adobe is an example of a material with a high thermal mass. Adobe bricks are made of clay, sand, silt, and straw. During the day they absorb energy from the sun, keeping the inside of the house cooler than the outside. At night, they release the absorbed energy, making the inside of the house warmer than the outside.



Figure 32: Wall insulation (left) for passive heating and clay walls (right) for passive cooling.

Possible Window Adaptations

Adapting or creating windows can also change the temperature in a building. Large, sealed windows that let in lots of sunlight while preventing heat loss can passively heat a building.

Having multiple open windows can allow airflow that passively cools buildings. Shades or awnings over windows can passively cool by helping prevent sunlight from warming a building too much. Sometimes shades can be designed to passively heat and cool by allowing in sunlight from the lower winter sun but preventing the higher summer sun from reaching the inside of a building.





Figure 33: Large, sealed windows that let in sunlight (left) for passive heating and windows open for ventilation (right) for passive cooling.

Possible Roof Adaptations

Adapting the roof of a building can also change its temperature. Some roofs passively cool buildings by absorbing heat from the sun and preventing it from entering buildings. For example, **green roofs**, or roofs covered in living plants, prevent heat from the sun being transferred to the building and can keep buildings cool. Some roofs, such as white roofs and aluminum roofs, passively cool buildings by reflecting sunlight. The shape of a roof can also help passively cool a home. Creating roofs with overhang that provides shade can help cool a home.



Figure 34: Homes with white roofs and walls (left) and a green roof (right).

8. Create a plan for adapting your building model for passive heating or cooling. You can create this plan by drawing a picture or writing the steps you will take to adapt your model. Be sure to consider the information in the Adapting to Extreme Temperatures and Sustainable Engineering Design Challenge boxes.



9. Use your plan to adapt your building model for passive heating or cooling. If you like, you can create a model for both passive heating and passive cooling.
10. Present each model to your whole team and discuss the resilience and sustainability of each design. As a team, discuss:
 - a. Resilience: Would the way you adapted this building model be effective? Does this model incorporate multiples strategies for passive heating or passive cooling?
 - b. Social: Would the way you adapted this building affect people's well-being? For example, if your building is missing a wall, that could affect someone's feelings of safety and security.
 - c. Environmental: Could your adaptation positively or negatively affect the air, water, land, or animals in a community? For example, a green roof can purify air.
 - d. Economic: Could this adaptation have an economic impact? For example, adaptations that require a lot of material or high cost materials can be expensive. Alternatively, adaptations that increase passive heating or cooling can lower energy bills.
 - e. Ethical: Can everyone adapt in this way? Are there things such as prices or labor that prevent this adaptation from benefiting all community members?
11. Assess your model buildings using the rubric your team created in the Discover activity. Which models have the highest scores for resilience and sustainability, using the four perspectives?



Act: *How can we make our built environment more resilient?*

In the Discover activity you assessed community structures to identify ways they need to be adapted. In the Understand activity you assessed the sustainability of possible adaptations. Once you understand how a structure needs to be adapted and the best strategies for meeting those needs, you can implement what you have learned by sustainably adapting a structure. In this activity, you will think about how you can use the assessments you've done in this task to adapt the built environment or spread awareness in your community.

1. Read what research mentor Shiromi says about creating a sustainable future. Why is it important to correct mistakes made in the past?





When an engineer sits at a table and prepares to adapt their built environment, sustainability should be in their mind. The main theme of sustainable development is that you can enjoy what you have today, but don't forget the future generations. The poor decisions we made in the past resulted in climate change issues. We have done some things wrong in the past, and it's our responsibility to correct them without passing down current issues to our future generations as much as possible.

—Dr. Shiromi Karunaratne

2. Retrieve the *Structure Assessment Rubrics* your team completed in the Discover activity.
3. Identify structures you can improve by applying what you've learned about passive heating and cooling. For example, a building where people often feel too warm or too cold may be a good choice.
4. Think about the influence you have over structures in your community. Identify actions or adaptations that could increase the resilience and sustainability of a structure. List anything you can think of in the *Responses* column of your *Built Environment Resilience Planner*. For example:
 - a. Could you start a rooftop garden that passively cools buildings and feeds community members?
 - b. Could you increase ventilation or shading in buildings to reduce your use of air conditioning?
 - c. Could you make changes to buildings that reduce their environmental impact?
 - d. Could you make changes to buildings that improve people's well-being (health, education, safety, etc.)?
 - e. Could you make changes to buildings that benefit the community economically?
 - f. Could make changes to buildings that allow all people to benefit from them?

For example, are there buildings you can try to make more accessible?
5. Also list "Do Nothing" in your *Responses* column. People often choose not to act, so it is important to consider it as a potential response to a vulnerability.



6. Analyze your potential responses. Would the response lead to transformation, recovering better, recovering, recovering worse, or collapse? Draw a line from each response to where it is on the range of potential outcomes.
7. Evaluate all the possible responses and identify a response that feels possible for you or others in your community.
8. If you cannot adapt this building, think of how you can encourage others in your community to adapt this structure. Infographics, videos, or posters that share the results from your assessment of this building in the Discover activity could help encourage others to adapt community structures.



Task 7: How can culture help us become more climate resilient?

How does **culture** relate to climate resilience? Culture is a shared way of life and understanding of the world. Climate resilience can mean more than just making sure we have access to food, water, and shelter. Climate resilience also means thinking about changes to our way of life. Often culture can be an important part of responding to climate challenges.

Interactions and connections in communities are often based on the culture a community has developed. Just as you are part of many communities, you may also be part of many cultures. In this task you will **discover** more about culture and how culture might be important to resilience. You will **understand** some of the threats a changing climate pose to cultures and how cultures can become more climate resilient. Finally, you will **act** to help build cultures of climate-resilience.



Discover: *How can cultures help us adapt to change?*

You remember from Task 2 that you are part of many communities. You are also part of many cultures. Some cultures are based around a community that is located in a specific place. Others may be part of another type of community, such as being part of an organization, a generation, an ethnic group, or a religion.

Cultures influence one another, and each person may identify with different cultures and cultural influences. Some parts of culture can be easy to notice, like food, celebrations, clothing, language, and important places. Other parts of culture might be harder to identify, like specific ways of thinking about the world or interacting with other people. Sometimes it can be difficult to recognize that something about the way you think or act is cultural, until you meet someone from a different culture who thinks or acts differently.

1. Turn to a partner and have the first partner answer the first thing that comes to mind for each of these prompts.
 - a. One idea you think is true
 - b. One personal, family, or community tradition
 - c. One thing you pick up frequently



2. Switch partners and have the second partner answer the first thing that comes to mind for each of these prompts.
 - a. The steps for brushing your teeth
 - b. The name of a song
 - c. The words you use to ask a friend about how their day has been
3. Think about the answers you shared with your partner. As a team, discuss different answers that were shared between partners.
 - a. Did your partner's answers feel familiar or unfamiliar to you?
 - b. Do you think someone from a different place might have very different answers?
 - c. Do you think someone who is a different age might have very different answers?
4. Read *Youth Cultural Investigation* and complete the activity.

Youth Cultural Investigation

The way you answered each of the prompts actually shows something about your culture. Think about the different parts of your daily life. Almost everything you do or touch relates in some way to your cultures. Try to think of a personal example for each of these parts of culture.

- **Beliefs, values, and relationships:** This is your belief system, what is important to you, and how you relate to other people and things. The “idea you thought was true” prompt is an example of this part of culture.
- **Traditions, heritage, and knowledge:** Traditions may be celebrations you have, ideas that have been passed down, and the knowledge you are able to draw on. The “personal, family, or community tradition” prompt is an example of this part of culture.
- **Places and materials:** Significant places and material items might be clothing, other objects, or foods. The “one thing you pick up frequently” prompt is an example of this part of culture.
- **Behaviors, customs, and norms:** The way people act, the expected way to do things, and the assumptions about the right way to do things. The “steps for brushing your teeth” prompt is an example of this part of culture.



- **Stories, art, and symbols:** Written oral stories, artistic expression (such as music, visual art, and film), and important symbols. The “name of a song” prompt is an example of this part of culture.
- **Language and communications:** The words and methods people use to communicate. The “words you use to ask a friend about how their day has been” prompt is an example of this part of culture.

There is no one way to define culture, but Figure 35 shows a graphic representing some parts of culture that are often important.

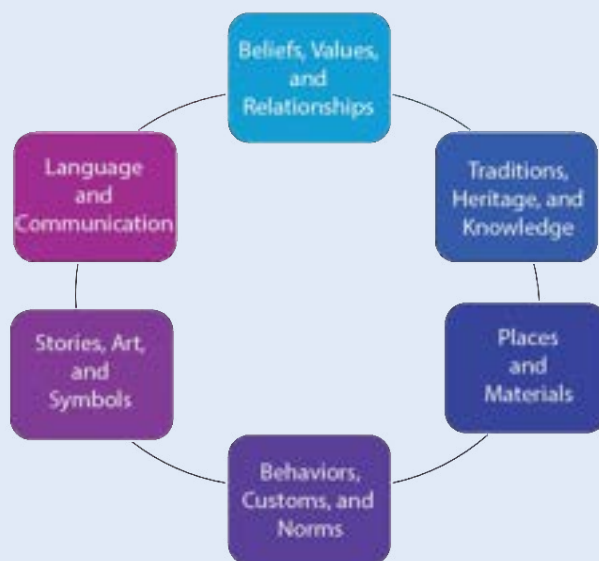


Figure 35: Parts of culture.

Cultures can be learned from others. But cultures are also always changing. Young people are often part of this change. The term **youth culture** means the culture of the newest generation. Today’s youth culture has an effect on how people choose to respond to the climate.

Think about your youth culture. What are the things you and your teammates think are important to the young people around you?

Youth Cultural Assets

- Examine the parts of culture from Figure 35. Turn to a partner and discuss:
 - Are there any parts of culture that surprise you?
 - Is there anything missing from the way you think about culture?



- b. Divide the parts of culture among your team members.
- c. Pick one **cultural asset** or thing related to the cultural part you were assigned that feels like it represents you and the youth in your community.
 - Cultural assets can be things you can touch, like an object, or things that are ideas, like a belief or skills or knowledge you have.
 - You can either show a physical item, a picture or drawing to represent the item, or find another way to share (for example, playing a song or video).
- d. Share your cultural asset with the rest of the team and tell them why you think it is important.
- e. Pay close attention while other team members share the cultural asset they picked.

Thinking about these cultural assets together can help you understand the culture created by young people in your community. How do these cultural assets help connect you as a group? Understanding a group's culture is an important part of determining how to take action for resilience.

 Emotional Safety Tip

Even though you are part of one generation, culture is not one thing and is not defined by one person. People have different perspectives on the value of different parts of the cultures they belong to. It can feel vulnerable to share something important to you. Each person's values and perspectives are important. Show respect to your teammates when they are sharing their cultural asset and expect that same respect to be shown to you.



5. Discuss as a team:
 - a. Were there cultural assets shared that are unique to your generation?
 - b. Think back to the generation of your parents or your grandparents. How do you think youth culture has changed over time?
 - c. Changes in culture often happen because of changing technologies or changing situations in the world.
 - Are there parts of the youth culture in your community that you think exist because of the changing climate?
 - Do you think youth culture might change in the future as the climate continues to change?
6. With your team, create a resilience planner like the one shown in Figure 8. Label it "Cultural Resilience Planner."
7. In the *Context* column of your Cultural Resilience Planner write down the different parts of culture from Figure 35.
8. Under each part, list some of the cultural assets your team just shared.
9. Take out your Identity Map from Task 1 and examine it. You know you are part of the culture of your generation. What other cultures do you think you are part of? For example, are there cultures related to your place, your ethnic group, your friends or family, your religion, or other things that are important to you?
10. Pick at least one additional cultural asset that you think is an important part another culture you connect to. Add that cultural asset to the *Context* column of your Cultural Resilience Planner.

Emotional Safety Tip

Sharing part of your culture might feel very personal. Only share what you are comfortable sharing with the team. It is okay to keep some of your ideas private if that feels less vulnerable.

11. In the *Challenges* column of your Cultural Resilience Planner. Write down your community's shocks and stressors you identified in Task 3. These are the shocks and stressors that are starred in the *Challenges* column of your Climate Resilience Planner.



12. Read *Cultural Resilience* and think about one way your cultures have helped you to be resilient to a challenge you faced.

Cultural Resilience

Think about a challenge you have overcome or a change you have had to deal with in the past. Was there anything about your personal beliefs, your relationships with other people, or the things you value that helped you overcome that challenge? If so, your culture was part of your resilience to that change.

In Task 3 your team learned about adaptive capacity. As a reminder, adaptive capacity is the ability to adapt to changes or challenges. Culture can help support adaptive capacity. Culture can help people adapt by:

- Bringing people together to collaboratively manage change
- Helping people create and connect to shared goals and a shared purpose
- Providing important information through stories and traditions about how to be resilient in a specific place
- Developing new ideas, perspectives, and approaches
- Giving a sense of joy, renewal, and safety for people under stress

Cultures that help people and communities adapt are promoting climate resilience.

13. By yourself, pick a climate shock or stressor that affects your community. You will now think about the ways your cultures could be helpful in helping you be resilient to that challenge.
14. Take out six sticky notes, index cards, or small pieces of paper. Across the top of each write one of the parts of culture from Figure 35.
15. For each part of culture, write how your cultures could be helpful when responding to the shock or stressor you selected. For example, perhaps you chose “flooding” as a shock and are thinking about beliefs, values, and relationships. You might write, “I have a strong family community. If a flood hurt my home, I would be able to rely on relatives for a place to stay.”
16. Individually complete your notes to show the way the six parts of culture could be helpful to you during a climate challenge.



17. Use a class board or poster to recreate the *Parts of Culture* diagram shown in Figure 35. Visit the *Climate Resilience!* StoryMap if you need additional resources and examples that can help you complete this activity.
18. Add each team member's notes or cards to the part of culture they go with on the diagram.
19. As a team, examine the notes or cards and discuss:
 - a. What themes do you notice?
 - b. How do you think culture can play a role in helping you be climate resilient?
20. Read research mentor Sharyl Pahe-Short's ideas about how her culture is a source of resilience. Sharyl works at the Smithsonian National Museum of the American Indian. She is also a member of the Diné (also known as Navajo) Nation. Does Sharyl make you think of any additional ways your culture has acted a source of resilience for you?



My culture has helped with my resilience a lot. Our elders are really the heart of our communities. They have all the knowledge.

They're the bearers of what they teach us, and when it's the right time to do so and when it's not, and just understanding the way that life is because they've lived it and then they're sharing that with you. But they do it in a way where it's not just like preaching or it's not just saying, "You have to do it this way."

But it's more so that you live it by doing and practicing your culture.

So for me, I think the community is really based in family. In my case, my grandpa, he also was a medicine man. He traveled quite a bit all over our reservations. He would be asked to do different ceremonies that would help heal people spiritually and physically. And he also did that for his own family and his own children, his grandchildren. I think that was the biggest thing that helped nurture my resilience. Those ceremonies really reset us in a positive way. And that was really helpful.

—Sharyl Pahe-Short

Sharyl Pahe-Short is the assistant director of interpretive services at the Smithsonian National Museum of the American Indian in Washington, D.C.



2. With your team, discuss:

- What do you think might happen if the sea levels rise and water covers areas where people are currently living?
- How do you think this will affect the **displaced** people and cultures currently in those areas? Displaced means having to move from your usual place.
- Do you think there are countries that are too small and do not appear on this map? Why might those countries be especially at risk from sea level rise?

 Emotional Safety Tip

It can be frightening to think about your or other communities being affected by rising sea levels. Many people are concerned, but that also means many people are trying to work together to find solutions. If you feel upset, it is okay to pause and take a break.

3. Read research mentor Sharyl's reflection on how her community had to be resilient after being **relocated**—forced to move to a different place in the past, under a policy called the Navajo-Hopi Land Dispute Settlement Act of 1996.



When the Land Settlement Act happened, many Navajo families got removed from that area. It was very challenging. I think I was 10 years old when this happened. They got assistance for moving. We got some houses that were built that the government provided. But we didn't get to pick the lands that we got. For my community, moving from what we call our old lands to the new lands took resilience. A lot of our resilience has come from really relying on each other.

When I go home today, I fly into Phoenix and then we drive the four hours to the reservation. Everyone knows when you're coming. That's what I mean by community. They'll know when a relative is coming in for a potluck, for that birthday gathering. And I think that has helped a lot—visiting each other, continuing to practice our traditions with each other.



For example, one of the things that I went through when I was younger is a coming-of-age ceremony, when a girl becomes a woman. We call it our *kinaaldá*. And when that happens, the whole community comes out for it. I was young enough then that I had my *kinaaldá* at the new lands. I remember everybody coming together to join that. And it was different than how we used to do it from old land, but I think that's a part of the way we adapt.

Even though the landscape might be a little different and the homes are different, we find a way to just stay together. We find a way to keep telling stories, having celebrations and ceremonies together, notifying everybody. I mean, it really is about communication and just being together as a family.

—Sharyl Pahe-Short

4. Discuss with a partner or your team:
 - a. What words or ideas stand out to you as important to remember?
 - b. Why might it be useful to consider Sharyl's experience when thinking about cultural resilience to climate change?
5. Examine your *Cultural Resilience Planner*. Are there cultural assets listed in the *Context* column that might be vulnerable to sea level rise? For example, an asset such as a historical site could be vulnerable to floods. An asset such as a type of music could be vulnerable if musicians are displaced from a community. Write down assets that could be vulnerable in the *Vulnerabilities* column.
6. Compare the remaining cultural assets listed in the *Context* column with the other challenges. Are there other cultural assets that might be vulnerable to the other shocks and stressors of climate change? If so, write those down in the *Vulnerabilities* column.
7. People across the world are thinking about how to protect vulnerable cultural assets that are threatened by climate change. The Smithsonian is a part of this effort. Read the *At the Smithsonian* to find out more. Are there things the Smithsonian is doing that you think might be helpful in your local community?





At the Smithsonian

Climate change threatens cultural assets in many places. Luckily, the Smithsonian Cultural Rescue Initiative (SCRI) and its partners are working hard to help respond to disasters and build resilience. From wildfires to flooding, climate related challenges often put cultural heritage at risk. And SCRI is part of the response, helping to provide resources and build local skills to help protect and conserve cultural assets. SCRI recognizes that not all cultural assets are in historical sites or museums. Each person and family holds cultural assets as well.

Whether it is a cherished photo or an heirloom quilt, cultural assets are important parts of identity and connection. Understanding how to prevent damage to cultural assets from storms or flooding is an important part of creating resilience to climate change. Small interventions such as not storing important assets in basements or attics where they are more vulnerable to water damage can make a difference.

When damage does occur, quick action can save heritage. SCRI Research Associate Dr. Nana Kaneko joined the SCRI effort to pilot a program called “Save Your Family Treasures” aimed at individuals impacted by disasters. Nana notes, “you can salvage water damage to family heirlooms using items that are readily available at a hardware store. Knowing which cultural assets are important to you and your family can help you prioritize and be prepared for an emergency.”



Figure 37: Nana Kaneko assisting Nebraskans in the “Save Your Family Treasure” pilot program.



Culture can be at risk from climate challenges, but it is also an important part of meeting those challenges. Nana explains, “After disasters, safety, survival, food and shelter need to come first. But culture is often a very strong second as a building block for community recovery.”

SCRI is now working with partners to expand this program. You can learn more about how to save your family treasures at the *Climate Resilience!* StoryMap.

8. Read *Resilience Triptych* and carry out the instructions.

Resilience Triptych

A **triptych** is a set of three pictures that tell a story. Similar to the stories you shared in Task 1, a triptych can tell a story about resilience. Often a triptych explores three different aspects of an idea. In this activity you will be creating a triptych related to culture and climate resilience.

Create the Triptych

Take, find, or create one picture for each of the three following prompts.

1. One family or personal treasure that would be important for you personally to save in an emergency—for example, an item, a photo, or a document.
2. One cultural asset that you worry could be affected by climate change—for example, a place, an important thing, or a way people connect with one another.
3. One way you or others are preserving or protecting culture for the future—for example, sharing pictures, using archives, or passing on a vulnerable language or tradition.

If you have access to a camera, you can use it to take pictures to show your ideas. If not, you can find pictures someone else has taken, for example online pictures. Or you can draw pictures. You can choose to represent any of the cultures you identify with. Remember, cultural assets can be physical, like a food or a place, or conceptual, like a belief or a relationship.



Create a Collage Triptych

Combine the pictures you took for each prompt with your teammates to create a **collage**. A collage is a grouping of pictures or objects. Create three collages, one for each prompt.

Examine Your Team's Collage Triptychs

Examine the collages closely and discuss with a partner:

- What do you notice about your teammates' pictures?
- What do you think are important cultural assets to pay attention to?
- What do you wonder about ways people can help protect cultural assets for the future?

Add in the Global Perspective

Protecting culture is not just something that is happening in one area; it is happening all around the world. Have each team member search for a picture of a way other cultures around the world are trying to protect their cultural assets from climate change. Add these pictures to your collage for prompt 3.

- Divide the *Responses* column in your *Cultural Resilience Planner* into three sections. Label the sections "Preserve Culture," "Build Community," and "Pass on Heritage."
- In the *Preserve Culture* section, write down two to three ideas about how you could prepare to preserve culture in case of emergency. For example, could you create a list of family treasures or help protect a local landmark?



Act: How can we make our culture more climate resilient?

Culture and community are important parts of resilience. Specific cultures might have some characteristics that help with their resilience. These characteristics are important to protect. They might have other characteristics that make it harder to be resilient. People should consider whether they would like to transform these characteristics.

- Read *Culture Builds Community* and follow the instructions.



Culture Builds Community

Culture connects us to other people. Through shared interests, experiences, and goals, we build a sense of community with other people. This shared sense of identity and community builds resilience and helps communities respond and adapt to changes and challenges.

- a. Take out your Identity Map and choose one thing you listed that you like to do. This activity is part of your personal cultural practice. For example, maybe you like to play games or music. Or maybe you like to cook or dance.
- b. Think to yourself about how many people you are connected to through the activity you chose. For example, have you made friends through this activity? Connected with family members? Gotten to know others online or those who live around you?
- c. Turn to a partner and share these connections with each other.
- d. Discuss with your partner: If there was an emergency, how could it be helpful to have these connections with other people?

2. In the *Build Community* section in the *Responses* column of your Cultural Resilience Planner, list two to three things you could do that would make you feel more a part of one of your communities. For example, could you participate in a cultural event or communicate with someone?
3. Read At the Smithsonian. Can you think of one cultural practice that's important to you that you would like to pass on?



At the Smithsonian

Culture builds connections and contributes to well-being. This helps make communities more resilient. But sometimes people forget how important culture is. The Cultural Vitality Program at the Smithsonian Center for Folklife & Cultural



Heritage works with communities around the world to support the diversity of cultures. Director of Special Projects Halle Butvin explains, “Culture helps us get to know our neighbors and understand ourselves better. Even something that just seems like fun, like a festival, can actually have a big impact and build a sense of community and belonging.”



Figure 38: Gulmira Akmatova, an artisan from Kyrgyzstan, shares her weaving skills as part of the Cultural Vitality Program at work.

Who are the people who help pass on cultural heritage? The Cultural Vitality Program supports the unique cultures of different communities. Sometimes this means helping **artisans**, or workers who are skilled in making things, share their products. Sometimes this means supporting those who speak a language to pass it along to the next generation. There is research that shows that when we invest in cultural heritage, we become more resilient and make progress on the SDGs.

4. In the *Pass on Heritage* section in the *Responses* column of your Cultural Resilience Planner, list two to three cultural practices from your community you would like to make sure are passed on. These could be from any of the parts of culture you learned about in the Discover activity.
5. Read research mentor Sharyl's ideas about finding resilience. Are there ways in which you think the youth culture in your area is finding its own resilience?





Communities find resilience in themselves. It's about overcoming challenges, finding a way, and knowing that you will get through this. One of the main messages about our resilience as Indigenous people is that it's ever ongoing. There have been many challenges along the way in our history, including some really bad ones. But we have found a way to incorporate those stories into the learning. Those stories can help future generations understand how to overcome challenges and how they can find new ways to have their own resilience.

—Sharyl Pahe-Short

6. Examine all the responses your team thought of to preserve culture, build community, and pass on cultural heritage. Compare them to the potential outcomes in your *Cultural Resilience Planner*. Are there any that you think could be transformative or lead you to recover better?
7. Make a choice. You and your team have explored different responses. By yourself, choose one response you would like to be a part of. How will you choose to help your culture find resilience?
8. Plan your action. Think quietly to yourself:
 - a. What do you need to do?
 - b. Who do you need to work with?
 - c. When will you start?
9. Share your plan with a partner. Come back after a week or two and check in. Telling others about your plan to act is a good way to create **accountability**, or a sense of responsibility to act.



Task 8: How can we act to ensure a resilient future?

As action researchers you now have a lot of information. You discovered what is important to you and your team. You understand more about the need for climate resilience. You understand the values of people in your community. Now you will put those ideas together. In this task, you will decide how your team will act to create a more resilient future. Then you will put your plan into action.

In this task you will **discover** more about creating transformative outcomes for the future. Then you will **understand** more about your role in working toward those outcomes. Finally, you will **act** on your ideas and work toward a sustainable and positive future.



Discover: *What are possible future outcomes?*

Before you decide what you want to do, you need to think about what you want to accomplish. Many different outcomes and futures are possible. Which one do you want to work toward?

1. Read research mentor Hussam's advice about taking action to build climate resilience. Who in your community could help your team take action?



I think the best thing for younger generations to reflect on is the fact that climate challenges are not going away any time soon. Climate change is something we all must deal with now and into the future. That's the unfortunate part.

The fortunate part is we know the steps we can take to find the right solutions to the problems we face. We need to work together, draw on multiple disciplines, and connect different areas of work together. Even I, as a researcher, cannot solve these problems alone. I work with engineers and people in social science to understand which solutions to climate issues are best.

—Dr. Hussam Mahmoud



2. Take out any resilience planners you completed from Tasks 4, 5, 6, and 7. Examine everything listed in the *Vulnerabilities* columns on all those planners. Are there important themes you notice, based on the four perspectives?
3. If you can, use four different color pens or pencils, or use another method, to mark items that represent the four perspectives. If you think a vulnerability relates to a perspective, circle it in that color. One vulnerability might relate to several perspectives. Be sure to consider:
 - a. Social: Are there any vulnerabilities to social systems, such as health care, education, culture, or other things related to the well-being of people?
 - b. Environmental: Are there ways in which the environment is vulnerable to the effects of climate change challenges?
 - c. Economic: Are there vulnerabilities to the economic system?
 - d. Ethical: Are there vulnerabilities that affect some people more than others?
4. Examine all the social vulnerabilities you circled and compare your ideas to the social vulnerabilities listed in the *Vulnerabilities* column from your *Climate Resilience Planner*. Are there important vulnerabilities missing from your *Climate Resilience Planner*? If so, add them now under the *Social* perspective.
5. Repeat for the remaining perspectives.
6. Take out your *My Resilient Community* sheet from Task 2 and remind yourself about your ideas about a climate resilient future.
7. Examine your *Climate Resilience Planner* to remind yourself about the context, challenges, and vulnerabilities you listed for your community.
8. Have each person fill in the following sentence with their ideas, and then post those sentences somewhere where everyone can examine them.
 - a. "When I think about our community's climate resilience, I think the most important thing to take action on is_____."
9. Individually, move around your learning area and examine each person's sentence.
10. Come back together as a team and discuss:
 - a. Are there themes that emerge about the most important thing to take action on?
11. As a team, come to consensus on one part of the future you want to take action on. There are many ways to come to consensus. Here are some ideas. You can choose whatever works best for your team. Try to come to a team consensus on the problem that is most important to take action on right now.



- a. List the good things and bad things about taking action for each future. Discuss as a team.
 - b. Try to find the same values. Are there some ideas about the future that are similar? Try to combine them.
 - c. Build a sense of your team's opinion. Are there some ideas about the future that many people would be interested in working toward?
 - d. Find a slow consensus. Find a partner and as a pair find consensus on which future idea is most important. Then in groups of two pairs (four team members) you can build consensus among the four of you. Then in groups of four pairs (eight team members) you can discuss further to build consensus. Keep adding groups together until you have found a team consensus.
 - e. Consider your impact. Think about who would benefit from your team working toward a specific idea about the future. Which group are you most interested in helping?
12. Examine the responses you listed in the resilience planners from Tasks 4, 5, 6, and 7. As a team, discuss and circle any responses you think you and your team would like to consider for the problem you just picked.
 13. Write down the circled responses from the other planners in the *Responses* column of the *Climate Resilience Planner*.
 14. If you can think of any additional responses, add them to the *Responses* column now.
 15. Divide into pairs and give each pair an equal number of the responses listed in the *Climate Resilience Planner*.
 16. As a pair, discuss for each response:
 - a. How might this response help our community be more climate resilient?
 - b. Is there any way this response might lead to **unintended consequences**?
An unintended consequence is when even though you were trying to help a situation, a harmful impact develops as a result. For example, maybe you want to build a community garden to help with food resilience, but that means displacing people currently living in that place.
 - c. Examine your range of potential outcomes. Where do you think this response would fall?
 17. As a pair, present your ideas to the rest of the team.



18. After each presentation, discuss whether everyone on your team agrees where the response would fall on the *Outcomes* arrow. Try to find a team consensus on where the response should go, then connect the response to the right place on the arrow in the *Climate Resilience Planner*.
19. After examining the positions on the *Outcomes* arrow, pick the response your team wants to take.
20. Make a list of potential actions. What action will your team take as part of this response? If you are having trouble thinking of actions you can take, here are some ideas you may want to consider.
 - a. Personal: Could you personally become involved in changing places, systems, or other things in your home, your school, or your broader community?
 - b. Educate others: Other people you know may not know much about the different parts of climate resilience and what they can do. Could you choose a group to educate to help them learn more?
 - c. Communicate with your community: Help your community understand how to become more climate resilient by designing posters, composing songs, recording podcasts, making public service announcements, creating a social media campaign, or using other ways to communicate.
 - d. Government change: Think about whether there are things you want your local or national government to do to help you become more climate resilient.
 - e. Global change: Collaborate with others around the world who are worried about the same problem. For example, join a group that is working toward a climate resilient future.
 - f. Come up with your own ideas!



Understand: What will my role be?

Now it is time to plan your action. As you have learned, variations among people's perspectives and abilities can make the whole team stronger. Think about what role you will take to help with the team action.



1. Take out your collaborative artwork from Task 1 and remind yourself of the many strengths on your team. These strengths are important to remember as you plan your action.
2. As a team, discuss the actions you thought of in the Discover activity. Remove any actions that would not be helpful or that you cannot do.
3. Share your ideas and listen to others. Come to a consensus about what action you will take, using your list of strengths from the *Personal Resilience Diagrams* you made in Task 1 to help you decide the best action for your team. You can use some of the consensus-building ideas from the Discover activity, if you want.
4. Think quietly to yourself about the steps that could be part of planning the action your team picked.
5. Write, draw, or use another way to record your ideas on small pieces of paper. Each piece of paper should have one step.
6. Have each team member share their steps by placing their pieces of paper on a table or by using a digital tool for collaboration.
7. Read through the steps from your teammates.
 - a. Did you notice any steps that were similar to yours?
 - b. Do you think your team is missing any steps?
8. Start to organize your team's steps. You can move the pieces of paper around as you do this. Thinking about your team's steps will help you decide how you will take action.
 - a. Group any similar steps together.
 - b. Remove any steps you don't think are needed to help your team take action.
 - c. Think about how each team member will help. Put their names with the steps they would like to help with.
 - d. Think about what steps might be missing. Add those steps.
9. Put the steps in order. For example, what do you think the team needs to do first? Place that piece of paper before all the others.



10. Title a sheet of paper “Action Plan” and record:
 - a. The steps your team would like to take
 - b. The order of those steps
 - c. Who will help with each step (it might be more than one person)
 - d. When and where you will take these steps
 - e. Partners or other people you will involve
 - f. How you will communicate your action plan to the community
11. Think about what you will do if your plan doesn’t work or you run into another problem. For example, what will you do if an adult in your community says you need permission to do something in your plan? Record these ideas as part of your *Action Plan*.
12. Remember to create an **inclusive** action plan. Being inclusive means everyone on your team can participate in some way. You may need to make changes to the plan so that everyone feels safe, comfortable, and able to help. Those changes are okay! They are part of being a good teammate.



Act: *How will I put my ideas into action?*

The time has come to act! You can use everything you have learned to take action to help create the future you want.

1. With your teammates, implement your *Action Plan*. This may take some time. There is no need to worry; take the time you need. When you are finished, come back and complete this activity.
2. Think quietly about the action you took. Consider:
 - a. What went well?
 - b. What do you think could have gone better?
 - c. How would you change your action if you had to do it again?
3. Discuss with your team:
 - a. What makes you proud of yourselves as a team?
 - b. What do you think you have learned for next time?



4. Examine your *My Resilient Community* ideas from Task 2. Do you feel you have moved closer to a resilient community?
5. Think quietly to yourself about what you plan to do to create the changes you want to see in the future.

Congratulations!

You finished the *Climate Resilience!* Community Research Guide!

All of us should be trying to do what we can to change ourselves and our world for the better. Maybe you took a big action. Maybe you took a small action. Maybe it had a big impact. Maybe it had a small impact. The most important thing is that you did something. When you take action to make your community better, you create the world you want to live in. You and your team are changing the world, one step at a time!



End Notes

1. Department for International Development, "Defining disaster resilience: A DFID approach paper." November 1, 2011. <https://www.gov.uk/government/publications/defining-disaster-resilience-a-dfid-approach-paper>
2. Richie, Hannah, and Pablo Rosado, "Global reported natural disasters by type." 2022. Data adapted from EM-DAT, CRED/UCLouvain. <https://ourworldindata.org/grapher/natural-disasters-by-type>
3. Cinner, J.E., W.N. Adger, E.H Allison, et al. "Building adaptive capacity to climate change in tropical coastal communities," *Nature Climate Change* 8 (2018): 117–123. <https://doi.org/10.1038/s41558-017-0065-x>
4. Hooijer, A., and R. Vernimmen. "Global LiDAR land elevation data reveal greatest sea-level rise vulnerability in the tropics." *Nature Communications* 12, (2021): 3592. <https://doi.org/10.1038/s41467-021-23810-9>



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 easily reach a place, thing, or idea

Accessible: Able to be used by everyone

Accountability: A sense of responsibility to act

Achievements: Experiences where you accomplished something or felt successful

Action researcher: People who use their own knowledge and information they find out from their community to make decisions and take action on important issues.

Adapt: To change in a way that helps you adjust to something new

Adaptive capacity: The ability to adapt to changes or challenges

Agency: Power

Archive: A place where historical documents are stored

Artisan: Workers who are skilled in making things

Assessment: A process of evaluating existing plans or circumstances to help communities understand how they need to adapt



Assets: Things that are useful or valuable

Built environment: The human-built structures in a community

Challenge: A problem facing people and ecosystems

Climate Challenge: A Climate related event that causes problems for people and ecosystems

Climate change: The rapid warming of the global climate

Climate: Weather conditions in a place over a long period

Climate resilience: The ability to respond and adapt to climate challenges and changes

Climate scenarios: Possible climate events

Climate shock: A climate event that can quickly cause a major challenge in a community

Climate stressor: A climate event that slowly challenges a community over time

Collaborate: To work together toward a common goal

Collaborative: Work together in way in which everyone tries to reach a common goal

Collage: A grouping of pictures or objects



Collapse: Respond and adapt but are not able to meet needs everyone's needs after a challenge, and therefore cannot function

Collectively: Working as a group

Community: A group of people who share something in common, such as a space or an identity

Compounding: A series of events that, taken together, make one another more severe

Consensus: A balanced decision that works for everyone

Conservationist: Someone who works to protect and preserve nature

Consumer: Someone who gets, buys and uses food or other items

Context: The circumstances that make up the setting for an event, statement, or idea

Cultural asset: An important thing from one of the parts of a culture; cultural assets can be things you can touch, like an object, or performances, like a dance or music, or ideas, like a belief

Culture: A shared way of life and understanding of the world

Damages: The cost to improve parts of the community that were harmed

Data: Pieces of factual information

Database: A large set of information stored digitally



Deplete: Decrease

Displaced: Having to move from your usual place

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

Environmental: About the natural world

Equitable: Fair for everyone

Ethical: The fairness of something

Food supply: Food that is grown or raised and is available to eat

Food system: The parts that work together to create a system for producing, moving, and accessing food; they include food, shops, farms, and transportation

Fresh water: Water that has very little salt and so can be used by people to drink

Functional: Working

Function: Ability to meet needs

Glacier: Large thick masses of ice

Global community: The community of all the people around the world

Global food supply: All the food grown or raised anywhere around the world



Gray water: Recycled water

Green roof: A roof that is covered in living plants

Groundwater reservoir: A place where groundwater is stored

Groundwater: Water that is stored under the ground

Homogenous: The same or alike

Horticulturist: Someone who specializes in growing plants

Identity: The unique characteristics that make you

Impact: The effect one thing has on another

Inclusive: Making sure no one is left out

Individual resilience: A single person's ability to respond and adapt to changes and challenges

Inequitable: Not fair

Insulation: Materials that are added to help prevent heat loss

Interdisciplinary: Something involving more than one academic discipline

Land degradation: Worsening land quality



Landslide: A sudden downhill movement of rocks and dirt

Local community: The community of people in your local area

Marginalized: People or groups treated as peripheral or insignificant

Mental resilience: The ability to be calm, confident, and motivated to solve problems when experiencing challenges

Mitigate: To make less severe or less harmful

Model: A representation of an object or system

Monitor: To collecting data on the quality of something over long periods of time

Natural disaster: A natural event that causes harm to people and the environment

Natural resources: The resources people get from natural spaces on Earth

Outcomes: Possible futures a community can have after a major challenge

Personal experiences: Events that have happened in your life

Perspective: A point of view; a specific way of thinking about the world around us

Physical resilience: The ability to manage challenges that could do physical harm to people, places, or the natural world

Projection: A prediction of what conditions will be like in the future



Qualitative: Measured by the quality of something, rather than how much there is

Quantitative: Measured by how much there is of something

Recover better: To respond and adapt to better meet the community's needs after a challenge than they were able to before they were challenged

Recover worse: To respond in a way that meets fewer of a community's needs after a challenge than they were able to before they were challenged

Recover: Return to normal

Recover: To respond after a challenge and return to how things were before the challenge

Redundancy: Multiple pathways in a system that are designed to make it more resilient

Regional food supply: Food grown or raised a few hours away, such as in a neighboring city, state, province, or country

Relocated: Forced to move to a different place

Replenish: To fill something up again

Research mentor: A professional researcher working in the field who shares information with you

Resilience: The ability to respond and adapt to changes and challenges



Resilient community: A community that works together to respond and adapt to challenges to meet people's needs

Risk: The likelihood of experiencing something negative

Rubric: A guide for rating or grading something

Sector: Part of the community

Sequential: Events that happen right after one another

Shock: A challenge that happens quickly or unexpectedly

Social Resilience: is the ability of a group of people to respond and adapt to changes and challenges together

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

Storm water: Water that comes from storms

Strategic planning: Making a long-term plan that considers the best way to achieve your goals with the resources you have available

Stress: A challenge that builds slowly over time

Stressor: Something that causes stress



Supply chain: The process of moving an item (such as food) from where it is produced (such as a farm or factory) to a place where it can be accessed (such as a shop)

Surface water: Water held above ground

Sustainability: An approach in which people do not use more resources or create more waste than the biocapacity of the Earth can meet

Sustainable Development Goals: Global goals set in 2015 to address the most important global problems to work on until 2030

Sustainable future: A future that balances social, economic, environmental, and ethical concerns and that works well for people and the planet

System: A group of things or living beings that interact with one another as part of a common network

Thermal mass: A material's ability to absorb heat without changing its temperature

Transform: To respond and adapt to meet people's needs after challenges and into the future

Trend: The general direction in which something is developing or changing

Triptych: A set of three pictures

Unintended consequence: When there is a harmful result, even though you were trying to help a situation



United Nations: A global organization designed to help governments and people around the world collaborate and use their shared knowledge and skills to solve problems faced by many communities around the world

Unprecedented: New or never occurring before

Vulnerability: Something's risk of future harm

Water harvesting: Collecting or storing water instead of letting it flow through a community

Water shortage: A lack of water supply

Weather: The pattern of temperature, precipitation, wind, and humidity in a place over a short period of time.

Weir: A special concrete dam that measures water flow

Well: A hole dug deep into the earth to access groundwater

Youth culture: The culture of young people



Image Credits

Cover – imaginewithme/iStoc/Getty Images Plus
 Figure 1 – Smithsonian Science Education Center
 Figure 2 – Smithsonian Science Education Center
 Figure 3 – Smithsonian Science Education Center
 Figure 4 – Khadijah Thibodeaux, Smithsonian Science Education Center
 Figure 5 – Ana Endara/STRI; Ana Endara/STRI
 Figure 6 – Map data: Google, Imagery@2022CNES/Airbus, Maxar Technologies
 Figure 7 – Smithsonian Science Education Center
 Figure 8 – Smithsonian Science Education Center
 Figure 9 – United Nations
 Figure 10 – TopVector/iStock/Getty Images Plus
 Figure 11 – Our World in Data
 Figure 12 – Smithsonian Science Education Center
 Figure 13 – Smithsonian Science Education Center
 Figure 14 – Steven Paton, Smithsonian Tropical Research Institute
 Figure 15 – Smithsonian Science Education Center
 Figure 16 – Smithsonian Science Education Center
 Figure 17 – Hannele Lahti for Smithsonian Gardens
 Figure 18 – Smithsonian Science Education Center; Smithsonian Science Education Center
 Figure 19 – Smithsonian Science Education Center
 Figure 20 – Smithsonian Science Education Center
 Figure 21 – Smithsonian Science Education Center
 Figure 22 – Smithsonian Science Education Center
 Figure 23 – Smithsonian Science Education Center
 Figure 24 – Smithsonian Science Education Center
 Figure 25 – Smithsonian Science Education Center
 Figure 26 – Smithsonian Science Education Center
 Figure 27 – KajaNi/iStock/Getty Images Plus
 Figure 28 – Smithsonian Science Education Center; Smithsonian Science Education Center
 Figure 29 – Smithsonian Science Education Center
 Figure 30 – Smithsonian Science Education Center
 Figure 31 – Smithsonian Science Education Center
 Figure 32 – Patryk_Kosmider/iStock/Getty Images Plus; Susan Vineyard/iStock/Getty Images Plus
 Figure 33 – imaginima/E+/Getty Images Plus; Antonio Jarosso/iStock/Getty Images Plus
 Figure 34 – Zigres/iStock/Getty Images Plus; manonallard/iStock/Getty Images Plus
 Figure 35 – Smithsonian Science Education Center
 Figure 36 – Smithsonian Science Education Center
 Figure 37 – Smithsonian Cultural Rescue Initiative
 Figure 38 – Salkyn Adysheva



Climate Resilience!

How can communities adapt to a changing climate?

Community Response Guide

Smithsonian Science for Global Goals Development Team

Lead Guide Developer/Writer

Khadijah Thibodeaux

Director

Dr. Carol O'Donnell

Division Director

Dr. Brian Mandell

Global Goals Series

Developers

Heidi Gibson
Andre Radloff
Logan Schmidt
Khadijah Thibodeaux

Project Manager

Hannah Osborn

Marketing & Communications Team

Carolina Gonzalez
Logan Werlinger

Digital Media Team

Sofia Elian
Joao Victor Lucena

Publishing Assistant

Raymond Williams, III

Smithsonian Science Education Center Staff

Executive Office

Kate Echevarria
Johnny McInerney

Advancement & Partnerships

Holly Glover, Division Director
Denise Anderson
Inola Walston

Finance & Administration

Lisa Rogers, Division Director
Allison Gamble
Jasmine Rogers

Professional Services

Dr. Amy D'Amico, Division
Director
Addy Allred
Katherine Blanchard
Katherine Fancher
Katie Gainsback
Jacqueline Kolb
Dr. Hyunju Lee
Shellie Pick
Layla Sastry
Ariel Waldman
Sherrell Williams

Smithsonian Science for the Classroom Developers

Dr. Sarah J. Glassman
Dr. Emily J. Harrison
Melissa J. B. Rogers
Dr. Mary E. Short



Senior Project Advisors

John Boright
Executive Director, International Affairs
National Academy of Sciences
Washington, D.C., USA

Peter McGrath, PhD
Coordinator
InterAcademy Partnership
Washington, D.C., USA

Research Mentors

Anne Fitchett, PhD
Retired professor of Civil and Environmental
Engineering, University of Witwatersrand
Johannesburg, South Africa

Alexandra Guzman
Research Technician, Smithsonian Tropical
Research Institute
Panama City, Panama

Shiromi Karunaratne, PhD
Professor of Civil Engineering
Sri Lanka Institute of Information Technology
Malabe, Sri Lanka

Hussam Mahmoud, PhD, F.SEI, F.ASCE
Professor of Civil and Environmental Engineering,
Colorado State University
Fort Collins, Colorado, USA

Sharyl Pahe-Short
Assistant Director of Interpretive Services,
National Museum of the American Indian,
Smithsonian Institution
Washington, D.C., USA

Keith Phiri, PhD
Senior Lecturer and Climate Change Specialist,
Lupane State University
Lupane, Zimbabwe

Ana K. Spalding, PhD
Director of the Adrienne Arsht Community-Based
Resilience Solutions Initiative, Smithsonian Tropical
Research Institute
Panama City, Panama

Lynda Zambrano
Executive Director of the Northwest Tribal Emergency
Council and Executive Director of the National
Tribal Emergency Management Council Seattle,
Washington, USA

Project Advisors

Ramia AlBakain, PhD
Professor of Analytical, Bioanalytical, and
Environmental Chemistry, The University of Jordan
Amman, Jordan

Robin Abraham
Deputy General Manager & Head –
Communications, WOTR
Pune, India

Elina Amadhila, PhD
Senior lecturer, Department of Enterprise
Development and Management,
University of Namibia
Windhoek, Khomas, Namibia

Kalirajan Arunachalam, PhD
Senior Lecturer, Mulungushi University School of
Natural and Applied Sciences
Kabwe, Zambia

Halle M. Butvin
Director of Special Projects, Center for Folklife and
Cultural Heritage, Smithsonian Institution
Washington, D.C., USA

Karen Jacqueline Cloete, PhD
Senior Scientist and Workshop lecturer,
University of South Africa
Pretoria, South Africa



Madhav Gholkar
Thematic Lead for Climate Resilient
Agriculture, WOTR
Pune, India

Lisa Gibbs, PhD
Director of the Disaster, Climate & Adversity Unit,
Centre for Mental Health, Melbourne School of
Population and Global Health, University of Melbourne
Melbourne, Australia

Bjoern Hagen, PhD
Assistant Teaching Professor, School of Sustainability
Senior Global Futures Scientist, Julie Ann Wrigley
Global Futures Laboratory
Honors Faculty, Barrett Honors College, Arizona
State University
Tempe, Arizona, USA

Nana Kaneko, PhD
Acting Coordinator, Heritage Emergency
National Task Force, Federal Emergency
Management Agency (FEMA) Office of
Environmental Planning & Historic
Preservation Resilience
Washington, D.C., USA

Liz Kirby
Senior Advisor for Programs and Partnerships,
Smithsonian Cultural Rescue Initiative
Washington, D.C., USA

Melanie Moser
Operations Coordinator, Urban Harvest STL
St. Louis, Missouri, USA

Kathleen Munn
Education Specialist, Smithsonian Gardens
Washington, D.C., USA

Steve Paton
Director of STRI's Physical Monitoring Program,
Smithsonian Tropical Research Institute
Panama City, Panama

Jenifer Henslee Peck
Science Translator and Communications
Specialist, South Central Climate Adaptation
Science Center (CASC)
Norman, Oklahoma, USA

Christine Price-Abelow
Lead Horticulturalist at National Museum of
the American Indian, Smithsonian Gardens
Washington, D.C., USA

Jennifer Vanos, PhD
Associate Professor, School of Sustainability,
College of Global Futures, Arizona State University
Tempe, Arizona, USA

Dipak Zade
Thematic Lead for Social Sciences, WOTR
Pune, India

Technical Reviewers

Elina Amadhila, PhD
Senior lecturer, Department of Enterprise
Development and Management,
University of Namibia
Windhoek, Khomas, Namibia

Kalirajan Arunachalam, PhD
Senior Lecturer, Mulungushi University School of
Natural and Applied Sciences
Kabwe, Zambia

Halle M. Butvin
Director of Special Projects, Center for Folklife and
Cultural Heritage, Smithsonian Institution
Washington, D.C., USA

Karen Jacqueline Cloete, PhD
Senior Scientist and Workshop lecturer,
University of South Africa
Pretoria, South Africa

Michelle Fouard
Mechanical Engineer
Affiliated Engineers, Inc.
Seattle, Washington, USA

Bjoern Hagen, PhD
Assistant Teaching Professor, School of Sustainability
Senior Global Futures Scientist, Julie Ann Wrigley
Global Futures Laboratory
Honors Faculty, Barrett Honors College,
Arizona State University
Tempe, Arizona, USA



Lynndy Hedgcoth
Mechanical Engineer, Affiliated Engineers, Inc.
Seattle, Washington, USA

Neda Mizani
Piping Engineer, Affiliated Engineers, Inc.
Seattle, Washington, USA

Jennifer Vanos, PhD
Associate Professor, School of Sustainability,
College of Global Futures, Arizona State University
Tempe, Arizona, USA

Arielle Wright
Education and Community Engagement Manager
Urban Harvest STL
St. Louis, Missouri, USA

Field Test Sites

Marjorie Huriez
Lycee Du Val De Lys
Estaires, France

Wendy Maitland
Wakefield High School
Arlington, Virginia, USA

Carl Joel Tilos
St. Paul University Dumaguete
Dumaguete City, Philippines





SCIENCE
for Global Goals

Parents, Caregivers, and Educators
Action Plans can be shared with us by using hashtag #SSfGG!

Twitter

@SmithsonianScie

Facebook

@SmithsonianScienceEducationCenter

Instagram

@SmithsonianScie

ScienceEducation.si.edu

Smithsonian Science for Global Goals (SSfGG) is a freely available curriculum developed by the Smithsonian Science Education Center in collaboration with the InterAcademy Partnership. It uses the United Nations Sustainable Development Goals (SDGs) as a framework to focus on sustainable actions that are student-defined and implemented.

Attempting to empower the next generation of decision-makers capable of making the right choices about the complex socio-scientific issues facing human society, SSfGG blends together previous practices in Inquiry-Based Science Education, Social Studies Education, Global Citizenship Education, Social Emotional Learning, and Education for Sustainable Development.

developed by



Smithsonian
Science Education Center

in collaboration with

iap SCIENCE
HEALTH
POLICY
the interacademy partnership

