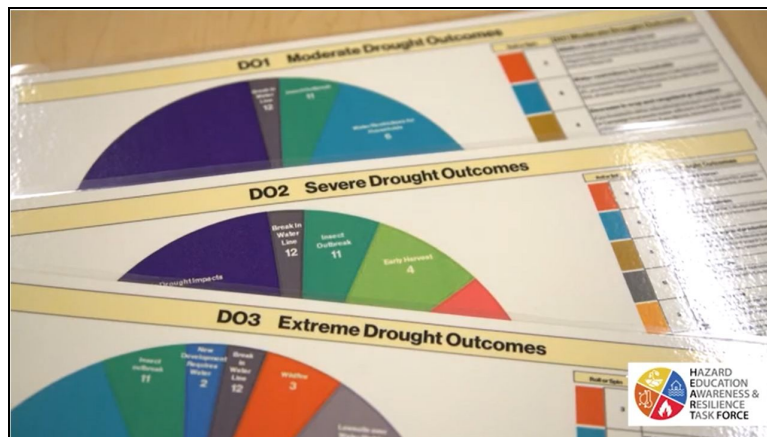




## Role-Playing Game to Build Community Drought Resilience

### Setting the Stage

It's late summer in our community and the weather has been hot and dry for a while. River levels are low and both farmers and homeowners would like some rain. These are moderate drought conditions, but without rain they will get worse. In this role-playing game, students explore their role as community members and develop a plan of how to work together to prepare for and respond to a drought event. The community members need to assess the costs and benefits of different resilience measures and keep their community from entering Critical Drought conditions.



Materials for HEART Force Drought Game

### Game Overview

Students must invest wisely in resilience measures that will maximize the community's ability to bounce back from drought. Students work in three "resilience teams" to determine the strategies that they will invest in as a community. Students take on the role of community stakeholders and consider the effects of climate on different sectors of their community.

Watch the [How to Play the HEART Force Drought Game Video](#) to learn how to play the game.

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Instructional Overview	
<b>Grade Level</b>	Middle and High School
<b>Instructional Time</b>	40-60 minutes
<b>Unit Driving Question</b>	How can we make our community more resilient to drought?
<b>Lesson Driving Question</b>	What community resources can we invest in to make our community more resilient to drought?
<b>Building Toward</b>	NGSS: <a href="#">MS-ESS3-2</a> , <a href="#">HS-ESS3-1</a> CDE: <a href="#">MS3.ESS.GLE9</a> , <a href="#">HS3.ESS.GLE10</a>
<b>Three Dimensions</b>	<p><b>Science and Engineering Practices:</b></p> <ul style="list-style-type: none"> <li>● Constructing Explanations and Designing Solutions</li> <li>● Obtaining, Evaluating, and Communicating Information</li> </ul> <p><b>Disciplinary Core Ideas:</b></p> <ul style="list-style-type: none"> <li>● ESS3.B: Natural Hazards</li> </ul> <p><b>Crosscutting Concepts:</b></p> <ul style="list-style-type: none"> <li>● Systems and System Models</li> <li>● Cause and effect</li> </ul>
<b>What Students Will Do</b>	<ul style="list-style-type: none"> <li>● <b>Evaluate information</b> on <b>drought conditions</b> to appropriately use community resources to respond to a drought in their community by assessing the <b>causes and effects of extreme drought</b>.</li> <li>● <b>Design solutions</b> to address <b>drought risk</b> using a <b>system model of a community drought response effort</b>.</li> </ul>
<b>Materials</b>	<p>Materials can be ordered from the HEART Force program staff or printed from the <a href="#">HEART Force website</a>; in addition, you will need a 100 mL graduated cylinder for each team to use as a reservoir.</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Facilitator guide (included in this document)</li> <li><input type="checkbox"/> <a href="#">Drought Game Board</a></li> <li><input type="checkbox"/> <a href="#">Drought Game Outcome Spinners</a> (or two dice)</li> <li><input type="checkbox"/> <a href="#">Drought Game Outcome Guide</a> (for facilitator)</li> </ul> <p>Each team will need (at least three teams needed to play):</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> <a href="#">Drought Game Role Nametag</a> and matching <a href="#">Drought Game Role Card</a> for each player</li> <li><input type="checkbox"/> A reservoir (see description of set-up below) with pipettes to remove water in 5 mL increments</li> <li><input type="checkbox"/> A <a href="#">Drought Game Resilience Strategy List</a></li> <li><input type="checkbox"/> Team token pieces - these can be coins or small dot stickers, they need to be different colors for each team and easily fit in the squares on the Drought game board (Facilitator, hold onto these until they are ready to be used)</li> <li><input type="checkbox"/> Optional: <a href="#">Drought Game Slides</a> that show the Drought Level</li> </ul>



<p><b>Material Preparation</b></p>	<p>Preparing reservoirs: A “reservoir” is a graduated cylinder with a <a href="#">Drought Game Reservoir Level Marker</a> printed out and taped to it (see images below). A 100 mL cylinder is recommended, but any size cylinder can be used and the label edited to fit.</p> <ul style="list-style-type: none"><li>❑ Print and attach the reservoir marker so that the top of the “Reservoir Full” section is aligned with the uppermost marks on the cylinder, which will make it easier to measure out 5 mL of water.</li><li>❑ Do a test run with your reservoirs to ensure that students can still reach the water when it reaches “Reservoir Below Critical Level.”</li><li>❑ Reservoir levels are designed to be at approximately 10 mL intervals, but depending on the size of your cylinders, you may want to adjust the size of the labels larger or smaller.</li><li>❑ If you have opaque cylinders, use the label template with the text next to the colored boxes and attach the labels so that they stick out from the cylinder (see images below).</li></ul> <div data-bbox="605 800 899 1419"></div> <p style="text-align: center;"><b>CORRECT</b></p> <p>(bold lines line up with 10 mL lines; pipette reaches below “critical level”)</p> <div data-bbox="1060 800 1295 1419"></div> <p style="text-align: center;"><b>INCORRECT</b></p> <p>(bold lines don't line up with 10 mL; pipette doesn't reach “critical level”)</p>
<p><b>Team Preparation</b></p>	<ul style="list-style-type: none"><li>❑ Divide students into three teams and assign stakeholder roles to team members (or let students choose roles).</li><li>❑ Hand out materials to each team, with the exception of tokens which will be handed out after stakeholders are introduced and investments made.</li><li>❑ <b>Optional:</b> Project the “<a href="#">Drought Game Slides</a>” presentation, so that it's showing “Drought Level 01 Moderate Drought.”</li></ul>
<p><b>Vocabulary</b></p>	<p><u>Drought</u> is a prolonged drier-than-normal period in a natural climate cycle that results in water-related problems.</p>



	<p><u>Precipitation</u> is any type of water that forms in the Earth's atmosphere and then drops onto the surface of the Earth (e.g., rain, snow, sleet, or hail).</p>
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## Scoring

Each team will invest in different strategies to protect their community against specific drought outcomes. In each round of the game, different drought outcomes will manifest (through the spinner or dice) and test whether each team's investments will mitigate the consequences. Teams that have not made the needed investments will have to take water out of their reservoir, until their reservoir reaches critical levels. Teams whose reservoirs reach "Below Critical Level" can answer trivia questions to have water added back into their reservoir, getting them back into the game. Play can end after any round; the team with the most water in their reservoir at the end of play wins.

## Facilitator Script

The facilitator script is shown in [blue](#), to be read aloud or paraphrased.

### Introduction to the game (5 minutes)

**Facilitator:** [Good afternoon, members of the \[Insert name of your town\] community! Thank you for joining us to play a game in which we are going to work together to protect our community from the effects of drought. Our goal is to learn how to invest our money wisely to help us rebound from a severe drought.](#)

### Assigning teams:

Have students count down numbers from 1-3 and repeat. All students assigned "1" will be Team A players, all students assigned "2" will be Team B players, etc. Hand each student a stakeholder nametag and role card.

**Facilitator:** [The game is played in "resilience teams," each made up of different community stakeholders. Each member of your team will represent the perspective of a different stakeholder. Put on your stakeholder name tag and read through the stakeholder role card. It is the job of each stakeholder to advocate for their priorities and to look for other stakeholders with whom they share goals and values so that they can work together to protect their interests.](#)



### **Introducing Stakeholders:**

Have students in each team introduce themselves as the stakeholder persona to the other stakeholders in their team and tell the other members of the team about themselves using the information on the role card. Encourage them to paraphrase the information in their own words and think about what kinds of measures their stakeholder might want to invest in. All team members should listen carefully to the introductions of the other stakeholders so they can think about whom they might work with to protect their shared interests.

The job of each resilience team is to make investments in their community that will help them be resilient when a drought occurs. It is up to each team to decide how to invest their limited resources to get the maximum protection for their community.

The game has multiple rounds and in each round, the spinner is used to find out which drought-related outcomes occur in your community. Depending on how each team has invested their funds, they will be better defended against some outcomes than others. When a team hasn't invested in the resilience measures that would protect against a particular drought outcome, they will have to take water out of their reservoir, which decreases their reserves and brings them closer to their reservoir's critical level. Teams that reach critical levels in their reservoir can opt to answer trivia questions to gain additional water and re-enter the game.

### **Optional Introduction Round (5 min)**

Pass out the [drought game resilience strategy list](#) to each resilience team. Ask each resilience team to pick four of the resilience strategies (regardless of cost) and put markers on the board to indicate their choices.

Spin the spinner and read the indicated drought outcome. If groups have not invested in the necessary precautions to mitigate the indicated outcome, have them take out the appropriate quantity of water from their reservoir. After demonstrating how the game works, have them pour the water back into their reservoir.

Play one or two rounds and then ask teams if there is anything they would have done differently in choosing their resilience strategies now that they have played a round.

### **Start play (10 minutes)**

Pass out the [drought game resilience strategy list](#) to each resilience team.



**Facilitator:** Each resilience team will need to decide which resources you want to invest in. Each team has 300 million credits to invest. You don't have to invest all 300 million, but you cannot invest more than 300 million.

Each stakeholder should consider which measures are most important to them and work with other stakeholders to convince the rest of their team to invest in those measures.

Once all resilience teams have invested their funds and recorded their choices on their drought resilience handouts, they may place one of their teams tokens on the game board on each measure they have invested in.

### **Start of Drought Outcomes Rounds** *(25-45 minutes)*

**Facilitator:** It's late summer in our community and the weather has been hot and dry for a while. River levels are low and both farmers and homeowners would like some rain. These are moderate drought conditions, but without rain they will get worse. Let's see how well your investments are going to protect our community.

Facilitator, or designated student, spins the spinner and uses the [Drought Outcome Guide](#) to determine which outcomes occur in the community.

**Facilitator:** With every spin, a new drought outcome impacts your community and, depending on the resilience measures that each team has invested in, some or all teams will have to remove water from their reservoirs.

### **To increase the Drought Level**

There are three Drought Levels in the game: moderate, severe, and extreme.

Start the game at Drought Level D01, Moderate Drought. If you are using the optional Powerpoint slides, make sure that the presentation is set to the first slide. It can be helpful to read the slide text to help players become familiar with the effects of moderate drought. Use the spinner or Drought Outcome Guide that matches D01.

It is up to the facilitator to decide when to increase the Drought Level. It is recommended that, depending on time, the Drought Level increases every two or three rounds. Do so by advancing the Powerpoint presentation and using the corresponding spinner or Drought Outcome Guide that matches the current drought level.

Rounds continue as resilience teams' reservoirs keep getting pushed closer to their critical limits. Once a team's reservoir falls below critical levels, they must answer a trivia question



(pages 9-11) correctly to get additional water added to their reservoir. Note that as the Drought Level increases, the water penalty for some consequences increases.

## Ending the Game

Play can end after any round; the team with the most water in their reservoir at the end of play wins.

## End of the Game Reflection Questions

**Facilitator:** Rain storms are now predicted for the next few days and the drought conditions are expected to end. Congratulations to your community for pulling together and working to protect your town!

Facilitator may choose from the following discussion questions as time and interest allow. Questions can also be divided between teams or individuals in a think-pair-share format.

- Before you played the game, you tried to anticipate which resilience measures would best protect your community from drought. Which were the easiest for your team to agree on? Are there measures you didn't invest in that you would invest in if you could play again?
- How well did the members of your team work together? Were there stakeholders who were able to work together to advocate for the resilience measures they wanted?
- How does having played this game change what you think about drought resilience in your community?
- What elements of the game felt like something that could happen in real life? What elements didn't feel very realistic? What can we learn about becoming more resilient from a game like this?
- Thinking about your community, are there measures that you would propose to members of your local government that would increase your drought resilience?

## Stakeholder Roles

There are 26 different stakeholders that players can be assigned (or chosen), if you have less than 26 players, you can omit stakeholders with higher numbers. If you have more than 26 players, you can double-up on the stakeholders with lower numbers. Additionally, blank name tags are included if players would like to include stakeholders not already represented.

Role	Category	Number
Cattle Rancher	Ranch/Agriculture	1



Emergency Manager	Government/Emergency Response	2
Teacher	Community	3
Healthcare Case Manager	Healthcare	4
Wildlife Manager	Wildlife/Outdoors	5
Gas Pipeline Technician	Energy	6
Regional Farm Manager	Ranch/Agriculture	7
Feed Store Owner	Ranch/Agriculture	8
Water Commissioner	Government/Emergency Response	9
Homeowner (historic)	Community	10
Healthcare Professional	Healthcare	11
Outdoor Adventure Company Owner	Wildlife/Outdoors	12
Large Animal Vet	Ranch/Agriculture	13
Organic Farmer	Ranch/Agriculture	14
Firefighter	Government/Emergency Response	15
Homeowner (new)	Community	16
Conservation Biologist	Wildlife/Outdoors	17
Air Quality Specialist	Government/Emergency Response	18
High School Student	Community	19
Solar Panel Installer	Energy	20
Extension Agent	Ranch/Agriculture	21
Technology Professional	Community	22
Hardware Store Owner	Community	23
Landscape Professional	Wildlife/Outdoors	24





Mayor	Government/Emergency Response	25
Small Farmer	Ranch/Agriculture	26

### Trivia Challenges

Teams whose reservoir has fallen below critical levels can choose to answer one of these questions to gain 10 mL of water to get back into the game.

Question	Answer
What is a natural hazard?	Natural hazards are naturally occurring phenomena such as drought, wildfire, extreme heat, or drought, which may disrupt or damage a community.
What is drought?	Drought is a prolonged drier-than-normal period in a natural climate cycle that results in water-related problems.
What does GIS stand for? What does it do?	GIS is an abbreviation for Geographic Information System, which is a computer-based process that gathers, manages, analyzes, and visualizes spatial data.
What is precipitation?	Precipitation is any type of water that forms in the Earth's atmosphere and then drops onto the surface of the Earth (e.g., rain, snow, sleet, or hail).
What does SWE stand for? What does it signify?	Snow Water Equivalent (SWE) is the amount of water contained in the snowpack at a location (if the entire snowpack were to melt).
What does the term "water year" refer to?	Water Year is a 12-month period that runs from October 1 through September 30 each year.



<p>Approximately how much precipitation does Colorado receive annually on average?</p> <ul style="list-style-type: none"><li>a. 10 inches</li><li>b. 17 inches</li><li>c. 23 inches</li></ul>	<p>b. Annual precipitation in Colorado averages only 17 inches statewide, with much of the state receiving only 12–16 inches annually.</p>
<p>When drought occurs, approximately how much less precipitation than average does Colorado receive?</p> <ul style="list-style-type: none"><li>a. 10% less than average</li><li>b. 15% less than average</li><li>c. 20–50% less than average</li></ul>	<p>c. In drought years, precipitation is typically only 50% to 80% of average (20% to 50% less than normal).</p>
<p>How can people in Colorado help during a drought?</p> <ul style="list-style-type: none"><li>a. Reduce personal water use</li><li>b. Talk to family members about their water use</li><li>c. Track precipitation in your backyard with a rain gauge</li><li>d. All of the above</li></ul>	<p>d. There are multiple ways for people to help during a drought, and these are just a few of those ways.</p>
<p>What is evapotranspiration?</p>	<p>Evapotranspiration (ET) is the “invisible” part of the water cycle, but it is incredibly important. It is the water evaporated from the ground back to the atmosphere—both as transpiration from the leaves of plants and also as direct evaporation from open water and soil.</p>



<p>What are two factors or indicators that can help to identify drought conditions? (for example: precipitation levels)</p>	<p>Possible answers include:</p> <ul style="list-style-type: none"><li>● Streamflow amount</li><li>● Temperature</li><li>● Reservoir levels</li><li>● Soil moisture levels</li></ul>
<p>What are two steps that homeowners can take to reduce the amount of water that they use on their landscaping?</p>	<p>Possible answers include:</p> <ul style="list-style-type: none"><li>● Get a check-up for your sprinkler system to check for leaks</li><li>● Use more native or xeric (dry-tolerant) plants</li><li>● Use mulch or compost in and on soil</li><li>● Let lawns go brown during drought conditions</li></ul>
<p>Approximately how much water does a typical household need each year?</p> <ol style="list-style-type: none"><li>50,000 gallons</li><li>100,000 gallons</li><li>150,000 gallons</li></ol>	<p>c. Water supply planners estimate that a typical household needs approximately 150,000 gallons to satisfy the demands of a home and landscape.</p>
<p>How much of a Colorado home's annual water use is typically spent on landscaping?</p> <ol style="list-style-type: none"><li>20%</li><li>40%</li><li>55%</li></ol>	<p>c. Outdoor water use accounts for about 55% of the residential water use in the Front Range urban area, most of which is used on turf.</p>

Many of these questions are drawn from Colorado State University Extension program at <https://drought.extension.colostate.edu>.

Find more HEART Force Curriculum here:  
<https://cires.colorado.edu/outreach/projects/HEARTForce>