



Droughts: Causes and Types

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Standards

Arizona

- **8.E1U3.7** - Obtain, evaluate, and communicate information about data and historical patterns to predict natural hazards and other geological events.
- **6.L2U1.14** - Construct a model that shows the cycling of matter and flow of energy in ecosystems.
- **7.E1U1.5** - Construct a model that shows the cycling of matter and flow of energy in the atmosphere, hydrosphere, and geosphere.

NGSS

- **MS-ESS3-2** – Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
- **MS-LS2-3** - Ecosystems - Develop a model describing cycling of matter & flow of energy among living & nonliving parts of an ecosystem.
- **MS-ESS2-4** - Earth Systems - Develop a model describing the cycling of water through Earth's system driven by energy from the sun & force of gravity.

Overview

This multi-day lesson introduces students to the science of droughts and the types and causes of droughts. Students will create their own drought model.

Grade Level: 6–8

Goals

Students will analyze data to recognize drought conditions and participate in group discussions on the causes of droughts. Students will create an informative illustrative model presentation that identifies the different types of droughts and identifies the types of drought conditions that exist in their local area using science vocabulary, claims, evidence and reasoning.

Learning Objectives

1. Students will create a definition of drought through research and discussion.
2. Students will engage in qualitative observation and documentation using objective descriptive words that explain how drought can affect soil.
3. Students will recognize that some types of drought can be climate, and/or weather events.
4. Students will identify environmental and geologic visual evidence of changes in water levels of surface water resources over time.
5. Students will create an illustrative model that explains how a specific type of drought occurs and the resulting water changes.

Vocabulary

Heat (noun): Added energy that causes substances to rise in temperature, fuse, evaporate, expand, or undergo any of various other related changes.

Erosion (noun): Removal of surface material from Earth's crust, primarily soil and rock debris, and the movement of the eroded materials by natural processes (such as water or wind).

Drought (noun): a deficiency of precipitation over an extended period of time (usually a season or more), resulting in a water shortage.

Droughts

Materials

- Science notebooks/notetaking supplies for each student
- Index Cards (3 X 5 lined)
- Blank white copy paper or poster board for student models
- Colored pencils/crayons
- Drought Research Activity Worksheet (1 per student)
- Before and After Photo Analysis Activity Worksheet (1 per group)
- Post-it notes (3 per student)
- Markers
- Erasers
- Pencils

Vocabulary (*continued*)

Meteorological drought (noun): Occurs when dry weather patterns dominate an area leading to below-normal precipitation.

Agricultural drought (noun): Characterized by lack of enough moisture in the soil layers to support crop and plant growth.

Hydrological drought (noun): Occurs when low water supply exists in streams, reservoirs, and groundwater levels, usually after many months of meteorological drought.

Socioeconomic drought (noun): Occurs when the demand for goods or services exceeds the supply due a deficit in water supply.

Evaporation (noun): Process by which liquid water becomes water vapor.

Weathering (noun): Process of breaking down or dissolving of rocks and minerals on Earth's surface. Once a rock has been broken down, a process called erosion transports the bits of rock and minerals away. Water, acids, salt, plants, animals, and changes in temperature are all agents of weathering and erosion.

Water Cycle (noun): Movement of water between atmosphere, land, and ocean.

Precipitation (noun): Precipitation is any liquid or frozen water that forms in the atmosphere and falls to the Earth. It is one of the three main steps of the global water cycle.

Set Up

In Person Learning: Students will need access to internet connected laptops or tablets. Some activities require small group interactions. Art supplies: Paper or poster board and markers, colored pencils, pencils and erasers will be needed for each student group. Teacher should print one copy of the Before & After Photo Analysis Activity Worksheet pages (worksheet printout (1 per student); and 6 waterbody images (A,B,C,D,E,F) for each student group). These waterbody images should be printed in color with one set given to each table or student team. PowerPoint projection is needed.

Online/Remote Learning: Suggestions are provided for adapting this lesson to online/remote learning within each of the lesson steps. Breakout rooms or collaborative google docs can be used for the activities that involve group work and brainstorming. The PowerPoint presentation, Drought Research Activity Worksheet, and the Before and After Photo Analysis Worksheet (river comparison photos) should be uploaded to google classroom or a google photo for students to access. These can be placed into separate documents for each photo pairing and for distribution to student groups. If you need more information on Google breakout rooms, go to: *How To Create Breakout Rooms for Google Meet, Classroom and Google docs*:

<https://www.youtube.com/watch?v=tk8Gm1phoCw&feature=youtu.be&app=desktop>

Droughts

Lesson Procedure

Follow the PowerPoint as a guide to the lesson.

Activity 1: Drought “Brainstorm” Activity (5 minutes)

(Slide 2)

Step 1 - Prompt: Conduct a class brainstorm using the following question: **What do we know about droughts?** After students discuss this question, they will have 1 minute to write down any thoughts that they have about droughts. To help students get started ask the following questions:

- What is a drought?
- Why are droughts and drought conditions significant for desert communities?

Step 2(Slide 2) – Record: Students will share their ideas. The teacher will fill in the web (slide 2) as students share. After the teacher creates the idea web on the board, ask students to write down any ideas that are different or missing from their own in their notes.

For in class presentation: Students will be working in groups (up to 4 students), or by table. The teacher will distribute one note card per group. Working in teams, students will have 2 minutes to create one or more definitions of drought and write them on the card. The teacher will pass by several times checking the students’ work, encouraging them and answering any questions they have. Once the time is up, one person from each team will present the definition they created to the whole class.

For online/remote presentation: For online/remote version, breakout-rooms can be used or alternatively, a group google doc can be used. Students (in breakout room teams or individually) will have 2 minutes to work on the definition of “drought” and write it down. Once the time is up, they will present their definition.

Step 3- Define: The teacher will group similar definitions on the board and facilitate a discussion. As a class, they will create one or two master definition(s) of drought and students will write the final definition(s) in their notebook.

Possible discussion questions the teacher can pose to generate idea flow:

- What is missing from our definitions?
- What should we add to our definitions?
- Which of our definitions seems to make the most sense given what we know?
- How would a drought affect our water supply if it is groundwater (not surface water)?

A sample definition for the teacher/students:

Drought is a continuous period of dry weather during which an area gets less than its normal amount of precipitation over months or even years. Drought affects the health of the ecosystem, as crops and other plants need water to grow, and animals need it to live.

Activity 2: Drought Research Activity (25 Minutes)

(Slides 3 & 4)

Droughts

Lesson Procedure (*continued*)

Step 1 (Slide 3) - Read and Respond: Teacher will direct students to www.drought.gov and have students use the observation template.

Students will fill in the ***Drought Research Activity Worksheet***

Note: Teacher should encourage students to take notes by asking the following questions before starting the research:

- Are all droughts the same?
- What causes droughts?
- How can droughts affect us here in the southwest? In our local region?
- What evidence would we look for to suggest a drought is occurring?

Step 2a (Slide 3) - Discussion: After the research, the teacher will facilitate a discussion concerning the slide. (Total time: 10-15 minutes)

Discussion Prompts/Questions:

- What are some different types of droughts?
- How are droughts created?
- What kind of droughts do you think can happen in our region?

Step 2b (Slide 4) – The teacher will ask students to create a definition of the 4 types of droughts that were presented in the slide. Students will add the information to the previous card used.

Step 3 (Slide 5) – Reinforce and Review: Drought Matching Game: Teachers can use this game to support comprehension, vocabulary, and spelling.

Activity 3: Photo Analysis Before and After (20 minutes)

(Slides 6-10)

About the Materials: Slide 6 is an example of a Before and After photo of a location affected by drought. This can be used as an example to students of how to identify evidence and pose hypotheses related to the causes and effects of water changes. In slide 6, the teacher can point out the existence of trees on the banks of the river as evidence for a very slow change over many years.

Step 1 - Photo Analysis Before and After Activity: Students work in groups of 4. (For remote learning this can be facilitated using breakout rooms or collaborative google docs shared by the group members.) Teacher will facilitate a discussion of the possible causes for drought conditions that students observe in the photos.

Facilitation: Teacher will provide each group a before and after photo pair (The documents are labeled ***Before and After Photo Analysis Activity Worksheet***).

Each group will be assigned a river photo set to analyze. The teacher will ask groups to analyze their before and after photos using the following instructions and questions:

- Analyze the two photos showing the impacts of drought on rivers over time and look for similarities and differences.
- What changes do you see that could impact plants, animals, and human communities?

Lesson Procedure (*continued*)

- Hypothesize what could have caused the changes in the river or lake.

For online facilitation: In order to carry out this activity, the teacher will use breakout rooms or google doc and provide each group a different river image (A, B, C, D, E or F) from **Folder: Before and After Photo Analysis Activity A_F**.

Step 2 (Slide 10) - Record: Student groups will record their findings on a shared/group document-- **Before and After Photo Analysis Activity Worksheet**

Activity 4: Drought Imagery Model Challenge (25 minutes)

(Slides 11-12)

Step 1 (Slide 11) - Explain: Students will work individually and create a detailed and labeled illustrative model that explains a type of drought, how it is created, how it affects the landscape, how it affects the community, and includes the definition of drought. Use slide 12 as an example of a drought model.

For in class instruction: Teacher will provide each student a sheet of white paper, crayons/markers and pencils. Follow the instructions on **slide 11**.

Students' model should include the following:

- Title (type of drought)
- Definition of drought
- How this type of drought is created
- How it affects the local landscape (one or more features)
- How it affects the local community
- Detailed and colorful pictures
- Inclusion of scientific vocabulary
- Name / date / class period on the back

Note: As students work on their model, the teacher should pass by several times checking their work, encouraging them and answering any questions they have.

For online instruction: Students will create the model using the same materials at home or using a digital app, such as PowerPoint. They can upload/submit their digitally created model or take a picture of their model and upload to a predesignated folder or email it to the teacher. Once this step is completed, all students will review the other models and can add their own comments to other groups' slide.

Lesson Procedure (*continued*)

Step 2 (Slide 12): Gallery 'Walk'

For in class presentation: Students' models will be taped to the walls of the room. Teacher will provide each student with 3 post-it notes. Students will have 10 minutes to walk around the classroom and observe the models.

Students should:

- Choose the most informative models they observe
- Write 2 things they liked the most about the model on the post-it.
- Write 2 questions they have about the information on the model.
- Initial and post their note onto the models.

Step 3 - Reflection: In their science notebooks, students will respond to the following questions:

- What did you learn from this activity?
- Why is this an important topic for your own community/region?
- What two things about droughts would like to know more about?

Step 4 - Share: To close the activity the teacher can facilitate a discussion by asking for volunteers to share their reflections and ideas (5 minutes).

Step 5 (Slide 13) - Family Poll: This activity will help students identify current problems and impacts associated with droughts in their communities. Students can conduct a short survey of family members or friends about whether droughts are happening in their region.

- Students should ask a member of their family if they have ever experienced a drought? If so, what type of drought did they experience?
- Students should summarize family member responses

Step 6 - Report: Students write down their family members perspectives

Step 7 – Share: Teacher asks students to share their findings in a 3 minute-presentation

Further Exploration (Resources, links, topics, etc.)

[Definition of Drought](#)

[Types of Droughts](#)

[Drought.gov National Integrated Drought Information System](#)

Lesson Procedure (*continued*)

Author Biographies

Rodrigo Rosalez is a second-year graduate student in the Department of Chemical and Material Engineering (CHME) at New Mexico State University. He obtained his bachelor's degree at NMSU and is an SBAR Fellow. As a first-generation college student, he wants to continue his academic work to become a community college instructor or a university professor where he will be able to teach others what he learned and encourage students to continue their own education. As an SBAR Fellow, he is proud to work with Cathy Bradley in Lynn Middle School, Las Cruces, NM, to encourage and spread education related to our current situation as well as promoting SBAR in the process.

Cathy Bradley: has been teaching middle school science for 10 years with a passion and drive that inspires students to dig further. Ms. Bradley is licensed in both Special Education and Sciences (K-Adult) in the state of New Mexico. Prior to her educational career, Ms. Bradley was a Medical Technologist for over 20 years in medical laboratories performing medical testing using various analyzers and equipment. She brings in an understanding of skills needed to be successful in science careers and communications well as an understanding of gathering, analyzing, and using data to predict and modify for best results or performance.

Karina G. Martinez-Molina is an international second-year Ph. D graduate student in the Department of Arid Lands Resource Sciences at the University of Arizona. She obtained her Master's Degree at the University of Arizona and is an SBAR Fellow. She's been working as a Research Associate at the Udall Center for Studies in Public Policy focusing on green infrastructure, urban agriculture, renewable energy and society and transboundary wastewater management.