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USGS Logo: Text: science of a changing world.


California

# Lesson 1

## Vocabulary

When studying a new topic, it is more interesting when you know some of the key words used in that subject. Find the definitions of the following words.

* aquifers
* drought
* groundwater
* land subsidence
* runoff
* precipitation
* surface water

## Activity

Where does California get its water? With a partner, discuss the groundwater and surface water components that make up California’s water resources. Create a summary to share with your group.

Create an illustration of the different surface water sources. Include all sources in your drawing on this page.

## Activity

Students, you are a team of USGS scientists tasked with examining the information in the **U.S. Drought Monitor (related link)**. In this assignment, you will explore the datasets and understand how the information is used in the real world. Using the website, what would be the three most essential pieces of knowledge about California drought you want to share with others? Give a detailed explanation as to why you think this information in important and discuss with your group. As a group, decide on the top five facts you learned and why they are important for others to learn.

<https://droughtmonitor.unl.edu/Maps/ComparisonSlider.aspx>

# Lesson 2

## Vocabulary

When studying a new topic, it is more interesting when you know some of the key words used in that subject. Find the definitions of the following words.

* contaminants
* nitrates

Use the U.S. Drought Monitor website (<https://www.drought.gov/states/California>) to define the following terms:

* D0 – Abnormally Dry
* D1 – Moderate Drought
* D2 – Severe Drought
* D3 – Extreme Drought
* D4 – Exceptional Drought

## Activity

Using the **Drought for Kids** website, answer the following questions and prepare to share with your class. The best way for humans to improve the issues caused by drought is to understand them.

<https://drought.unl.edu/Education/DroughtforKids.aspx>

What causes a drought?

*Weather and climate*

What is weather?

*Water cycle*

What percentage of the Earth’s surface is covered by water?

List the locations where water is found:

Can new water be created?

Why do we call water a limited renewable resource?

How does water travel?

What percentage of Earth’s water is saltwater?

What percentage of Earth’s water is freshwater?

What percentage of Earth’s freshwater is frozen and unavailable to humans?

What other reasons make water a limited resource? These reasons can decrease both the quality and amount of water available to people, plants, and wildlife.

List the five facts from this excerpt that you think are most important to know.

*Causes of Drought*

"Drought has many causes. It can be caused by not receiving rain or snow over a period of time. In the discussions about the water cycle and weather, we learned that changes in the wind patterns that move clouds and moisture through the atmosphere could cause a place to not receive its normal amount of rain or snow over a long period.

If you live in a place where most of the water you use comes from a river, a drought in your area can be caused by places upstream from you not receiving enough moisture. There would be less water in the river for you and other people who live along the river to use.

People can also play a big role in drought. If we use too much water during times of normal rainfall, we might not have enough water when a drought happens."

<https://drought.unl.edu/Education/DroughtforKids.aspx>

List the five facts from this excerpt that you think are most important to know.

*Drought and Floods*

"Earlier we learned that droughts are normal parts of climate just like floods, hurricanes, and tornadoes. That might sound strange to you if you have seen pictures of what floods, tornadoes, and hurricanes can do to houses, trees, and the land. Droughts, floods, hurricanes, and tornadoes are what we call natural hazards.

We usually can't see drought coming. We can see water rising in a river, watch the wind pick up as a hurricane approaches, or see thunderclouds approaching. We also can turn on the television, radio, or internet to see storms on radar and find out what we should do to protect ourselves from storms. We don't have watches or warnings for drought like we do for other natural hazards such as tornadoes, floods, or hurricanes.

Drought doesn't have a clear beginning and end like tornadoes, hurricanes, or floods. It starts and ends slowly and often we don't see the effects of drought for weeks, months, or even years. This is why we often say that drought is a creeping natural hazard.

Drought can sneak up on us because we might enjoy being outside in the sunshine and not having rain interrupt our plans. We can have several weeks of enjoying the sunny weather before we notice that our lawns or plants start to look brown. We can even go for months before we notice that there isn't as much water in a nearby lake. It doesn't take weeks or months to notice the effects of floods, tornadoes, or hurricanes, does it?"

<https://drought.unl.edu/Education/DroughtforKids.aspx>

## Activity

Using the **Increased Pumping in California's Central Valley During Drought Worsens Groundwater Quality** website, complete the diagram below. The best way for humans to improve the issues caused by drought is to understand them. This diagram provides us with a visual of this complex problem.

<https://www.usgs.gov/news/state-news-release/increased-pumping-californias-central-valley-during-drought-worsens>

**Nitrate in groundwater pumping**

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| --- | --- |
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# Lesson 3

## Vocabulary

When studying a new topic, it is more interesting when you know some of the key words used in that subject. Find the definitions of the following words.

* aquaculture water use
* commercial water use
* domestic water use
* hydroelectric power water use
* industrial water use
* irrigation water use

## Activity

With a partner, you will have an opportunity to research, discuss, and prepare a slideshow to share with the rest of your classmates. The slideshow will focus on the information in the website **Water use varies dramatically across regions and between wet and dry years** <https://www.ppic.org/publication/water-use-in-california/>

Use the link to discuss and record what your classmates should learn about California’s water use and sources. Students, this is your chance to be the teacher! Create a slideshow that would inspire others to learn as much as you have learned.

You get to create a 10-slide slideshow to present this information and discover or practice with this tool. Each water source will have a slide.

Each slide must include the content listed below.

**Slide 1:**

* The title of your presentation
* By… (you and your partner’s name in alphabetical order)

**Slide 2:**

* Water source facts

**Slide 3:**

* Water source facts

**Slide 4:**

* Water source facts

**Slide 5:**

* Water source facts

**Slide 6:**

* Water source facts

**Slide 7:**

* Water source facts

**Slide 8:**

* Water source facts

**Slide 9:**

* Water source facts

**Slide 10:**

* Concluding statement and cite sources

## Activity

Technology is a powerful tool to understanding our world, educating yourself, and becoming a changemaker. With this assignment, you get to use research methods to purify water to solve drought issues faced across our nation! Your mission is to research and present a method humans can use to help solve the water needs created by drought. You can make a diagram, chart, or any other method to show your knowledge.

Students, this is your chance to choose how you learn. The goal is to discover the most interesting and plausible method to purify water. You want your classmates to learn from your work, so make it fun, engaging, and factual. You will use this sheet of paper to make a diagram of your purification apparatus.

## Activity

**Show what you know!** Using the different links in this lesson, you and your group members get to create a presentation that shows what you have learned. The information presented must be factual, relevant, interesting, and essential for other students to know. Being creative makes learning fun! Because of this, you and your group may use any format to present your knowledge to the rest of the class. Listed are a few possible methods. Your group presentation should be between five and ten minutes long and include the essential information covered in your research.

Possible methods include:

* Make an instructional video
* Create an interactive notebook
* Make a pamphlet or brochure
* Write a newspaper
* Perform a puppet show
* Hold a debate
* Hold a mock court case
* Create a game show
* Have a panel discussion of "experts."
* Compose a rap or other song
* Use Venn diagrams to compare
* other

# Lesson 4

## Vocabulary

When studying a new topic, it is more interesting when you know some of the key words used in that subject. Using the USGS Water Science School Desalination website, find the definitions of the following words.

[https://www.usgs.gov/special-topics/water-science-school/science/desalination desalination](https://www.usgs.gov/special-topics/water-science-school/science/desalination%20desalination)

* desalination
* distillation
* reverse osmosis
* saline

## Activity

What is the most interesting fact you learned about desalination in the video. **Is desalination the answer to California’s drought?**

<https://abc7news.com/california-drought-water-shortages-seawater-desalination-brackish/10900176/>

As a group, research one pro and one con regarding desalination. Be prepared to share with the class. You can use the **USGS Water Science School Desalination website** and the internet to search for answers.

[https://www.usgs.gov/special-topics/water-science-school/science/desalination desalination](https://www.usgs.gov/special-topics/water-science-school/science/desalination%20desalination)

Pro of desalination:

Con of desalination:

## Activity

Creating solutions to everyday problems begins with first understanding the topic at hand. The more you learn about a subject, the more avenues to finding solutions. Using the **Desalination Facts (Texas Water Development Board)** website, you and your team will complete the worksheet based on the general FAQs on this website.

What is desalination?

I often hear terms like brackish water, saline water, seawater, and brine about desalination. What is the difference between them? Define each term and then explain the difference.

How can water users not located on the coast benefit from desalinated seawater?

How are the impacts to the environment considered in the development of desalination projects?

How much does desalination cost?

What is the average unit cost of desalinated brackish groundwater? Seawater?

Does desalinating seawater hurt the marine life in the ocean?

What happens to the salt that is removed from the water?

How will desalinated seawater reach non-coastal areas for use?

How many desalination (brackish water and seawater) plants are there in the United States? Where are most of them located?

Are there desalination plants in other countries?

## Activity

Using the link, provide four observations that your group finds interesting below. You may use any approach that would best represent your knowledge (photos, drawings, comics, etc.). You will get to share with the class.

**Existing Seawater Desalination Facilities**

<https://www.waterboards.ca.gov/water_issues/programs/ocean/desalination/docs/170105_desal_map_existing.pdf>

Observation #1

Observation #2

Observation #3

Observation #4

## Activity

Water is vital to California's agriculture industry, people, and overall success. In this activity, you will try to create a solution for the drought issues faced in California. We have learned of the importance of water to California's success in business and life. With your team, research the topic of desalination to create fresh water and prepare a presentation to educate your community about the viability of using salt water to increase the amount of freshwater available.

**Where would it be best to install a desalination plant? Why?** Make a map, diagram, chart, or anything else that would make it easier for others to learn this information. Use this space for notes.

**Describe how humans can improve the issues created by drought.** Describe and produce a creative way of solving this problem. Share with the rest of your classmates.

## Activity

You have learned about some of the drought issues faced in California and how desalination can be used to make saltwater into freshwater. Your job is to research different methods to desalinate water and develop a sketch, model of the apparatus, and a presentation to teach your classmates how you would use desalination in California. You will be given the freedom to present your information and knowledge in any way you choose. Ensure that you cover all the essential parts of your water desalination method. Please make sure to have a group discussion about each group member's facts.

**Sketch your desalination apparatus:**

**Write down the steps taken to build the model of your apparatus:**