KANSAS CORN STEM

Kansas Corn: Wondering About Water

This breakout is made possible with the support and content contributions of the Kansas Corn Commission.

KANSAS CORN COMMISSION

kansascornstem.com

Kansas Corn: Wondering About Water
Grade Level: Middle School / High School

Overview
Water usage and conservation is an important issue. Only one percent of the total water supply on Earth is available for humans. Of that, 42 percent is used in agriculture. Not all freshwater resources are evenly distributed. In Kansas, water usage and water rights are very important topics. As a state, how do we balance the need for water in agriculture, manufacturing, and our daily lives?

Water is an important commodity in the American culture. The U.S. Department of Agriculture estimates that agriculture accounts for approximately 80 percent of the nation's water usage. In agriculture, water is used to grow fruits, vegetables and crops as well as raise livestock. Even further, water in agriculture is used for irrigation and the application of pesticides and fertilizers. In Kansas, 29 percent of corn acres are irrigated.

Kansas has a diverse climate from the east to west ends of the state. In many parts of the state, corn farms are rainfed, known as dryland or non-irrigated farms. These farmers normally receive enough rainfall to raise a crop. As you move toward the western part of the state, the climate is more arid, and more farmers supplement their crops through irrigation with the water sources coming mainly from underground aquifers. Farmers also can irrigate their crops from surface water sources, such as rivers and ponds. Many areas of the High Plains region, such as western Kansas, benefit from the Ogallala Aquifer, which provides a water source for irrigation. Yet, the aquifer is a limited resource, and farmers are working hard to extend its life by finding ways to use less water to produce their crops.

Next Generation Science Standards (NGSS)
Middle School Science

- **MS-LS2-1.** Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.MS-LS-1 From Molecules to Organisms: Structures and Processes
- **MS-ESS2-2.** Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
- **MS-ESS2-4.** Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.
- **MS-ESS3-1.** Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.
- **MS-ESS3-3.** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

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High School Science

- **HS-ESS2-5.** Plan and conduct an investigation of the properties of water and its effects on Earth's materials and surface processes.
- **HS-ESS3-1.** Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards and changes in climate have influenced human activity.
- **HS-ESS3-4.** Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
- **LS2-7.** Design, evaluate and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

Learning Objectives

- Students will be able to assess water risk.
- Students will be able to investigate the properties of water and its effect on Earth's materials and surface processes.
- Students will learn the proportion of fresh water available for human use.
- Students will understand processes of the water cycle.

Materials

- Instagram "Post" cards
- Instagram Profile Page
- Rice County Rainfall Sheet
- QR Code card
- Water Cycle mat
- Water Cycle Pieces
- Water Risk Map
- Invisible Ink Pen
- Water Quality Three-Digit worksheet
- Water Quality Number cards

Breakout Edu Tips

If this is your first time using a Breakout Edu box, you are in for a treat. Once you've done one breakout box your students will be ready for the next time.

- You can use breakout boxes as a whole class, in addition to small groups.
- You have the opportunity to give students hints. Every box comes with at least two hint cards. If you have a higher performing group, you may want to challenge them with fewer hints while a different hour may need more hints.

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- Having a visual timer for students while they are working is really helpful. It allows them to budget their time and when they may want to use their hints.
- As the teacher, you have the discretion to hide things wherever they best fit in your room. Feel free to adjust. Just make sure the clues for the locks don't change. Otherwise, students may not be able to get in.
- Do note when programming the locks, there is a starter ring that has mini teeth. This ring needs to come first.

Background
Water covers three-quarters of the Earth's surface. More than 97 percent of the earth's water is found in the oceans as salt water. Only three percent of Earth's water is fresh water. Of that, three percent, only a limited amount of usable fresh water is available for human use. About two percent of the Earth's fresh water is stored in glaciers, ice caps, and snowy mountain ranges. This leaves only one percent of the Earth's water for our water supply needs. Freshwater supplies are found in the atmosphere, beneath the ground, or on the surfaces of lakes, rivers, and streams.

We use fresh water for a variety of purposes. According to the U.S. Environmental Protection Agency, agriculture represents the largest consumer use of fresh water, about 42 percent. Approximately 39 percent of our fresh water is used for the production of electricity. About 11 percent of available fresh water is used in homes and businesses. The remaining eight percent is used in manufacturing and mining.

The total amount of water on the planet does not change. Water moves around on the planet and changes form, but we will never have any more water than we have right now. With our growing population and ever-increasing demand on our freshwater supply, it is more important than ever that we learn to conserve the limited freshwater supplies.

Breakout Activity
Game Name
Wondering About Water?

Game Designer
Kansas Corn Commission and Jessica Sadler

Content Areas
STEM, Agriculture, Corn, Water Quality and Conservation, Science

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Recommended Ages
K-Adult

Ideal Group Size
Can be used small group or whole class

Suggested Time
30-40 minutes

Story
Drip... drip... drip. Your faucet just woke you up. You consider getting up to turn it off. Yet, you decide that a small drip isn't going to do much. Later in the day, while sitting in class, your teacher announces a local farmer will be coming in as a guest speaker. As you listen to the farmer talk about all the ways they conserve water and test its qualities, you feel a little guilty about the dripping sink. You've decided to learn more about sustainable farming practices related to water and how water or lack of can seriously affect crops. If you're ready to test your water knowledge, let's begin.

Lock Combinations
The following codes will open the locks on the box.

3-Digit Lock -
9, 3, 2

4-Digit Lock -
3, 0, 8, 8

Letter Lock -
S, F, E, L, B

Shape Lock -
▲★➡●■

Key Lock -
Teacher

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Setup Instructions

Steps

1. To take the letter lock off the large box, students will need to collect five Instagram "post" cards. They will have a water management practice name, letter, and picture on them. These cards can be hidden, spread out amongst the room in sight, or left all together. You may want to vary it depending on your classes. Once students have found the five "post" cards, they will match them to the correct definition on the Instagram Profile Page. The orange numbers are clues for students on how to enter the letters into the lock.
2. Students will use the Rice County Rainfall Sheet to unlock the four-digit number lock and remove it from the large box. They will need some sort of device to access the website. Students can either type in the website or use the QR code to take them there. They will then need to locate Rice County on the map. They will also need to change the tab at the top to yearly. You may not want to tell all of your classes this hint, so they have to really look at the information to figure it out. Students will record the last five years of rainfall in the month of June for Rice County, Kansas. After recording all five measurements, students will divide by five to find the average, 30.88 inches. This will be the answer on the four-digit lock excluding the decimal.
3. Students will use the QR Code card to gain access to an animated video of the water cycle. By watching the video, students will begin placing the water cycle pieces in their correct position on the Water Cycle Mat. Once they have the steps in the correct place, they will be able to place the shapes into the correct order. This will allow students to remove the shape lock off of the large box. These pieces can be left with the mat or hidden to add an additional challenge.
4. To find the key, students will learn about the Ogallala Aquifer and its importance to Kansas and many other states. Using the Water Risk map, students will use the QR code to access a video based on farming in Kansas with the assistance of the aquifer. Students will watch the video. On the water risk map, use invisible ink pen to write information on where to find the key. The key lock can be placed on the large box for this breakout. If you would like to leave the small box out as a decoy or even put the key lock on it as a red herring, that's completely fine and will not mess up any part of the breakout.
5. The teacher will need to break students into three groups. You can split them whichever works best for your classroom. These groups are for solving one of the clues and do not need to have all students. Usually choosing students who don't have a job at the moment or struggle to work in large groups are great choices for this step. There needs to be three copies of the "Water Quality Three-Digit" worksheet. The three different groups will need to complete the sheet. Using the Water Quality Number Cards, the first group to complete the sheet will receive the first number of the three-digit lock, 9, from the teacher. The second group receives the second number, 3. The third group receives the third number, 2. Students will have roughly the same answers for number 2, but there should be some variance in the other three answers. Students can be sent back to rework anything that the teacher does not approve. The students will then need to figure out that they need to put their three cards in order to help their groups open the 3 digit lock on the large box.

6. Add some kind of reward in the large box. Candy is always popular. Another option is to have information about their next project which could be connected to what they learned from this Breakout Box activity.

   Fun certificates are provided to have a group photo taken after they finish the activity.

Reflection and Conclusion

At the completion of this breakout, your students should have a better understanding of water conservation, average rainfalls in Kansas by county, and the importance of the Ogallala Aquifer. Feel free to give students the following questions as an exit ticket or a knowledge check at the end of the breakout. If you have groups that do not breakout, it is always nice to go over the information and/or clues that would have led to the last locks coming off.

1. Name five practices farmers use to save water.
2. Why is water quality important?
3. Why would farmers improve their management practices to preserve water?
4. Water is moved around the Earth through what system?
5. Why is the Ogallala Aquifer important?
6. Is water a renewable or nonrenewable resource?

Extensions

Students can use this calculator to check how much water they use https://www.watercalculator.org/wfc2/q/household/

Any educator electing to perform demonstrations is expected to follow *NSTA Minimum Safety Practices and Regulations for Demonstrations, Experiments, and Workshops*, which are available at http://static.nsta.org/pdfs/MinimumSafetyPracticesAndRegulations.pdf, as well as all school policies and rules and all state and federal laws, regulations, codes and professional standards. Educators are under a duty of care to make laboratories and demonstrations in and out of the classroom as safe as possible. If in doubt, do not perform the demonstrations.

F

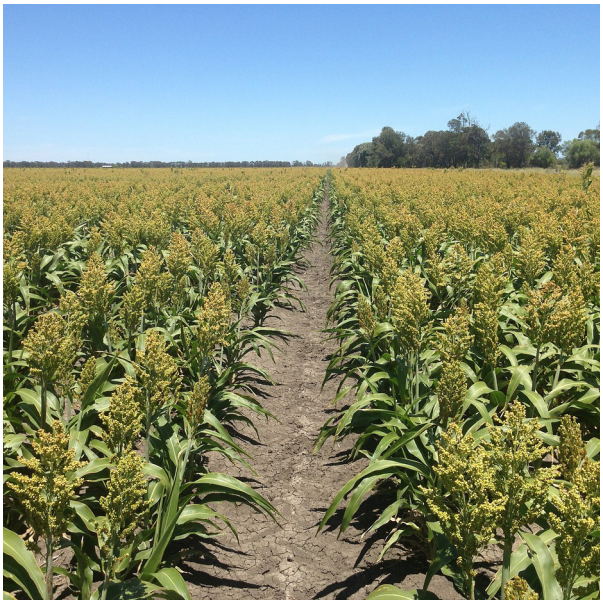
waterwonders
Water Wonders

213 views

waterwonders Irrigation Scheduling

B

waterwonders
Water Wonders



213 views

waterwonders Drought Tolerant Crops

S

waterwonders
Water Wonders

213 views

waterwonders Soil Management
Conservation Tillage

L

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Water Wonders

213 views

waterwonders Irrigation Segmentation

E

waterwonders
Water Wonders

213 views

waterwonders Cover Crops

9

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3

KANSAS CORN STEM

KANSAS CORN STEM

2

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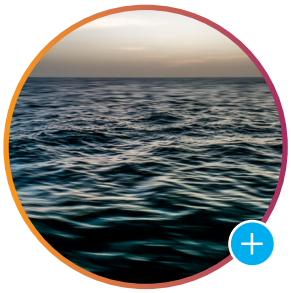

Water Wonders

427 posts

480 followers

325 following

Water Wonders

Describes the soil. Farmers can also use tilling practices that leave at least 30 percent of vegitative crops. 1	Farmers change when they water based on “current conditions.” 2	Planted as a way to protect soil that would go bare. 3
Some farmers divide their fields into parts for watering since not all parts need the same amount. 4	Seeds are genetically engineered to produce points that can live in drier conditions. 5	

Precipitation ▲

Evaporation ●

Surface Runoff ★

Ground Water ➡

Condensation ■

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Rice County Rainfall

Visit http://climate.k-state.edu/precip/county and select **Rice County**.

How much rain did Rice County get in the last 5 years during the month of **June**?
(Look at yearly and observed totals)

Year	Inches of Rain
2017	
2016	
2015	
2014	
2013	
Average: (total inches of rain / 5)	

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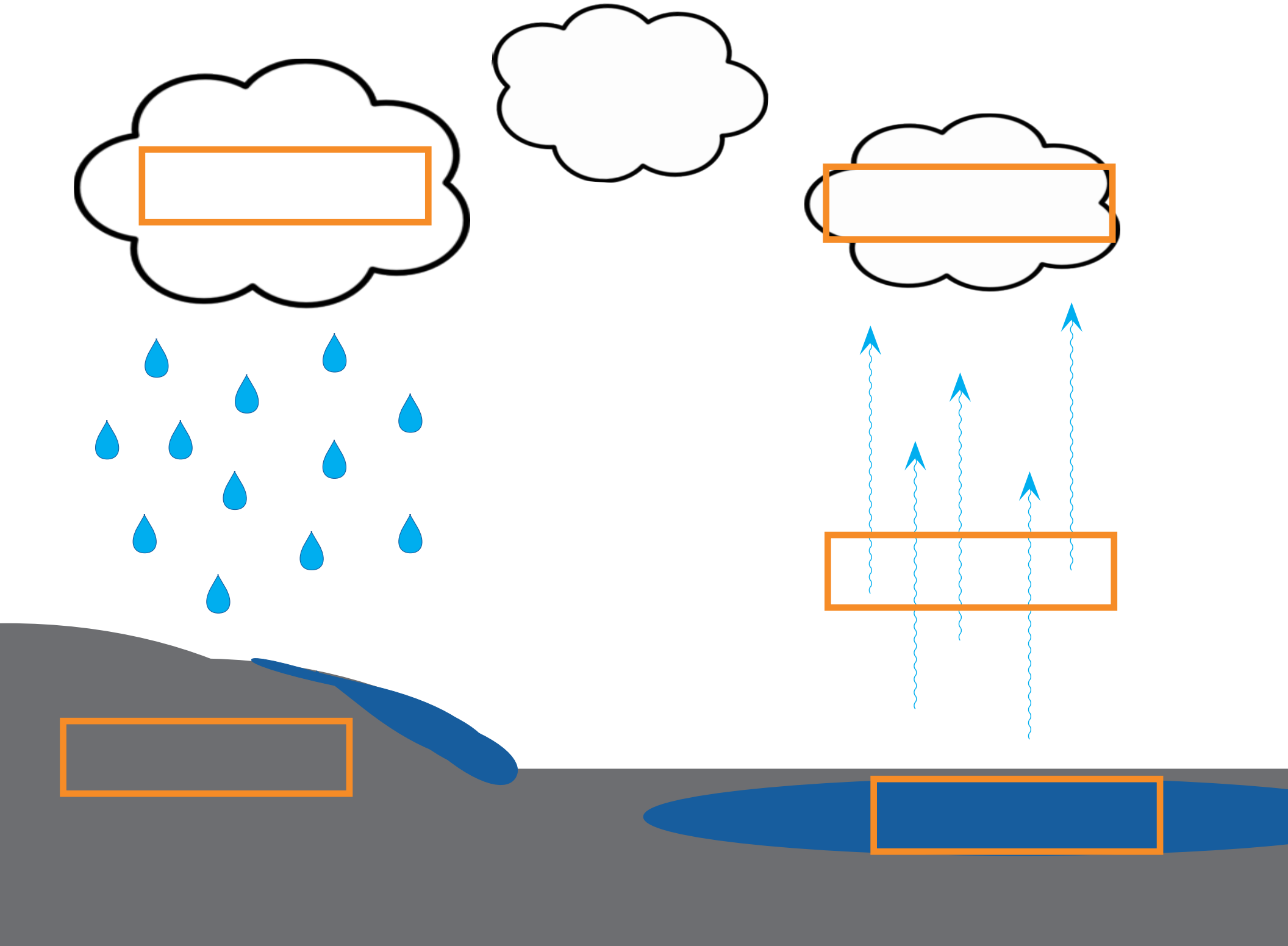
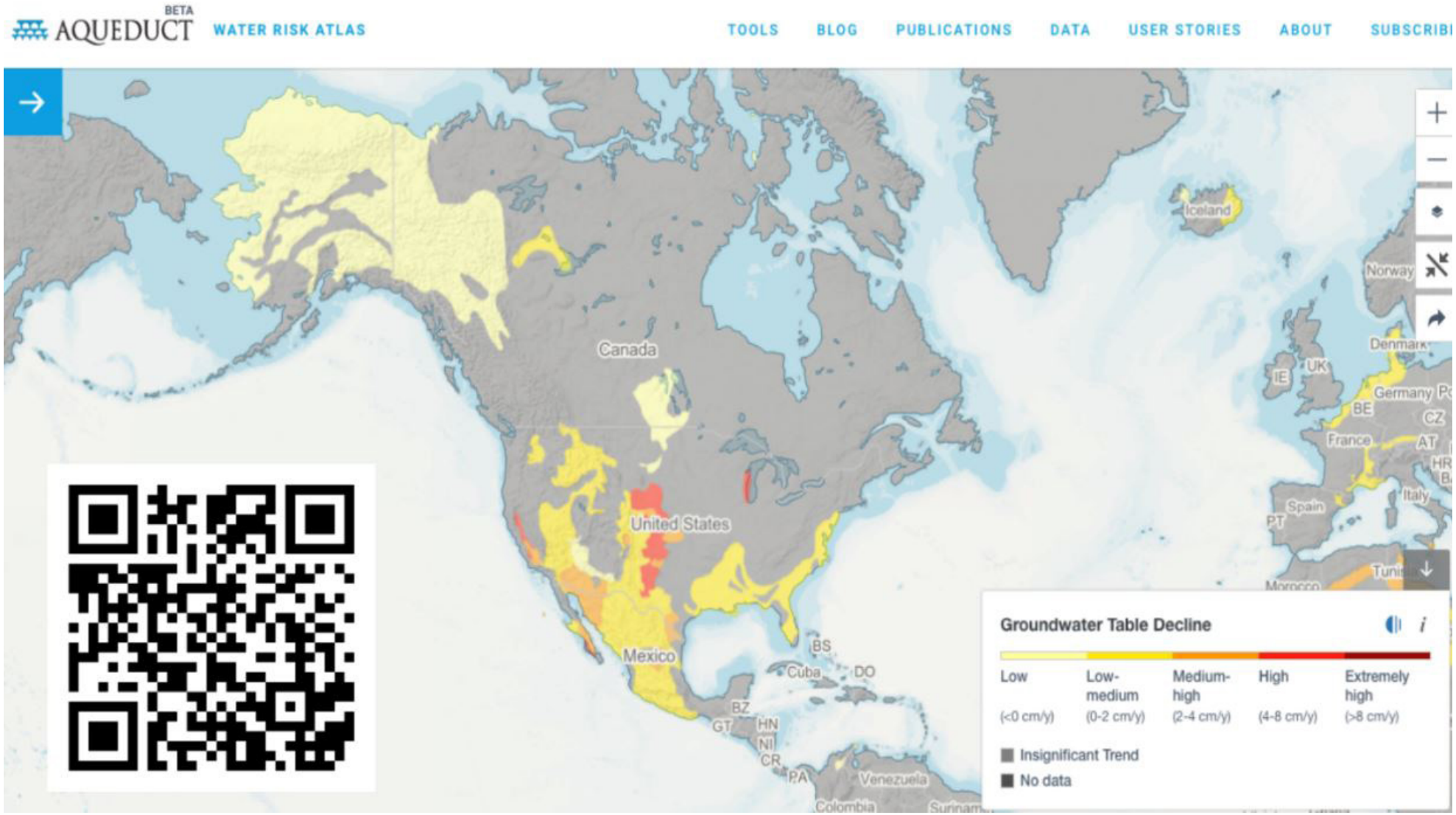
How much rain did Rice County get in the last 5 years during the month of **June**?
(Look at yearly and observed totals)

Year	Inches of Rain
2017	26.4
2016	33.1
2015	28.6
2014	27.1
2013	39.2
Average: (total inches of rain / 5)	30.88



Water Risk Map



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Water Quality

Water is used for a number of tasks such as irrigation, farming, swimming, food preparation and of course, drinking. It is not enough to just look at water and decide if it is okay for humans to drink. Even clear water can contain invisible contaminants. The testing of water can help find things in the water like bacteria, nutrients, pesticides, and oxygen. Once the quality of a water source is known, it can then be decided how it should be used.

Scientists analyze water samples by observing its color, cloudiness (turbidity) and odor. They can also test for Ph (acidity) and saltiness (salinity). By using a microscope people may also see small animals like mosquitos, wrigglers, and algae. Things like chemical, bacteria, and animal waste can be difficult to detect without further testing.

1. If water looks clear, it is probably clean and safe for drinking. Do you agree or disagree? Explain your answer.

2. What do scientists analyze when testing water samples?

3. Why is a microscope important when testing water quality?

4. IF water is unfit for drinking, can we still use it? What other purposes could we use it for?

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1. If water looks clear, it is probably clean and safe for drinking. Do you agree or disagree? Explain your answer.
   Ideally students would say that they disagree, or that is it NOT safe to drink. Their explanations might vary.

2. What do scientists analyze when testing water samples?
   Scientists analyze color, cloudiness, odor, Ph, and salinity when testing water samples.
   - You can also require students to use the words turbidity, acidity, and salinity instead of the common explanations for an additional challenge.

3. Why is a microscope important when testing water quality?
   Microscopes are important for testing water quality to see things that might be hidden from the naked eye when looking at water. Microscopes can help find things like mosquitos, wrigglers, and algae.

4. IF water is unfit for drinking, can we still use it? What other purposes could we use it for?
   Student's answers will vary.

CORNGRATULATIONS

You Broke Out!

You are CORNriffic!

Take this to your teacher for the KEY to your reward.

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