

How Does Your Garden Grow?

DEAR EDUCATOR,

Water is essential for every living being on the planet. Help your students learn about the many ways we use this critical resource and how important it is for their daily lives.

Brought to you by the Irrigation Association® and the curriculum specialists at Young Minds Inspired, this program explores the many reasons and ways humans have been moving water for thousands of years, both to produce food and to improve our quality of life. Standards-based lessons address the life cycle of plants and the importance of the water cycle. Exercises in reading maps are also included.

We hope that you will share this valuable program with other teachers in your school. Although the materials are copyrighted, you may make as many copies as needed for educational purposes.

Please let us know your opinion of this program by commenting online at ymiclassroom.com/feedback-irrigation. We look forward to hearing from you.

Sincerely,



Dominic Kinsley
Editor in Chief
Young Minds Inspired

TARGET AUDIENCE

This program is designed for grades 3–5.

PROGRAM OBJECTIVES

- **Reinforce** that, like all living things, plants need water to survive.
- **Explore** the importance of the water cycle.
- **Explain** that irrigation is moving water to where it is needed.
- **Teach** why agricultural irrigation is vital to our food supply.
- **Investigate** how landscape irrigation improves our quality of life.

PROGRAM COMPONENTS

- This teacher's guide
- Three classroom activities
- Maps to support the activities available at ymiclassroom.com/irrigation
- Next Generation Science Standards available at ymiclassroom.com/irrigation

HOW TO USE THIS PROGRAM

Photocopy the teacher's guide and activity sheets. Go to ymiclassroom.com/irrigation to download the charts and maps that support the activities. Schedule the activities and provide ample time for classroom discussion of the relevant concepts.

ACTIVITY 1

HOW DOES YOUR LANDSCAPE GROW?

Distribute the activity sheets. Ask the class to consider all of the ways they use water every day. Also, ask them to think about how the living things around them, such as plants and animals, use water.

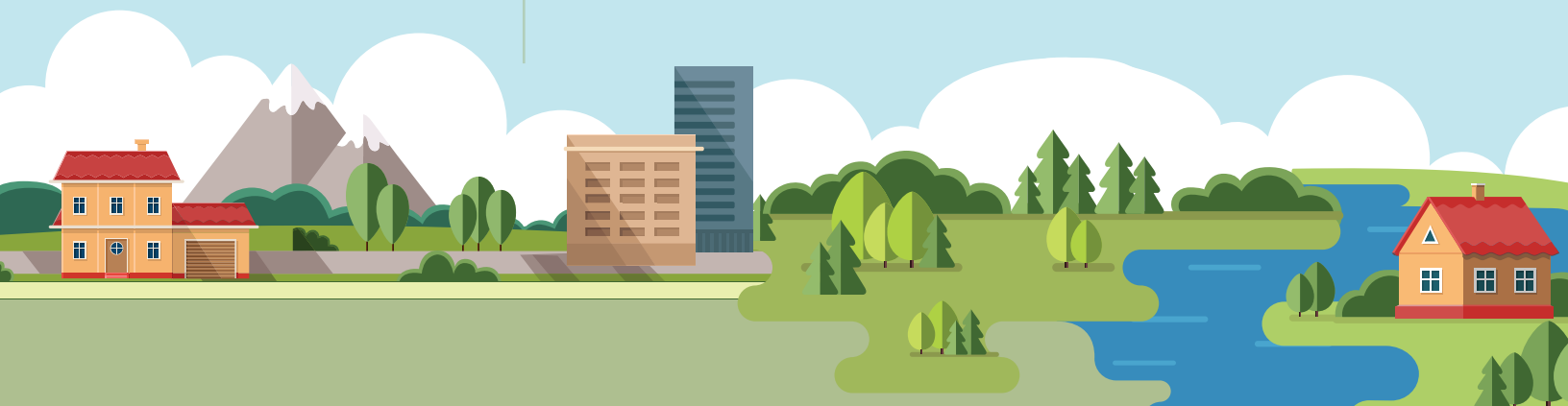
Part 1: Tell students that they are going to use a graphic to better understand the process of photosynthesis. They can use the underlined words to help them determine the order of the steps in the process.

Part 2: Explain that the answers to the jumbled words will help students learn the science behind keeping our green spaces irrigated and why green spaces are important to everyone.

Answer key:

Part 1: 5, 3, 1, 4, 2

Part 2: CARBON DIOXIDE; OXYGEN; TURFGRASS; SHADE; WATER; ATMOSPHERE; HABITAT



ACTIVITY 2

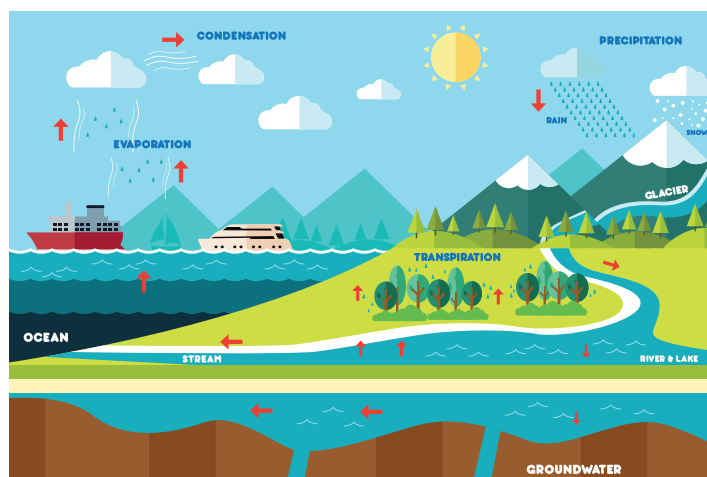
WATER ON THE MOVE!

Part 1: Go through the timeline together, pointing out how each of the different tools and types of irrigation have accessed water at different points in time.

Answers from earliest to most recent: C, B, D, F, A, H, E, G

Part 2: Introduce Part 2 of this activity by talking about the cycle of water in our atmosphere. (For background, visit <https://water.usgs.gov/edu/watercyclesummary.html>.) Then read the sentences with students and help them complete each sentence.

Answers: Rainwater, rivers, lakes, groundwater, drip micro, sprinkler systems, central pivot, aquifer, furrow, surface, subsurface



EXTENSION ACTIVITY

After your class has completed the worksheet, extend the activity by having students play the role of engineers. Ask them to choose a project from the list below and select or design an irrigation system for it. Factors to consider include landscape features, such as whether the ground is sloping or flat; size of the area to be irrigated; weather, including amount of rainfall and seasonal temperatures; soil features, and plant needs.

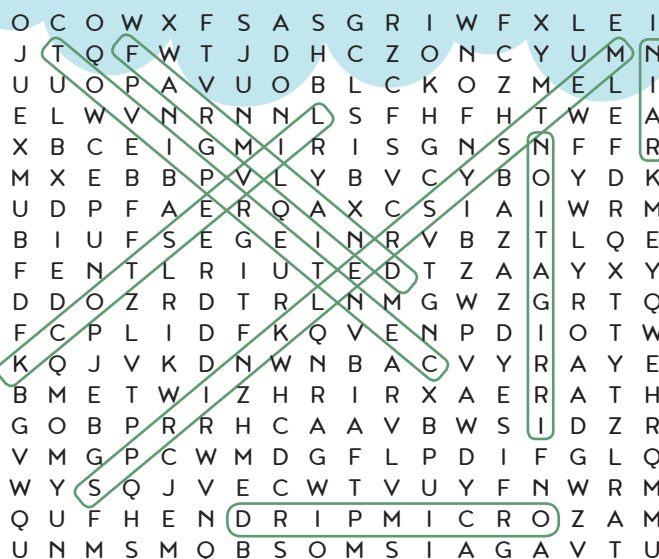
- A golf course in hot, sunny Florida
- A small 100-acre vegetable farm in Nebraska
- An orange grove on a sloping mountainside in California
- A football field in Texas
- A backyard garden in Pennsylvania
- A lawn in Georgia

ACTIVITY 3

HELPING THE HARVEST

Part 1: Start the activity by explaining that water is necessary for farmers to grow the food we need, including crops and livestock, and that both are essential to providing consistent and healthful food sources. Then have students look for the key words.

Answer Key:



Part 2: Start by downloading and distributing the U.S. Precipitation Map for this activity at ymiclassroom.com/ irrigation. Then introduce this activity by pointing out the different colors on the map and what they mean. Ask students what they know about the geography of the U.S. and each of the different regions (e.g., Northeast, Midwest). Divide them into teams to complete the answers.

Answers:

1. These agricultural centers are relatively flat, with open areas ideal for pasturing animals or growing large amounts of food. The Southwestern states receive more sunlight and are generally warmer than the rest of the country, extending growing/pasturing seasons. California's coastal soil is better suited for vegetables, while the more central states have less fertile conditions, making them ideal for livestock.
2. Crops and livestock require large amounts of water to grow. These states have arid climates, meaning they don't get a lot of rain. These states have a lot of agriculture.
3. Answers will vary.

Part 3: Have students read this comprehension exercise either individually or as a class. Explain that Nebraska is a very important state because it provides crops and supports livestock that feed our country.

Answers: 1.b, 2.c, 3.c

As a follow-up activity, lead students in a discussion of challenges farmers face when they design irrigation systems for their crops. Examples include water availability, water transport costs, salination, and sustainability. Ask each student to bring in a news article addressing one major issue and brainstorm solutions as a class.

RESOURCES:

- Irrigation.org
- Irrigationmuseum.org
- Water.usgs.gov
- https://www.agcensus.usda.gov/Publications/2012/Online_Resources/Farm_and_Ranch_Irrigation_Survey/
- Ymiclassroom.com



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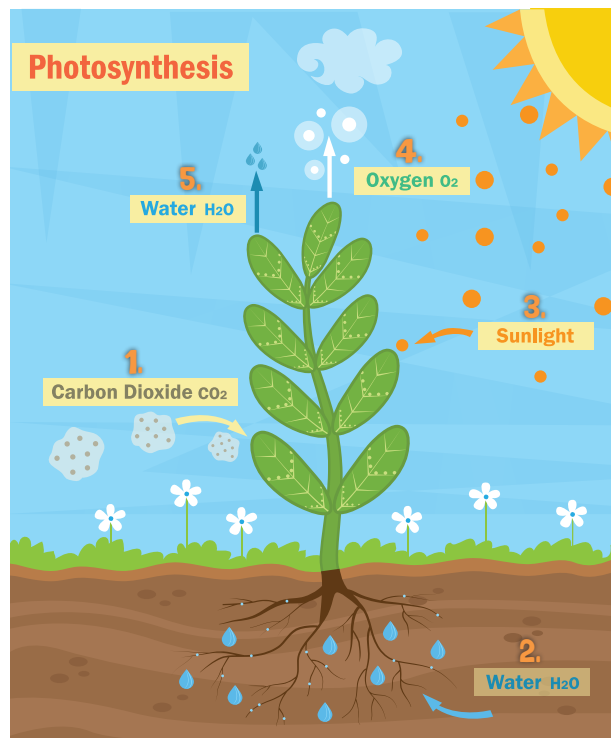
HOW DOES YOUR LANDSCAPE GROW?

Plants are all around us. They provide food, clean air, habitats for birds and animals, and protection for the environment. We need plants to survive! But plants have needs, too, including sunlight, carbon dioxide, and water.

PART 1: PHOTOSYNTHESIS

When plants are hungry, they make their food using a process called *photosynthesis*. This illustration shows all the stages of photosynthesis. Number the following sentences to put them in the order that shows how photosynthesis works. The underlined words match the correct parts of the diagram.

- ☐ In a separate process known as *transpiration*, plants also release excess water back into the air.
- ☐ Plant leaves contain a chemical called *chlorophyll*. It's what makes them green! Using energy from the sun, plants use chlorophyll to convert the carbon dioxide and water into sugar and oxygen.
- ☐ Plants pull carbon dioxide from the air through holes in their leaves called *stomata*.
- ☐ The sugar helps the plants grow, and oxygen is released back into the air.
- ☐ The plant's roots absorb water from the ground and transport it up to the leaves and other plant cells.



PART 2: HAPPY TOGETHER

Green spaces like our yards, public parks, and fields help people live happier, healthier lives. Complete the following word jumbles to learn why.



During photosynthesis, plants clean the air. They absorb **NRACOB XIDDEOI** (_____), which contributes to global warming, and they release **EGOYNX** (_____) that people and animals need to breathe.



A grassy lawn or field of **FRUTRSSAG** (_____) is the perfect place for sports like soccer and golf, playing catch or tag, and for hiking, running—all kinds of fun recreational activities that keep your body healthy.



Trees and taller plants provide **SADHE** (_____) that helps keep us cool and prevents sunburn.



Through a process called *transpiration*, which is a bit like sweating, plants release **WTREA** (_____) that helps cool the **RHAEOTPSME** (_____).



Parks, gardens, and home landscapes support local ecosystems by providing a **HTABIAT** (_____) for all kinds of wildlife—everything from rabbits and squirrels to predatory birds to bumblebees and other pollinators.

FUN FACT!

Turfgrass, used on football and soccer fields, golf courses, public parks, and botanical gardens, is the most irrigated plant in the United States!



WATER ON THE MOVE!

WATER IS ESSENTIAL!

Did you ever think about all the times you or someone in your family turns on a faucet? How about all the times you water the lawn or a garden? On the back of this sheet, make a list of all the different ways you use water every day. You might be surprised!

PART 1: FLOWING THROUGH TIME

Water is not always available when and where we need it. So, for thousands of years, people have been using technology to move water from one place to another. This is called *irrigation*.

To follow how irrigation has shaped our history, match the letter of each event described below to the correct date on the timeline.

A. Amidst the Great Depression, the Hoover Dam is completed. Designed to control flooding of the Colorado River and provide water to arid Southwestern states, it stores enough water to irrigate 2 million acres.

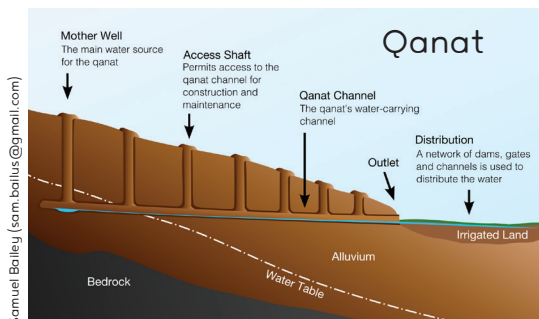


D. Following closely behind the Assyrians, the Persians develop the first water “pump” or water wheel (Sakia), which uses a series of pots on a wheel powered by oxen to lift water up.



Courtesy of Special Collections,
University of Houston Libraries.

B. More than 2000 years after King Menes’ canals, the Assyrians develop the Qanat, a sloping underground channel that carries water from a well to where it is needed. These are still in use across the world, typically in arid, mountainous areas.



E. The worst drought in California history begins. Over the next five years, it will kill 102 million trees and cause incredible hardships for farmers.



F. In the early-20th century, irrigation pumps across the U.S. allow farmers to access and use water from below the ground.



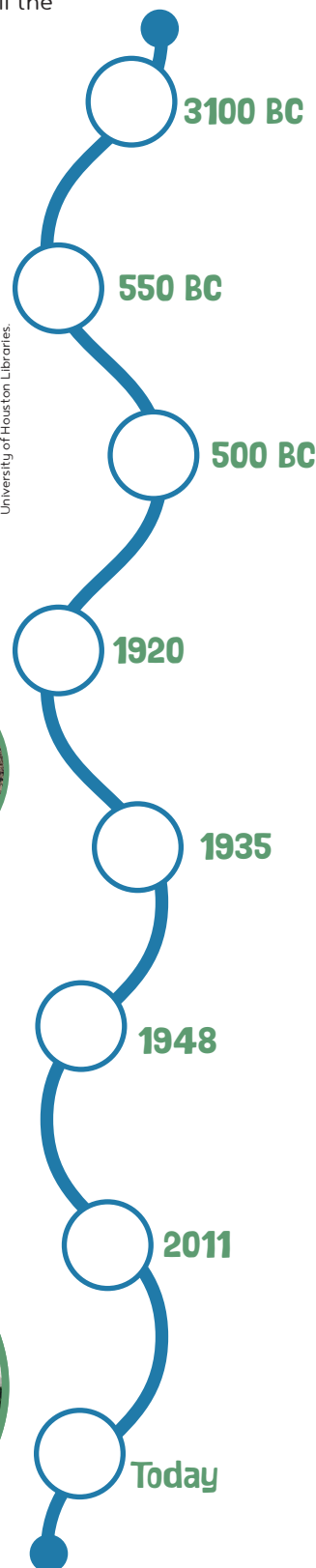
Michael Trolove

G. Today, more than 600 million acres of land are irrigated worldwide.

C. King Menes of Egypt makes one of the earliest attempts to control seasonal flooding of the Nile River, with a series of dams and canals that direct the overflow into a manmade lake so farmers can use the water for their crops.



H. Colorado farmer Frank Zybek, introduces the first center pivot system for watering crops, one of the key agricultural advancements of the mid-20th century.



WATER ON THE MOVE! (continued)



PART 2: WATER, WATER, EVERYWHERE

The earth is surrounded by oceans, but only fresh water can be used for irrigation. Use this word bank to complete the following sentences to learn about our primary sources of water and common irrigation systems:

aquifer

furrow

riders

center pivot

groundwater

sprinkler systems

drip micro

lakes

subsurface

evaporation

rainfall

surface

- The primary sources of water for irrigation are _____ n _____ collected at the surface in _____ s, _____ e _____ and reservoirs, and g _____ pumped from wells.
- A series of tubes and tunnels with small holes that deposit water directly to the roots of plants is called a _____ i _____ r _____ system. This type of irrigation uses less water and minimizes _____ o _____ and runoff into local waterways.
- _____ k _____ s _____, which spray water across an area of land, can irrigate a large area quickly, with minimal labor.
- Many large, modern farms use a _____ t _____ o _____ system, a massive device that rotates from a central source and sprays a large quantity of water very evenly across massive crop fields.
- Best for sloping areas downhill from a large _____ q _____ or other water source, _____ r _____ irrigation is a type of _____ f _____ irrigation. Groundwater is siphoned or pumped into a series of trenches and channels that run along the ground between rows of crops to flood the surface.
- In _____ s _____ irrigation, water is piped directly from below the ground to greatly reduce evaporation and waste.

FUN FACT!

An acre of corn can release more than 3,000 gallons of water into the atmosphere every day. A large oak tree is capable of giving off 40,000 gallons of water in one year!



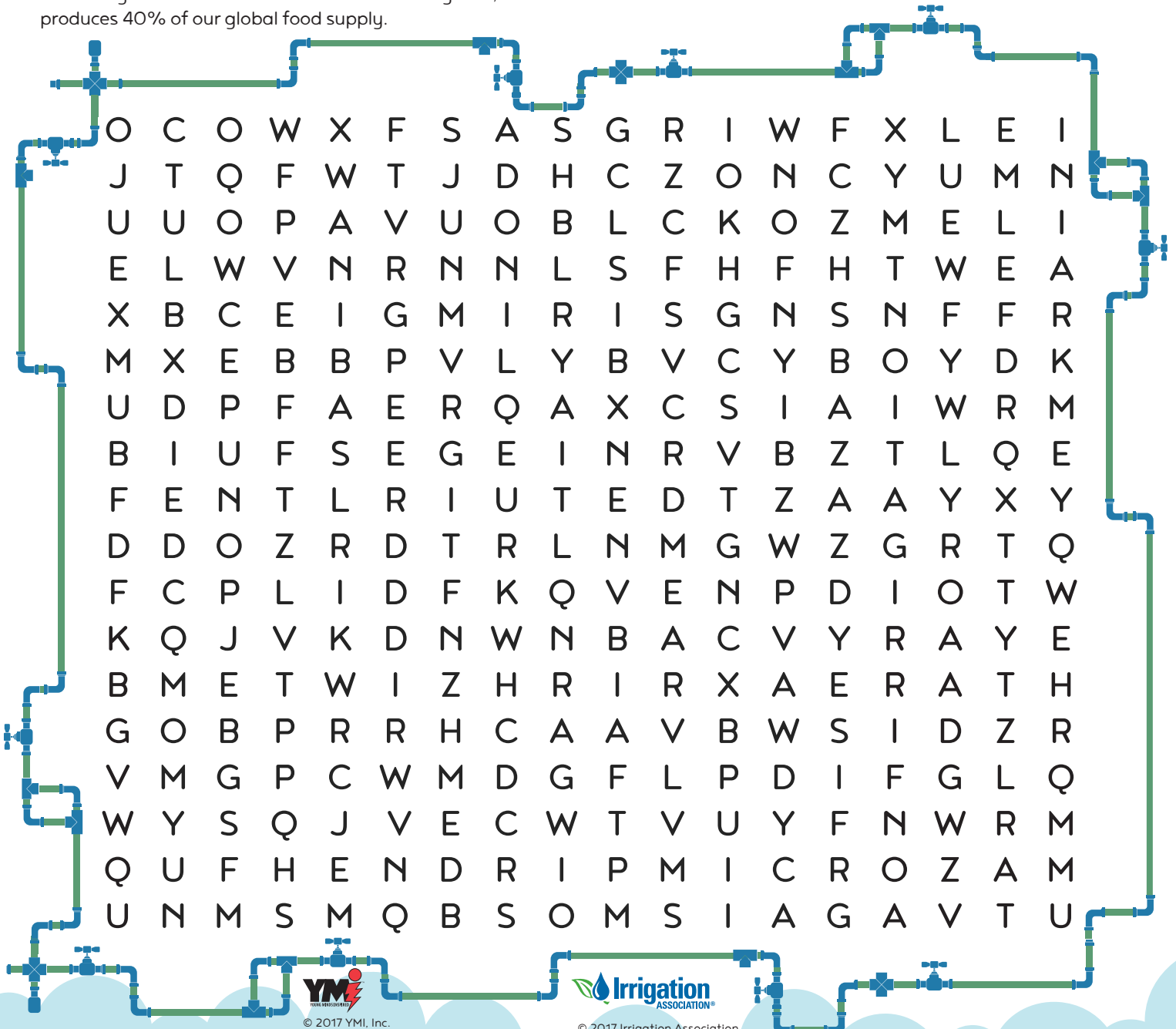
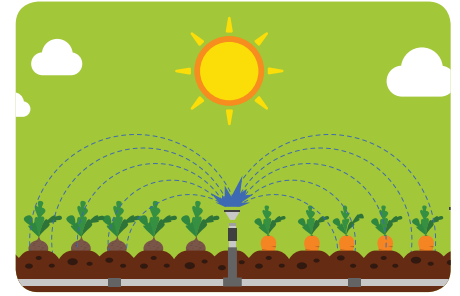
HELPING THE HARVEST

PART 1: ON THE FARM

Water is necessary for farmers to grow the food we need. Use the capitalized words in this word bank to solve this word-find puzzle.

WATER WORD BANK

- **RAIN** does not provide enough water to grow all the food we buy at the grocery store.
- **IRRIGATION** moves water to fields and helps farmers overcome drought.
- **LIVESTOCK** like cows, pigs, and chickens need water to drink and eat food produced with irrigation. These animals provide us with cheese, milk, bacon, and other meats.
- While only 20% of the world's **FARMLAND** is irrigated, it produces 40% of our global food supply.
- A **CENTER PIVOT** is a huge device that rotates from a central source and sprays a large quantity of water evenly across large fields.
- **DRIP MICRO** is a series of tubes and tunnels with small holes that deposit water directly to the roots of the plant.
- **SPRINKLER SYSTEMS** spray water across an area of land to irrigate a large area quickly with minimal labor.



HELPING THE HARVEST (continued)

PART 2: GREEN PASTURES

More than 55 million acres of U.S. land are irrigated. The states listed below use the most irrigation water. Label them on the U.S. Precipitation Map provided by your teacher.

Arkansas - mainly poultry; primary crops are rice, soybeans

California - mainly dairy cows; primary crops are fruits, vegetables, greenhouse plants

Idaho - mainly dairy cows and beef cattle; primary crop is potatoes

Kansas - mainly beef cattle; primary crops are wheat, corn

Nebraska - mainly beef cattle; primary crops are corn, soybeans

Texas - mainly beef cattle; primary crops are cotton, corn

- Using the U.S. Precipitation Map, compare and contrast the climates and natural resources of these states. What are the pros and cons of growing crops in these environments?

- Why do these states need more water?

- What kinds of livestock, crops, or garden plants grow where you live? What are the water requirements of these plants?

PART 3: Rainfall can vary greatly from year to year, so farmers irrigate to make sure crops always get the right amount of water. Become an irrigation expert. Read the text below, then answer the questions.

The state of Nebraska is an important agricultural center in the U.S. Farmers in the "Sagebrush State" raise cows and sheep for dairy and meat, and grow crops like corn, soybeans, and potatoes. Crops and livestock need a lot of water.

The western part of the state gets much less rain than the east, and crops only grow for part of the year. For example, corn grows between May and September and needs at least 20-25 inches of rain. It needs the most water during the summer months of July and August. In addition, some of the rainfall evaporates before it can be used. As a result, Nebraska has to irrigate nearly 9 million acres of land.

*Nebraska's main source of water is the Ogallala Aquifer. The Ogallala Aquifer is one of the largest in the world. An **aquifer** is a region under the ground where the earth is saturated with water. Water is usually pumped out from wells. The Ogallala Aquifer runs beneath 8 states that use it for irrigation. Most of the water in the Ogallala Aquifer came from glaciers that melted millions of years ago. It is*

replenished by rainfall. The surrounding states need to be careful not to take more water out of the aquifer than nature can replenish. Farmers and government agencies are working hard to install efficient irrigation systems.

- Nebraska is known for which important crops and livestock?
 - Grapes and chickens
 - Corn and cows
 - Lettuce and sheep
- Why does Nebraska irrigate nearly 9 million acres of land?
 - Because the state is experiencing a drought
 - Because Nebraska has desert-like temperatures
 - Because rain is not enough to help the crops grow
- How are farmers working to preserve the Ogallala Aquifer?
 - By pumping more water into the aquifer
 - By seeding the clouds to deliver more rain
 - By making their irrigation systems more efficient