

Colorado Water and Agriculture



Water is very important. All living things require water to grow and reproduce. Water is used for agriculture and industry. Household, recreational and environmental activities also use water.

One of the main uses of water in Colorado is for agriculture, which is both farming and ranching. Colorado agriculture uses 86 percent of the state's water. Agriculture is important to Colorado. Agriculture is Colorado's number two industry, behind manufacturing. Agriculture provides jobs for about 175,000 people and produces \$40 billion in sales. Colorado is a large state. Half of the land is used for farms and ranches, a total of 31.8 million acres.

The United States has 3,000 counties with agriculture sales and Colorado has two counties in the top 25! Weld County ranks 9th and Yuma County ranks 24th.

The climate in Colorado affects agriculture and water availability. Colorado is in the middle of the United States. It is a long distance from the oceans or other large bodies of water. The Continental Divide runs down the center of the state. It divides where rain and snowmelt water flows. Water on the west side of the Continental Divide flows to the Gulf of California and the Pacific Ocean. Water on the east side flows to the Gulf of Mexico and the Atlantic Ocean.

Part of the Rocky Mountain Range runs through Colorado. The elevation in Colorado is much higher than any other state in the U.S., with average elevation at 6,800 feet above sea level. Colorado is halfway between the equator and the North Pole.

Identify or color in the following items on the map of the Western Hemisphere to the right:

United States of America

Mexico

Canada

South America

Central America

Equator

Pacific Ocean

Atlantic Ocean

North Pole

Map of the Western Hemisphere



Identify or color in the following items on the map of the United States of America below:

Rocky Mountain Range

Gulf of Mexico

Colorado

Great Lakes

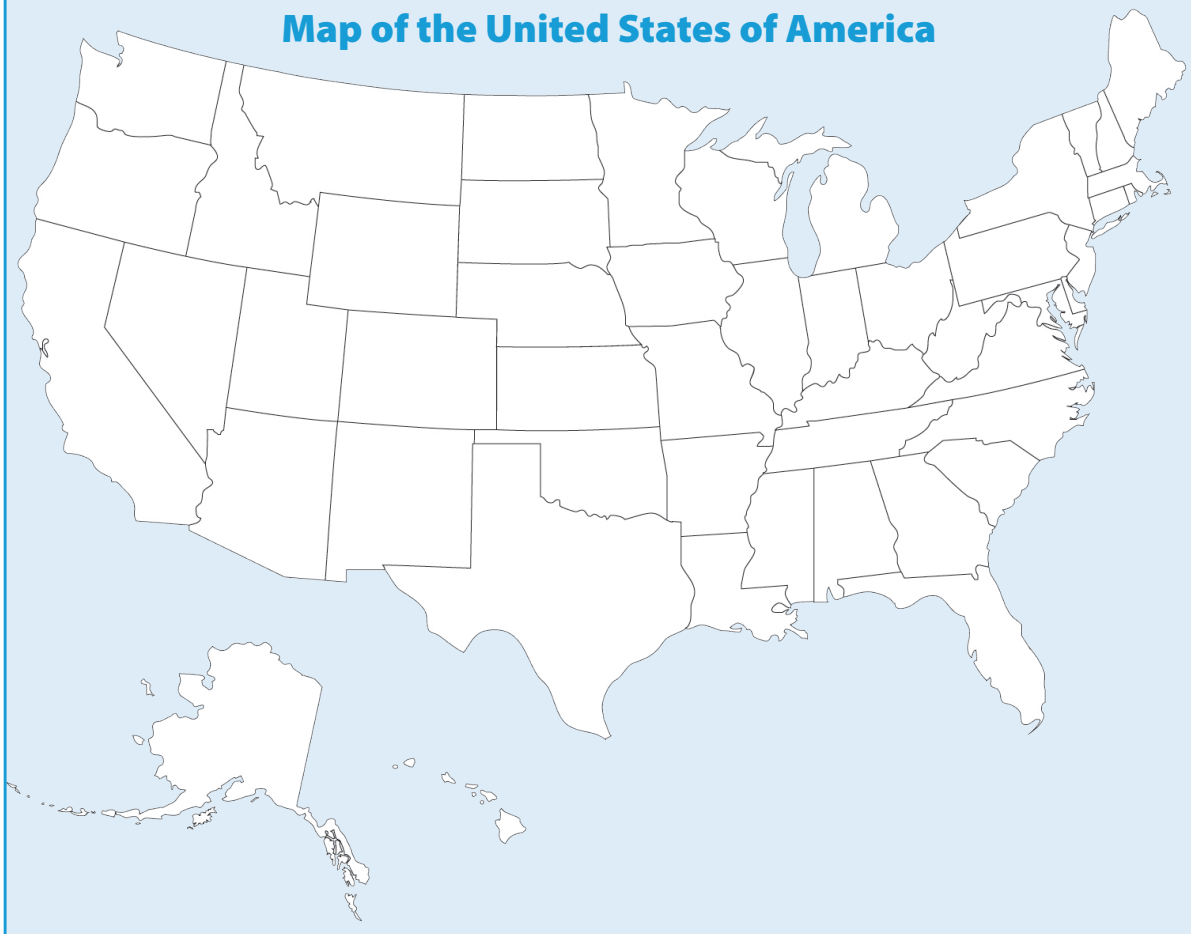
U.S. Midwest Region

U.S. Western Region

U.S. Southern Region

U.S. Northeast Region

Map of the United States of America



Let's learn more!

Lesson focus: Use geographic tools to identify, locate and describe places and regions on a map.

The geographic location of Colorado affects the climate, agriculture, and the amount of water.

Colorado – A State of *EXTREME* Weather

Snowstorms, hail storms and drought – the weather in Colorado changes a lot. Northeastern Colorado is number two in the world for the amount of hail it receives. Lack of water should be a concern for all Coloradans.

The amount of water we get depends on the climate. Our climate changes from year to year. Colorado is mostly a dry state. The average amount of water we get from rain and snow is 16 inches per year, but this amount can change yearly. It also changes from region to region. The San Luis Valley receives an average of seven inches per year. The mountains receive an average of 50 inches. Mountain snowfall may reach more than 300 inches in a single year!

Rainfall and snowmelt soaks into the ground. This increases soil moisture and fills rivers and **aquifers**. Most Colorado rivers get the majority of their water from snowmelt that flows down from the mountains. So winter storms are very important in filling the rivers and reservoirs.

Precipitation, which is what we call water from rain or snowmelt, in Colorado changes a lot. Years of drought can be followed by sudden floods. Some years are drier or wetter than others. Sometimes Colorado's climate seems to follow no pattern at all.



Aquifer: A place for groundwater that is primarily sand, gravel and porous rock through which water may move, but which is surrounded by rock that water can't go through. Aquifers may be thin or thick, may be small or may stretch for hundreds of miles. The refilling or replacement of water in aquifers is called recharging. Aquifers can sit along rivers, just under the surface, or they can be hundreds of feet underground.

We Share Colorado Water

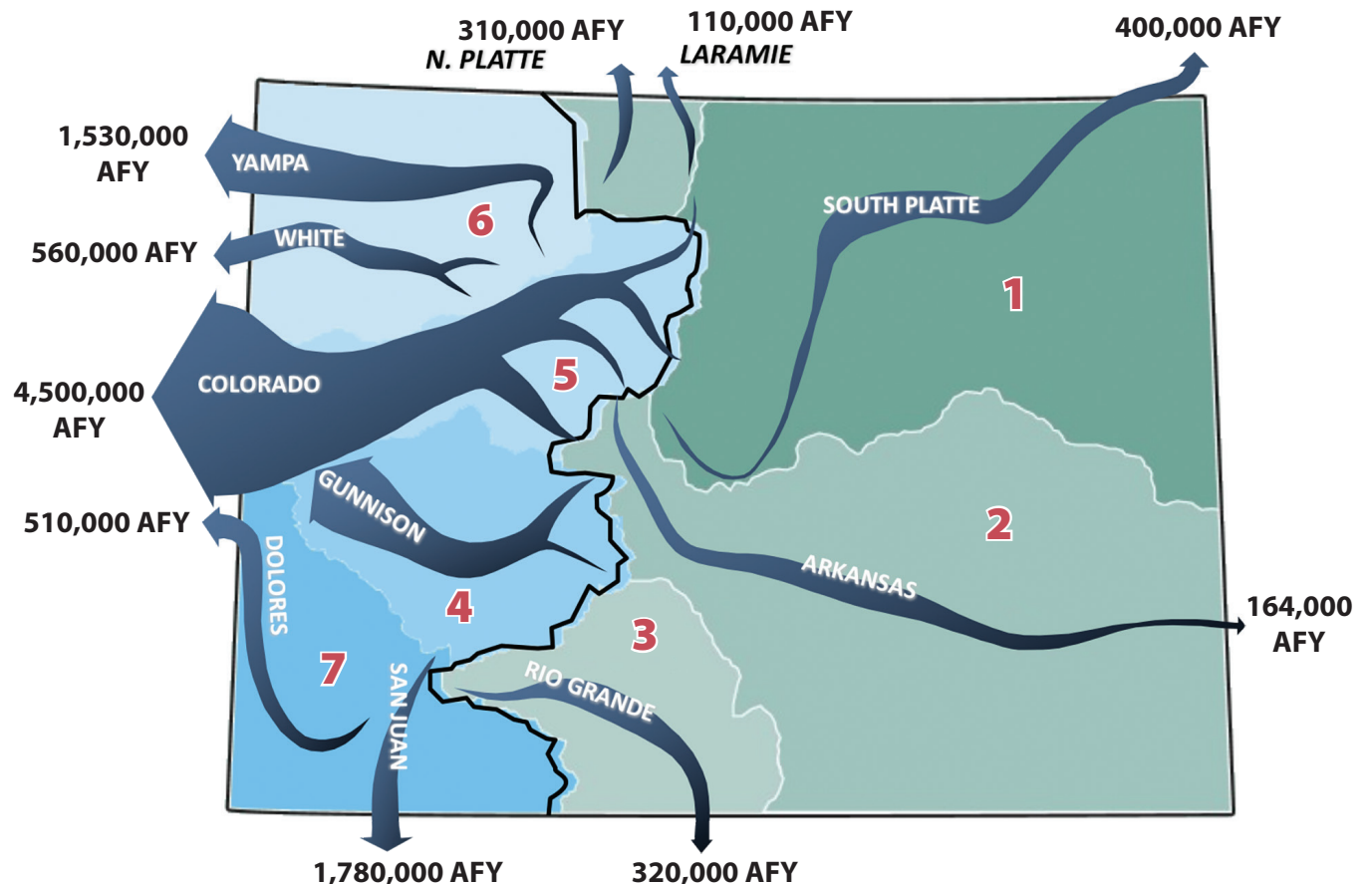
Colorado is a headwaters state. This means that six major rivers begin in Colorado. Those rivers are the North Platte, South Platte, Arkansas, Rio Grande, San Juan and the Colorado. Water from our state flows to 18 other states and Mexico. It is important to leave water in the rivers for other states to use. Almost no water flows into Colorado from other states.

The diagram on this page is called the snake diagram. It shows how water flows in Colorado rivers. The water flows downhill from the Colorado Rockies to other states.

Colorado sends water to both the Pacific and Atlantic Oceans. The dividing point is the Continental Divide, which is the black line separating the blue and green regions on the diagram.

On the diagram, the areas marked 1, 2 and 3 (and part of 6) flow east into the Gulf of Mexico. The areas marked 4, 5, 7, and the other part of 6 flow west into the Gulf of California.

Snake diagram showing how water flows in Colorado rivers.

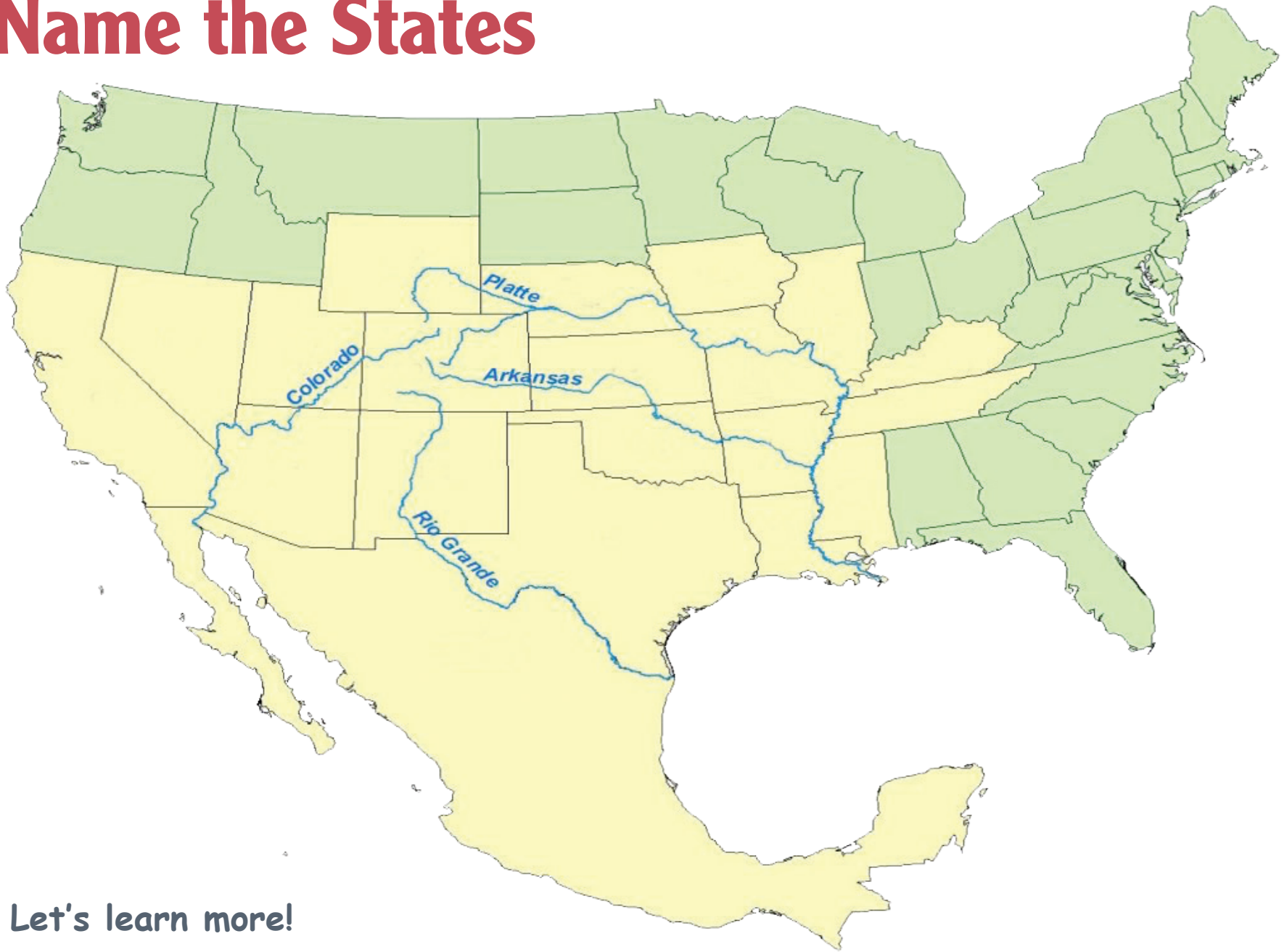


AFY: acre-foot per year; a unit of volume to measure large-scale water resources

More water is located in western Colorado. The amount of water flowing west is almost eight times the water flowing east. This is because more rain and snow falls on the western half of the state.

Big winter storms are key for Colorado's water. If big storms miss us, especially over eastern and southern Colorado, drought can follow. Changes to Colorado's snowpack has BIG consequences. More or less snow means more or less water for Colorado and the 18 other states.

Name the States



Let's learn more!

Can you name the 18 states, plus Colorado, and one country in yellow on the map above? These are the states and country that get water from Colorado.

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Irrigation

Farmers water their crops, which is called irrigation. After seeds are planted in the ground, they need water to grow into seedlings. The seedlings need water and sunshine to grow into big plants.

Water is given to plants throughout the growing season. It is important to give growing plants as much water as they need, but too much water can hurt them. Farmers watch the weather. If it rains a lot, they don't want to irrigate because plants can drown.

There are many ways to irrigate.

One way is to dig little ditches between rows of crops and let the water run between the rows. This is called **furrow irrigation**.

Another way to irrigate is to **flood** an area with water. Hay fields and pasture land are often flooded with water at the right times.

A third way to irrigate is to use a **"drip"** system of hoses buried just under the soil. This is where water comes out of holes in the hose placed next to the plants.

A fourth way to irrigate is **surge irrigation**. A computerized valve turns on and off the water supply to furrows. This system is designed to allow water to soak into the ground before more is applied.

Yet another way to irrigate is to use a **sprinkler** system. This is often called **center pivot irrigation**. In this method, equipment rotates around a pivot and crops are watered with sprinklers. A circular area centered on the pivot is irrigated.

Of Colorado's 10.6 million acres of cropland, about 2.5 million acres are irrigated. Irrigation increases the amount of crops a farmer can grow.



Furrow Irrigation - Water stays in ditches



Flood Irrigation - Water spreads everywhere



Center Pivot Irrigation - Water is sprayed

Colorado History Lesson

Center pivot irrigation was invented in the 1940s by farmer Frank Zyback. He lived near Strasburg, Colorado. Strasburg is located 40 miles east of Denver on Interstate 70, near Bennett, in Adams County.

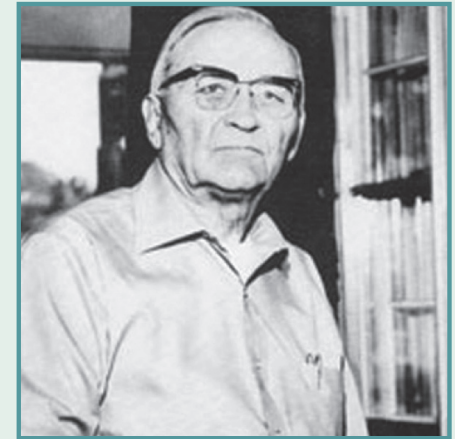
Frank Zybach watched as workers moved pipes from one section of a field to another. The pipes had been fitted with sprinklers on posts. The sprinklers sprayed water. But it was a lot of work to turn the sprinklers on and off and to move the pipes. Zybach figured out a way that sprinklers could move themselves to supply water to fields. A year after he saw the workers in the field, Zybach had built the first center pivot irrigation system.

Frank Zybach applied for a patent on his "Zybach Self-Propelled Sprinkling Apparatus" in July 1949. He didn't know at the time that his invention would become the center pivot irrigation system. It greatly changed farming in the U.S. and around the world.

Within 25 years of Frank Zybach's invention, center pivots were used across the United States. U.S. astronauts could clearly pick out clusters of fields with center pivot systems from 270 miles in space. They could see the patterns of lush, green, round fields made by center pivots.

Today's center pivot irrigation system is even better. It is now controlled by computers and uses technology. The technology solves a lot of problems. One problem included supporting the weight of the water and distributing it evenly across huge, rolling fields. There is also an arm that swings out to get water to the corners of square fields.

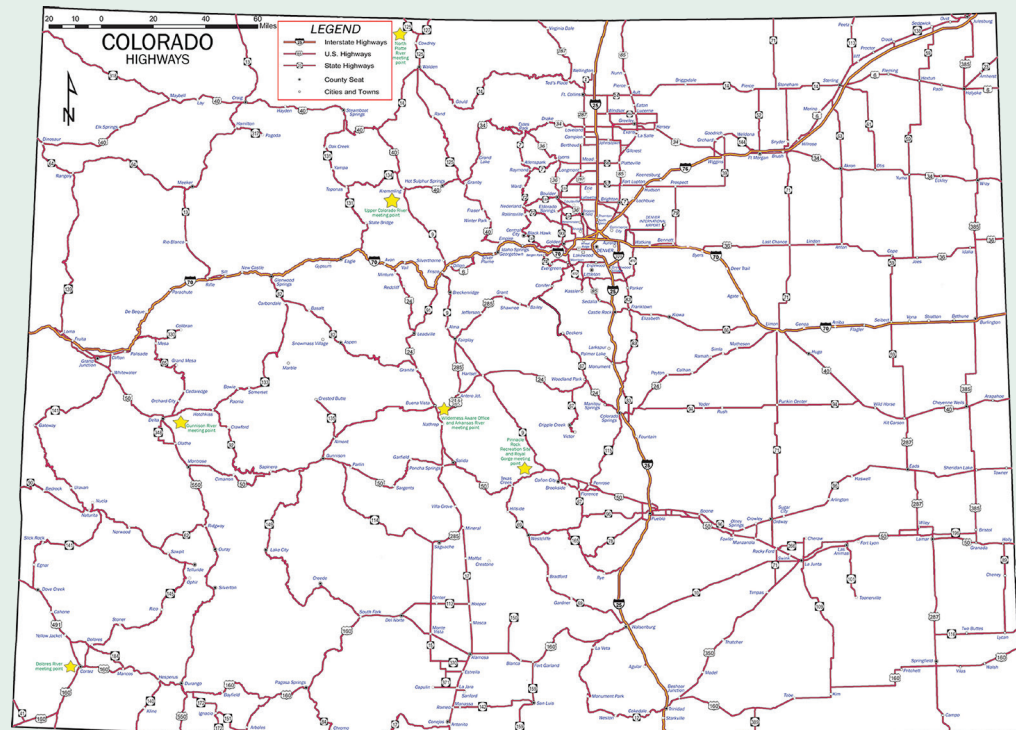
Many irrigation systems are controlled by a smart phone! Farmers and ranchers can turn the water on and off, move the pivot and more without going to the field.



Frank Zybach

Let's learn more!

Draw an X on the map to show where Strasburg, CO is located.



Water is Needed to Grow Food

Plants and animals need water to grow. Farmers and ranchers use water and soil to raise crops and livestock to create food. Water is important to this process. Water is the main element that makes up the structure of plants. Human bodies are made up of around 70 percent water. Plants can be as much as 95 percent water. Water also helps the plant soak up nutrients and energy. Water is essential for plants.

Colorado farmers and ranchers make great use of water. Much of the agriculture water is re-used from farm to farm. Excess water from irrigation is collected in rivers, aquifers and reservoirs. This water is then used to irrigate other fields or for other water uses. The amount of agriculture products grown in Colorado would be much lower without irrigation. Farmers could not grow many of the products Coloradans enjoy, such as cantaloupe, without irrigation.



Learn about the agriculture products grown in Colorado using the chart below.

Colorado ranks in the top 10 in the United States for growing these foods and products!

Animals, Livestock and Products	Crops	Fruits and Vegetables
Cows and Calves Beef Cattle Sheep and Lambs Trout Wool	Alfalfa Barley Dry Beans Millet Sorghum Sugar Beets Sunflower Wheat	Cabbage Cantaloupe Carrots Mushrooms Onions Peaches Potatoes Spinach

The Colorado Reader publication and Ag in the Classroom are projects of the Colorado Foundation for Agriculture. Educational projects are produced in cooperation with the Colorado Department of Agriculture, other state and federal agencies, Colorado commodity groups, Colorado agricultural associations, state universities and colleges and interested individuals. Colorado Readers are provided free to educators requesting them. For more information, visit www.GrowingYourFuture.com, or contact Jennifer Scharpe, Colorado Foundation for Agriculture, P.O. Box 10, Livermore, CO 80536 or phone 970-818-3308. Special thank you goes to Colorado Commissioner of Agriculture Don Brown for providing some of the content used in this reader. Financial support for this reader has been provided by the Colorado Department of Agriculture.



COLORADO
Department of Agriculture

Colorado Reader - Teacher's Guide

Ag in the Classroom - Helping the Next Generation Understand Their Connection to Agriculture

Colorado Water and Agriculture

Colorado Academic Standard Focus

4th Grade Geography:

- Answer questions about Colorado regions using maps and other geographic tools (DOK 1-2)
- Describe how places in Colorado are connected by movement of goods and services and technology (DOK 1-2)

4th Grade History:

- Describe the impact of various technological developments (DOK 1-2)

5th Grade Geography:

- Answer questions about regions of the United States using various types of maps (DOK 1-2)
- Use geographic tools to identify, locate, and describe places and regions in the United States and suggest reasons for their location (DOK 1-3)

National Agriculture Literacy Outcomes

Agriculture and the Environment Outcomes

- Identify land and water conservation methods used in farming systems (wind barriers, conservation tillage, laser leveling, GPS planting, irrigation)
- Recognize the natural resources used in agricultural practices to produce food, feed, clothing, landscaping plants, and fuel (e.g. soil, water, air plants, animals, and minerals)

Science, Technology, Engineering and Mathematics Outcomes

- Describe how technology helps farmers/ranchers increase their outputs (crop and livestock yields) with fewer inputs (less water, fertilizer, and land) while using the same amount of space

Introduction

Water is a precious resource in Colorado. It is an essential part of all life and needed to grow livestock and plants. Agriculture is one of the main users of Colorado water, accounting for 86 percent of the water use. Other users of Colorado water include: municipal/domestic at 7 percent; recreation/fisheries at 3 percent; industrial/commercial at 2 percent; augmentation at 1 percent; and recharge at 1 percent.

The geographic location and climate of Colorado are essential factors to Colorado's water supply. This Reader requires students to use outside resources to expand

their knowledge of geography and identify specific items and regions on a map of the Western Hemisphere. This is designed to go beyond agriculture and connect learning to the student's core subject areas.

The section on "We Share Colorado Water" shows how Colorado water is connected to 18 other states and Mexico. It is important for students to understand that water flows out of Colorado and impacts states to the east and west. The second map activity requires students to identify these states and country.

The use of irrigation (method to deliver water to fields) by farmers in Colorado is key. Irrigation allows farmers to reuse water. Excess water that runs off from irrigated fields collects in rivers, aquifers and reservoirs, and is then available to be reused to irrigate other fields or for other water uses.

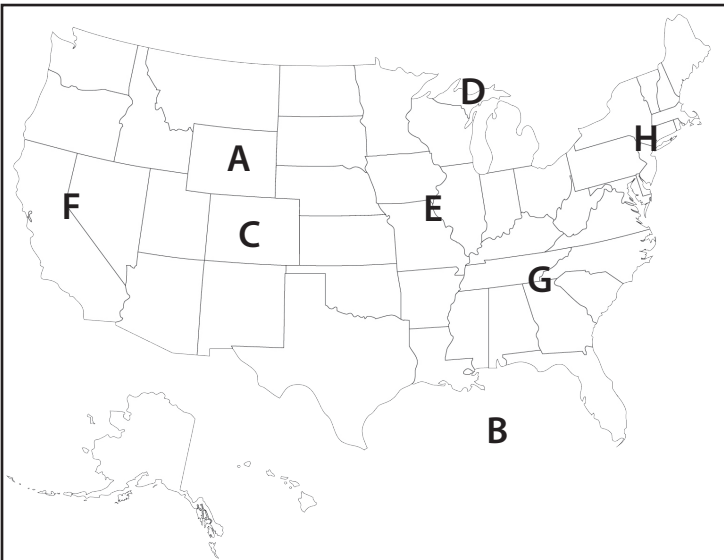
There are several irrigation methods, but the most common is the center pivot irrigation. The center pivot irrigation system was invented by Frank Zyback, who lived near Strasburg, Colorado. His invention revolutionized farming in the U.S. and around the world. The center pivot system uses sprinklers attached to pipes and mounted on wheels. It is self-propelled, allowing the system to easily move across fields of different terrain. Irrigation systems now use high-tech engineering and are controlled by computers. In fact, many systems can be controlled by a smart phone, allowing the farmer to adjust the system without going to the field.

Bottom line, water is needed to grow food. While water resources are limited in Colorado, farmers and ranchers use technology, like irrigation, to conserve water. Without irrigation, farmers could not grow many of the crops produced in Colorado, such as fruits and vegetables and other crops.

Additional Resources

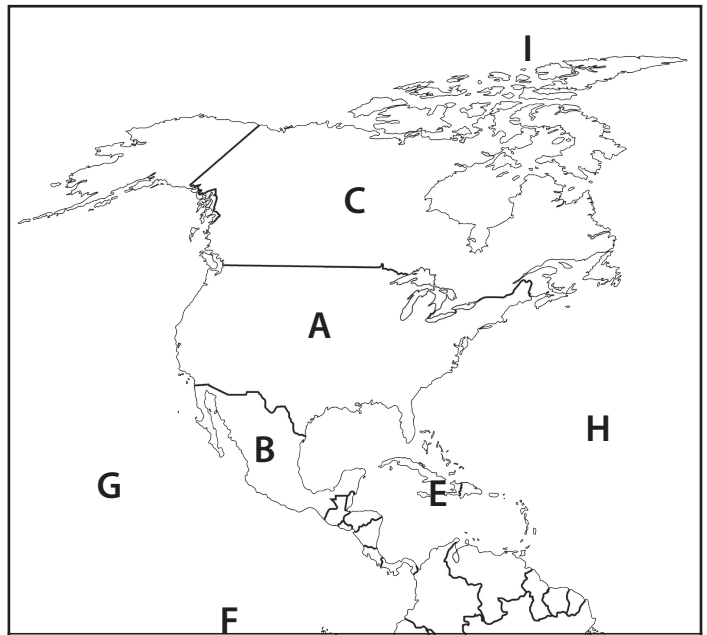
www.GrowingYourFuture.com - connects you to Colorado's Agriculture in the Classroom program. A variety of resources are available at this site. Click on the Curriculum Matrix page for access to an online, searchable, and standards-based curriculum database for K-12 teachers. The Matrix contextualizes national education standards in science, social studies, and nutrition education with relevant instructional resources linked to Common Core Standards.

Colorado Department of Agriculture - Visit <https://www.colorado.gov/agmain> for more information and resources from the Colorado Department of Agriculture. Click on the Learn About Ag page under the Home tab for education resources.



Answers: Page 2 - United States of America

- | | |
|--------------------------|---------------------------|
| A - Rocky Mountain Range | E - U.S. Midwest Region |
| B - Gulf of Mexico | F - U.S. Western Region |
| C - Colorado | G - U.S. Southern Region |
| D - Great Lakes | H - U.S. Northeast Region |



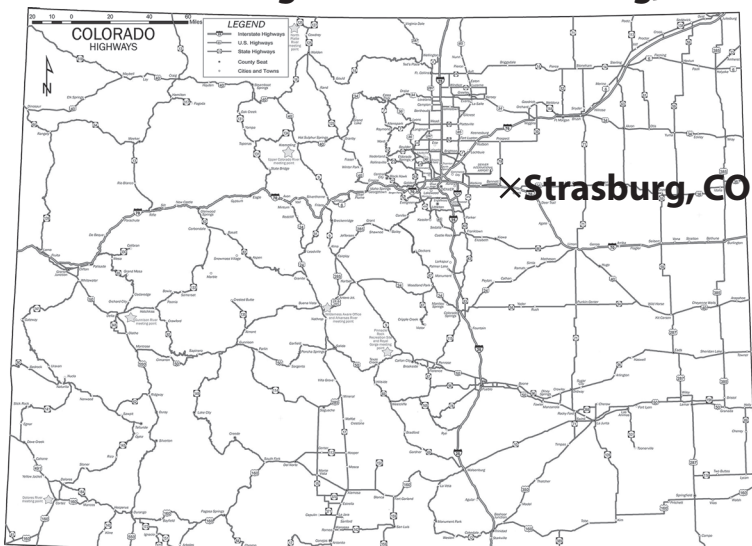
Answers: Page 2 - Western Hemisphere

- | | |
|------------------------------|--------------------|
| A - United States of America | F - Equator |
| B - Mexico | G - Pacific Ocean |
| C - Canada | H - Atlantic Ocean |
| D - South America | I - North Pole |
| E - Central America | |

Answers: Page 5 - Name the States

- | | | |
|------------|----------|-------------|
| California | Nebraska | Louisiana |
| Nevada | Kansas | Illinois |
| Utah | Oklahoma | Kentucky |
| Arizona | Texas | Tennessee |
| Wyoming | Iowa | Mississippi |
| Colorado | Missouri | Mexico |
| New Mexico | Arkansas | |

Answers: Page 7 - Locate Strasburg, CO



Comments, questions, suggestions and feedback about the Colorado Reader are welcome.

Contact: Colorado Foundation for Agriculture,
 Jennifer Scharpe, Executive Director,
 PO Box 10, Livermore, CO 80536,
 970-818-3308 or 720-788-3224
 Jennifer@GrowingYourFuture.com,
 www.GrowingYourFuture.com

The mission of the Colorado Foundation for Agriculture is to educate the public about the significance of agriculture and how food, fiber and natural resources impact their lives.

EVALUATION

Colorado Water and Agriculture • February 2018

Colorado Reader ~ Agriculture in the Classroom

Please take a few minutes to evaluate your students' knowledge of this topic.

There is an area for additional comments.

Your comments help us improve future Colorado Reader issues. Thank you!

How many students used this reader? _____

How many of your students can name one way to irrigate? _____

How many of your students can identify that agriculture is a user of Colorado water? _____

How many of your students understand that irrigation is needed to grow crops in Colorado? _____

How many of your students can identify that agriculture is Colorado's number 2 industry? _____

How many of your students can name several of the agriculture products grown in Colorado as described on page 8? _____

How many of your students can describe what is an aquifer? _____

How many of your students realize that Colorado shares its water with 18 other states and Mexico? _____

Additional Comments _____

How many of your students can name several of the states and the one country that get water from Colorado? _____

SUBMIT THIS EVALUATION FOR A CHANCE TO WIN A \$100 VISA CARD!

Please rate:	Good		Average		Poor
Student Activities Throughout Reader	5	4	3	2	1
Teacher's Guide	5	4	3	2	1
Reading Level	5	4	3	2	1

I would like to see more activities like: _____

School _____ Grade Level _____

Subject Area (s) _____

Name _____ Phone _____

Email _____

Additional Agriculture in the Classroom Programs!

Food, Fiber and More Summer AgriCULUTRE Institute - A five-day course designed for teachers who have little or no agriculture background. This is an opportunity to go "behind the scenes" of Colorado agriculture. You will learn innovative ways to incorporate agriculture and natural resource topics into your academic curriculum. The highlight of the Institute is the day spent one-on-one working with an agriculture producer, where you will gain hands-on experience on a farm or ranch. The course is offered in three different locations in Colorado. Participants receive three continuing education credits. Scholarships are available!

Colorado Literacy Project - Farmers and ranchers visit classrooms and read a book about Colorado agriculture. They answer questions, talk about their farm or ranch, and do an activity with the students. The class keeps the book! A new book on a different agriculture topic is selected each year. This program is appropriate for students in kindergarten through fourth grades. Lesson plans, vocabulary guides, and worksheets are provided for the different grade levels. The 2018 Colorado Literacy Project Book is *Little Grandpa and Me - Learning to be a Dairy Farmer*.

Sign up today for both programs by visiting www.GrowingYourFuture.com

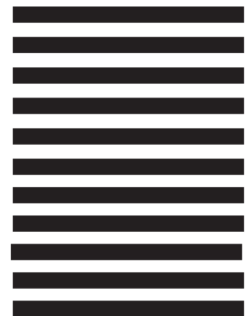


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Colorado Reader



Educating the public about the significance of agriculture and how food, fiber and natural resources impact their lives.