

Soil, Water, and Air Stewardship

Think about the world right outside your classroom. What do you see? Maybe grass, a few trees, a parking lot full of cars, and other buildings off in the distance?

Nearly everything you can see was made from natural resources.

Just like us, plants and animals need natural resources to live! Natural resources are our treasures to protect. Agriculture depends on them – and we depend on agriculture.

Sun – The sun is a source of energy for all life. Plant leaves capture sunlight to make food, or energy, to grow. Farm animals eat plants. By eating food from plants and animals, the sun gives us energy too.

Soil – The soil beneath our feet is as important as the air we breathe and the water we drink. Soil holds water and nutrients plants need. Animals and people depend on plants for food, so we need soil too.

Water – Plants drink water just like we do! Plant roots absorb water from the soil. Farm animals also need plenty of clean water to grow and stay healthy.

Air – Plants and animals need clean air to live. Plants take in carbon dioxide that we breathe out. Animals and humans breathe in oxygen that plants release.



What is a natural resource?

A natural resource is something that exists freely in nature. They are not created by humans, but humans do use their supplies to survive and function. There are two types of natural resources: nonrenewable and renewable.

Nonrenewable resource: cannot be easily replaced once destroyed; examples include fossil fuels, rocks, and minerals

Renewable resource: replenishes itself naturally; examples include animals, plants, air, soil, and water

Natural resources are all connected in one way or another. If something happens to one, it will affect the supply or quality of all the others.

We can protect and preserve our natural resources through **stewardship**. A steward is someone who takes responsibility for how they use and protect the environment. They utilize practices that help conserve our natural resources so generations in the future can use and enjoy them, as well.

Earth's land resources are limited

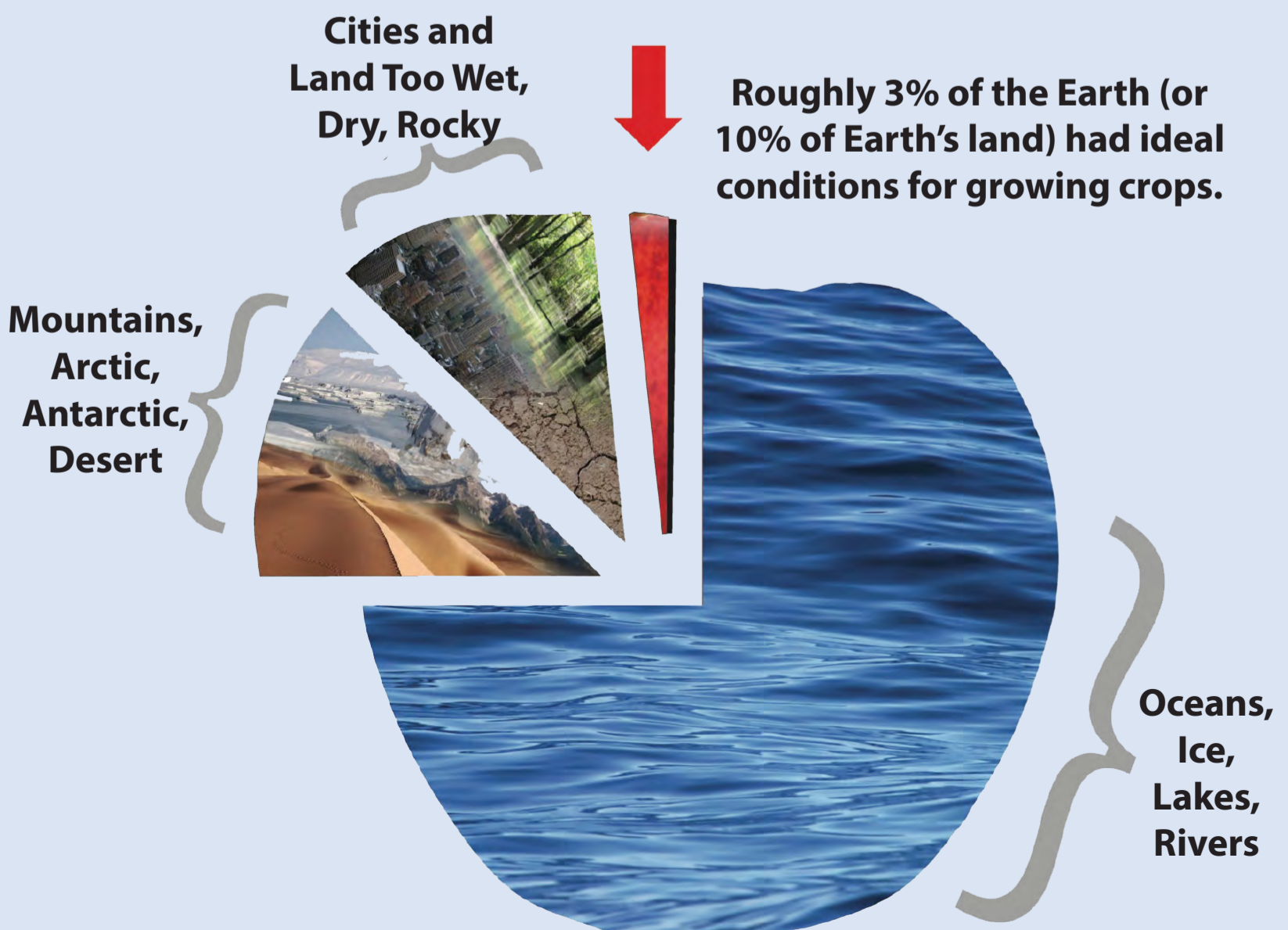
Imagine the Earth as an apple. Nearly three-quarters of the Earth is covered in water. The remaining quarter represents land area.

Of that remaining quarter, one-eighth or 12.5 percent of the Earth's surface is deserts, swamps, mountains, and polar region. This area represents half of our land area and is not suitable for people to live or to grow crops on.

The other one-eighth of the section of our land area (or 3/32 of the total Earth's surface) represents land where

people can live. There are some places where people can live, but crops can't be grown because it is too rocky, hot, wet, or it has been developed.

The fourth section, roughly three percent of the Earth's surface, represents the area of the world that is most suitable for development and agricultural cultivation. The best lands for agriculture are often desirable places to build homes and towns as well. This small piece represents all the soil of our earth upon which humans depend for food production.



Soil - More than dirt!

We interact with soil every day, even when we aren't thinking about it! We walk on it, we dig into it, we build with it, and we grow things in it. But what is soil? Is it just dirt that gets under our fingernails and stains our clothes when we play in it? No! Soil is a mixture of minerals, dead and living organisms, air, and water. Soil is one of our most useful natural resources.

Soils are **limited natural resources**. That means that while they are renewable because they are constantly forming, they do so at an extremely slow rate. One inch of topsoil can take hundreds or even thousands of years to develop.

A few ways soil can be negatively impacted are:

- **Erosion** – The wearing of soil by water, wind, and human actions.
- **Urban development** – Moving soil around or removing the soil to construct buildings and roads.

- **Contamination** – When harmful objects, chemicals, or substances pollute the soil in a way that causes harm to other living things or destroys the soil ecosystem.
- **Compaction** – The pressing together of soil particles causing the soil to become hard and usually very dry.



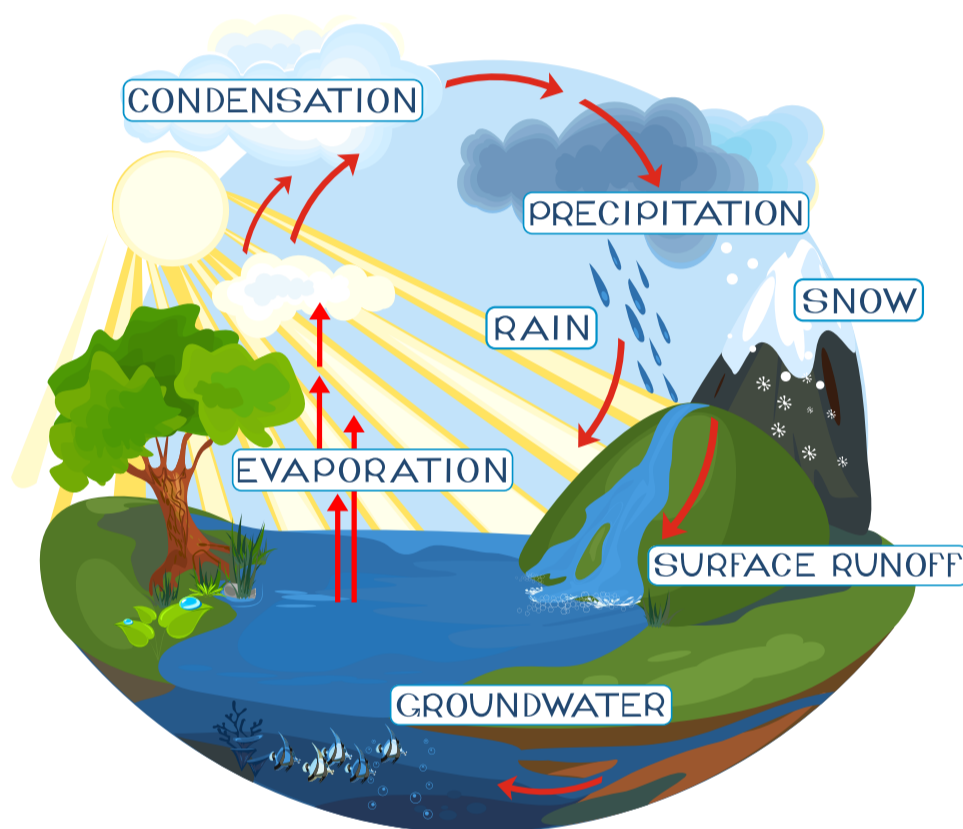
Water - Essential for all life

You have probably heard the phrase, "Water is essential for all life." And that is 100% true! Life on earth cannot be sustained without water. We rely on it to hydrate and clean our bodies, nourish our crops and our gardens, cook food, keep our animals healthy, for use in many industrial applications, and SO MUCH MORE. Water is considered a **renewable resource** because it is restored again and again by the water cycle.

In Colorado, we are in a unique position as a "headwater state." Hawaii is the only other headwater state. There are no rivers that flow into Colorado. Nearly all of our water supply comes from the rain and snow that falls throughout the year. Amazingly, the water that falls in Colorado supports millions of people in our state, plus 17 other states and Mexico!

Statewide the annual average precipitation is only 17 inches of rain, snow, hail, and sleet. However, the mountains receive closer to 60 inches. The

natural environment – all the living and non-living things in our ecosystem – uses 85 percent of the precipitation. That leaves only 15 percent of the water for the many other ways we use water.



The Water Cycle

How does Colorado make sure everyone gets their share of the water? One way is through the Colorado Water Plan. The **Colorado Water Plan** was developed in 2015 to look ahead and develop solutions to meet the future water needs of a growing population, while still supporting the existing water uses Coloradans value and rely on. It is like a road map to support healthy watersheds, the environment, recreation and tourism, thriving cities, and viable agriculture.

Colorado's population is estimated to double from the current five million residents today to ten million by 2050. This means we must be working today to figure out the best ways to sustain that many people in the future!

Air - Fresh air

There's no way around it – plants, animals, and humans rely on air every moment of every day! Air is essential to all life and it's important we keep our air clean. When the air is clean, we can breathe more easily and be more active. Plants grow better and animals can thrive when they aren't breathing in pollutants.

Air pollution is the presence of a substance in the air which has harmful or poisonous effects. Pollution in the air is harmful to humans and animals, and it can damage the environment. We can't always see pollution right in front of us, but have you ever noticed a brown haze hanging in the sky? That is air pollution. Unfortunately, we cannot get around some air pollution because we, as humans, do a lot of things that cause it. We drive cars, run factories, burn fossil fuels, and so much more that can negatively affect

our environment. But there are ways each of us can minimize how much air pollution we are responsible for!

Here are a few tips on how you and your family can reduce air pollution:

1. Conserve energy by turning off lights, using the furnace or A/C only when needed and use appliances minimally.
2. Carpool, use public transportation, walk, or bike whenever possible.
3. Make sure your parents aren't letting their cars idle before driving.
4. Use environmentally safe cleaning products.
5. Recycle! Plastic, glass, aluminum, and paper goods are all easily recycled.
6. Carry around and refill a reusable water bottle every day instead of drinking from single-use plastic water bottles.





Colorado Commissioner of Agriculture Kate Greenberg

Kate Greenberg was appointed to serve as Colorado's Commissioner of Agriculture by Governor Jared Polis in December 2019. As Commissioner, Kate provides leadership and direction to the Colorado Department of Agriculture and its 300 employees. Commissioner Greenberg has worked in agriculture for more than 12 years, from boots-on-the-ground experience to advocating for family farmers. While she currently spends much of her time on Colorado's Front Range and traveling the state, she still calls Durango home.

Q: What is stewardship and why is it important to Colorado agriculture?

Commissioner Greenberg: Being a steward of something means to take care of it. People are stewards of all kinds of special things, like friends

and family, pets, homes, schools, and other things they care about. Agriculture is an important part of our lives. Farmers and ranchers provide the food we eat, the fabric for our clothing, and help keep our environment healthy. The success of agriculture is something that touches all of us, and it's affected by the weather, laws, prices, the support of consumers, and many other factors. It's very important for people to be stewards of agriculture in our state of Colorado because we all want and need healthy food, soil, and water today and in the future.

Q: What do you mean when you say "soil health"? Does a doctor check the soil?

Commissioner Greenberg: There are many experts--sometimes called soil scientists--who are focused on the health of the earth's soil. Soil is a living, active, natural resource that agriculture relies on to grow and raise food and other products. Soil needs care and attention to stay healthy, just like you. We know that certain practices, like keeping the ground covered, changing crops from season to season, and actively managing grazing by livestock can help keep Colorado's soil healthy and strong. When it's healthy, soil has more nutrients, it can hold more water (which helps save water), and it can even play a part in keeping our earth cool. There is a lot going on in the soil under our feet!

Q: What are Colorado farmers and ranchers doing to be good stewards of our natural resources?

Commissioner Greenberg: Farmers and ranchers have been excellent stewards of our natural resources for hundreds of years and that continues today. The way they act as stewards has changed over the generations, just like life has changed. They are more concerned than ever before with taking care of our state's water, soil, and air because that's important to agriculture and to all who eat. At the Colorado Department of Agriculture, we are working with farmers and ranchers to create a new Colorado Soil Health Program that will help farmers and ranchers build new ways to improve water, soil, and air quality. We also help farmers and ranchers develop renewable energy on their land to save money and help the environment.

Q: How can students get involved in agriculture?

Commissioner Greenberg: There are many fun and delicious ways to support agriculture! One good way to start is to look for and talk to your family about eating foods that are grown or raised in Colorado--many of these have a "Colorado Proud" label on them. Visiting local markets and farms is a fun experience and another place to find Colorado foods. Help with a community garden, plant your own garden, or join an ag-focused club like 4-H or FFA. Keep learning about agriculture. Knowledge is power, and the more people who know about agriculture, the stronger it will be!

Climate smart agriculture

Farmers and ranchers use many climate smart agriculture practices. These practices reduce the negative impact on the environment. They keep the soil healthy, conserve water use, and reduce air pollution. The goals of climate smart agriculture are:

Increase Productivity: Producing food, fuel, and fiber for our world requires the use of natural resources and comes at a cost to our environment. If we can increase the productivity and efficiency of our farming practices, the overall environmental impact of producing food (per calorie) will be less.

Enhance Resilience: Although lessening climate change is important, our climate is changing. Measures to enhance the resilience of livestock and crops to climate change are necessary to continue to produce food for a growing population.

Reduce Emissions: Science and technology are helping us identify ways we can change farming practices to reduce greenhouse gas emissions.

Take a look at these climate smart agriculture practices Colorado farmers and ranchers are using.

Minimum tillage or no-till – Farmers till their fields to loosen soil and make it better for seeds to start growing. Loose soil is more at risk to wind and water erosion. Tilling turns the soil over allowing carbon that was stored in the soil to be released into the atmosphere. Depending on the soil type, many farmers are able to reduce (minimum till) or eliminate (no-till) the number of times they disturb the soil before seeds are planted. Minimum or no tillage helps preserve the microorganisms that live in the soil. The organic matter from previous years helps hold the soil in place. It also helps preserve the moisture in the soil and decrease carbon emissions.

Precision agriculture – Farmers and ranchers use technology to be more productive while using fewer inputs. This is called precision agriculture. Global Positioning System (GPS) technology allows

farmers to vary the amount of water and fertilizer added to a field depending on the needs of the plants in each area of the field. Drones are also used to treat specific areas of the field for weeds, pests, and apply nutrients. This technology increases productivity and efficiency of crop production leading to a higher yield.

Cover crops – Farmers can plant cover crops after harvest. The growing plant roots help hold the soil in place during winter and early spring. Wind and water erosion can be greatly reduced. Cover crops can also absorb extra nutrients in the soil (like nitrogen). This prevents them from running into watersheds. Cover crops can increase soil health, water retention, and even yield. Healthy soil decreases greenhouse gas emissions by increasing soil carbon storage.

Rotational grazing – Cattle, sheep, or horses graze (eat) on grasses and other forages in pastures and fields. To prevent soil erosion or compaction, ranchers rotate their animals to different pastures or



Photo by Jennifer Nichols

different areas within one pasture. This practice helps more plants grow and improves the quality of the soil.

Selective breeding – Selective breeding is the process by which humans select plants and animals with desired traits to propagate. These desired traits could include growth rate and milk production in livestock or time from seed to harvest and cold tolerance in plants. The opposite of selective breeding is natural selection where plants and animals reproduce only by “survival of the fittest” rather than humans helping to select helpful traits. In terms of food production, plants and animals would be less productive without selective breeding. Selective breeding enhances our resilience to climate change.

Crop rotation – Crop rotation is a farming practice where farmers change the crop they grow on a piece of land each year. In Colorado, it is common for farmers to rotate crops like corn and wheat. This practice helps to control weeds and reduces pests. Rotating crops also improves the crop yields, or the amount of

a crop that is harvested from one field. When crops are planted in rotation, less nutrients in the form of fertilizers are needed for plants to grow. Reducing fertilizer use reduces greenhouse gas emissions.

Irrigation - Farmers use efficient irrigation techniques, like center pivot sprinklers or even subsurface (underground) drip irrigation. Irrigation is the application of controlled amounts of water to plants. In Colorado, most farmers are in areas where they don't get enough rainfall to support certain crops, so they must add water to the ground with irrigation.

Recycling water – Many farmers are able to recycle the water they use for multiple uses. For example, on a dairy farm, water is used to clean the area where the cows are milked and the equipment to milk the cows. That same water is then used to flush the manure out of the barns. Next, it is blended with irrigation water to nourish crops being grown in the field. Those crops are oftentimes used as feed for the dairy cows. It is a complete cycle!

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COLORADO
Department of Agriculture

Colorado Foundation for Agriculture

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The Colorado Foundation for Agriculture thanks all of our sponsors and supporters. When you donate to the Colorado Foundation for Agriculture, you help make the next generation agriculturally literate. To learn more or to make a tax deductible donation, visit www.GrowingYourFuture.com.

Professional Development Opportunity

The Colorado Foundation for Agriculture offers a professional development program for educators called the Food, Fiber, and More Summer AgriCULTURE Institutes. These Institutes are five-day courses, designed for teachers. Attendees learn about Colorado agriculture, tour farms, ranches, and food production facilities, and learn innovative, standards-based ways to incorporate food, fiber, fuel, and natural resource topics into academic curriculum. Teachers are able to earn Continuing Education Units or graduate level credits from Colorado State University by completing the course. The 2020 course locations and dates are listed below:

• **June 15-19, 2020 - Advanced course (201)**, designed for anyone who has previously attended a



Summer AgriCULTURE Institute. This course will be located in Brighton.

• **July 6-10, 2020 - Regular course (101)** “Agriculture on the Western Slope” to be held in Grand Junction.

Free lesson plans on the Curriculum Matrix

The National Agricultural Literacy Curriculum Matrix is an online, searchable, standards-based database of classroom ready lesson plans and resources for K-12 educators. The Matrix contextualizes national education standards in science, social studies, and nutrition education with relevant instructional resources linked to Common Core Standards. Start searching the Matrix now at: <http://bit.ly/2Ebc0l5> or visit www.GrowingYourFuture.com.

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