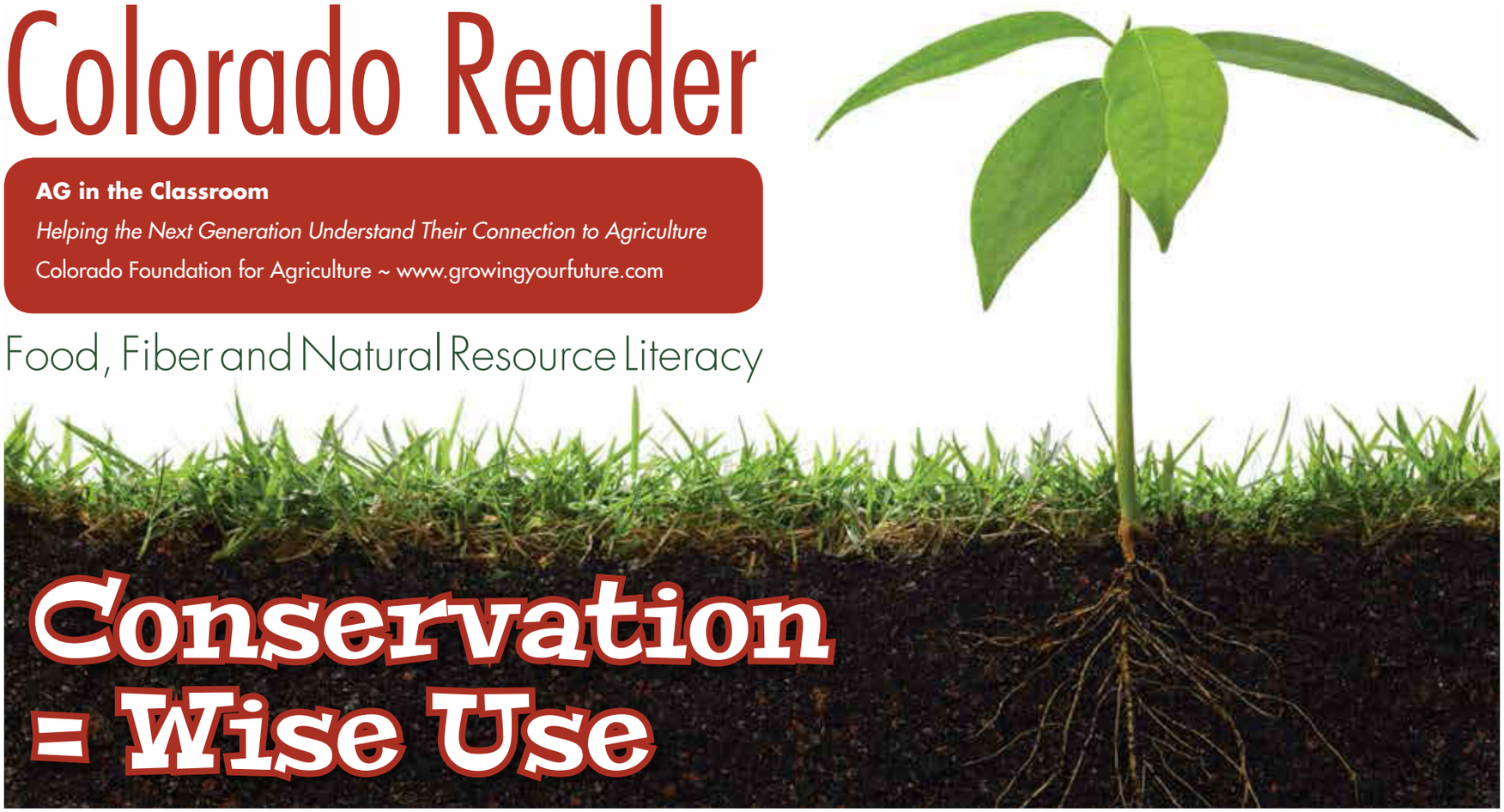
Colorado Reader

AG in the Classroom
Helping the Next Generation Understand Their Connection to Agriculture
Colorado Foundation for Agriculture ~ www.growingyourfuture.com

Food, Fiber and Natural Resource Literacy



Conservation = Wise Use

"While the farmer holds the title to the land, actually it belongs to all the people because civilization itself rests upon the soil."
—Thomas Jefferson

Back when our nation was young, natural resources seemed unlimited. Over time we've grown to understand that we have to care for and use these resources wisely.

We sometimes forget that soil—the skin of the Earth—is one of the most important and valuable natural resources.

When you play outside—away from the pavement—the ground under your feet may seem like 'dirt' and plants. That 'dirt' is actually soil—a mixture of rock particles, clay, living and dead organisms, minerals and nutrients. Soil is a living thing, and it is as important to our lives as air and water.

Soil provides vital functions. It sustains plant and animal life below and above the surface. It absorbs, filters and controls water flow. It contains and cycles nutrients. It provides support for buildings.

Soil is the basis for the ecosystem that includes all of the plants and animals—even you.

"Conservation" is the word we use when talking about caring for and using our natural resources wisely, including soil. Over the following pages, we'll explore what conservation means and more about soil.

From the Ground Up

The Common Thread

All of the items in the shopping cart have something in common—they all come from the soil. Consider a couple of the options. Milk comes from cows. The dairy cows eat a mixture of grains and other plants that are grown on a farm. Without soils, the farmer couldn't grow the feed for the cows. The bread is made from flour and other ingredients. Flour usually comes from wheat. Wheat seeds are planted in the soil and grow to be harvested by the farmer.

The connection to soil doesn't stop with the food itself. The raw materials for packaging or to make the cart start in the ground.

List some of the things you ate for breakfast and then explain how they are related to soil:

1 .....

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2 .....

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3 .....

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4 .....

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Bonus Question—The materials for your clothes are also tied to the soil. Pick one item and explain how the materials are related to soil:

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It's Official...

You probably know that Colorado has an official state flag, state song *(Where the Columbines Grow)*, state bird *(Lark Bunting),* and state fossil *(Stegosaurus)*. But did you know we have a state soil? It's called Seitz. This type of soil doesn't cover the entire state, but is found in the mountain areas of southwestern and central Colorado. Seitz soils are particularly good for forests of spruce trees and some grasses.

Spruce Grouse (below) and Mule Deer are just two of the many animal species that depend on spruce forests and Seitz soils.

A female Spruce Grouse

Digging in...

The Earth's Land

Soils have unique physical, chemical and biological properties important to their use. Lands that are being farmed to produce crops are called arable lands. These lands have the soils and climate favorable for farmers to grow food. While world population is growing, there is a limit to the amount of land that can be used to grow food.

To better understand how valuable arable lands are, use an apple to represent the Earth. Cut the apple into four pieces. Set aside three of those pieces (or eat them); they represent water. Cut the remaining piece in half. Set aside one piece. The remaining piece represents the land where people live. Cut this piece into four sections and set aside three of the pieces, they represent land not usable for farming. The remaining piece represents the portion of land that can be farmed. Now peel the skin. The skin represents the soil—the source for nearly all of our food.

A Worm's-Eye View... What's on, and in, the horizon?

Did you know that there are horizons in the soil? They're named O, A, B, and C. O is the top horizon. It's about an inch thick made up of dead stuff that breaks down and keeps the soil "O"-so healthy. The A horizon is topsoil that's alive with roots, tiny micro stuff like bacteria and fungi, and all kinds of critters like me. The A horizon is "A-OK" with me. Number three is horizon B. Plants and animals have a tough time getting through B. Why? "B"-cause it's very hard. See horizon C? You see, horizon C has less living stuff in it than O, A, and B. C is parent material that's made up of the rock and soil that formed the three layers above it.

Topsoil is What Sustains Us

Topsoil is the most productive of the soil layers. It is generally 2 to 8 inches deep. Plants usually have most of their roots in and obtain most of their food from this layer. Topsoil is also the layer with the most microorganisms.

When topsoil is healthy, it helps maximize the growth of plants, including food crops.

If topsoil isn't cared for properly, plants don't grow as well. In the case of crops, both food production and nutrient value can be reduced if soil is degraded. In severe cases of soil degradation, once productive landscapes can become deserts.

Understanding Soil

What is soil?

Soil is the basis of the ecosystems that support life in and above the ground. It is often called the “skin of the earth” because it is the thin layer that covers the top of the land. Soil has three major parts—minerals that come from rocks below or nearby, organic matter which is the remains of plants and animals that use the soil, and the organisms that live in the soil.

Not all soil is the same. How the mixture of the major components is balanced helps us describe what the soil is like and helps us understand what types of plants might grow well in an area.

Soil Types

Parent materials, climate, living organisms, topography and time determine the kind of soil.

Soils are divided into classes depending on depth, color, texture and chemical composition. All soils contain a combination of sand, silt and clay. Sands are individual particles of rock. They are easily seen. Sandy soil is coarse and feels gritty to the touch. Silt particles are not easily seen without a microscope. They feel like flour. Clay soil particles are nearly invisible. Clay forms a gummy mass when wet.

Making Soil

Soil is formed from rocks and decaying plants and animals. Even under ideal conditions, it can take more than 500 years to create 1 inch of topsoil. Because it takes so long to make soil, it is considered a limited resource and needs to be managed wisely.

Did you know...

...a teaspoon of soil may have billions of microbes divided among 5,000 different types, thousands of species of fungi and protozoa, nematodes, and mites.

- Topsoil is the most productive soil layer. It has varying amounts of organic matter (living and dead organisms), minerals and nutrients.
- An average soil sample is 45% minerals, 25%water, 25% air and 5% organic matter.
- Different sized mineral particles, such as sand, silt and clay, give soil texture.
- Plant roots break up rocks, which become part of new soil.
- Roots loosen the soil and allow oxygen to penetrate. This is beneficial to the animals living in the soil.
- Roots hold soil together and help prevent erosion.
- Earthworms digest organic matter, recycle nutrients and make the surface soil richer.
- Many medicines (antibiotics) are derived from bacteria found in soil.

Helping People Help the Land

Careers in Conservation

Wildlife Biologist

"My job is to help with conserving, restoring and enhancing wildlife habitat on private lands. I enjoy assisting landowners to be good wildlife stewards and managers." *—Noe Marymor*

Noe Marymor is the Natural Resources Conservation Service (NRCS) Area Biologist for northeast Colorado. She is based in Greeley.

Noe's job responsibilities include working with landowners to develop habitat projects; providing wildlife-related technical assistance to NRCS field offices; and working with other state, federal and nongovernment office partners to develop habitat conservation programs.

She graduated from Colorado State University with degrees in wildlife biology and statistics.When asked how she heard about the NRCS, Noe replied,

"One of my professors at CSU, Wendell Gilgert, was the NRCS West Regional Wildlife Biologist in the Portland State Office. He was instrumental in introducing me to habitat management and the NRCS."

Beaver

Sage Grouse

Habitat management is land planning that seeks to conserve, protect or restore the environment for wild plants and animals.

Some of Noe's major accomplishments as a wildlife biologist include: drafting and leading a group that provided input into the Western Slope Grouse Conservation Reserve Program; assisting in the creation of a unique system of beaver damage control called the "beaver deceiver," which has since been adopted for use in other states; and recording the first capture of a Spotted Bat in the state of Washington.

Noe also volunteers with the Colorado Wildlife Society and a group called Special Youth Challenge of Colorado, which takes disabled youth hunting.

That Was Then...This Is Now

A dust storm during the Dust Bowl of the 1930s blackens the sky. The dust came from farm fields that were bare of plant life.

Farmers check the results of no-till farming in their fields No-till farming is a way of growing crops from year to year without disturbing the soil through tillage. No-till is an agricultural technique, which increases the amount of water and organic matter (nutrients) in the soil and decreases erosion.

How we use soil affects quality. Farmers depend on healthy soils to grow the food we eat.

Agriculture is currently facing a big challenge. By the year 2050, global population is estimated to reach 9.1 billion people. Current estimates by the Food and Agricultural Organization of the United Nations say that food production needs to increase by 70 percent to meet this new demand. The wise use and care of soil is part of the solution.

Farmers have available to them a wide-range of crops, chemistry, equipment and techniques that can be used to build soil health and improve crop yields. In Colorado and beyond, these conservation practices include the wise use of water and a respect for the natural environment.

Ranchers commonly graze cattle, sheep and goats on lands that aren't suitable for crop production. Known as rangelands, these are natural landscapes in the form of grasslands, shrublands, woodlands, wetlands and deserts. Ranchers too are working to improve practices that help soils.

The Dust Bowl

During the 1930s, the United States experienced both the Great Depression and an ecological disaster that became known as the Dust Bowl. The Great Depression was a time of economic collapse. High unemployment and poverty plagued the nation. The Dust Bowl, which severely impacted parts of Colorado, was the result of poor farming practices and a period of extreme and persistent drought (drought is a length of time where rainfall is below normal).

Leading up to the Dust Bowl, vast areas in the west were being transformed from grasslands to farm fields to grow grain. Tractors were replacing horses, and could do much more work in a day. At the time, many people thought the equipment and practices would produce much more food for the country, but when the rain didn't come, crops died or failed to grow. Without plants or roots to hold the soil in place, the soil began to erode and blow in the wind. Huge dust clouds blotted out the sun and covered the land.

Some of these storms stretched across the nation

Wise Use of Natural Resources

and out to sea. Dust even sifted into the White House and onto the President's desk. As dust blackened the sky around Capitol Hill in Washington, D.C., Congress recognized the disaster and unanimously passed legislation declaring soil and water conservation a national priority.

Conservation Districts are Born

Conservation districts began in the 1930s when Congress passed the Soil Conservation Act of 1935. This act established a program for the control and prevention of soil erosion. It directed the Secretary of Agriculture to establish the Soil Erosion Service.

In 1937 President Roosevelt wrote the governors of all the states suggesting legislation to allow local landowners to form soil conservation districts. Since three-fourths of the continental United States is privately owned, the President and Congress realized only active, voluntary support from landowners would make conservation on private lands successful.

From this effort, 3,000 districts were formed across the nation. These districts are units of local government that help people and communities take care of the natural resources in their area including soil, water, wildlife, trees and other plants. Conservation Districts offer technical assistance and educational guidance to land owners and managers, local governments, teachers, students and people from every walk of life.

Fast Forward

Colorado can still have periods of below average rainfall. Currently, southeast Colorado is experiencing a multi-year, extreme shortage of rain which has led to dust storms similar to the Dust Bowl era.

The good news is that farming practices are much better than in the past. The work of Conservation districts also helps provide farmers and communities with the knowledge and programs they need to face ecological challenges now and in the future.

Colorado has 76 conservation districts (see map) working with the Natural Resources Conservation Service to help landowners make wise decisions about the use of natural resources.

Colorado Conservation Districts—find your nearest districts and see if you can visit their website.

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 contact: Bette Blinde, Colorado Foundation for Agriculture, P.O. Box 10, Livermore, CO 80536 or phone 970 881.2902 or e-mail bblinde@growingyourfuture.com. Financial support for this reader has been provided by the West Greeley Conservation District.

The Farm and Beyond


Conventional farm tillage

Tillage is a word that refers to the mechanical preparation of soil for planting. In your garden, this might mean using a shovel to turn the soil or a hoe to remove weeds. On the farm, tillage is usually a tractor pulling some type of implement. You may have heard of using a plow as seen in the picture above.

Tillage is primarily used to get more air in the soil, mix old plant matter into the ground, and control weeds. Soil is also tilled to facilitate some irrigation methods.


A seedling in a "no till" field

Tillage can also have negative effects on soil. There can be a loss of microbes, earthworms and nutrients leading to poor soil health. Tilled soil can also decrease the rate at which water soaks into the ground. Bare soil can more easily be blown away by the wind.

Alternative systems that reduce the amount of tillage balance crop and soil requirements. In some cases, the new seeds are planted into the residue from the previous crop without tillage (above). Some farmers change what crops they plant or plant specific crops solely for the purpose of managing soil health.

Conservation is an idea that begins with soils but includes entire ecosystems. Maintaining, improving or creating habitat that attracts or supports wildlife and fish is important.


Eastern Bluebird


Rainbow Trout


Mule Deer

Nearly all of the water in our streams and lakes, flows over or through soil. Soil can filter and remove pollutants from water. If soil erodes and washes into the water, it can negatively impact water quality and aquatic life.

When it rains or snow melts, some of the water soaks into the ground. Soil type impacts how fast and how much water is absorbed.

To find out more about conservation, visit your conservation district or the Natural Resource Conservation Service (NRCS) online.

Teacher's Guide

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Conservation Reader

Additional Resources

Conservation Resources

Want to find out what a conservation district does? Check out their website. Here is West Greeley Conservation District's website: http://www.wgcd.org/

Find your local conservation district at: http://www.coloradoacd.org/

Find out how your state government works to encourage conservation at: http://www.colorado.gov/cs/Satellite/ag_Conservation/CBON/1251617524244

The federal government also encourages conservation. Check out: USDA Natural Resource Conservation Service: http://www.nrcs.usda.gov/wps/portal/nrcs/site/national/home/

Other Resources

Myamericanfarm.org – Interactive online games which educate as they entertain - videos, teacher resources and family activities – all free!

agclassroom.org

This is the national website for Agriculture in the Classroom programs from across the nation. A site search will bring up a variety of lessons, books, videos and links.

colorado.gov/ag - connects you to the Colorado Department of Agriculture. You can learn about the various departments and access agriculture maps of Colorado.

growingyourfuture.com - connects you to Colorado's Agriculture in the Classroom program. A variety of resources are available at this site including past Colorado Readers.

INTRODUCTION:

Agriculture benefits everyone but it is often taken for granted because when we go to the grocery store we see shelves and shelves of food with plenty of food choices. Agriculture provides us these choices. Unless there is a hurricane or blizzard, we don't see empty shelves. Agriculture also provides many of the raw materials for the products we use everyday. From the wood to build our homes and schools to paper, medicines, vehicles and much more, agriculture keeps our society humming. Agriculture also provides open space and habitat for wildlife.

This reader discusses the conservation of natural resources or the wise use of these resources.

Page 2

Your students should recognize that the corn in their cereal and the wheat in their bread are grown in soil. Their orange juice comes from trees that also grow in the soil. Eggs are laid by chickens that eat grain grown in the soil.

Bonus question: Student should realize that cotton is grown, wool comes from sheep that eat grasses and forbs that grow in soil. Some might recognize that the leather in their shoes comes from cattle that graze the grass that grows in the soil.

This is a good opportunity to have the students build food webs.

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

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VOCABULARY

New words introduced in this reader:

Conservation - wise use of natural resources

Arable lands - lands that are being farmed

Horizons - the different layers of soil

Microorganisms - small organisms like bacteria, fungi, protozoa, nematodes

Tillage - mechanical preparation of the soil for planting

Standards:

National Agricultural Literacy Outcomes

Science Upper Elementary (3-5)

Agriculture and the Environment

Explain how the interaction of the sun, soil, water, and weather in plant and animal growth impacts agricultural production

- 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)
- Identify land and water conservation methods used in farming systems (wind barriers, conservation tillage, laser leveling, GPS planting, etc.)

Plants and Animals for Food, Fiber & Energy Outcomes

- Understand the concept of stewardship and identify ways farmers/ranchers care for soil, water, plants, and animals
- Explain how the availability of soil nutrients affects plant growth and development

ELA-Literacy

CCSS.ELA-Literacy.CCRA.L.4

Determine or clarify the meaning of unknown and multiple-meaning words and phrases by using context clues, analyzing meaningful word parts, and consulting general and specialized reference materials, as appropriate.

CCSS.ELA-Literacy.CCRA.R.1

Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

CCSS.ELA-Literacy.CCRI.R.3

Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.

MAKE YOUR OWN EARTHWORM FARM

Worms may not seem like one of nature's most inspiring creatures, but they play a vital role in the environment.

Worms help increase the amount of air and water in the soil. They break down things like leaves and grass into things plants can use. When worms eat, they leave behind castings. These castings are a valuable type of plant food.
Seeing worms in your garden is a sign the soil is healthy.

MATERIALS NEEDED:

- One dozen (12) night crawlers (buy them from a bait shop) or earthworms (collect from dark-colored moist soils
- Two medium sized flower pots with drain holes (do not use clear pots) Soil to fill the containers
- Dry plant materials
- Cardboard to cover pots

STEPS:

Fill both containers with soil. Do not use peat and do not use soil with much sand ~ it is rough on the skin of worms. The soil should be kept moist, but not soggy. Moisten the soil slowly

Add earthworms to one of the pots. The other pot is the control to see what happens without any earthworms. Make sure the worms get plenty of darkness every day by covering the top of the pots with cardboard. Earthworms like to work in the dark and covering them lets them work on the surface of the pot.

Sprinkle dry plant material on the surface of each pot. Use dry leaves, grass clipping or other plant material from you yard or a nearby field. Make a single thin layer of this material. Leave some soil visible.

Watch what happens. Each day take a look at the pots to see if anything changes. Look for burrow openings, worm poop (castings) and the disappearance of plant materials. The worms will bury the plant material in the soil and also mix the soil.

CAUTION:

A sick worm can infect and kill the whole bunch. Avoid this by removing dead worms quickly and by starting with healthy worms. They should be plump, quick-,moving and show no physical damage.

If you watch them for several weeks you may need to sprinkle both pots with water. When done with the experiment, the soil can be added to a flower bed.

Source: Bureau of Land Management

WORM FACTS

- There are approximately 2,700 different kinds of earthworms.
- Worms live where there is food, moisture, oxygen and a favorable temperature.
- Earthworms can move both forward and backward.
- Worms die if they dry out.
- Worms don't have teeth, but they have strong mouth muscles.
- Worms can eat their won weight each day.

Conservation
Evaluation ~ 2014

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 or what percentage of your students can describe what conservation is? _____

How many or what percentage of your students can describe the connection of food to the soil? _____

How many or what percentage of your students can explain what arable lands are? _____

How many or what percentage of your students recognize that there are different horizons in soil? _____

How many of your students understand that topsoil is the most productive soil horizon? _____

How many or what percentage of your students understand that different types of soil is made up of sand, silt and clay? _____

How many or what percentage of your students can describe what a wildlife biologist might do? _____

How many or what percentage of your students can describe what the Dust Bowl was? _____

How many or what percentage of your students can describe what tillage is? _____

Additional Comments _____

_____

_____

_____

_____

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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: _____

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EVALUATION

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June 2015 Fort Collins

Food, Fiber & More Summer Institute

Two continuing education credits

Five day course learning about Colorado agriculture and natural resource industries. The course includes classroom session, tours and a day walking in another person's boots!

See course description at www.growingyourfuture.com

Request electronic resources!

Colorado Foundation for Agriculture

Colorado Foundation for Agriculture is converting resource materials and adding new materials in electronic format for use on I-Pads, notebooks and computers. We need some "testers" before we sign off on unlimited release. Send an email to bblinde@growingyourfuture.com. Specify the technology your students will use and the grade level.

www.growingyourfuture.com