



Ag@School

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Stewardship: Protecting Agriculture's Resources

Farmers depend on the same tools which have been used since farming began more than 10,000 years ago. These basic tools are essential for plant life. Plant life is the source of food for every living thing. Farmers in America are among the best in the world. American farmers practice good **stewardship**, protect their tools, and use their tools wisely to produce **sustainable agriculture**.

A FARMER'S TOOLBOX CONTAINS THE RESOURCES THAT WORK TOGETHER TO GROW PLANTS.

Fill in the blanks with the correct resource:

1. The sun provides _____ which plants need to grow.
2. Healthy _____ provides nutrients and minerals that are taken up by plant roots.
3. People, crops, animals, industry, and aquatic life all must share the _____ supply.
4. Trees and crops use carbon dioxide and produce oxygen, making the _____ healthier for people.



Today's Children... Tomorrow's Leaders

Sustainable Agriculture: Using technology and resources to keep farms profitable, improve human lives, yet respect the environment.





Agriculture Feeds the World

If you ate food today, you should thank a farmer! Producing food to feed 7.8 billion people is no small task! Farmers understand that we need to use resources to produce food today without using up those resources. We will need those same resources to produce food in the future. While countries around the world will take one day, April 22, to celebrate and appreciate our environment, **everyday is Earth Day for farmers.**

This issue of Ag@School touches on two of the most important resources, soil and water. Every ecosystem on earth relies on soil. It is a complex layer teeming with life. Soil is where the atmosphere, water, sunlight, and the earth's crust mix and interact. Almost all the biological activity in the soil takes place in the top one or two inches (called the **topsoil**). Water is essential for all life. To produce food for you to eat, farmers need water, either rain or water stored for irrigation.

Farmers are able to grow more food on each acre by using science and technology. They choose improved seeds and plants and often test the soil before planting to determine the composition, pH (acidity or alkalinity), and balance of nutrients present. Results are used to determine the proper type and amount of fertilizer to apply for the specific crop they are planting. Farmers also manage pests and use better equipment and techniques to increase production.

Farmers know and appreciate their land and the advancements in science and technology which have allowed farmers to be more efficient at using critical resources.

*"Treat the earth well; we do not inherit the Earth from our Ancestors, we borrow it from our Children."
- Ancient Indian Proverb*



A VERY "FRUITFUL" STATE

WASHINGTON IS A TOP PRODUCER OF APPLES, PEARS, SWEET CHERRIES, RED RASPBERRIES AND CONCORD GRAPES.



TREE FRUIT

Washington produces 69% of all US apples, but accounts for 90% of all apples exported to other nations. Our slogan "The Best Apples on Earth" certainly describes Washington apples that are shipped to over 60 countries around the world. Washington produces nearly 45% of the pears grown in the US. Thanks to advancements in Controlled Atmosphere (CA) storage technology, fresh apples and pears are available to consumers nearly year-round. The three main tree fruit regions are the Wenatchee Valley, Columbia Basin and Yakima Valley. These areas are ideal because of the mild climate, dry growing season, good soils, and plentiful irrigation water from nearby rivers.



1. Because we produce over half of the U.S. crop of this fruit and ship them world wide, Washington is know as the _____ Capital of the World.

A BERRY NICE PLACE

Berries are grown in many areas of our state but the major production area is the Puget Sound lowlands. The soil and climate there are great for blueberries, strawberries, raspberries and blackberries. Most cranberries are grown in the Willapa Hills region. 60% of America's red raspberries used in processing (quick frozen berries, concentrates, purees and other products) are grown in Washington, most of those in Whatcom County



3. If WA harvests 9,600 acres of red raspberries and the yield is 8,070 pounds per acre, the total harvest will be _____ pounds.

How many tons? _____

STONE FRUIT

No, they don't grow out of rocks! **Stone fruits** have a large, hard seed called a pit. Cherries, apricots, peaches, nectarines, plums and prunes are all stone fruits produced in our state. Weather is very important to a stone fruit grower. Rain and hail can damage the tender fruit and destroy an entire crop in the blink of an eye.

Even gentle rain on cherries is bad. A water drop collects in the dimple where the stem is attached and causes the cherry's skin to split open. This ruins the fruit. If it rains a grower might pay a helicopter to hover over his trees to blow the water off and dry the fruit quickly.



2. Comparing weather across the state, why would most stone fruit be grown in Eastern Washington?

GRAPES

The grape industry has grown to become Washington's 9th most valuable crop. We lead the nation in production of Concord grapes (used for juices and jams) at 42%. We also produce 25% of the nation's Niagara grapes and are second nationally in the production of wine grapes.



Nearly all our grapes are raised east of the Cascades.



4. Which is your favorite – grape juice, grape jelly, or fresh grapes?

Which one is better nutritionally?

SUSTAINABLE AGRICULTURE ...

American agriculture is the most earth-friendly in the world. Our farmers know they need to be friends of the land, soil and water. Why? If they treat the earth well, it will be able to keep giving back... and not just for us today, but for future generations too.

Sustainable agriculture meets the needs of today but does not use up resources for the future. It must be:

- Environmentally friendly; taking care of the soil so it will remain productive now and in the future
- Profitable enough to keep farmers in business
- Able to improve the quality of life for farmers and all of society

Both conventional agriculture and organic agriculture can be sustainable.

Organic food is produced without using fertilizers made with synthetic ingredients, genetically engineered seeds, or synthetic pesticides (but natural pesticides and mineral salts can be used).



Organic food accounts for nearly 6% of total sales in Washington. Organic production certainly meets the first condition of sustainability, being environmentally friendly. Organic food is usually

more expensive than conventionally produced food. It needs to be, because it is often more expensive to produce organic crops because there is more labor involved. The majority of organic foods are higher cost fruits and vegetables. It is easier to farm organically on smaller farms, or with established fruit trees or vines that do not require annual planting.

Large-field crops like grains are less likely to change to organic because there is not enough profit to pay for the extra labor, while growing fewer bushels, and losing a year of production when producing green manure. Remember to be sustainable, farmers have to make enough money to stay in business.

Sustainability does not mean raising crops without the benefit of commercial fertilizers, pesticides or biotechnology.

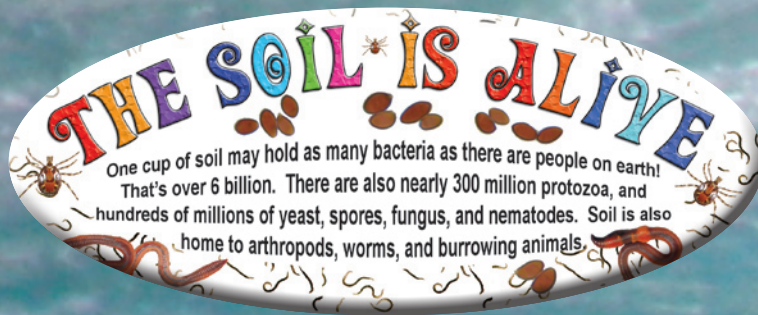
It is true that organic production does not use synthetic (man-made) fertilizers. If we went to only organic production, we would have to produce the necessary nitrogen (the main plant nutrient) by either:

- Converting 1/3 of all crop land into green manure production (where crops are plowed down into the soil). This is a great method for improving the soil and adding nitrogen, but it takes that land out of production for that growing season (and perhaps for a second year in dryland Eastern Washington in order to build up enough soil moisture for a grain crop).
- Or increasing the number of cattle to produce the manure necessary to replace synthetic fertilizer. The US currently has 97 million head of cattle; we would need to add another billion head. Can some of them stay in your backyard?



Isn't organic food better?

The answer is more about varieties and handling than production systems. Locally grown food (whether organic or conventional) may indeed taste better. Characteristics that make fruits and vegetables ship well, process easily, or extend the shelf-life may come at the expense of flavor and texture. Buying from local growers gives you the chance to try varieties of red, juicy strawberries, flavorful tomatoes, and carrots with more vitamin A.



IT ALL BEGINS

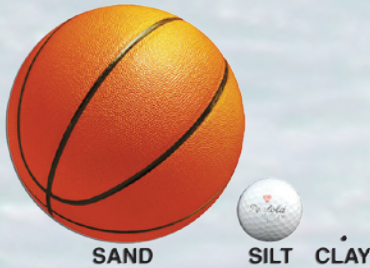
Natural resources fit together like puzzle pieces on earth. Caring for soil and water helps us to produce food today, and in the future.



Fill in the blanks with the correct response.

1. The sun provides _____ energy.
2. Healthy _____ provides nutrients _____ by plant roots.
3. People, crops, animals, industry, aquatic life, and _____ supply _____.
4. Trees and crops use carbon dioxide and release oxygen, making the _____ healthier.

3 Basic Soil Particle Sizes



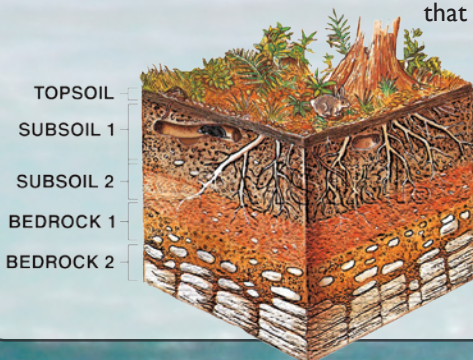
CAN YOU DIG IT?

Soils are made of three basic particles called sand, silt, and clay. The difference in size between the three would be like comparing a basketball (sand), a golf ball (silt), and the tip of a ballpoint pen (clay). Soils from different locations vary in their amounts of each of the three particles. The amount of each type of particle is important because that determines the capacity of the soil to hold water and air. In the Columbia Basin soil can be very sandy whereas near Mica, WA the soil is nearly all clay. In fact, there is a business in Mica that uses the soil to make bricks.

Ideally soil is:

- 45% particles (sand, silt, and clay)
- 5% organic matter (dead plants and animals)
- 50% empty space (pores) with half filled with air, and half filled with water

Without decayed organic matter (**humus**), the soil loses its capacity to retain the water and air that soil organisms need.



Grazing Benefits Animals and Soil Alike

Beef is one commodity that is produced in all 39 of the counties in Washington State. Cattle and other grazers such as sheep and goats are able to utilize land that is not useful for growing crops. This land may be too steep, too rocky, or even too wet to grow other crops. Grazers convert solar energy (in the form of grass and other plants) into nutritious high-protein foods for the human diet. Some of the many environmental benefits of well-managed grazing land are: plant growth is promoted, soil erosion is reduced, brush is controlled, and at the same time the ground is fertilized with manure. Grazers can clear excess vegetation from forest undergrowth which reduces the fuel load for wildfires.

Grazing along streams removes excess plant matter that would otherwise decompose into the water (think about how water in a vase of flowers looks and smells after a few days). Grazing animals are also used in cities to control overgrowth. Well-managed grazing utilizes land which is not good for growing crops and it can also improve the water quality and habitat for fish and wildlife.



SOIL CONSERVATION



With help from science, farmers have developed conservation practices that reduce soil loss. The movement of soil from one place to another by wind or water is called **erosion**. Erosion can occur anywhere but is usually worse in places that are steep or where there are no plant roots to hold the soil in place. Stopping erosion is important because it can take hundreds of years for nature to replace just one inch of good topsoil.

One conservation practice is planting windbreaks. Another conservation method includes farming with the contour of the land and planting strips of crops across hillsides (these

methods slow down the gravity flow of water). Another is **conservation tillage**. To stop erosion many farmers now use equipment and methods that use less tillage. When land is tilled (plowed or cultivated), soil particles are exposed to wind and water erosion. The more times a farmer disturbs the soil, the finer the particles become and the worse the erosion potential. Following harvest, crop residue is left in the field and often the field is not disturbed until it is time to plant the next crop. The roots hold the soil in place. Less tilling means fewer tractor trips across the fields using less fuel therefore less air pollution from dust and machine exhaust.

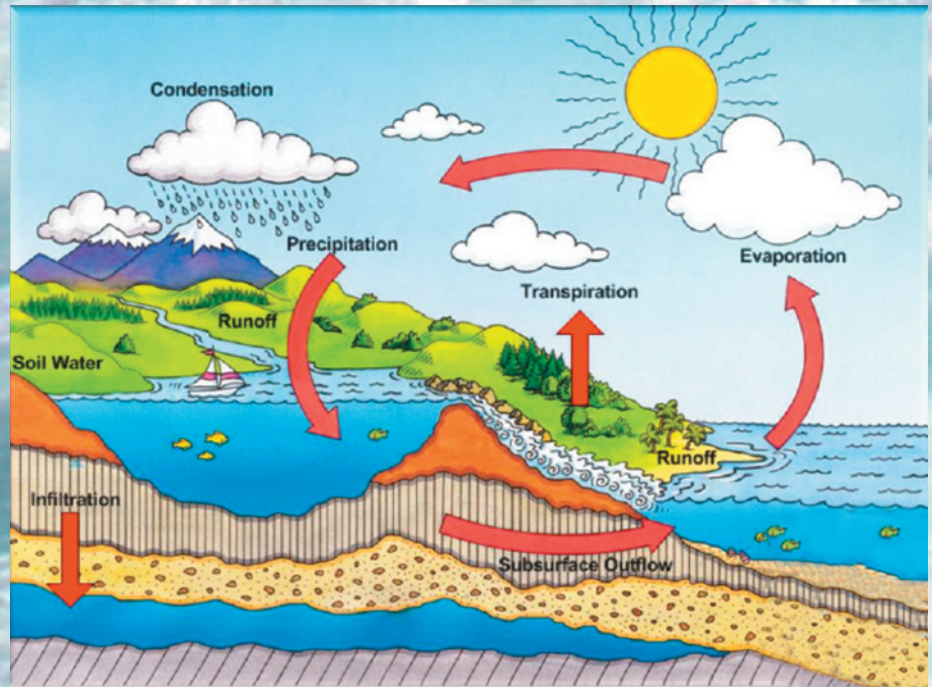
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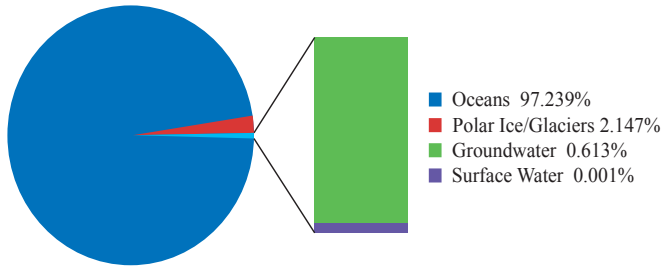
Water—The Most Common Material on Earth



<http://youtu.be/vYBjPE0wekw>

Total Water on Earth

Remember that about 70% of the earth is covered by oceans and those oceans hold more than 97% of all the water. Just over 2% of the water is frozen in glaciers. That means that less than 1% of the earth's water is available for drinking, and most of that is groundwater. The very thin purple line at the bottom of the bar to the right of the pie chart represents all the combined water in lakes (0.017%), the atmosphere (0.001%) and rivers (0.00001%)



The water cycle is the circulation of the earth's water in a never-ending process. The heat from the sun causes (1) water from the ocean, streams, lakes, and even plants to evaporate. As the water vapor rises, it is cooled by the upper air. Cold air cannot hold as much water vapor as warm air so (2) water vapor condenses into water droplets and creates clouds. The wind carries clouds over the land and (3) water falls back to earth as precipitation.

Water is Life!

All living things (plants, animals, humans) must have water to survive. **The amount of water on earth stays the same. It is never 'used up', but continues to move through the water cycle.** However, the water in a specific location can change in amount or form, sometimes we have a drought and sometimes we have extra snow or rain. A growing human population puts pressure on available water.

Condensation: The process of water vapor in the air turning into liquid. As water vapor rises it cools and becomes liquid again. These droplets form around dust particles in the air and become clouds.

Evaporation: Changing from a liquid or solid state to a vapor or gas. Only pure water evaporates. Substances like salt and minerals are left behind when water evaporates.

Groundwater: Water which has seeped below the earth's surface and is held there in the underlying sand and gravel. Water bearing layers are called **aquifers**. In Washington, 2/3 of the people get their drinking water from aquifers.

Percolation: The movement of water into soil through pores, holes and cracks.

Precipitation: Rain, snow, hail, sleet, dew, and frost.

Transpiration: Water that is absorbed by plants, usually through the roots, is evaporated into the atmosphere from the plant surface through leaf pores.

Irrigation Water Benefits Fish



Any water used for irrigation of crops that is not absorbed by growing plants moves as groundwater back to streams and rivers. This water returns more slowly and at a much cooler temperature than water left in the stream. Cool, clean water entering rivers in summer and late fall is very good for fish!



What insect helps you the most?

The honeybee. If it weren't for bees carrying pollen between the male and female flower parts, there wouldn't be any apples, almonds, or cherries. One-third of all our food - fruits and vegetables - would not exist without bees visiting plants.

Take some guesses on this "Bee Trivia" quiz:

1. How fast can a honeybee fly? _____
2. How many eggs does a queen bee lay in a day? _____
3. How many times does a honeybee need to visit an apple blossom to help create a perfect apple? _____
4. How much honey (fuel) would it take for a honeybee to fly one trip around the world? _____

1. 15 miles per hour 2. 800 to 1500 3. 40 to 50
4. 2 tablespoons of fuel (honey)

Protecting Crops From Pests

What's a pest?

A **pest** is anything someone doesn't want around. It can be a weed, a bug, a germ or your neighbor's dog. Pests aren't necessarily bad; we just wish they'd go someplace else.

Pests are a big concern for farmers and weeds are the biggest problem. More than 1,800 kinds of weeds compete with crops for nutrients, water and sunlight. There are about 10,000 insect species that can attack crops and animals.

Why do we need pest control?

If weeds, harmful insects and diseases are not controlled, crop yields could be cut in half. This would result in needing twice as much land to meet today's food needs. As the population grows, even more food will be needed. In order to save land for things such as: wildlife, forests, and recreation, we must grow our food on the least amount of land possible.

What's a pesticide?

The word pesticide is like an umbrella. Under this umbrella are various classes of chemicals that work on different pests - things like weeds, insects, fungus, germs and disease.

Pesticides are not bad or scary. We use them every day in our homes without even thinking about it. They kill germs in the kitchen, molds in the bathroom, and bacteria in our mouths. That's right! Mouthwash is a pesticide; it kills germs.

Pest control in agriculture

In the past, farmers relied mainly on chemical pesticides to kill pests. This method often killed good insects like ladybugs, lacewings, and praying mantises that feed on harmful insects. Today, farmers use a whole "toolbox" of pest control methods, called **Integrated Pest Management** or IPM. These tools include cultural, mechanical, biological and chemical methods (definition on Page 4). IPM systems are kinder to both the environment and are beneficial to insects. Agricultural pesticide use has been dropping for over 20 years. This is due, in part, to the use of IPM. Newer pesticides are used in very tiny amounts. Pesticides are very expensive and farmers can't afford not to use them wisely.

Weeds - Agriculture's #1 Pest

A weed is a plant growing in the wrong place. A rose bush growing on a football field is a weed.

How Do Weeds Travel?

Weeds are able to spread and grow without human help and they are pretty sneaky about spreading their seeds. Seeds travel by wind, water, animals and humans. They stick on cars, boats, shoes, pets and bike tires. Some weed plants can even "throw" their seeds as far as 15 feet.

How Are Weeds Controlled?

Weeds can be controlled by planting other plants to compete with them, by mowing them down, or by introducing insects or diseases to control the plant. Also, farmers carefully and responsibly use chemical herbicides. The best control is achieved by using a combination of all those methods, called Integrated Pest Management.

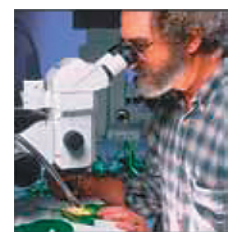


This may look like a pretty flower, but it is actually Canada thistle, a bad weed.

Liquid herbicides such as this are sprayed on the bad weeds (like Canada thistle) to kill them.



This scientist studies ragweed leaves under the microscope. He is searching for a biological way to control this bad weed using natural fungi.



Forestry

Trees grown in managed forests are essential to our lives. Just look around. Products made from trees can be found everywhere from plywood and paper to components in toothpaste and artificial bones. Wood naturally stores carbon, helping slow climate change. When it's used in buildings as lumber and cross-laminated beams, that carbon is stored away permanently. The great news is that wood harvested in Washington is



grown sustainably. That means this resource will continue to produce wood and store carbon for generations to come. Private foresters practice guidelines for keeping water clean and cool for fish. When they harvest, foresters leave some trees for wildlife habitat. The open areas created by harvesting timber provide berries for wildlife to eat. Birds, squirrels and other animals make their homes in growing trees. As trees mature and fill in the open areas, foresters remove some trees to prevent wildfires and keep the forest healthy. Foresters also control weeds and brush so the baby trees they plant will grow strong and healthy.

Each year forest landowners in Washington plant an average of 52 million tree seedlings in areas that have been harvested; about three trees for every one harvested. Through their detailed planning and wise stewardship, Washington's private timberland owners will continue to create jobs from healthy forests lasting indefinitely into the future.



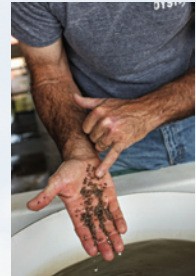
Foresters manage the land that keeps Washington world famous as the Evergreen State! Contributed by Washington Friends of Farms & Forests

Clams in Agriculture?

Did you know Washington State is the nation's leading producer of farmed clams, oysters, and mussels? That's right. We harvest almost 10 million pounds of Manila clams every year and sell them across the country. The value of all shellfish harvested in Washington in one year is \$182 million!



Wait, why are we talking about shellfish in an agriculture article? We harvest so many clams, oysters, mussels, and geoduck we have to replant every year with seed. Did you notice words in that last sentence that related to farming? Exactly! We consider commercial shellfish production farming. Many of the companies in WA include the word "farm" in their name.



Just as we plant corn and carrot seed in the ground, we seed baby shellfish in the water and wait for them to grow. Nature feeds the shellfish with the phytoplankton floating through the salt water. Farmers have to beware of pests like moon snails, sea stars, shrimp, and ducks instead of slugs or crows. Then the farmers pick or dig the crop and take it to market. So yes, shellfish are an agricultural item. It takes one to three years for each of these baby oysters to grow to full size.)

As recently as 40 years ago farmers relied on Mother Nature to provide the new baby shellfish every year. Each species of shellfish needs the right conditions to grow; the water needs to be the right temperature and salinity, phytoplankton needs sunlight to grow to feed the shellfish, and the water needs to be healthy and free of pollution.

Clams, oysters, and mussels are filter feeders. They suck water in through their siphons, circulate it through their gills to keep the nutrients, and force the extra water and waste back out. By doing this, shellfish clean our waters.

The photo on the left shows regular seawater. You can see the water gets clearer in the two middle photos where the oysters have been filtering. The right photo shows water with the algae removed and no oysters.)

Each of us need to be stewards of the tidelands. Excess fertilizer put on lawns or golf courses can be washed by the rain into the water system. Even the poo from our dogs and cats could affect the shellfish we eat. The rain washes the poo into the rivers that lead to the bay. The shellfish filter that water through their stomachs and can become polluted if there is too much poo in the water. It is our responsibility to prevent sewage spills and to think before we put anything in the water.



Shellfish farmers work really hard to keep their growing areas clean. Puget Sound, Hood Canal, Willapa Bay and Grays Harbor are beautiful waterways that can produce the best shellfish in the world. Please help us keep that water clean so that we can all enjoy the feast from the sea!





Earth Day is Every Day for Agriculture!

Earth Day was first celebrated on April 22, 1970, and has been celebrated on the 22nd of April each year since. Farmers and ranchers celebrate the earth every day by protecting and conserving the Earth's resources all year round. Farmers and ranchers know that without plants - all humans, animals, and agriculture could not exist. Caring for the environment allows the needed renewable resources to continue to be produced now and into the future.



More than 90% of US farms are operated by individuals or families. Maintaining and improving the environment is necessary to keep the family business going. Today's farmers are restoring wetlands, reducing soil erosion, protecting wildlife, and generating far less waste than ever before. Every day is Earth Day for agriculture!

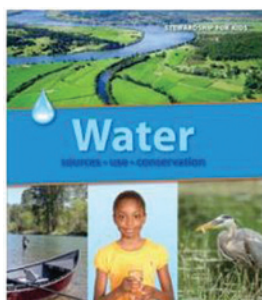
FIRE

Did you know that fire can be beneficial? Prescribed or controlled burning of land is planned, monitored, and has a specific purpose. Controlled fires are used to reduce the buildup of fuel which could lead to uncontrolled, more serious, and possibly devastating fires. Fire is a natural part of the forest and grassland ecology. Controlling the extent and intensity of a fire can better promote the growth of trees, wildflowers, and other plants. **Controlled burning** also benefits the soil by returning more readily available nutrients.

Uncontrolled fires are usually unplanned and threaten to destroy lives, property, or natural resources. **Wildfires** are uncontrolled fires that destroy large areas of land and can cause damage to the soil and the environment. Wildfires burn so hot that they kill organic matter in the soil. Wildfires can be started by humans or by nature. Think of three ways people could be responsible for starting a wildfire and three ways nature may start a wildfire.



LIBRARY CORNER



Water: Sources, Use, Conservation

This 32-page book is perfect for any lesson on water. It contains informative text, pictures, and facts. Learn about the importance of water as well as the states, supply, and availability of it. Learn about the water cycle, rain, water tables, irrigation, and how water is used in agriculture. The book also includes numerous activities, websites, and other resources for teachers. Written by Nancy Carlson.

Soil! Get the Inside Scoop

This book will help get kids excited about the living world of soil. Targeted for children aged 9-12, this 36-page, full-color book



explores how soil is part of our life-the food we eat, the air we breathe, the water we drink, the houses we live in, and more. Along the way, readers learn about different kinds of soil and meet the scientists who work with soil every day.