

Ag@School

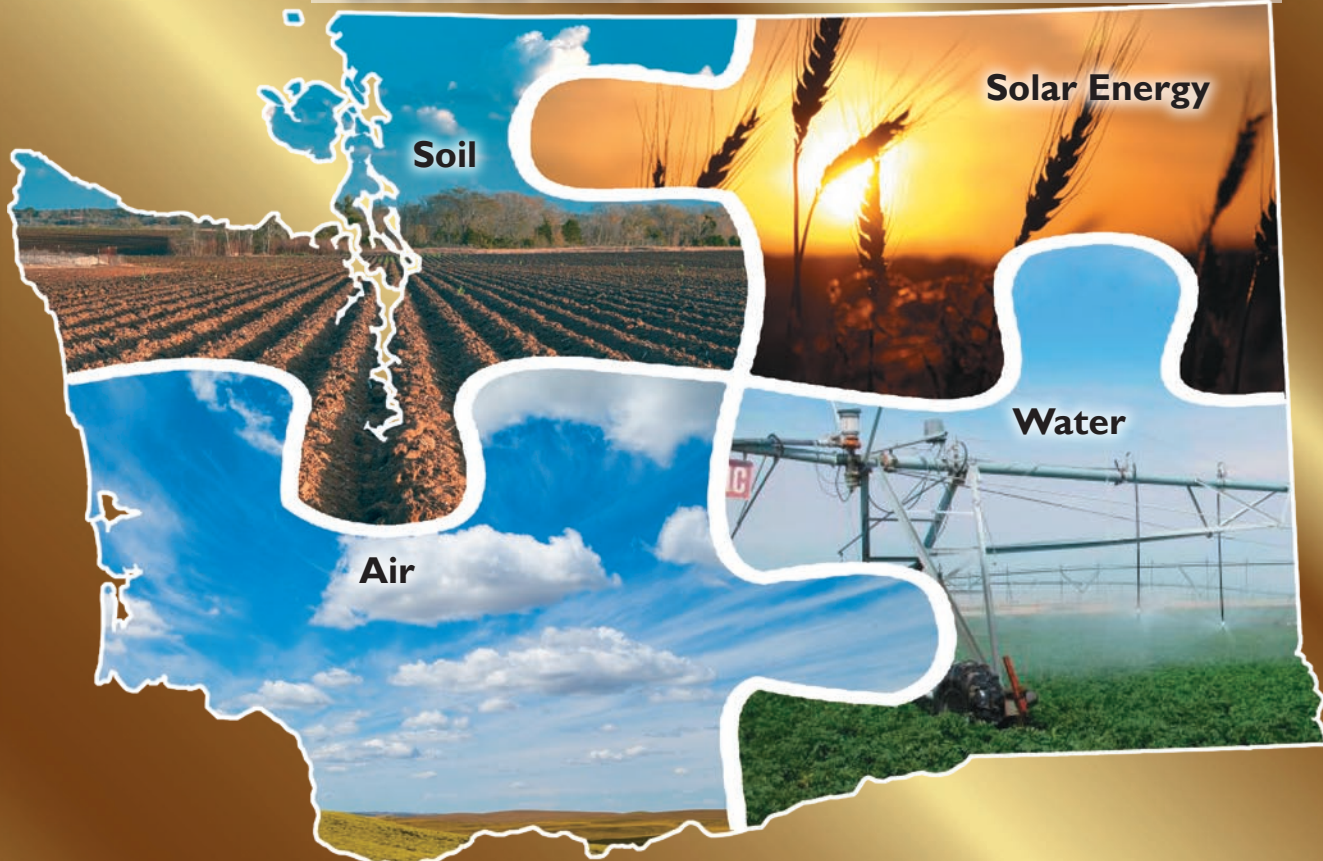
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Earth Day is Every Day for Farmers!

Natural resources fit together like puzzle pieces to sustain life on earth. Caring for soil and water resources allows farmers to produce food today, and in the future.



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, aquatic life, and recreation 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 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. This is **high-yield agriculture.**

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 60% 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 60 countries around the world. We also produce nearly 46% 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 known 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. Over 29% of America's red raspberries are grown in Washington, most of those in Whatcom County



3. If WA harvests 9,200 acres of red raspberries and the yield is 7,910 pounds per acre, the total harvest will be _____ pounds. (2015 NASS data)

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 44%. We also produce 26% of the nation's Niagra grapes and are second nationally in the production of wine grapes.



Washington's wine industry contributes more than \$3 billion to the state's economy. Wine tourism attracts nearly two million visitors annually. Nearly all our grapes are raised east of the Cascades.



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

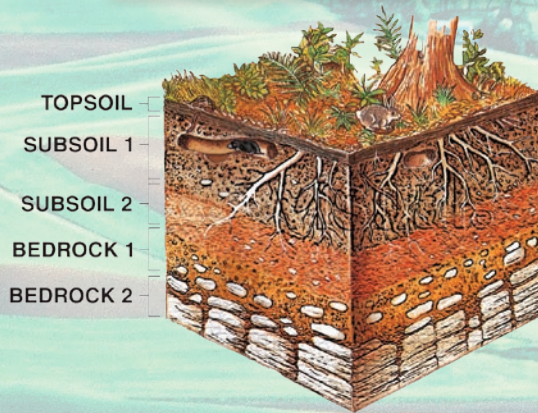
Which one is better nutritionally? _____

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) 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 ero-

sion 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.



SUSTAINABLE AGRICULTURE ...

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.

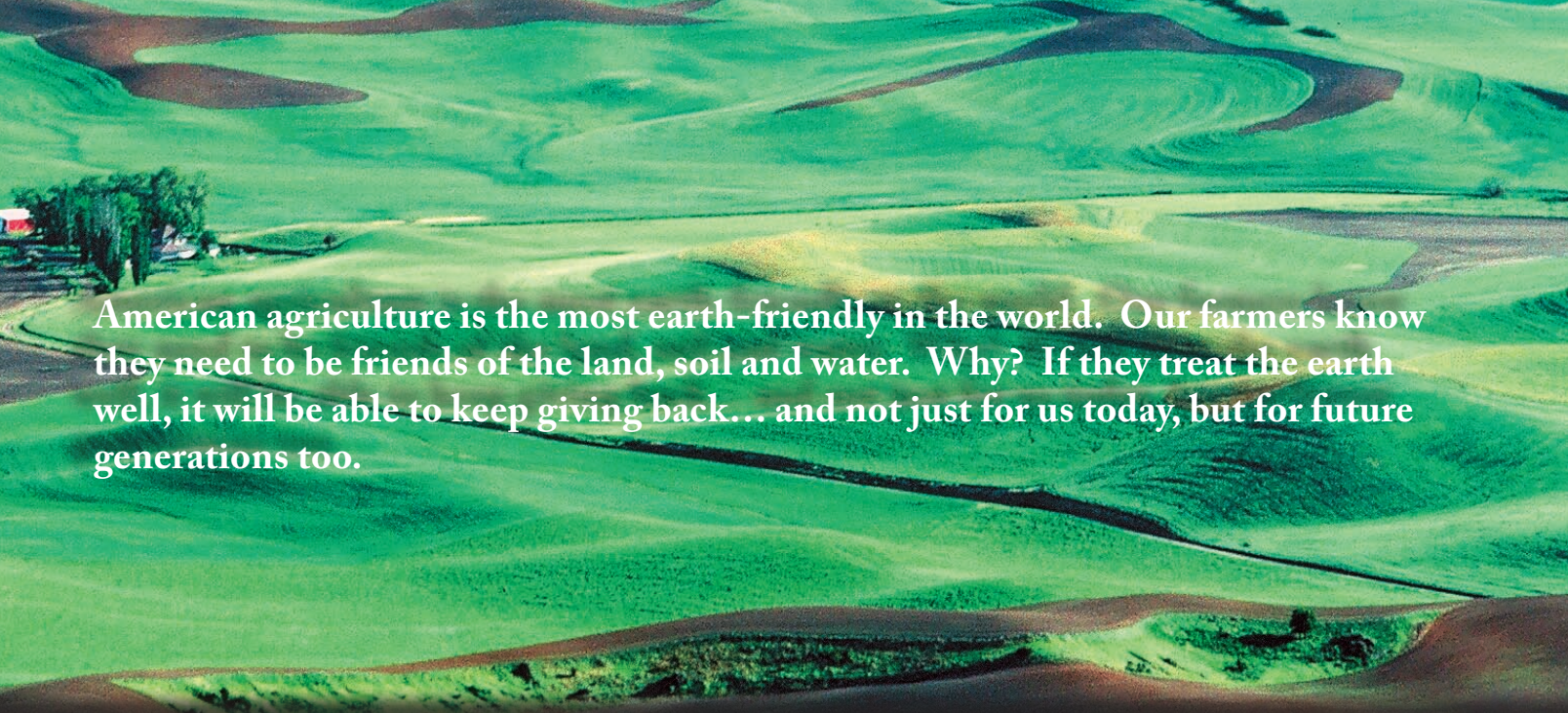
The majority of organic foods are higher cost fruits and vegetables. It is easier to farm organically on smaller farms, or with established fruit trees or vines that do not require annual planting.



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.

There are at least four farming methods that promote environmental sustainability that non-organic farmers are using:

- Direct seeding Seeds are planted directly into the left-over plant material from the crop that came before it, without turning the soil with a plow. This reduces soil erosion, keeping soil from streams and rivers.
- Variable rate technology This precision agriculture method uses satellite mapping to apply precisely the right amount of fertilizer to each area of a field. This prevents wasting fertilizer and helps keep excess amounts out of our streams.
- Use of GMOs Genetically modified plants can reduce tillage and also reduce the amount of pesticides used.
- Integrated Pest Management IPM programs use information on the life cycles of pests (weeds, insects, fungus, etc) to manage pest damage at the least cost, and with the least possible hazard to people, property, and the environment.



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.

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

Synthetic fungicides for example, can prevent crop disease outbreaks, like potato late blight. Caused by the fungus *Phytophthora infestans*, it is one of the most important potato diseases in the world. It was responsible for the great Irish Potato Famine of the 1840's, causing the death of over 1 million people and resulting in more than 1.5 million people leaving Ireland. This organism is still present worldwide and without synthetic fungicides we would run the risk of catastrophic crop losses.



- 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?



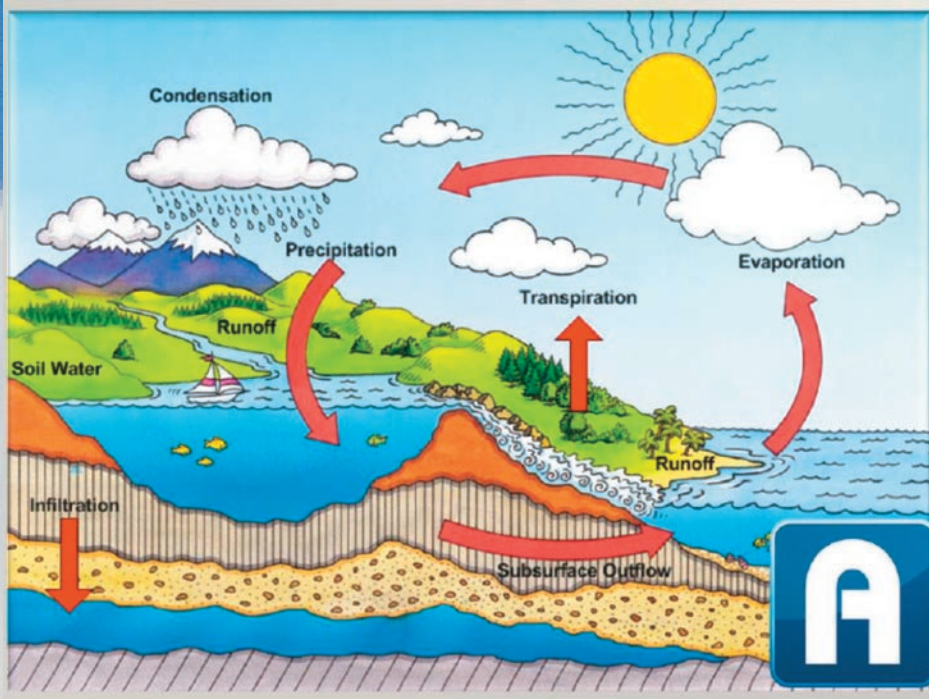
It is true that organic production does not use synthetic (man-made) fertilizers. If we went to only organic production, we would have to produce the necessary nitrogen (the main plant nutrient) by either:

- 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).

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.

Water—The Most Common Material on Earth



<http://youtu.be/vYBjPE0wekw>

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.

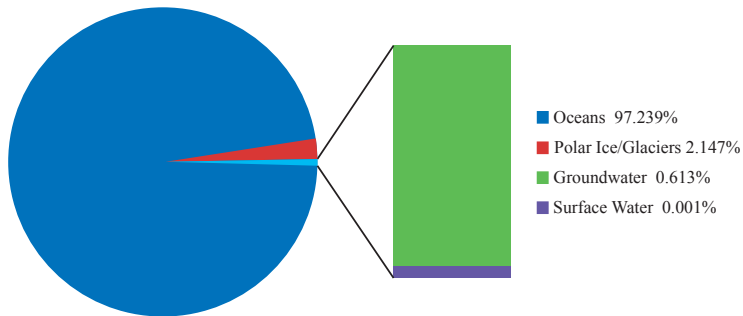
Percolation: The movement of water into soil through pores, holes and cracks.

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.

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%)



Water Cycle

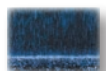


Clouds

Evaporate



Precipitate



Condensate



e	d	p	h	m	s	i	x	e	f	m	m	u	m	p	c	u	g
v	i	y	p	r	e	c	i	p	i	t	a	t	e	p	i	a	a
a	u	r	o	c	g	h	s	w	h	z	n	f	g	s	o	r	
p	q	m	q	k	a	f	p	b	o	u	f	a	j	p	o	k	n
o	i	a	z	s	h	v	h	w	s	c	p	c	t	h	l	o	f
r	l	i	c	s	d	u	o	l	c	a	w	e	b	y	i	d	c
a	w	a	t	e	r	v	a	p	o	r	r	v	u	a	d	v	j
t	d	o	u	s	c	w	x	r	y	x	v	e	d	j	a	g	c
e	n	i	l	e	r	i	v	e	r	z	a	w	c	p	r	h	c
s	c	r	a	b	a	e	c	o	n	d	e	n	s	a	t	e	
z	w	b	g	q	s	p	v	g	y	m	m	u	m	v	b	f	y



Solid

Liquid



Gas



Ice



Water Vapor

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?

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

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.

Protecting Crops

Weeds are a farmer's #1 pest but insects are also a problem. It is often said that the pioneers planted 4 kernels of corn for every plant they hoped to harvest:

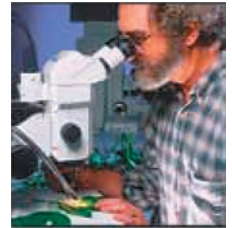
- ✓ 1 for the maggot
- ✓ 1 for the crow,
- ✓ 1 for the cutworm,
- ✓ and 1 to grow

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.



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.



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

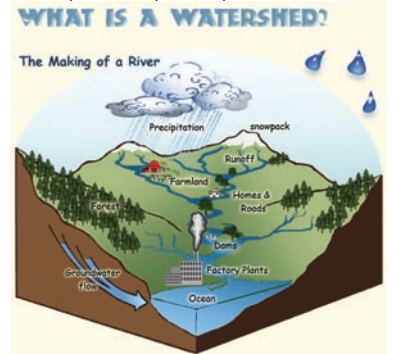
without plants - all humans, animals, and agriculture could not exist. Caring for the environment allows the needed renewable resources to continue to be produced now and into the future.

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!

What is a Watershed?

A **watershed** is the land area that delivers run-off water to the area's lowest point – a stream, river or lake. Small watersheds flow into bigger ones until they eventually reach the ocean. This water travels across and under fields, forests, cities, streets and lawns.

We all live in a watershed and everything we do in our watershed affects its water. Run-off from streets, yards, farms and forests eventually end up in our water.



- Do you live in a watershed?
- Can you think of two actions you might take at home or school to help stop pollution in your watershed?

1. _____
2. _____

A Day on a Dairy Goat Farm

A day on our farm begins at 6 am. I get up around 5:30 and am usually out in the barn before 6 am as it feels good to get a jump start on the day, even if it's only 5 minutes. If it's still dark, the goats are usually asleep, the babies piled up in an adorable cuddle puddle. During our long summer days when the sun rises very early, the goats are often out in the yard in the sunlight and/or watching the door for me to enter.

Milking begins with washing hands and sanitizing all the necessary equipment, then we open or close various gates to allow the goats to enter the milk room. We fill their water troughs, grain buckets on the milking stanchions are filled, notes from previous milking observed, gloves go on, teat wipes and teat dip stand ready, the vacuum pump is turned on and away we go.

We milk 2 goats at a time, and with 24 goats, this part takes about an hour. After milking we feed the goats hay, or let them out to pasture. Once the goats are fully taken care of we head back into the dairy to filter and chill the milk, then clean all the milking equipment. The entire milking process takes about 2 hours, after which we turn to our cheese and yogurt production. There are many steps in the process of turning milk to cheese or yogurt beginning with pasteurization and ending one to 3 days later (in our case) in packaging for sale. All of this needs to be done, before evening milking starts at 5 pm.

Additionally, during non-milking hours we need to manage pastures with our portable fencing, keep up on the book work/accounting for the farm, make sure adequate cleaning happens in the dairy, eat and take breaks. There are always unexpected things that come up on the farm, some are fun and exciting while others are real challenges. The most common things for us have been: goat health issues (from mastitis a bacterial infection in the udder, to broken legs), broken equipment and fences.

By 7 pm, if everything goes as planned, milk from the evening milking is chilled for processing the next day, and we humans can sit down for a good meal and some relaxation! Here on our farm we love to cook outside over a fire and share stories of the day as the sky gets dark, then head to bed so we can wake up early the next morning. Just about every day we go to bed tired, yet happy, after a good day's work.

Mystery Bay Farm, photo Cora age 9



LIBRARY CORNER

You Wouldn't Want to Live Without Dirt!

Without dirt, or soil, life would have developed differently and we humans probably wouldn't be here at all. Soil supplies a surprising variety of raw materials for making things and provides the foundation for growing the plants that feed us. This book is full of information about the ways soil has been used by humans over the centuries. Each spread highlights a different topic, including types of soil, life in the soil, growing plants, soil erosion, and protecting soil resources for the future. Many sections also include suggestions for activities that can be used to further explore soil in the classroom.

