Ag@School

Volume 13, Issue 3 2013/2014

Published by Washington Agriculture in the Classroom





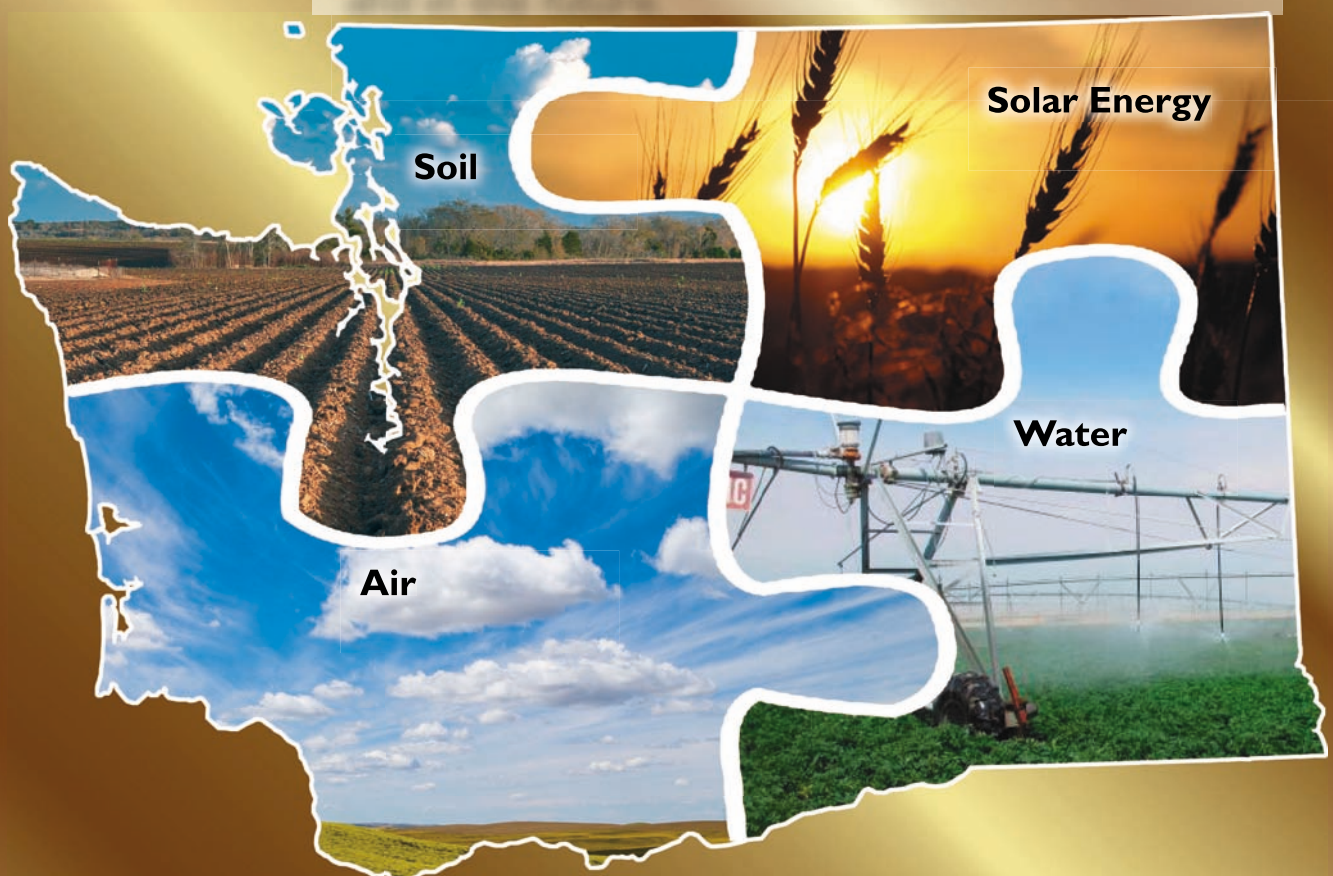







Earthday is Everyday for Farmers!

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 and 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, because we will need them to produce food in the future. While countries around the world will take one day, April 22, to celebrate an appreciation of 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, 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 its 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 advancements in science and technology 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 57% 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 48% 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. Over 90% of US red raspberries to be frozen are grown in Washington, most of those in Whatcom County.

3. *If WA harvests 9,800 acres of red raspberries and the yield is 7,400 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 skin to split open, ruining 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 juice and jams) at 55%. We also produce 36% of the nation's Niagra grapes and are second nationally in the production of wine grapes.

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

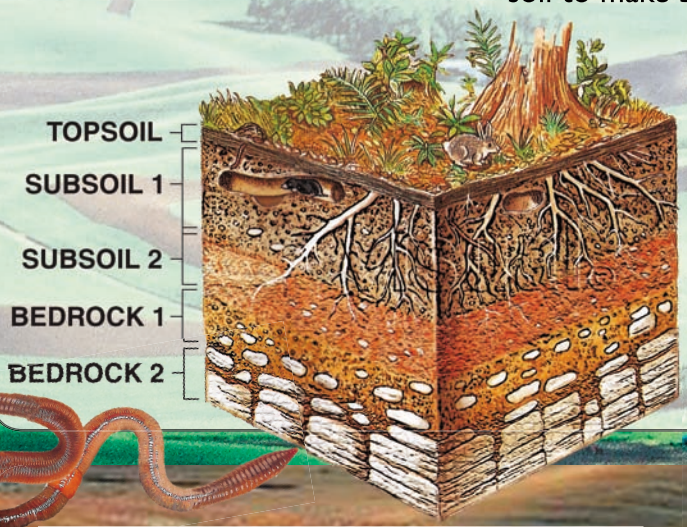
4. *Which is your favorite – grape juice, grape jelly, or table grapes? _____*

Which one is better nutritionally?

_____

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 there that uses the soil to make bricks.



Ideally soil is:

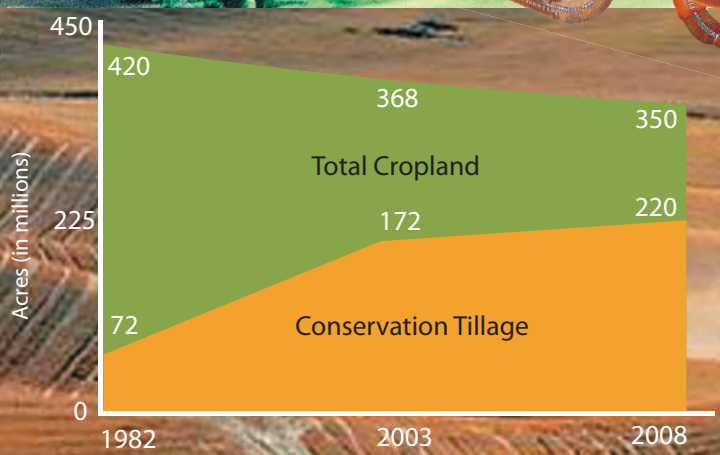
- 45% particles (sand, silt, and clay)
- 5% organic matter (dead plants and animals)
- 50% empty space (pores) with half filled with air, and half filled with water

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

U.S. Farmland Use

Conservation tillage has grown from 17% of acreage in 1982 to 63% today. At the same time, total land used for crops declined by 15% (70 million acres) because US farmers have been able to grow more crops on less land.

Sources: AFBF; USDA National Resources Inventory (2007); USDA-NRCS



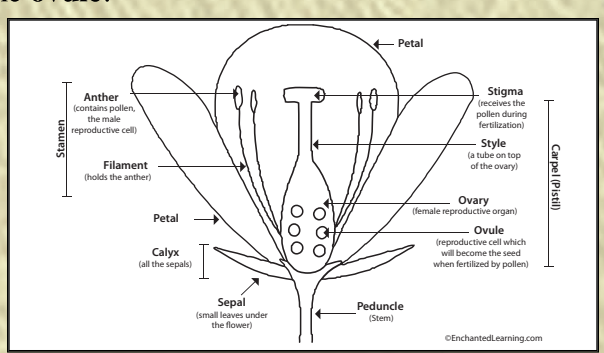
SOIL CONSERVATION

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**. It can occur anywhere but is usually worse in places that are steep or where there are no plant roots to hold soil in place. Stopping erosion is important because it can take hundreds of years for nature to replace just one inch of good topsoil.

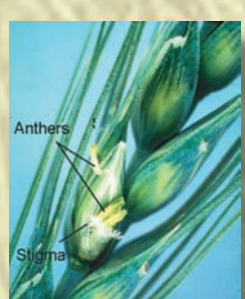
These practices include planting windbreaks, farming with the contour of the land and planting strips of crops across hillsides (both slow down the gravity flow of water). Another is **conservation tillage.** When land is tilled (plowed or cultivated), soil particles are exposed to wind and water erosion. The more times a farmer disturbs the soil, the finer the particles become and the worse the erosion potential. To stop erosion many farmers now use equipment and methods that use less tillage. Following harvest, crop residue is left in the field and often the field is not disturbed until time to plant the next crop. The roots hold the soil in place. Less tilling means fewer tractor trips across the field and less air pollution from dust and burning fuel and less fuel used.

Pollination is the transfer of pollen from an anther to the stigma in flowering plants and starts the production of seeds, or fruits that contain seeds.

How does pollination work? It all begins in the flower. Flowering plants have several different parts that are important in pollination. Flowers have male parts called **stamens** that produce a sticky powder called **pollen**. Flowers also have a female part called the **pistil**. The top of the pistil is called the **stigma**, and is often sticky. Seeds are made at the base of the pistil, in the **ovule**.



For pollination to occur, pollen must be moved from an anther to the stigma. When pollen from a plant's stamen is transferred to that same plant's stigma, it is called **self-pollination**. Self-pollination means that an individual flower on a plant stem can pollinate itself, or other flowers on the same individual plant stem. Wheat, other grains, and most grasses are self-pollinators.



When pollen from a plant's stamen is transferred to a different plant's stigma, it is called **cross-pollination**. The plants must be of the same species. For example, only pollen from a daisy can pollinate another daisy. Pollen from a rose or an apple tree would not work.

How does pollen from one plant get moved to another?

About 80% of plant pollination requires the help of other living, moving creatures such as insects, birds, or bats, to transfer pollen from one plant to another.

When animals such as bees, butterflies, moths, flies, and hummingbirds pollinate plants, it's accidental. They are not trying to pollinate the plant. Usually they are looking for food, either the sticky pollen or a sweet **nectar** made at the base of the petals. When feeding, the animals accidentally rub against the stamens and get pollen stuck all over themselves. When they move to another flower to feed, some of the pollen can rub off onto this new plant's stigma.

What about the other 20% of plants, how are they pollinated?

Some plants, especially grasses, most conifers, and some deciduous trees, are pollinated by wind. Plants that are not self-pollinators, but need to be pollinated by wind often have long stamens and pistils to enable pollen grains to be blown from one plant onto another. Since they do not need to attract animal pollinators, they can be dully colored, unscented, and

with small or no petals since no insect needs to land on them. There are also a small number of water plants that rely on water movement for pollination.

Thanks to the University of Illinois for the information on this page; see more at:
http://www.life.illinois.edu/entomology/pollinators (select activity book)
Videos about pollination can be seen at:
http://www.neok12.com/Pollination.htm

Achoo!

Why does pollen trigger allergies?

Examining the weird, spiky shapes of pollen gives us a clue about why it sticks to insects as they transport it between flowers. For the same reason, pollen tends to stick in our noses when we breathe it in. The protein in pollen can cause allergic reactions in some people (sneezing, coughing, and watery eyes).

Electron microscope images of pollen

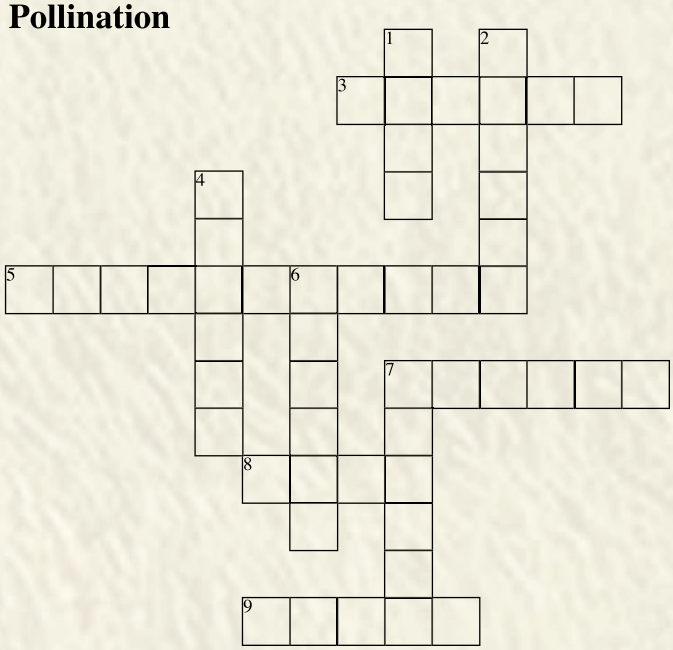
Why we should care about pollinators?

1. One out of every 3 bites of food we eat is courtesy of a pollinator.
2. Birds and other animals are even more dependent upon fruits and seeds than we are.

Check out---http://www.buzzaboutbees.net

To learn more about different pollinators; insects, bats, birds, see: http://www.kidsgrowingstrong.org/pollination

Pollination



Across

3. Sweet fluid in flowers
5. Pollen reaching the stigma
7. Male reproductive cells in plant
8. Important pollinators; produce honey
9. Female reproductive cells in plant

Down

1. Created when pollen fertilizes ovule
2. Male plant parts
4. Top of pistil
6. Part of stamen producing pollen
7. Female plant parts

Bursting with flavor & packed with nutrition...

Raspberries

The fertile land and cool climate on the west side of the Cascade Mountains is ideal for producing raspberries. Washington produces nearly 70,000,000 pounds of berries, over 90% of the US supply of frozen raspberries.

Whatcom County produces over 90% of our state's crop, so how much of the US crop is produced there? _____

Raspberries are a **perennial** (plant that lives for multiple years) with woody stems (canes). Although the canes are **biennial** (live for only 2 years), the roots are perennial. Red raspberry plantings generally have a commercially productive life of 6 years to as long as 20 years in western Washington.

The fruiting season is mostly in July and August. Raspberries require about 30 to 35 days to mature after pollination. To attain maximum productivity, flavor, and sweetness, raspberries must reach full maturity and full size before harvest. Because of the high cost of picking by hand, most raspberries in Washington are harvested mechanically. The harvester moves over the rows and gently shakes the canes (travelling about 1 mile per hour).

Korvan over-the-row raspberry harvester

Are red raspberries nutritious?

Yes, indeed. A one-cup serving has only 80 calories but provides 60% of the recommended daily allowance of vitamin C, 36% fiber, 45% of manganese, 5% of potassium, only 1 gram of fat, and no cholesterol. In addition to being high in antioxidants, red raspberries are also chock full of several phytonutrients.

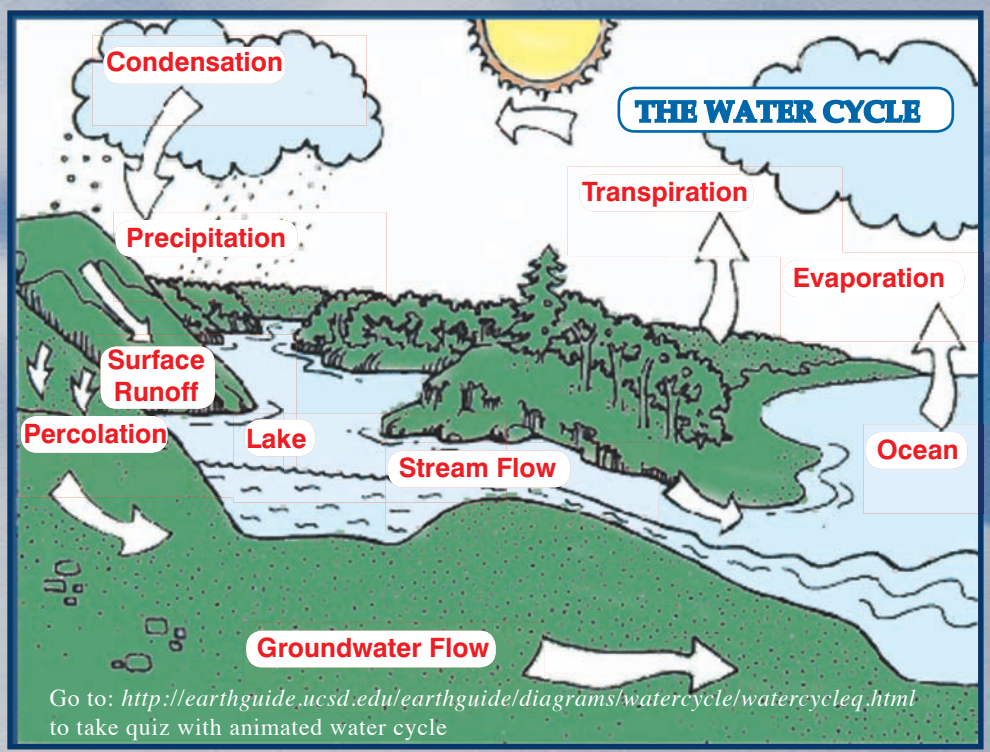
Fresh raspberries are fragile and highly perishable. Keep them in your refrigerator and use within two days. Because raspberries are so perishable, Washington processors now use state of the art flash freezing for Individually Quick Frozen (IQF) berries. In addition to consistent quality and no worries about waste, IQF berries are reasonably priced all year around.

Why do raspberries have so many seeds?

Technically speaking, a raspberry fruit is not a berry. A berry contains many seeds lying together within the pulp (blueberries and grapes, for example). A **drupe**, in contrast, is a fruit containing a single seed or pit (for example, cherries and plums). Raspberries are aggregate fruits made up of many **drupelets**, each of which contains a single seed. The number of drupelets per berry is determined by how many ovules are fertilized.

Photos courtesy of Cheryl DeHaan

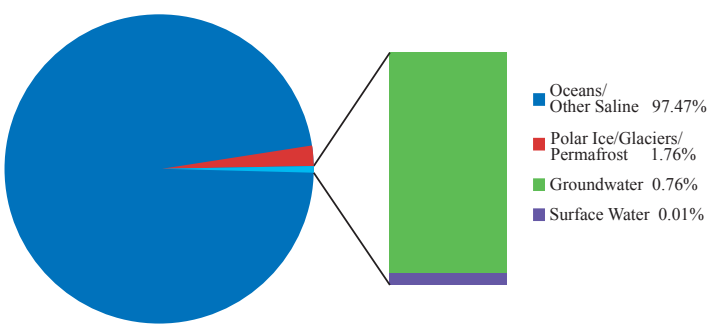
Water–The Most Common Material on Earth



Go to: *http://earthguide.ucsd.edu/earthguide/diagrams/watercycle/watercycleq.html* to take quiz with animated water cycle

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. Nearly 1.5% of total water is frozen. 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 (0.007%), the atmosphere (0.001%) and rivers (0.00002%)



How Much Water is Enough? There's An 'App' for That!

Farmers can use their smart phones or computers to operate center pivot irrigation systems. They can also use a new irrigation scheduling program that will calculate how much water to use based on soil types, weather (rain, wind, heat), crop being grown, how much water has already been applied, etc. The goal is to keep crops growing at an optimum without wasting water. WSU researchers at Prosser developed the program.

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.

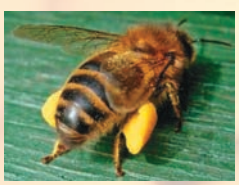
Percolation: The movement of water into soil through pores, holes and cracks.

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.

Honey Bees

Honey bees are very important insect pollinators. For honey bees to produce honey, they consume pollen and nectar from a variety of flowers. **Pollen** is one of the purest and richest natural foods, containing all of the nutritional requirements of a honey bee: sugar, carbohydrates, protein, enzymes, vitamins and minerals. **Nectar** is a sweet fluid found in flowers.



When a honey bee is collecting pollen from the anthers of a flower, it puts the pollen in a special pollen basket on its hind legs, and then takes it back to the hive.

BUSY AS A BEE

- Honeybees will usually travel approximately 3 miles from their hive.
- Each bee will visit 50-100 flowers on a single trip out of the hive.
- Honey bees fly at 15 miles per hour.
- Honey bees' wings stroke 11,400 times per minute, thus making their distinctive buzz.
- Bees communicate with each other by dancing and by using pheromones (scents).
- Honeybees are the only insect that produce food for humans.
- Honeybees never sleep!

HONEY

- Worker bees suck up the nectar and water from flowers and store them in a special honey stomach. When the stomach is full, the bee returns to the hive and puts the nectar in an empty honeycomb. Natural chemicals from the bee's head glands and the evaporation of the water from the nectar change the nectar into honey.

- Bees produce honey as food stores for the hive during the long months of winter when flowers aren't blooming and they can't forage for nectar.

- To make one pound of honey, bees must visit 2 million flowers and fly over 55,000 miles.
- A typical beehive can make up to 400 pounds of honey per year.

- A honeycomb cell has six sides and is tipped up to keep the honey from sliding out.

Learn More About Agriculture

Check out the Ag Research Service website, Dr. Watts, Science for kids

www.ars.usda.gov/is/kids

If you need an idea for a science fair project, think agriculture.

www.ars.usda.gov/is/kids/AgSciProjects/agscitoc.htm

Library Corner

The Magic School Bus Inside a Beehive

By Joanna Cole, illustrated by Bruce Degen

When the Magic School Bus turns into a beehive, Ms. Frizzle's class learns firsthand about how workers, drones, and the queen bees live together. Readers will be abuzz with knowledge as they discover how honeybees find food; make a comb, honey, and beeswax; and care for their young, all from the bee's perspective.