AQUARIUM OF THE PACIFIC
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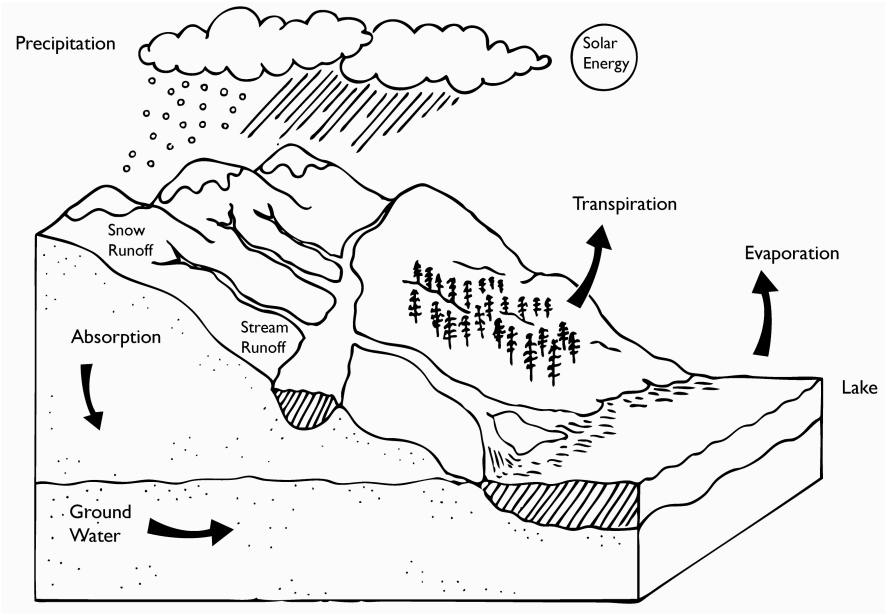
What Is a Watershed?

A watershed is a piece of land that drains all of the water on the top of the land (surface water) and beneath it (groundwater), to the same place.

How does water get into the watershed?

Water enters the watershed from a three stage cycle that starts when water falls from the sky in a process called precipitation.



Stage 1: Precipitation
Water vapor molecules become too large and heavy to remain in the atmosphere and fall to the ground in the form of rain, snow, sleet, hail, etc.

Stage 2: Evaporation
Water transforms from a liquid into a gas; this gas rises up toward the sky.

Stage 3: Condensation
Water transforms from a gas into a vapor and becomes suspended in the atmosphere; this is visually represented by clouds.

How do people use the watershed?

The watershed is used to:

Grow food
Farmers grow plants in land and these plants need to regularly absorb water into their roots, so that they may grow. These plants grow through a process called photosynthesis.

The rain that falls on the watershed also supplies water to plants that not only feed people, but other animals too. These animals include the herbivores (plant eating animals) and omnivores (plant and meat eating animals).

Watersheds provide farmland for crops. (Photo courtesy of USGS)

Make oxygen

Plants that grow on the watershed also produce oxygen as a product of photosynthesis.

At least half of all the oxygen we breathe comes from the ocean. (Photo courtesy of PDPhoto)

Recycle water

The liquid form of water (lakes, rivers, ponds, ocean, etc.) evaporates to become a gas, condenses to become a vapor, and then transforms to a solid or liquid and falls to the ground. Water never really disappears, because it is always being recycled.

Condensation leads to the formation of water droplets. (Photo courtesy of ImageAfter)

Serve as a recreation space
People play soccer on fields, build concert halls, swim in lakes, scuba dive in the ocean and do much more in the watershed.

Many people enjoy scuba diving in the ocean. (Photo courtesy of USNOAA)

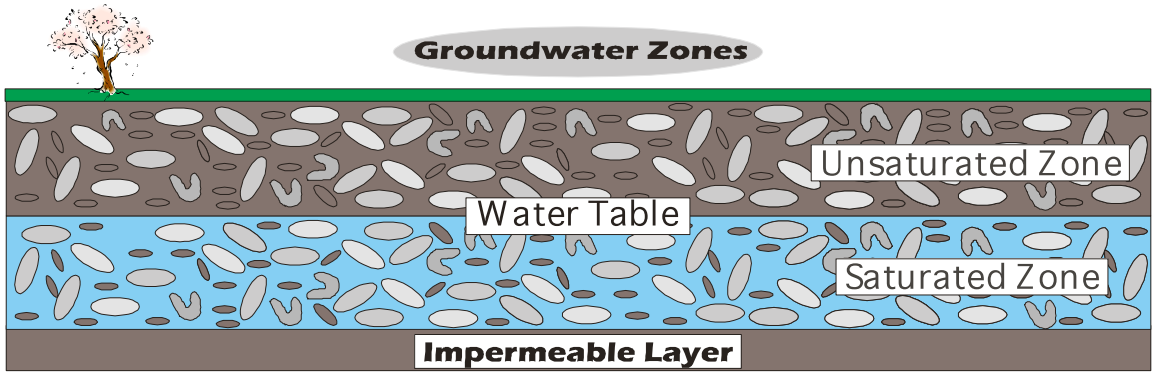
Provide a habitat
People, plants, and animals all live in the watershed together.

Many people, plants and animals make their home by lakes. (Photo courtesy of USFWS)

Store water
Freshwater (the water that we drink) is stored underground in aquifers. The water that is stored underground must enter through exposed areas of soil that are called recharge areas.

The fresh water we drink comes from aquifers. (Photo courtesy of Charlie Rahm, USDA NRCS)

A Closer Look at Groundwater & Aquifers



Aquifer
A geological formation of sand and gravel where groundwater is stored.

Unsaturated Zone
The zone above the saturation zone through which water flows down.

How deep is this zone?
When a lake or marsh is at the surface, then the unsaturated zone can be right at the surface. In arid areas it can be hundreds of meters thick.

What happens in this zone?
1) Water, plant nutrients, and other substances are stored here. This zone stores only a small amount of water and therefore it is quite difficult to extract large amounts of water for consumption.

2) This zone basically controls the transmission of water to aquifers, land surfaces, water surfaces, and to the atmosphere. Some scientists believe that this zone may give information that would allow the process of groundwater replenishment to be quantified with numbers.

Saturated Zone
The area where the water completely fills the spaces between soil, sand, and rocks underground.

How deep is this zone? Depth varies due to rainfall. During times of heavier rainfall this will become deeper and during times of drought this zone will become shallower. The water table (surface of the saturated zone) rises and falls as water fills up the saturated zone.

What happens in this zone?
1) Water is stored in this zone and may be pumped out by wells to be processed for drinking water or may flow out on to the surface.

Do different types of sediment hold the same amount of water?
No, different types of sediment (rock, sand, dirt, etc.) hold different amounts of water.

Impermeable Layer
A solid layer, of rock or clay through which water cannot pass.

Discharge Area
A discharge area is an area where water from the aquifer moves back to the surface (e.g. spring, stream, river, lake, ocean, etc.).

Recharge Area
An area where rain, imported, or recycled water can be absorbed into the ground and travel down to the aquifers (e.g. parks, lawns, fields, etc.).

Note: If the ground is covered by concrete, then this surface area cannot be a recharge area, as concrete is not permeable to water. Over development can lead to low water supplies, when recharge areas are paved with concrete and unable to collect rain water. This is one reason why "public green spaces," such as wetlands, forests, parks and grassy play grounds, are so important to our communities.

Suburban development. (Photo courtesy of Lynn Betts, USDA NRCS)

What is Watershed Pollution?

Pollution

A negative or undesirable change in the environment. This is something that is usually hazardous or detrimental to the ecology of habitats.

There are two types of pollution that affect the environment. They are called non-point source pollution and point source pollution.

Point Source Pollution

This is a type of pollution that can be easily tracked back to its source (e.g. oil spill, factory, refineries).

Note: If you can point to the source of pollution, then it is point source pollution.

Smoke stacks are a type of point source pollution. (Photo courtesy of John Mosesso Jr, NBII)

Non-point Source Pollution

This is a type of pollution that cannot be easily tracked back to its source (e.g. trash, pet waste, pesticide, used motor oil, fertilizer, etc.).

Non-point source pollution may be left behind by a person and is carried by the rain into the ocean or local aquifer. For example, when we leave a piece of trash on the ground, the rain comes and washes it into the gutters and then into the storm drains. The storm drains lead directly to the ocean, so the water is never filtered.

This is the type of pollution that we are all responsible for. It happens everyday and in all communities.

Litter from our streets can wash away into our harbors, creating non-point source pollution.

<u>Why are different types of pollution harmful?</u>

Trash

Some animals in the ocean mistake trash for food and, when these animals eat trash, they can become very ill. Animals like leatherback sea turtles often mistake trash for their prey items and sometimes try to eat plastic bags, mistaking them for sea jellies. Other animals may become entangled by trash. For instance, some animals get their mouths and necks caught in six-pack soda rings.

This bird's neck was caught in a six-pack ring. (Photo courtesy of USFWS)

Waste
Animal waste is very harmful to the marine environment causing a population growth called an algal bloom. Animal waste can also carry many diseases that may harm ocean animals and even people. For this reason, people should always pick up after their dog when they take it for a walk.

Picking up after your dog helps keep the watershed clean.

Pesticide
Pesticides can become dangerous to people if they travel into an aquifer and contaminate our groundwater supply. If pesticides are washed into the watershed, they may also harm marine animals.

Dusting crops with too much pesticide can harm the environment. (Photo courtesy of USGS)

Oil
Oil is harmful for many reasons. It acts as a poison if digested or inhaled by animals. Oil may also foul fur or feathers and make it impossible for some types of marine animals to stay warm.

Oil spills are very dangerous to marine environments.

Fertilizer
In order for plants to grow they need water, sunlight, and nutrients. Some gardeners give their plants extra nutrients by adding fertilizer to their lawns and flowerbeds; however, this same fertilizer can also stimulate growth in marine plants (including algae). When algae is exposed to extra nutrients it can result in an algal bloom (excessive growth of plants). Algae growth can significantly reduce the amount of oxygen in the ocean, because this large amount of algae will eventually die and become decomposed by bacteria. Bacteria take oxygen out of the ocean and use it to decompose biological materials. Therefore, decomposing plant material from an algal bloom can remove a large portion of oxygen from the ocean.

Adding the proper amounts of fertilizer will keep hazardous chemicals out of our water supply.

<u>Where do we find pollution?</u>
We can find pollution anywhere in the watershed. Pollution exists in our lake, rivers, streams, oceans, mountains, forests, parks, neighborhoods, cities, and communities.

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Future of watersheds

Without civic support for watershed protection initiatives, many habitats may be harmed by pollution. For instance, 60% of the oxygen that we breathe is created by plant-like organisms that live in the ocean. People may spray their yards with weed killers and, when it rains, these same chemicals enter the ocean. These garden chemicals that are used on unwanted weeds may have long lasting negative effects on marine organisms that produce oxygen. If less oxygen producing organisms exist in the world, then less oxygen will be produced for everyone to breathe.

Similar chemicals can not only harm plants, but also animals. There was a pesticide called DDT that has been outlawed in many places, but is still used in some parts of the world today. It entered the watershed and was absorbed by small animals, who were eaten by larger animals, and finally many of those large animals were eaten by people. Over time, people realized that the absorption of this chemical increases a person's chance of contracting cancer.

This same chemical has also weakened the egg shells of many birds and has pushed many types of birds (e.g. brown pelicans and bald eagle) almost to extinction. When the birds incubate their eggs, they tend to crack them because the eggs are not strong enough to withstand the weight of their bodies.

Each person can limit the amount of non-point source pollution that they release into the environment, whether it is a chemical or trash item. This can be accomplished by recycling and reusing materials, in addition to placing trash in designated areas only. Together, we can limit the effects of pollution on our world and in our communities.

Placing trash in the proper receptacle can help keep our watersheds clean.