

The Eruption of Mount St. Helens in 1980

HOW DID THE MOUNTAIN COME TO LIFE?

On March 20, 1980, an earthquake rocked Mount St. Helens. It was the most significant in decades. During the following week earthquake activity increased, and the geologists knew something was happening underneath the volcano. Earthquakes are usually the first sign of a volcano becoming active. Molten rock, called *magma*, starts to work its way up into the mountain from a *magma chamber* located beneath the mountain. As magma rises it breaks rock and as the rock breaks, it shakes the earth causing earthquakes. Throughout the next two months about 10,000 earthquakes were recorded in and around Mount St. Helens indicating the movement of magma.

As magma continued squeezing into the mountain, the pressure inside kept growing and significant swelling occurred. Why didn't the magma come out of the volcano as a lava flow? There are two reasons for that. First of all the whole summit of Mount St. Helens worked as a huge cap stopping the magma. Secondly, the magma was very stiff, like toothpaste and this type of magma doesn't form liquid lava flows. The north side of the mountain gradually gave way to the pressure and the mountain was actually growing on the north side about five to eight feet per day. How long did / will it take you to grow five feet'? Fractures developed on the swelling mountain through which water reached the hot magma below. Water turned to steam which was released in numerous small ash and steam explosions between March 27 and May 14.

Because of all this activity, the area within three to eight miles of the volcano was closed to protect people. They called this area the "Red Zone". People were evacuated from homes, lodges and camps at Spirit Lake. Nobody knew exactly what the mountain would do next.

WHAT HAPPENED ON MAY 18, 1980?

The day was Sunday, the sky was clear and the mountain seemed quiet, but geologists continued to monitor the volcano. At 8:32 a.m. the biggest earthquake yet hit the mountain and the weakened north side collapsed. Never before had an event like this been witnessed or photographed. From numerous photos and eye-witness stories and physical evidence around the mountain geologists have been able to figure out what happened that day. The eruption had five different components: landslide, lateral blast, vertical ash cloud, pyroclastic flows and *mudflows*.

The collapsing north side rushed down the valleys in a gigantic landslide. Part of the landslide slid into Spirit Lake and displaced the water just like if you'd jump into a bath tub full of water. Another part of the landslide ramped up and over a ridge that was 1200 feet above the valley floor, scraping parts of the ridge to bedrock. Most of the landslide was deflected toward the North Fork of the Toutle River valley, where it traveled 15 miles covering everything with an average of 150 feet of *debris*. Roads, bridges and homes in the valley were buried within minutes.

The north side of the mountain was like the cap of a huge pop bottle. What would happen if you shook a pop bottle for two months and then opened it? When the landslide removed the cap from Mount St. Helens, the gas from magma burst out creating an enormous lateral blast. Volcanic steam and gases exploded northward, traveling about six times faster than the strongest hurricane winds. The blast carried pulverized rock from the side of the mountain stripping the land and leveling about 230 square miles of forest within minutes. Close to mountain the blast pulverized the trees. As the blast weakened, it slowed and dropped some of the rock and further away it knocked trees over like dominoes. At the edges of the blast zone the gas was still hot enough to kill the trees. An eerie forest of standing dead trees was left.

Following the lateral blast, a vertical ash cloud developed. Volcanic *ash* is not burned material, rather it is very fine ground rock, almost like sand or dust. The mountain spewed this ash into the air for nine hours and the winds carried it to the east. In most of eastern Washington the beautiful day turned to night as the thick ash cloud

blocked the sunlight. Some ash rose miles into the atmosphere circling the earth within two weeks. Mount St. Helens spewed so much ash that if we piled it all on a football field, it would bury the field to a depth of 150 miles! I

About four hours after the initial blast, fresh, gas-rich magma poured out of the crater. The magma had hardened and came out as superheated rocks and boulders. Temperatures measured up to 1500 degrees Fahrenheit. We call these rocks *pumice* and the event is called a pyroclastic flow. These flows traveled at speeds of 100 miles per hour down the sides of the mountain, scorching the landscape. At the base of Mount St. Helens we now have a Pumice Plain, an area where everything was killed by the pyroclastic flows.

The landslide contained huge amounts of snow and ice. As the snow and ice started to melt, water saturated the landslide deposits in the North Fork Toutle River valley. Later that afternoon the water flowed down the valley and as it mixed with volcanic ash, rocks and wood, it created a huge mudflow. This dense steaming mudflow crushed buildings and bridges and traveled all the way to the Columbia River. Smaller mudflows took place in many other creeks and rivers that drain the mountain, but they didn't travel as far or do as much damage as the one in the Toutle River.

HOW DID THE ERUPTION AFFECT THE LANDSCAPE AND THE PEOPLE?

The next morning the area north of Mount St. Helens looked like a vast, lifeless desert. Spirit Lake was filled with logs, volcanic ash and pumice and heated to body temperature. Most of the blast zone was covered with one to three feet of blast *deposits* and ash. About 200 homes, hundreds of miles of roads and 27 bridges were destroyed. Fifty-seven people had died or disappeared. Most of the wildlife in the area was killed. The effects reached far beyond the blast zone. People as far as Castle Rock lost their homes to the mudflow. The depth of the Columbia River was decreased from 40 to only 14 feet as the debris is poured into it. People living east of Mount St. Helens, in cities like Yakima and Spokane, had to deal with large amounts of ashfall. For several days people had to wear masks on their face to keep from inhaling the dust, which could be very harmful to the lungs. Cars didn't run well as the air filters were clogged quickly. It was six months before the city of Yakima was cleared of ash.

Even though the eruption caused a lot of problems to people, we can also look at it as a creative event. Two new lakes were formed as the landslide dammed creeks. One of them, Coldwater Lake, is now 4.5 miles long. In the Toutle River valley, where the landslide settled, new wetlands have been established. The eruption created many new habitats for plants and animals.

WHAT HAS HAPPENED SINCE MAY 1980?

Mount St. Helens had 17 smaller eruptions after May 18th. Pasty magma came out of the mountain in these eruptions and built up the new *lava dome* in the crater. Minor mudflows and small steam explosions occurred causing no major damage. The last time magma erupted was in October 1986. Since then the lava dome has not grown.

Between 1989-1991 Mount St. Helens experienced six small steam explosions. These eruptions most likely show the cooling of the *magma* beneath the volcano. Hot magma contains steam and other gases and when magma cools it contracts and the gases escape. When gases are not able to vent slowly, they may vent in small but dramatic explosions.

DO WE KNOW WHAT MOUNT ST. HELENS WILL DO IN THE FUTURE?

For all its history Mount St. Helens has been one of the most active volcanoes in the Cascade Range. There is no reason to suggest that this would change. Many scientists believe that Mount St. Helens will erupt again. When exactly this will happen is impossible to say, but if history repeats, an eruption should take place within *100-300* years.

Monitoring volcanoes is very important in order for us to be prepared for future eruptions. Mount St. Helens has been one of the best monitored volcanoes in the world. The US Geological Survey and the University of Washington continue monitoring Mount St. Helens, Mount Rainier and other volcanoes in the Cascades. If anything started to happen we would soon hear about it. However, we still need to

remember that there is a lot more to learn about forecasting eruptions.

Glossary

Ash - rock particles, sand sized and smaller, ejected from a volcano

Blast zone - the entire area around Mount St. Helens that was affected by the heat and force of the lateral blast (appr. 230 square miles) accumulation of loose rock and plant fragments

Debris - accumulation of loose rock and plant fragments

Deposit - material set down by a natural process

Lava - molten rock at the Earth's surface

Lava dome - a usually rounded and steep sided formation of thick, hardened (or hardening) lava or magma

Magma - molten volcanic rock that is still below the Earth's surface.

Magma chamber - an underground packet of magma, from which the molten material comes to the surface in volcanic eruptions

Mudflow - slurry of mud, rock, water and debris that flows down valleys

Pumice - a light-colored, frothy volcanic rock that may float in water because of the bubbles trapped inside it

Steam Explosion- explosive release of steam, usually occurs when water comes into contact with hot rock or magma

Life at Mount St. Helens

The May 18, 1980, eruption was quite an event! No wonder scientists thought all plants and animals had died. They were right about large mammals and birds that were above ground. But if you were lucky enough to be in the right place, you could survive even the stone-filled blast, the heat and the *ash*. Think about...

Where at Mount St. Helens would you have wanted to be on that day?

To the great surprise of scientists, some plants and animals did survive the eruption of Mount St. Helens. Can you guess where?

The key was to be underneath or inside something! In mid-May there was still a lot of snow on the ground and small plants and young trees that were blanketed by the snow were protected. Fish, frogs, salamanders and insect *larvae* survived in lakes that were covered by ice and snow. Some insects, like Carpenter Ants, survived hidden in tree trunks. Burrowing mammals were insulated under several feet of soil, including Pocket Gophers, Deer Mice and the hibernating Jumping Mice. In some spots protected by tall ridges even parts of the forest remained untouched. These patches of forest and some small protected lakes are called islands of survival. They were small, living islands in the "sea" of ash and blown down trees. From these "islands" within the blast zone life spread, speeding the revegetation of

the area.

After the eruption life was very hard for plants and animals. Think about how the eruption had changed the landscape. If you were a plant or an animal, ...

What kinds of problems might you face in the changed environment?

Mount St. Helens looked like a gray desert or a moonscape. The ground was carpeted by a thick layer of fine, dusty ash which covered small plants and filled the rivers. Because most of the tall trees had been blown down, there was no shade and many forest plants died of heat and drought. Animals had a hard time finding food, shelter and places to nest. Only the most adaptable survived the conditions that followed the eruption. These survivors became very important, because they started to help life return to Mount St. Helens.

Gradually, new plants and animals are moving into the area. We call them colonizers. Now the survivors and colonizers all help each other. Every plant and animal has their special role in the reforestation process. For example, the Fireweed provides food for the Elk. In turn, the Elk help plants grow and colonize new areas. Elk *fertilize* the soil, mix the ash and fertile soil below with their hooves, and spread seeds in their droppings, as do Coyotes, Ground Squirrels, birds and many others.

How have plants continued to change the landscape?

Animals need plants to survive, but few plants could live at Mount St. Helens right after the eruption. Luckily, there are some very hardy plants that often return early to disrupted areas, for example after a forest fire, clear cut or an eruption of a volcano. Do you know any plants like that? Perhaps you have seen grown-ups vigorously trying to get rid of Dandelions and Thistles in a lawn - with poor results, because those plants really are quite tough!

Many of these "pioneers", like the Fireweed, Pearly Everlasting, False Dandelion and Thistle, produce lots of fluffy seeds that are carried by the wind to colonize new areas. The seeds sprout and the plants grow fast as long as they have lots of sunlight. They attract animals and provide them with nutritious food. When they die they break down and become organic soil, which helps support other plants.

Another important wildflower at Mount St. Helens is the Lupine. The ash of Mount St. Helens lacks nitrogen, which is an important "food" for plants. The Lupine has a very special advantage: with the help of some bacteria that grow on its roots, the Lupine can take nitrogen from the air, so it can grow even in places where there is none in the soil! The Lupine not only helps itself, but other plants too, by fertilizing the soil around its roots.

Many *deciduous* trees, such as the Willow, Red Alder and Cottonwood also grow in disturbed areas with plenty of sunlight. They are often the first trees to appear, and they also provide food for animals. One animal that eats these plants is the Elk. People thought Elk could not live at Mount St. Helens after the eruption, but they thrive here. There are now three times as many Elk as before the eruption, thanks to all the good food sources like the Fireweed, Willow and Red Alder, and the protection from hunting in some areas.

Coniferous trees take longer to return and, at first, they grow more slowly than other trees. But as the years pass, they become the tallest trees of the new forest. This process is called succession. What do you think will happen to the sun-loving Fireweed, Pearly Everlasting and Thistle when the trees grow and start to shade them?

How do animals change Mount St. Helens?

Have you ever had a Pocket Gopher in your back yard? What does it do to the lawn? It digs tunnels and builds mounds of soil on the ground, and stores seeds and bulbs in underground chambers. That is exactly what the Pocket Gopher did at Mount St. Helens following the eruption. Its pantries full of food kept it from starving and, as it burrowed up and down in the soil, it gradually mixed ash into the soil and built mounds of fertile earth on top of the ash, creating suitable spots for plants to grow. Mixed with organic soil, volcanic ash can help plants grow.

The ash keeps the soil from getting too wet or too dry and traps nutrients from water.

Even as the plants and animals return to Mount St. Helens, it is still a challenging environment for many of them. In order to live here, animals have to be adaptable. For example birds have to be able to build their nest on the ground, in dead trees or in shrubs and small young trees. Neither can animals be too picky about what they eat. The Coyote and the Raven eat just about anything and are very successful here! The Black-tailed Deer, Bobcat, Ground Squirrel, Chipmunk, Pocket Gopher, woodpeckers and many other animals are now doing well.

Gradually, as the trees grow, more and different plants and animals will be able to colonize and survive here. ON the other hand, some birds and other animals that prefer open areas will have to find new homes as the young forest develops. One day there could be an old forest – until Mount St. Helens erupts again!

Do you know what happened to the lakes?

Unlike smaller lakes, Spirit Lake was not covered by ice. The eruption filled the lake with volcanic ash, organic material from the landslide and hot pumice from the pyroclastic flows, and covered it with blown tree trunks. No plants or animals survived and the lake itself became a stew of ash, mud and wood. Many people thought it would never be clear again, but they were not thinking about nature's little helpers: *bacteria*! Nature is full of helpful bacteria for all kinds of purposes, even ones that can clean up dirty lakes. In Spirit Lake the conditions were favorable for them. There was lots of organic material for them to eat and a comfortable temperature thanks to the hot pyroclastic flows that had rolled into the lake, heating up the water. The bacteria started to decompose the organic material and, after just five years, the water in the lake was clear again.

Sunlight could now penetrate the algae, tiny little water plants started to grow. These plants are the first link in the food chain of a lake. They provide food for small animals, which are eaten by larger animals, like fish. In 1993 scientists found the first fish in Spirit Lake *since* the eruption - a Rainbow Trout! Fish may eventually be eaten by an Osprey, or a Bald Eagle, which do not have natural enemies.

The 1980 eruption also created two new lakes, called Coldwater Lake and Castle Lake. These were formed when the landslide buried North Fork Toutle River Valley and damned Coldwater and Castle Creeks. Water started to fill behind the dams and two years later there were two brand new lakes. The water in these lakes *was* dirty at first because the creek transported ash and organic material. Here, too, bacteria helped clear the water.

When Ducks and other water birds flew by, they saw the new lakes and landed on them to rest. On their feet they carried algae, water plants, and tiny animals like Water Fleas, from other lakes. This is how the new lakes got some of their first residents. The creeks also delivered algae and animals, and the wind brought the seeds of Cat Tails that grow on the shores. The two young lakes now have functioning ecosystems.

The Eruption Of Life at Mount St. Helens

The biggest and most wonderful surprise that the May 18, 1980, eruption provided us was the eruption of life that followed.

Scientists thought that no plants or animals could have survived such a catastrophic event. Before they first visited the mountain just days after the eruption, they believed they would be the only living in the blast zone. Some of them even estimated it would take decades before life would return. Can you imagine their astonishment and excitement, when they found many living things there. Plants and animals had survived under the ground and the snow blanket, in tree trunks, in ice-covered lakes and protected patches of forest. From these islands of survival plants and animals spread into the blast zone.

From the first day on more plants and animals also from the vicinity of Mount St. Helens returned to colonize the area: birds, Coyotes, Elk, insects, Spiders, fish and so on. Seeds of plants arrived carried by the wind, water, or animals. Because the environment is very harsh, only a few kinds of plants and animals can live there, but little by little they will turn the desert-like, gray landscape into a forest. As Mount St. Helens continues to change more sensitive species of plants and animals will move in. The process will take several decades but, even so, the rate at which life is returning to Mount St. Helens has surprised all scientists.

Mount St. Helens has taught us that the renewing force of nature is as powerful as the eruption of a volcano.

Glossary of new and more difficult words

Bacteria are living creatures so small that you can only see them through a microscope. They only have one cell, which can look very different depending on the family they belong to. Nature is full of bacteria. Some of them cause disease, but most of them are essential for us. For example, bacteria help you digest the food you eat. (*sing. Bacterium*)

Coniferous trees are evergreen plants with needles instead of leaves. Their seeds are in cones. For example, Douglas Fir and Western Red Cedar are conifers.

Deciduous trees have leaves which they drop every year. Oak and Aspen are deciduous trees.

An *Ecosystem* consists of all the plants and animals that live in a certain place, and their non-living environment: rocks, soil, water, air, and so on.

Fertilizing means adding to the soil some ingredients that plants need for growth other than sun, air and water. These ingredients are called nutrients. The most important nutrients for plants are nitrogen and phosphorus. In nature, decaying plants and animals, some bacteria, ash from burning, and lightning all fertilize the soil. People use artificial fertilizers and compost soil to help their plants and lawn grow.

Larvae are young insects that don't have wings yet. They often look like worms. For instance, butterfly larvae have to go through a process called metamorphosis to become adult butterflies with wings.

Organic material is the part of the soil that is formed from living creatures when plants and animals die and decay. Organic material is needed to make good soil for plants. You can make it by composting fallen leaves, potato skins or dry bread. What else could you put into your compost?

Pyroclastic flows are flows of super-hot rocks, volcanic ash and hot gases that erupt from volcanoes like Mount St. Helens. They are actually one type of lava flow.