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Seminar Paper

The Eruption of Mount Saint Helens

Of the 40 volcanos in the continental United States, the only one to be active in the last 75 years is Mount Saint Helens. This paper will step through the events surrounding eruption of Mount Saint Helens, including activities that started two months before the eruption all the way through the events of May 18, 1980. I will also talk about the extent of the eruption and the continuing effects of the event. Additionally I will talk about the areas affected by the eruption both before and after the eruption. The third item I will discuss is the effects the eruption had on the population in the area. This will include the loss of life from the explosion itself, as well as any related deaths from mud flows or ash clouds, and the effect it had on the economies of the Inland Northwest. To close I will discuss the activity that has happened since the volcano erupted in 1980.

On March 20, 1980 there was an earthquake at Mount Saint Helens that signaled a return to life for the volcano. This event was led by some smaller quakes that were not substantial. During the week after the earthquake on March 20 there were many small events these tremors started to pick up steam on the 25 of March, the quakes during this period did not do much damage other than some minor avalanches on the mountain. In the early afternoon of March 27 there was an audible blast heard in the immediate vicinity of the volcano coinciding with the first eruption of Mount Saint Helens. The eruption spewed debris a mile into the air and caused a new crater to appear on top of Mount Saint Helens.

For the following four weeks Mount Saint Helens continued to release ash and steam plumes into the air. The length of the plumes varied in time from moments to twenty minutes or more. Additionally a second crater formed and eventually combined with the first crater. These plumes caused avalanches to occur on the southern slope which produced a black and a white side to the volcano. All of the ash up until May 18, 1980 was made entirely from the existing rock from the summit. From the initial explosion, on March 20th, through to the May 18th explosion there was a continuous tremor that is normally found in places like Hawaii or Japan while there magma is being pushed into the volcano. This was noticed on March 31st and up until May there was a visible bulge forming on the northern side of the mountain. At its peak the bulge was advancing at a rate of more than 5 feet per day. Meanwhile the summit was declining.

On the day of the explosion there were no additional warnings that would have signaled the mountain may explode. Every metric seemed to be holding steady. At approximately 8:32 A.M. on May 18th, 1980 there was an earthquake, measuring 5.1 on the Richter scale. This caused the mountain, which was already being wedged apart, to partially collapse, creating a land slide. This land slide occurred on the north side of the mountain. Parts of the collapse entered Spirit Lake and caused the lake to rise some 200 feet from where it had previously been. It also continued down the North Fork of the Toutle River when all is said and done it covered approximately 23 square miles and had progressed nearly 13 miles.

After the side of mountain had collapsed there was a "lateral blast". This was caused by the release of the pressure of the superheated steam that had been building up in the fissures in the cryptodome. A cryptodome is a dome of magma that is not

visible from the surface, which had been building up in the base of Mount Saint Helens. This cryptodome is what had caused the surface bulge on the north side of the volcano. This blast was released at a speed roughly three times the speed of the avalanche, and over took the avalanche of debris in a few moments. The blast wave was heard over a large swath of the Pacific Northwest, approximately 250 to 300 miles. However there was also a "quiet zone" that extended for about 50 miles around Mount Saint Helens. The Oregon Museum of Science and Industry attributed this "quiet zone" to atmospheric conditions around the time of the explosion.

The blast had multiple levels of destruction. The first zone was the area where there was total annihilation of all features. This extended roughly 8 miles from Mount Saint Helens. In this zone there was almost nothing left. The second area, from the edge of the 8 mile zone to as much as 19 miles in some places, merely toppled everything in its path. Most of the debris was still there, unlike in the first zone where there was a total erasure of all debris. The third zone formed beyond the second zone and in this place there was a significant amount of tree destruction. The majority of the damage was done when the gasses from the eruption flash fried everything in this zone; however there was very little knock down effect.

There also appears to have been several pyroclastic flows that originated from the ash plume falling back toward the earth and the top of the volcano itself. These flows caused several steam explosions when they came in contact with water due to the fact that the flow was over 550 degrees Fahrenheit. Additionally there were also mudflows, or lahars, that started when the pyroclastic flows and the debris avalanche mixed with the local river system. This ultimately caused a large reduction in capacity in

most of the rivers around Mount Saint Helens as well as depositing enough sediment into the Columbia River to cause the navigational channel to be blocked causing huge losses in the amount of shipping that could be conducted as well as stranding some vessels upstream for some time.

During the morning of the eruption a large ash cloud formed over the volcano. While the ash cloud was forming, it built up significant static electricity causing multiple lightning strikes and starting many forest fires. Within an hour it had traveled 60 miles dropping ash on Yakima, WA. By noon it had made it to Spokane, WA. In both of these places the ash cloud was so thick it blocked out the sun for a significant portion of the day. Even though the ash cloud had stopped being fed that same day the ash had already traveled to the central United States. Within two days it had made it to the eastern seaboard, and in two weeks it had traveled around the globe. Most of the ash was deposited in the area directly downwind of the volcano in eastern Washington.

These were the immediate effects of the explosion of Mount Saint Helens. It all started with a long buildup where there were warning signs that an explosion was likely to happen. Then on the morning of May 18th 1980 there was an earthquake that started a landslide. This exposed the superheated cryptodome which proceeded to explode because it was infused with superheated steam. Additionally the explosion also caused an ash plume and lahars.

Secondly, I would like to talk about the effects that the eruption of Mount Saint Helens had on the surrounding areas. To do this I will talk about what the area was like before the explosion and after, as well as the long lasting effects of the eruption on the economy and agriculture. The majority of the effects took place in the area directly

downwind of the volcano, Eastern Washington and North Idaho. The Eastern Washington area is home to large amounts of agricultural land. Additionally the Cascade region most affected by the eruption was rich in timber stocks. Finally there was a large effect on the wildlife in the area. I will step through how all of these natural resources were affected by the explosion on May 18th 1980.

The eruption of Mount Saint Helens spread ash over large swaths of Eastern Washington. The amount measured in Yakima, which was directly in the path of the falling ash, was roughly one inch. This ash fall would cause some freshly germinated plants issues however it would largely be mixed in within a year, if left untended. In the area around Yakima there was very little effect on growing plants because it was at the start of the growing season. The farmers there were able to cope by retiling the soil and replanting. Additionally the forestry industry didn't have any noticeable drop in productivity in this area due to the spread of ash. In fact for the fruit growers of the region the ash turned out to be a blessing because it locked moisture into the ground. This made the fruit trees much more plentiful during the year of 1980. However there was an atmospheric anomaly which caused a large amount of ash to fall on the Ritzville area. The area is roughly three times further away from Mount Saint Helens than Yakima. The amount of ash that fell around Ritzville was approximately two inches. This wreaked serious havoc with agricultural production in the area. However the area was able to start producing agricultural products in one year.

The timber sector of the economy laid off almost all of their staff in the days following the eruption because most of the camps that the loggers used were wiped out in the debris avalanche. Additionally they weren't allowed to get to their timber cutting

zones because the area was considered a disaster zone and closed from outside access. This caused a large number of loggers to get laid off for a period of time. However after the mud flows and debris avalanche had settled the logging companies were able to go in and pull out more trees than ever because they had been knocked down. By the end of the year a quarter of the trees that had been blown down had been removed from the area, sometimes at a rate of 600 trucks a day, according to the United States Geological Survey.

The third item of the eruption that I would like to cover is the effect on the animals that lived on or around Mount Saint Helens. Washington State estimated that over 7,000 large animals were killed; they specifically mentioned deer, elk and bears. Additionally all bird life in the area perished because of the air differential that occurred during the blast. In the resulting mud flows there was a large amount of damage done to stream beds which has destroyed the fish populations. Again the State of Washington estimated this number to be roughly 400,000 fish. It is clear there was a significant negative effect on the animal population that inhabited the area. The large game has however recovered well in the aftermath. The bird populations have moved back into the area but have not settled permanently, this is largely due to the fact that there is little suitable habitat for breeding. The fish stocks have largely recovered but in some places the stream bed is too unstable or rapid to support recovery.

These were the major disruptive effects of the eruption of Mount Saint Helens. The ash cloud caused a poor year in some of the grain growing regions, however it caused a good year for fruit growers in the area. The same could be said for the timber industry. They immediately laid off their entire staffs however in the cleanup of the

mudslides and lahars they were more productive than predicted. Finally the animal population was almost completely wiped out in the area of the blast. However, the animal stocks did recover in a relatively short amount of time.

For this section of this paper I will focus on the human dimensions to this natural disaster. The first to come to mind is the economy. Manufacturing plays a large role in the economy of the Inland Northwest. Another very important industry for the Cascade region of Washington is tourism. Finally we need to talk about those who were directly affected in the explosion. Who were the people at risk, why were they there, and why did they die.

The first human dimension that was affected by the eruption of Mount Saint Helens was manufacturing. The reason why this happened was not because a large shutdown was required to protect machinery but because shipping lanes were closed for more than a week making it difficult for raw materials to make it into the Inland Northwest and for finished products to go out. For instance Interstate 90 which runs in between Seattle and Spokane was shut down for more than a week in some locations; additionally Interstate 82 that runs from the tri-cities to Ellensburg was also closed. As I mentioned above there was a large amount of sediment that flowed into the Columbia River, this caused the shipping channel to be blocked for a few months, and levied a huge economic toll. There were also significant problems with air travel during this time. The airports in the region were closed first for concerns with ash falling on the runways but also because the fine particles in the ash clouds could cause airplane engines to fail. This was also true of passenger vehicles as well. There were concerns that ash could get into the engines and cause the air filters to plug so that air could not pass through

them. This inability to get raw materials into and out of the Inland Northwest made significant problems for the time around the eruption.

The second item that was largely affected from the ash cloud was tourism. The way that the media portrayed the eruption of Mount Saint Helens was that the area was going to be dangerous for a long period of time. This caused people who would have come to the Pacific Northwest to change their travel itineraries. The entire summer of 1980 the tourism industry was brought to its knees by this false information. The slow down was not just for the area around Mount Saint Helens, but the entire Pacific Northwest. Reasons why vacationers didn't come to the area that year included being scared of future eruptions. However, the tourism industry had pretty much rebounded by the next year. In fact there were a record number of people coming to see the remains of Mount Saint Helens, and learn about what had happened there.

The final human factor to this hazard was the people who died directly from the explosion of Mount Saint Helens. Upon inspection of a list of the 57 deaths attributed to the eruption of Mount Saint Helens, most of the deaths were caused by asphyxiation. There were some notable exceptions. The volcanologist who was working on the mountain that day died from the side blast. Additionally the owner of the Spirit Lake lodge was entombed in the debris avalanche. The truly fortunate part of all of this was that it happened early on a Sunday morning. If it had happened at any other time there would have been a large number of loggers in the area, some estimates put the number at 300 people. This disaster could have been much more destructive in terms of human lives had it not been for luck.

Since the events of May 18, 1980 there have been signs of renewed life in the volcano. During the period following the 1980 eruption there was a significant period of seismic activity. The first event took place only seven days after the initial eruption. Throughout the rest of the year there were seismic events that led up to the largest eruption which spewed an ash cloud 10 miles in the air. This event occurred late October and caused a new dome of lava to be formed. Between 1981 and 1991, there were many small seismic events. These small events were caused by magma slowly releasing and forming lava domes. By the time the domes were finished extruding, the largest was 1,200 feet in diameter and 150 feet high in 1980. In 1990 all three domes had grown together causing the total size to be 3,480 feet by 2,280 feet and had an elevation of 1,150 feet. After these dome building events had ceased in 1991, the volcano went into a dormant period.

This period of dormancy was ended in September of 2004, when the United States Geological Survey and the Pacific Northwest Seismograph Network noticed activity. The activity that was noticed was an earthquake swarm about a half mile beneath the lava dome created in the 1980's. This consisted of many earthquakes all below a 1.0 on the Richter scale. In the next few days the swarm started to slow but the earthquakes increased in magnitude eventually culminating in a 3.3 magnitude earthquake on September 29th. These previous seismic events led to a plume of steam and ash being released on October 1st 2004. This was followed by several other plumes and steam expulsions in progressively smaller amounts. On the sixth of October it was announced by the United States Geological Survey that "the vigorous unrest of the past few days has lessened and that the probability of an imminent eruption that would

endanger life and property is significantly less than at any time since Saturday, October 2". However, just five days later magma surfaced and started the dome building process again. This process continued until May 5th of 2005 when the "whaleback" feature finished growing. It was measured to be 688 feet below the top of the volcano. There was a vigorous steam release on March 8th when a cloud of steam and ash was emitted. Scientists believe this to be due to the melting of the glacier caused by the building of the whaleback. In 2006, a new feature began, it is known by scientists as the slab and at its peak the slab was growing at 6 feet a day. In January of 2008, the volcano released a cloud of steam. However by July of 2008, all activity had stopped and it was determined that the eruption, that started in 2004, had ended.

There were portions of this disaster which impacted humans in a number of ways. The first, was that a large manufacturing sector had troubles coping with the ash cloud. Additionally key trade routes were closed for multiple days. The second was the tourism industry which had a large falling out for the summer of 1980, however has recovered and flourished in the time since. The final dimension of the disaster was the human death toll. This included vacationers that were outside the restricted zone. As well as scientists who were studying the volcano and monitoring it to protect the public at large. These scientists are the ones who protected the public by accurately communicating the danger to the local government as well as taking precise measurements of the effects of the volcano coming back to life.

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