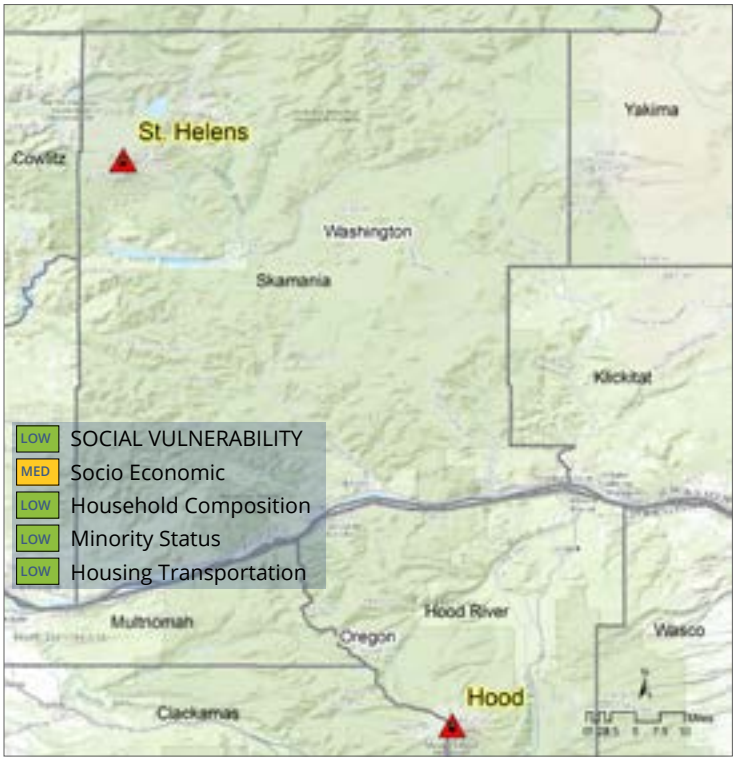
MT. ST. HELENS, WA

HAZARD PROFILE

Mt St Helens, known as Fuji-san of America prior to its 1980 eruption, was a youthful, conical volcano rising 9,677 ft. into the skyline. Located about 50 miles northeast of the Vancouver, WA-Portland, OR metropolitan areas, it is the most active volcano in the Cascade Range. St. Helen's gained notoriety for its 1980 eruption during which a large debris avalanche removed over 1,300 ft of the summit leaving behind a horseshoe shaped crater, now partially filled by a lava dome.

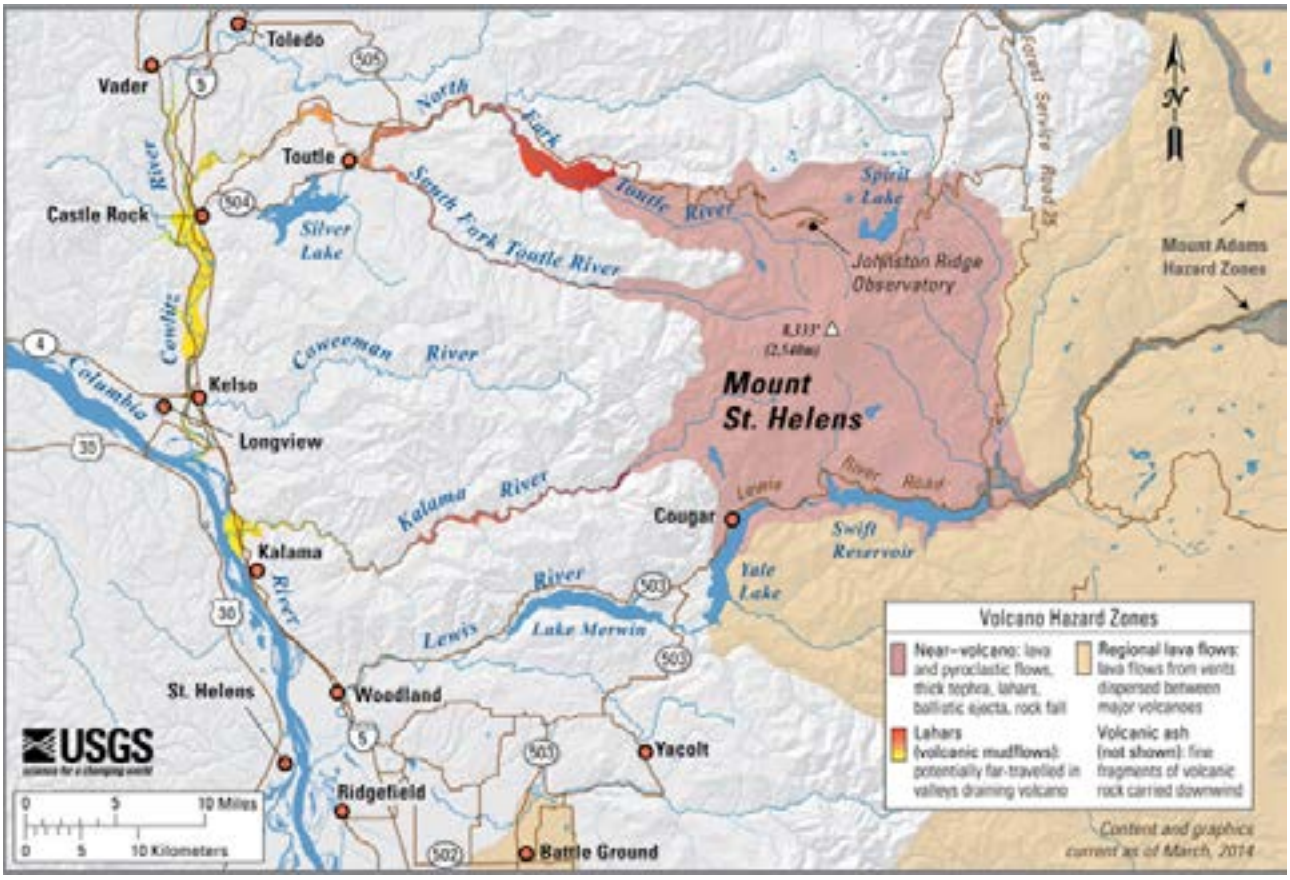
The pre-1980 volcano was probably constructed during the last 3,000 years. The volcano erupted vast amounts of fragmented rock, gasses, lava debris from the summit and flank vents. 19th century early settlers noted eruptions form the Goat Rocks area on the north flank. Although Mt. St. Helen's will erupt again, it is not likely that a repeat of the May 1980 large debris avalanche or a major lateral blast will occur now that a deep crater has formed.

Mount St. Helens is the most explosive of the Cascade volcanoes, and has repeatedly produced large explosive eruptions that deposited ash and pumice over long distances.



FEMA URBAN DESIGN & PLANNING

AREAS OF IMPACT



MONITORING

The USGS maintains a robust monitoring program at the volcano to detect signs of renewed unrest and works with Federal, State, and local agencies to develop crisis plans and risk-mitigation strategies.

- Seismometers: The largest seismic monitoring array of all Cascade Range volcanoes. Millions of earthquakes, as well as other non-earthquake signals (e.g., rock falls, explosions, avalanches, glacier quakes, helicopters) have been recorded.
- Sediment Retention Dam Threatened: Formation of a panel to help agencies determine the pros and cons of a permanent fix for the again Spirit Lake Dam.
- GPS to study ground deformation & Multiple types of cameras are used to monitor volcanic activity
- Gas Emissions Studies: Direct measurement of fumaroles on the ground, Airborne measurements of eruption plumes & Analysis of water chemistry for gas content
- Observation Flights: FLIR (forward looking infrared monitoring instrument) mounts on the nose of a helicopter
- Hydrology: The USGS, in cooperation with the U.S. Army Corps of Engineers (USACE), operates four gauging stations to measure surface water flow and amount of suspended sediment in the rivers draining Mount St. Helens.
- Ash Cloud Simulation: models the potential path of an ash cloud if an eruption were to occur from Mount St. Helens today. https://volcanoes.usgs.gov/volcanoes/st_helens/monitoring_ash_cloud.html

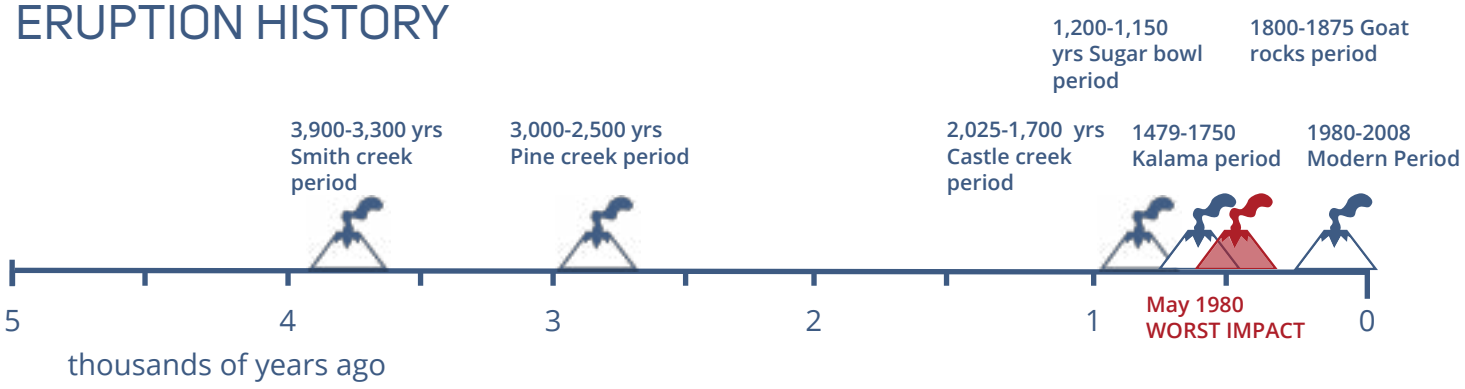
MOUNTAIN FACTS

coordinates	46.2° N, 122.18° W
summit / elevation	2549 m / 8361 ft
last known eruption	2008 CE
population	within 5 km / 78 10 km / 427 30 km / 2221 100 km / 2,173,101
county	Skamania
nearby towns	Castle Rock, WA Olympia, WA Vancouver, WA Yakima, WA Portland, OR

GEOLOGICAL SUMMARY

Four eruptive stages formed the volcano beginning about 275,000 years ago. The early stages show that the volcano was mostly a cluster of domes surrounded by a scattered fan of rock fragments and particles left from earlier eruptions. About 3000 years ago thick basalt lava flows of moderate viscosity began to erupt between explosive ash and pumice activity. These thick, heavy lava flows buried large parts of a central cluster of domes built of the more explosive dacite, forming the beginning of the cone. Studies of each stage of eruptions it has been suggested that Mt St. Helen's magma system has evolved from earliest, simple, more silica-rich (explosive dacite) magma to the later, more complex basalt lava flows rich in iron and magnesium. Leading up to the momentous and violent May 1980 eruption, crystallized magma thrust from the interior of the volcano, began forming a bulge in the north flank. By mid May, due to pressure, the bulge was probably heading toward failure when a magnitude 5+ earthquake and subsequent debris avalanche carried away the bulge material. The abrupt release of pressure turned hot water in the system immediately into steam which expanded explosively into a hydrothermal blast directed laterally through the scar of the landslide.

ERUPTION HISTORY



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VOLCANO THREAT ASSESSMENT

OVERALL THREAT
VERY HIGH

HAZARD THREAT
HIGH (15)

EXPOSURE THREAT
HIGH(17.8)

MONITORING

REQUIRED	CURRENT
4	4

Overall Threat
This is an overall ranking based on multiple factors including tectonic setting, population density, eruption frequency, and potential to erupt again. The variations in these factors make this volcano uniquely dangerous.

Hazard Threat
This includes volcano type, max volcano explosivity index, explosive activity, eruption recurrence, holocene - pyroclastic flows, lava flows, lahar, tsunami, hydrothermal explosion potential, sector collapse potential, primary lahar source, and historical unrest.

Exposure Threat
This is based on volcano population index, population downstream, historical fatalities and evacuations, local and regional aviation exposure, infrastructure, major development of sensitive areas, and populated island location.

Current Monitoring
This assesses the current ability to detect and track pre-eruptive and eruptive changes in real-time, including what is occurring. This assessment considers seismic, deformation, gas, hydrologic, and remote sensing monitoring capabilities.

MORE RESOURCES

Suscribe to Volcano Notification Service
http://volcanoes.usgs.gov/vns/

Find Designated Public Shelter
Text SHELTER + ZIP code to 43362 (4FEMA)

BE INFORMED.
MAKE A PLAN.
BUILD A KIT.

Mount St. helens and Mount Adams Volcanic Region Coordination Plan
Washington Military Department (2014).
Washington Emergency Management Division.
https://volcanoes.usgs.gov/vsc/file_mngr/file-132/mount-st.-helens---mount-adams-volcanic-region-coordination-plan-october-2014.pdf

Skamania County
Preparedness- Emergency Management
http://www.skamania-dem.org/Preparedness.html

Washington State Department of Natural Resources
Volcano and Lahar Hazards
Information about understanding volcano and lahar hazards as well as Emergency Preparedness.
http://www.dnr.wa.gov/programs-and-services/geology/geologic-hazards/volcanoes-and-lahars

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MT. BAKER, WA

HAZARD PROFILE

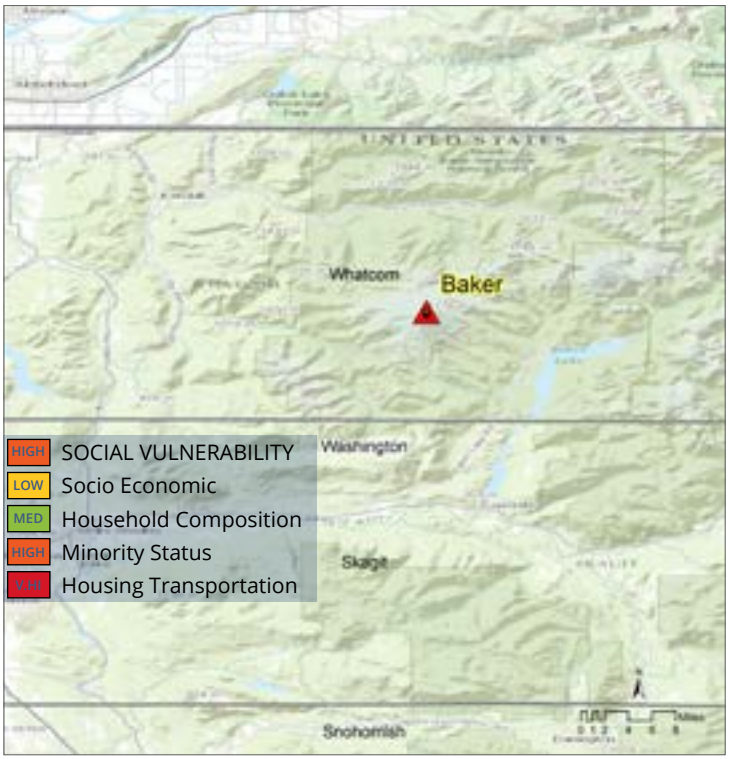
Located in Northern Washington, in the Cascade Range, Mt Baker is second to Mt. St Helen's in thermal activity. It is about 31 miles from Bellingham, Whatcom County. Composed mainly of andesite lava flows and snow and ice covered, it is subject to flank collapse, which results in Lahars, flooding the Middle Fork and Nooksack Rivers.

Mt Baker is visible from Victoria, Nanaimo, and Vancouver, BC. From the south, the volcano dominates the Seattle, Bellingham, and Tacoma (when clear), skyline. On clear winter days, residents can see a dramatic increase in the steam cloud continuously puffing from the east side of the Volcano. The plume occurs as a result of cold air being heated by the thermal activity at the summit of Mt. Baker. A change the snow melt and resulting steam could signify a change in the interior output and possibly the first phase of an eruption.

Two fumaroles pathways, Dorr Fumarole, northeast of the summit and Sherman Crater to the south, allow in the sulfurous gases to reach the surface. Both sites show hydrothermal activity, which converts lavas to weak, yellowish clays. Sulphur is a commonly found around these exit pathways.

An hour drive from most urban centers, Mt Baker National Recreation area offers popular summer and winter activities.

USGS research in the last decade shows Mount Baker to be the youngest of several volcanic centers in the area and one of the youngest volcanoes in the Cascade Range.



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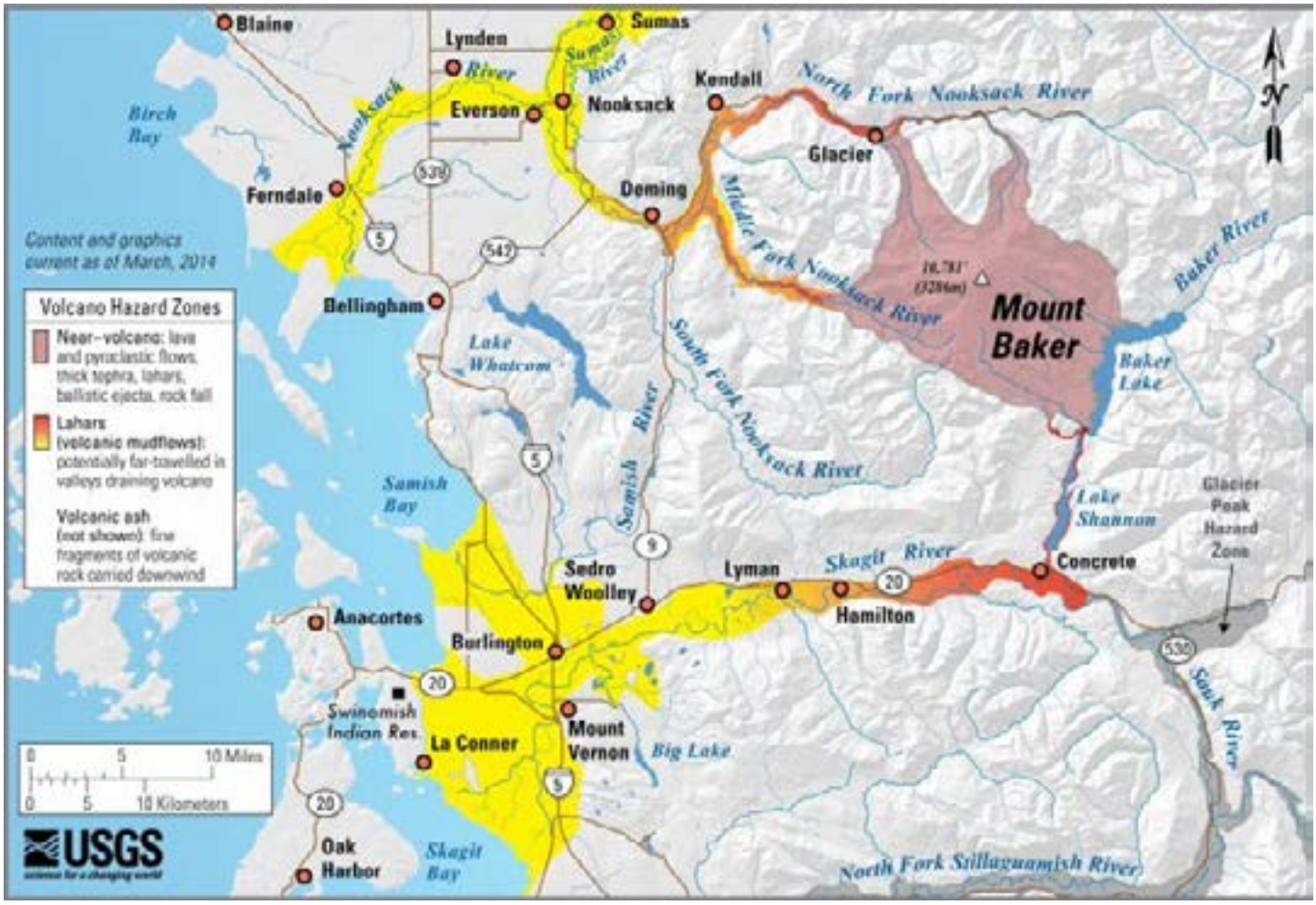
URBAN DESIGN & PLANNING

AREAS OF IMPACT



MONITORING

- Based on observations and analysis, Mt. Baker is considered one of the most seismically quiet volcanoes in Washington State.
- The Pacific Northwest Seismic Network (PNSN) and Cascade Volcano Center (CVO) monitor earthquake activity at Mt Baker via two seismic stations located within 12 miles of the summit.
- The PNSN maintains 24 hour webcam seismometer data for stations MBW and SHUK
- Geochemical monitoring: Mt. Baker Volunteer Research Center, (MBVRC) periodically sample fumarole gases at Sherman Crater.
- The USGS conducted an eruption simulation based on actual wind direction and strength to calculate ash dispersal and thickness.
- Mount Baker is also monitored by several gravity stations, which were initially installed by the University of Washington in response to volcanic unrest in 1975.

MOUNTAIN FACTS

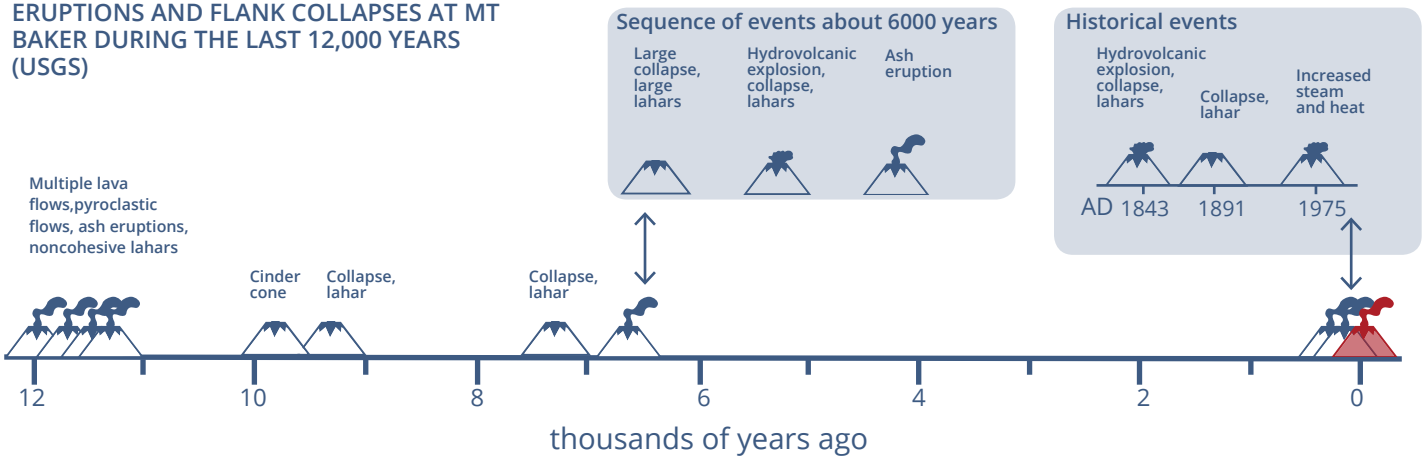
coordinates	48.112° N, 121.113° W
summit / elevation	3286 m / 10781 ft
last known eruption	1880CE
population	within 5 km / 0 10 km / 46 30 km / 8,568 100 km / 1,990,504
county	Whatcom
nearby communities	Glacier, Kendall, Deming, Welcome, Concrete, Hamilton, Lyman, Sedro Woolley, Nooksak, Burlington, Bellingham

GEOLOGICAL SUMMARY

Mount Baker, the northernmost of Washington's volcanoes, is a glacier-clad andesitic stratovolcano constructed above the E flank of the eroded mid-Pleistocene Black Buttes volcano and SW of the early Pleistocene 4.5 x 8 km rhyodacitic Kulshan caldera. With the exception of the Schreibers Meadow cinder cone on the SE flank, which formed about 9800 years ago, Holocene volcanism has been confined to the central conduit. A major eruption about 6500 years ago was it's largest eruptive event during the Holocene, and was accompanied by a collapse that produced a lahars down the Nooksack drainage. Early settlers in the Puget Sound region as far away as Victoria, British Columbia, observed 19th-century activity, all of which consisted of relatively minor phreatic eruptions. Sherman Crater, the historically active crater immediately south of the summit, has been the site of increased steam emission since 1975.

ERUPTION HISTORY

ERUPTIONS AND FLANK COLLAPSES AT MT BAKER DURING THE LAST 12,000 YEARS (USGS)



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VOLCANO THREAT ASSESSMENT

OVERALL THREAT
VERY HIGH

HAZARD THREAT
HIGH (9)

EXPOSURE THREAT
HIGH(17.4)

MONITORING

REQUIRED	CURRENT
4	2

Overall Threat
This is an overall ranking based on multiple factors including tectonic setting, population density, eruption frequency, and potential to erupt again. The variations in these factors make this volcano uniquely dangerous.

Hazard Threat
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MORE RESOURCES

Suscribe to Volcano Notification Service
http://volcanoes.usgs.gov/vns/

Find Designated Public Shelter
Text SHELTER + ZIP code to 43362 (4FEMA)

Mount Baker and Glacier Peak Coordination Plan
Washington Military Department (2012).
Washington Emergency Management Division.
http://mil.wa.gov/emergency-management-division

Whatcom County
Volcano Information and Preparedness
http://www.whatcomcounty.us/2030/Volcano

Washington State Department of Natural Resources
Volcano and Lahar Hazards
Information about understanding volcano and lahar hazards as well as Emergency Preparedness.
http://www.dnr.wa.gov/programs-and-services/geology/geologic-hazards/volcanoes-and-lahars

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MT. RAINIER, WA

HAZARD PROFILE

Mt. Rainier is an active volcano of the Cascade Range in Washington State. It stands 3 mi above sea level and about 30-40 SE of the Seattle–Tacoma metropolitan area. The tallest of the Cascade Volcanos, it stretches more than 14,400 ft above the Puget Lowlands. Its elevation and location make it an excellent collector of snow and ice. Mt. Rainer now holds more snow and ice than all the other Cascade Volcanos combined. Each year more than 2 million visitors come to Mt. Rainier National Park to admire its glaciers, alpine meadows, and icy ridges.

Combined with loose clay and rock fragments, the abundant supply of snow and ice, readily flows down the steeply cut glacial valleys of Mt. Rainier's flanks. These large and fast moving debris flows are a hazard to visitors and can threaten nearby river communities, surrounding rivers, and forests. Major lahars will level and absorb everything in its path, gaining momentum and likely affecting a wider range of communities.

At most risk is the west flank of the mountain, including the head of the Puyallup River because of the large amount of weakened clay-rich rock at high altitude which could release large landslides that would become swiftly moving, far reaching lahars. These events would greatly affect the Puyallup River valley and to a lesser degree, the Nisqually River valley.

Mount Rainier, the highest peak in the Cascade Range, towers above the city of Tacoma and forms a prominent landmark that dominates much of central Washington.

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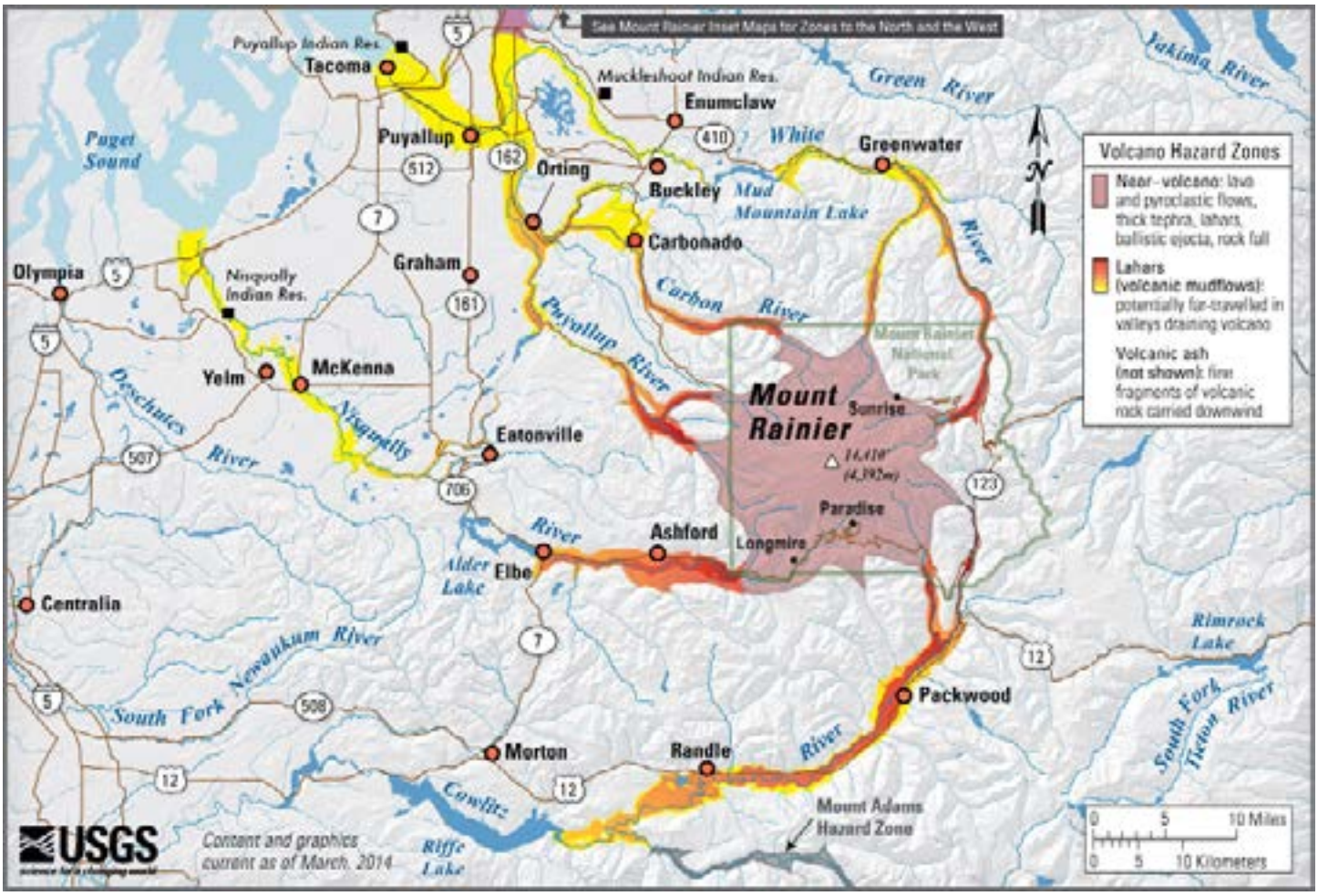
AREAS OF IMPACT



MONITORING

The 2005 National Volcano Early Warning System (NVEWS) open-file report 2005-1164 shows Mt. Rainer to be a very high threat volcano but was only monitored at a level "2", although level "4" coverage was required. Improvements have been made since 2005 and further work is being planned by CVO and the National Parks Service to fill in remaining gaps in our monitoring efforts.

The higher risk level from lahar damage in Carbon and Puyallup River valleys encouraged the implementation of an array of 5 acoustic flow monitors (AFM) to detect lahar ground vibrations. Computerized evaluation of the resulting data can confirm the presence of a flowing lahar and issue automatic alerts.

Park officials and scientists have been a crucial partner by conducting research and monitoring in sensitive and very difficult terrain at Mt. Rainer.

- USGS, CVO, PNSN seismic station array of seismometers
- GPS instrument to monitor deformation,
- Tiltmeters to measure earth deformation which can precursor an eruption
- Gas monitors
- Temperature gauges
- web cams https://www.nps.gov/mora/learn/photosmultimedia/webcams.htm#CP_JUMP_636381
- Stream flow gauges

MOUNTAIN FACTS

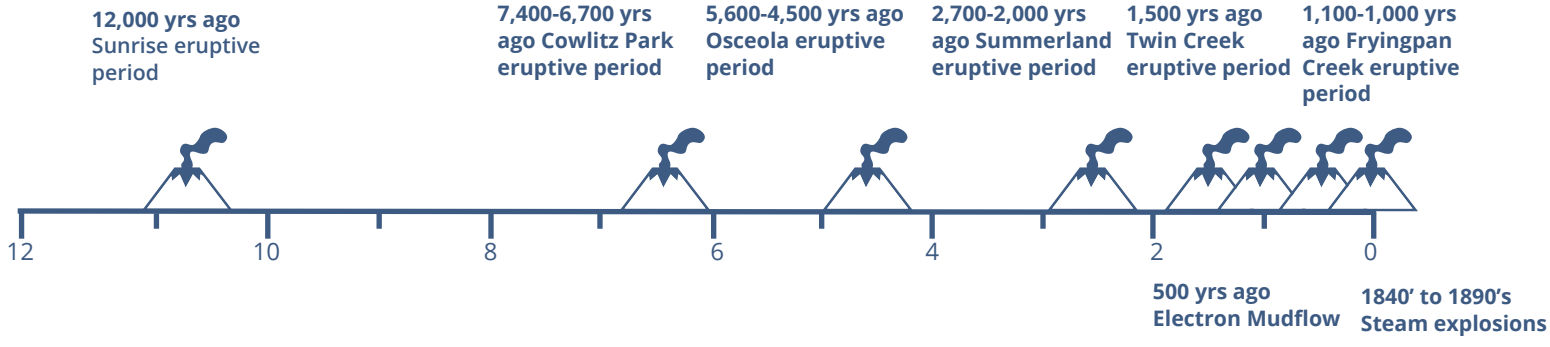
coordinates	46.853° N, 121.76° W
summit / elevation	4,392 m / 14,406 ft
last known eruption	1894CE
population	within 5 km / 0 10 km / 128 30 km / 3187 100 km / 2,667,609
county	Pierce
nearby communities	Paradise, Sunrise, Longmire, Ashford, Packwood, Carbonado, Greenwater, Enumclaw, Buckley, Orting, Eatonville, Elbe, Morton, Randle, McKenna, Graham, Puyallup, Tacoma, Yelm, Olympia


(Smithsonian Institute)

GEOLOGICAL SUMMARY

Mount Rainier, at 4392 m the highest peak in the Cascade Range, forms a dramatic backdrop to the Puget Sound region. Large Holocene mudflows from collapse of this massive, heavily glaciated andesitic volcano have reached as far as the Puget Sound lowlands. The present summit was constructed within a large crater breached to the northeast formed by collapse of the volcano during a major explosive eruption about 5600 years that produced the widespread Osceola Mudflow. Rainier has produced eruptions throughout the Holocene, including about a dozen during the past 2600 years; the largest of these occurred about 2200 years ago. The present-day summit cone is capped by two overlapping craters. Extensive hydrothermal alteration of the upper portion of the volcano has contributed to its structural weakness; an active thermal system has caused periodic melting on flank glaciers and produced an elaborate system of steam caves in the summit icecap. Reported 19th-century eruptions have not left identifiable deposits, but a phreatic eruption may have taken place as recently as 1894.

ERUPTION HISTORY



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VOLCANO THREAT ASSESSMENT

OVERALL THREAT
VERY HIGH

HAZARD THREAT
HIGH (13)

EXPOSURE THREAT
HIGH(18.8)

MONITORING

REQUIRED	CURRENT
4	2

Overall Threat
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Mount Rainier Volcanic Hazards Plan
Pierce County Department of Emergency Management (2008) New Plan expected 2017
https://volcanoes.usgs.gov/vsc/file_mngr/file-130/Mt%20Rainier%20Volcanic%20Hazards%20Plan%2010-2008_20120817093131140.pdf

Pierce County
Volcano Preparedness
Information relating to eruption history and preparedness for Mt. Rainier
https://www.piercecountywa.org/3730/Mount-Rainier-Active-Volcano

Washington State Department of Natural Resources
Volcano and Lahar Hazards
Information about understanding volcano and lahar hazards as well as Emergency Preparedness.
http://www.dnr.wa.gov/programs-and-services/geology/geologic-hazards/volcanoes-and-lahars

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