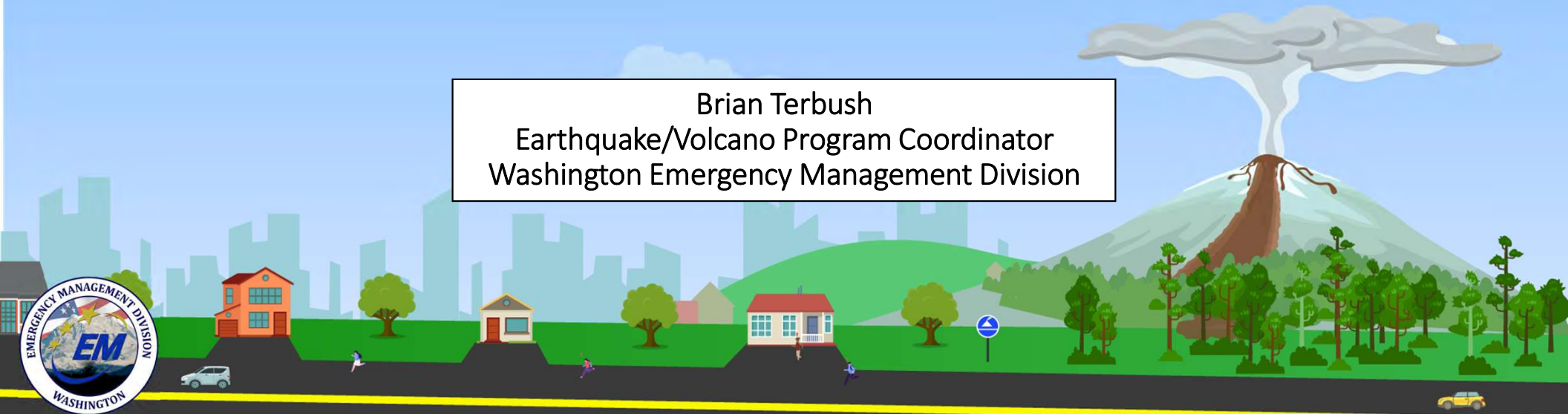
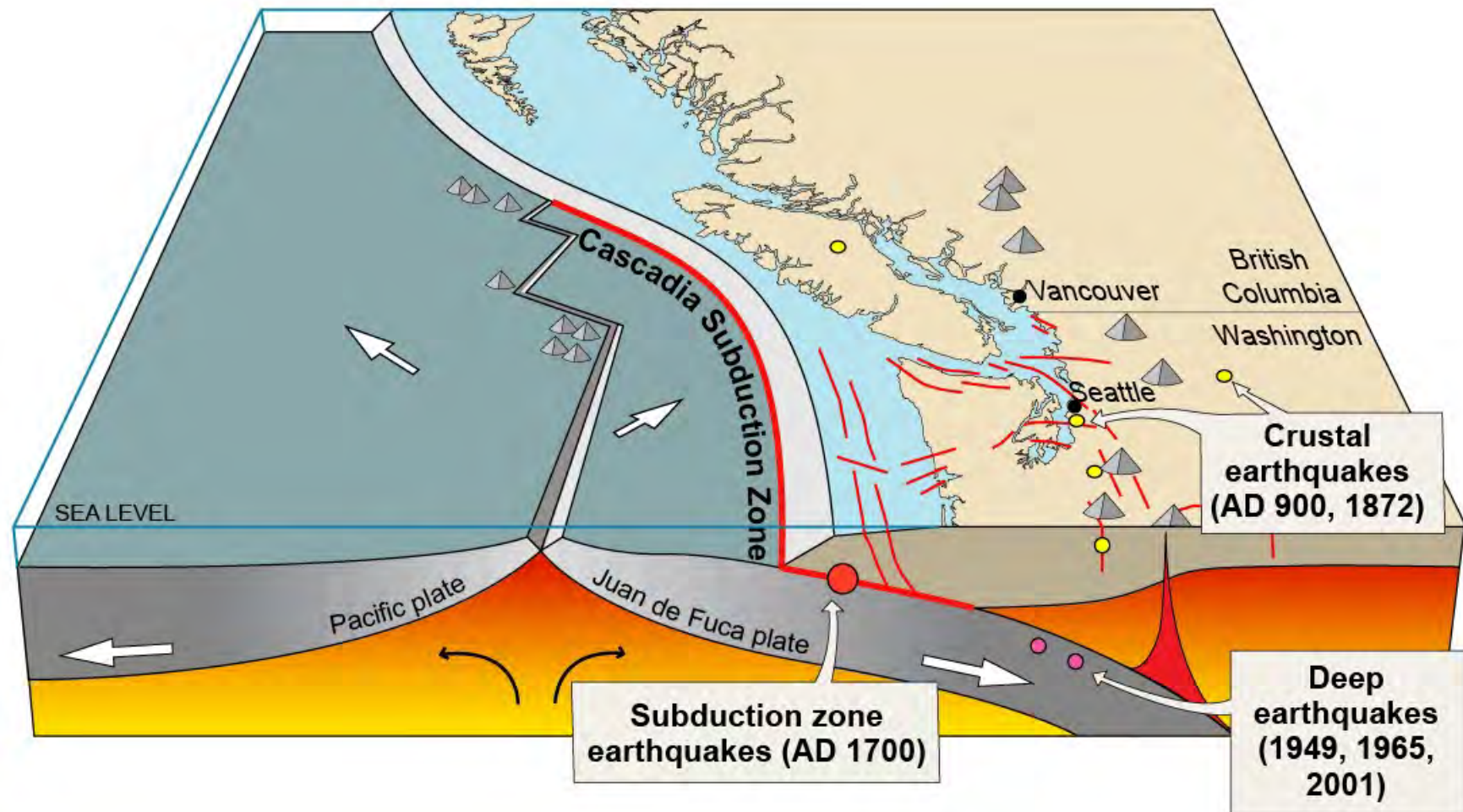


# Volcanoes In Washington: Threats, hazards, and preparedness

Brian Terbush  
Earthquake/Volcano Program Coordinator  
Washington Emergency Management Division



**Washington is an exciting place to live!**



# Volcanoes in Washington: The Basics

- 5 Active Volcanoes, perpetually in a state of “Just add magma”
- Volcanoes are well-monitored, Won’t *erupt* without warning
  - Landslides/Landslides that turn into lahars Possible (but low-probability)
- Eruptions can’t be predicted – details can only be forecast
- High degree of uncertainty associated with eruptions
  - What they’ll erupt, when they’ll erupt it, and for how long an eruption will last
- Hazard maps are there so you know what *could* happen
- Understand hazards and know how to get alerted





## The U.S. is one of Earth's most volcanically active countries

Since 1980, there have been 120 eruptions and 52 episodes of notable volcanic unrest at 44 U.S. volcanoes.

### What makes a volcano dangerous?

#### The Volcanic Threat Assessment scores U.S. volcanoes and assigns threat levels



#### USGS monitors volcanoes and provides timely warnings of volcanic activity in the U.S.



#### Volcanoes by location



### What defines Volcanic Threat?

2018 USGS Study of 161 Volcanoes they are responsible for monitoring

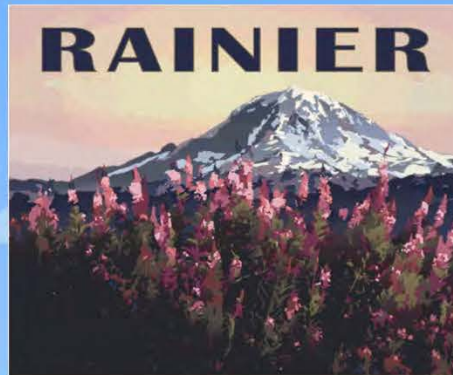
- Population at risk from eruption hazards
- Frequency of Eruptions

Study used to determine where to prioritize additional monitoring equipment.

## ***Very High Threat***



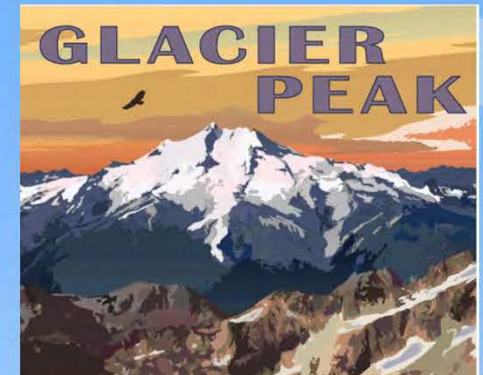
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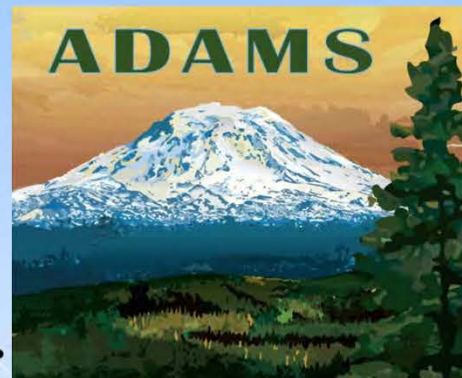


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## **High Threat**

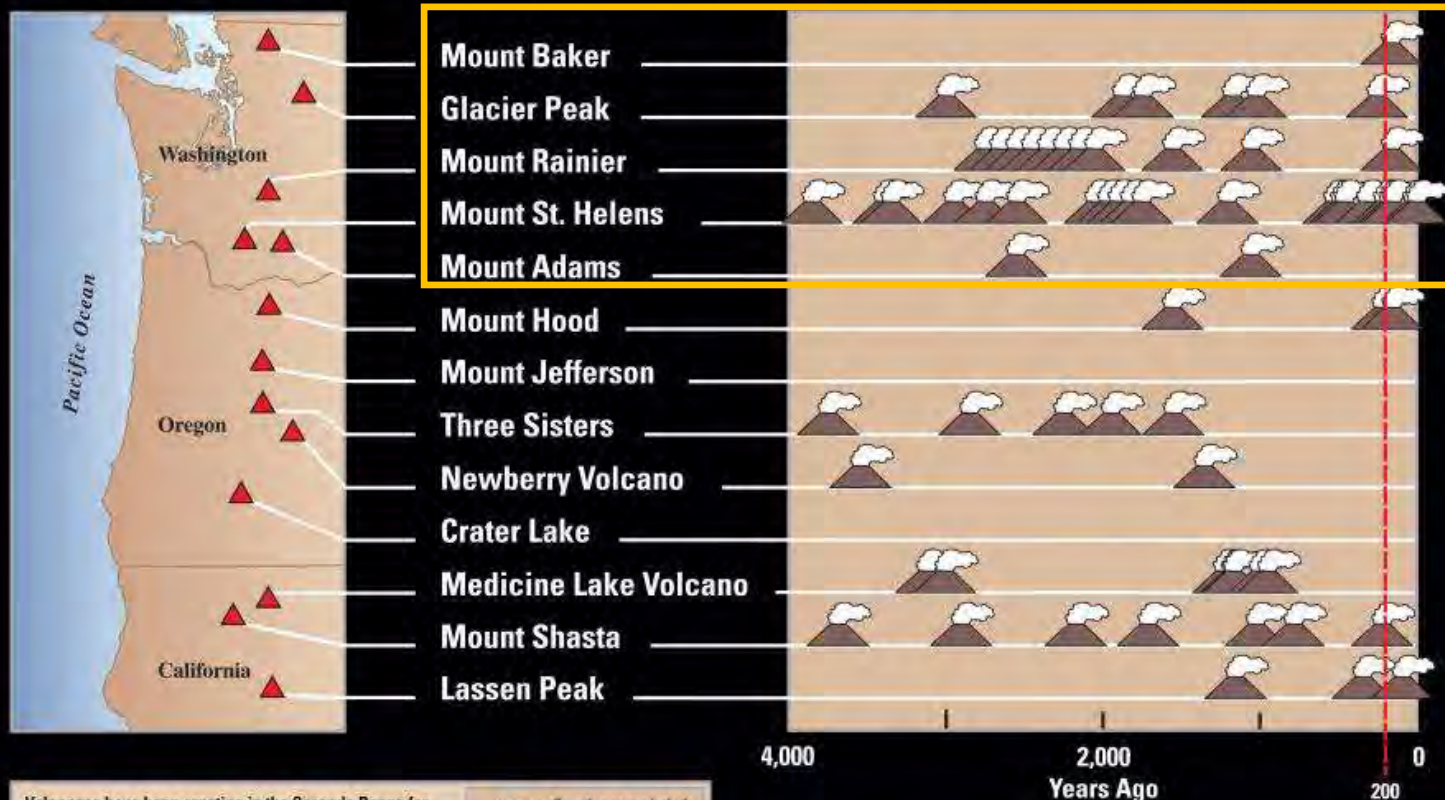


#34





# Eruptions in the Cascade Range During the Past 4,000 Years



Volcanoes have been erupting in the Cascade Range for over 500,000 years. During the past 4,000 years eruptions have occurred at an average rate of about 2 per century.

Eruption or period of multiple eruptions at or near listed volcano

By Bobbie Myers and Carolyn Driedger  
2008

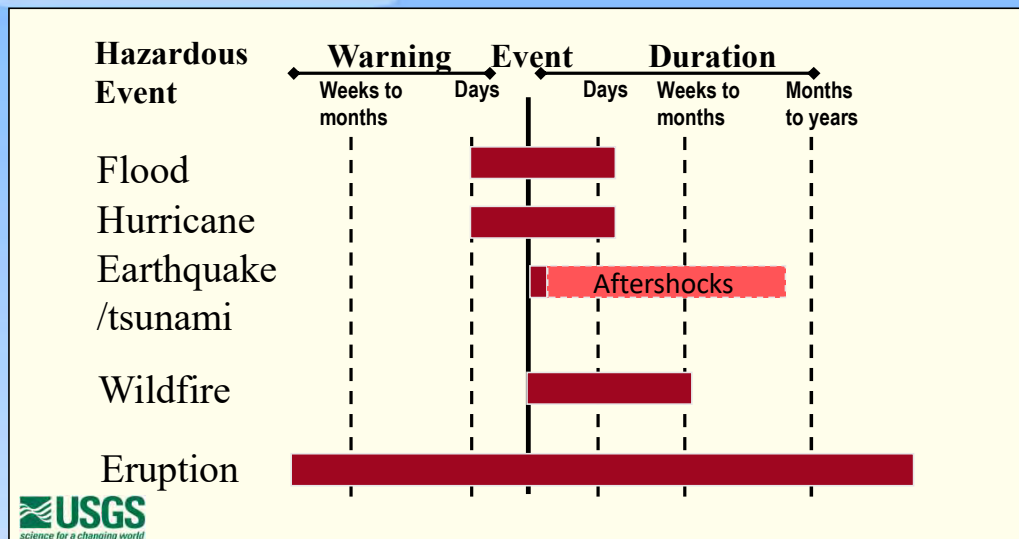
Available from U.S. Geological Survey, Information Services, Box 25199, Federal Center, Denver, CO, 80225. 1-888-486-USGS.  
Digital files available at <http://data.usgs.gov/volcano/>

U.S. Department of the Interior  
U.S. Geological Survey



Revised Information Product 25

## Volcanic eruptions are unique natural hazards



# Monitoring

## How to tell when a Volcano will “wake up”

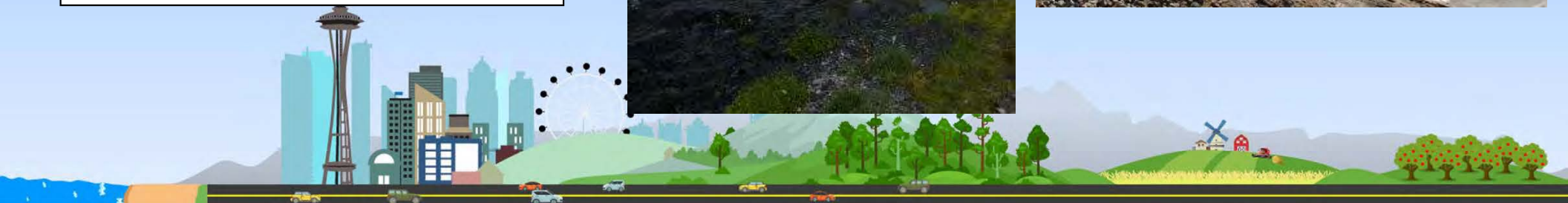
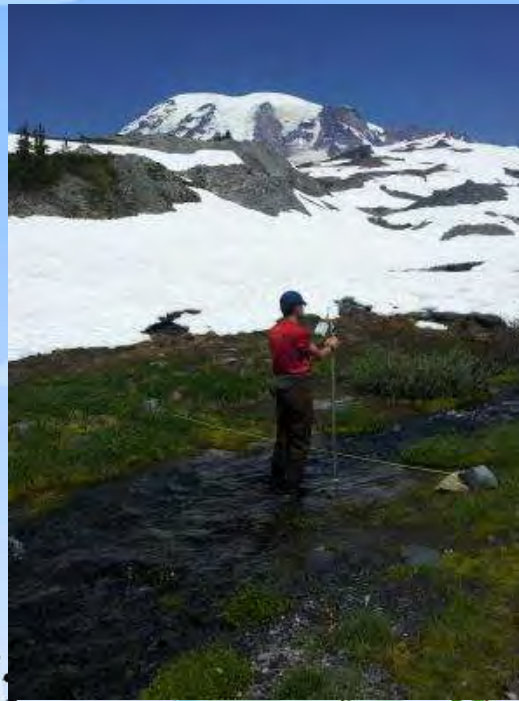
- *Seismic*
  - *Earthquakes and tremors*
- *Deformation*
  - *GPS*
  - *tiltmeters*

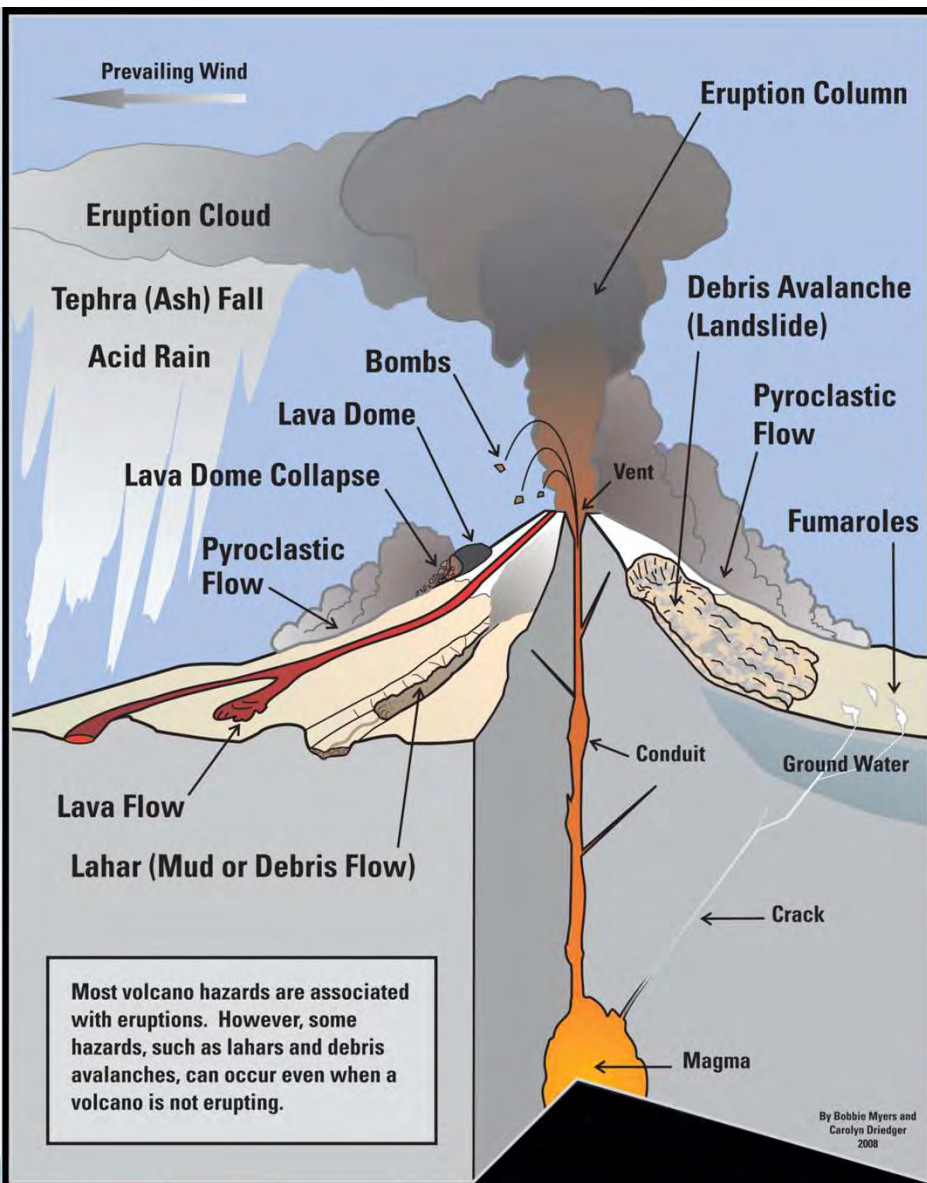




# Monitoring (continued):

- Gas
- Stream Chemistry/Temperature
- Visual





## Wide Variety of eruption products/hazards, based on:

- Magma type
- Gas content
- Vent geography
- Snow cover/hydrology
- Chemical weathering
- Magma ascent rate
- ...more

*Each of these hazards (all possible at Washington Volcanoes) pose their own unique challenges*



# Hazard Mapping

## What will a volcano erupt?

*Study the past to understand the present, and future possibilities*

Deposits from old eruptions to show what future eruptions might do:

Mount Rainier's Osceola Mudflow (5,600 years ago)

31 miles downstream; 26 feet thick!





# Volcanic Ash

- Tiny pieces of lava fractured by the explosion



- Small amounts of ash are a nuisance
- Large amounts can be dangerous

Photos: USGS





- Significant hazard from St. Helens and Glacier Peak, but possible at all volcanoes



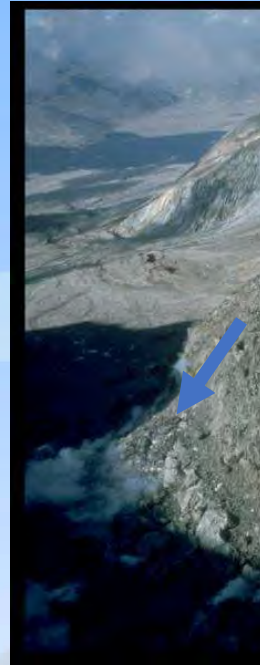
Photos: USGS





# Near-Volcano Ha

- **Tephra:** heavy ash fall, ballistics
- Lava Flows
  - Thick, blocky, slow moving
- Rock falls



This photo provided by the U.S. Geological Survey shows an ash column rising from the overlook at Halema'uma'u Crater at the summit of Kilauea Volcano in Hawaii Volcanoes National Park on the island of Hawaii at 8:29 a.m. HST Wednesday, May 9. Hawaii Volcanoes Observatory interprets the short-lived explosion was triggered by a rockfall from the steep walls of the crater.

## Volcano in Hawaii may spew fridge-sized refrigerators

By SOPHIA YAN  
and SETH BORENSTEIN  
Associated Press

PAHOA, HAWAII (AP) — If Hawaii's Kilauea volcano blows its top in the coming days or weeks, as experts fear, it could hurl ash and boulders the size of refrigerators miles into the air, shutting down airline traffic and endangering lives in all directions, scientists said Thursday.

"If it goes up, it will come down," said Charles Mandeville, volcano hazards coordinator for the U.S. Geological Survey. "You don't want to be underneath anything that weighs 10 tons when it's coming out at 120 mph."

The volcano, which has been spitting

the plant desecrates traditional beliefs and angers Pele, the goddess of fire, who lives at the summit crater.

Now that the plant is threatened by Kilauea, Dedman says he feels vindicated. "You really can't hurt Pele," he said. "It's just reinforcement of my beliefs — she's present! And the plant could get covered by lava tomorrow."

Barbara Lozano, who lives within a mile of the plant, said she would have thought twice about buying her property if she had known the risks.

"Why did they let us buy residential property, knowing it was a dangerous situation? Why did they let people build



# More Near-Volcano Hazards

- Pyroclastic Density Currents (Flows)
  - Hot avalanches of gas, rocks, and ash
- Debris Flows/Lahar initiations
- Possible at **all** Washington Volcanoes



# Downstream - Lahars

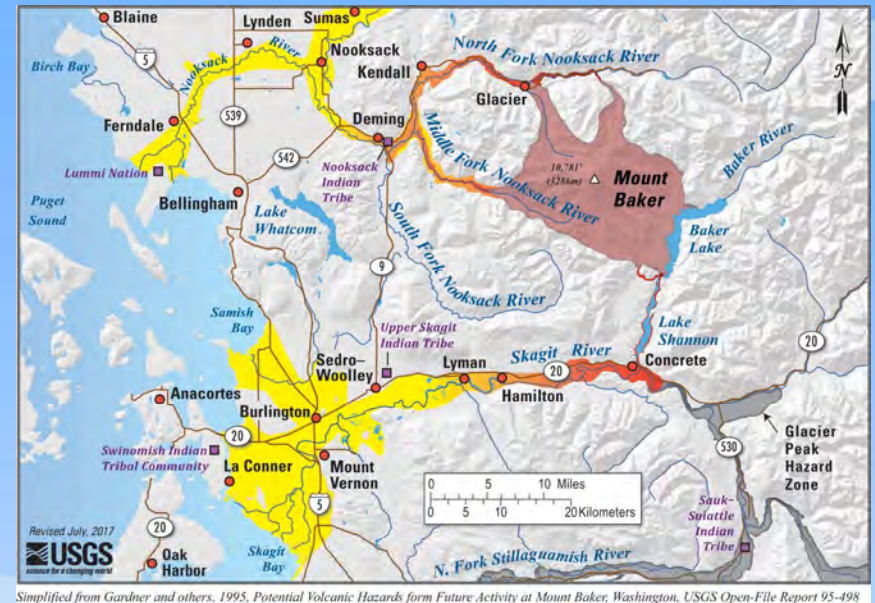
- **Lahars:**

- “Volcanic Mudflows” mix of water, ash, and debris
- Common Hazard from Glaciated volcanoes
  - Most likely to occur with eruption, but can rarely happen without one



# Lahars

- Can travel miles downstream from the volcanic Vent
- Spread out in flat areas and river valleys



Highly destructive

Hazard at all Washington  
Volcanoes



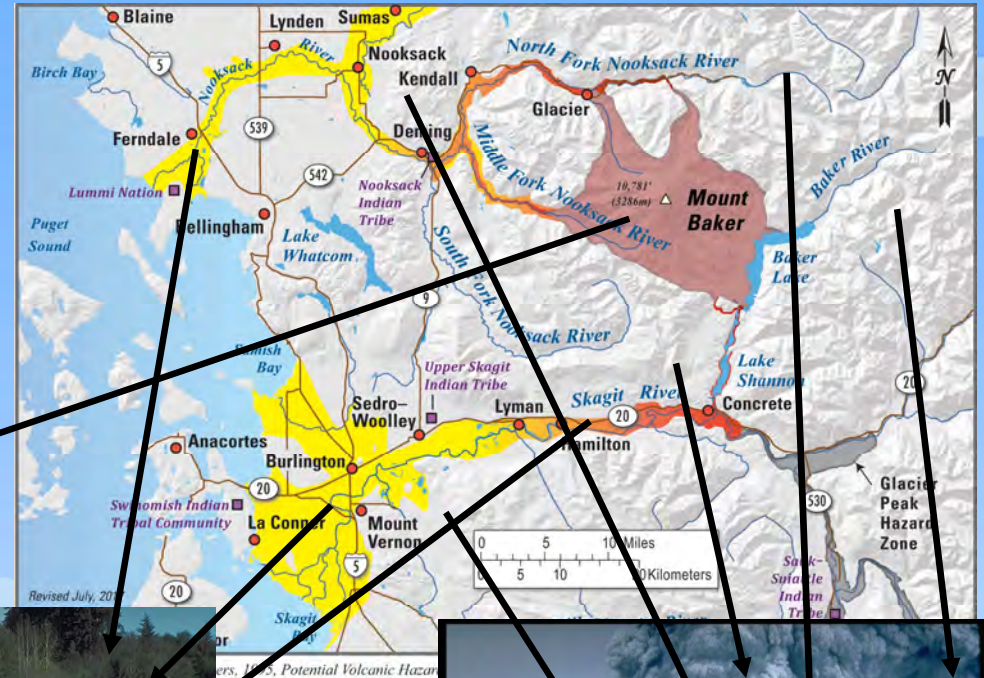
# Lahars – Warning System

- Mt. Rainier's Puyallup River Valley has a Lahar Warning System
- AHAB Sirens owned by Pierce County – City of Orting has about 1 hour to evacuate; Puyallup, 1.5 – 3 hours depending on the lahar size and composition.
- Why only for Rainier? In case of a spontaneous lahar generated by a landslide.



# Learn your hazards:

- Know what to expect
  - Area hazards
  - Understand their impacts
  - How will you be alerted?
  - How do you protect yourself?
    - Evacuate, or Shelter in place?



Near



Lahar



...Wherever you are

# Volcano Alert Levels

## ALERT-LEVEL TERMS.

When the volcano alert-level is changed, a Volcano Activity Notice (VAN) is issued.

<b>NORMAL</b>	Volcano is in typical background, noneruptive state <i>or, after a change from a higher level,</i> volcanic activity has ceased and volcano has returned to noneruptive background state.
<b>ADVISORY</b>	Volcano is exhibiting signs of elevated unrest above known background level <i>or, after a change from a higher level,</i> volcanic activity has decreased significantly but continues to be closely monitored for possible renewed increase.
<b>WATCH</b>	Volcano is exhibiting heightened or escalating unrest with increased potential of eruption, timeframe uncertain, <b>OR</b> eruption is underway but poses limited hazards.
<b>WARNING</b>	Hazardous eruption is imminent, underway, or suspected.

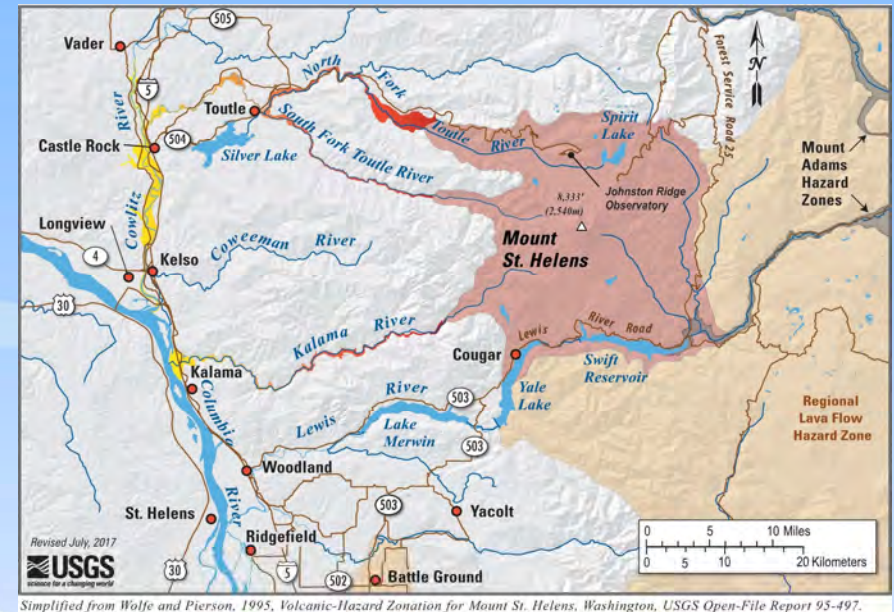
- Be aware of alerts and warnings (CVO)
  - Sign up for Volcano Notification Service (VNS)
- If a National Park or Forest around a volcano is closed, it's for your safety!





# Safety (Continued):

- Follow guidance of volcano monitoring agencies and local officials
- *Know the hazards in your area:*
  - *Do you live in a lahar inundation zone?*
  - *Are places that you travel, work, commute, etc. in a volcano hazard zone?*



***Washington's Volcanoes are beautiful! Enjoy them!!***

# Questions?

Visit [mil.wa.gov/alerts](https://mil.wa.gov/alerts) to find details on Volcano Notification Service, and to connect to your local alerts!

Feel free to reach out with questions:

[Brian.Terbush@mil.wa.gov](mailto:Brian.Terbush@mil.wa.gov)



[\*\*@WaShakeOut\*\*](#) for Washington Geohazards info!

