Cascadia Subduction Zone-

Am I prepared for the BIG ONE?

Oregon Association for Family and Community Education

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Items for Preparation

- Leader Guide- familiarize yourself with the leader guide the INDEX of terms, and the preparedness handouts
- There is a lot of information in the leader guide, and it is not meant to be read word for word, use as a GUIDE for your presentation
- PowerPoint- if you choose to use the PowerPoint you will need a projector, computer, screen, and power cords

Resources used:
Oregon State University ***OSU College of Earth, Ocean, and Atmospheric Sciences (CEOAS)***
Geology of the Pacific Northwest- Wikipedia
US Forest Service
US Geological Survey
US National Park Service

Preparedness Handouts-FEMA and Oregon Emergency Management

See the last page of the leader guide for links to some of the information used.

Cascadia Subduction Zone…Are you ready for the BIG ONE?

Disclaimer: I am not advocating that the 'BIG ONE' (Earthquake) is going to happen in the near future, or even in our lifetime, what I am saying is that we need to be educated on the possibilities, understand what may happen in Oregon, and be prepared for the aftermath.

ASK: What is the Cascadia Subduction Zone? What do you know about it?
Discussion:

Share: "The Cascadia Subduction Zone is a 600-mile fault that runs from northern California up to British Columbia and is about 70-100 miles off the Pacific coast shoreline. There have been 41 earthquakes in the last 10,000 years within this fault that have occurred as few as 190 years or as much as 1200 years apart. The last earthquake that occurred in this fault was on January 26, 1700, with an estimated 9.0 magnitude. This earthquake caused the coastline to drop several feet and a tsunami to form and crash into the land. What is most surprising is that evidence for this great earthquake also came from Japan. Japanese historic records indicate that a destructive distantly produced tsunami struck their coast on January 26, 1700. By studying the geological records and the flow of the Pacific Ocean, scientists have been able to link the tsunami in Japan with the great earthquake from the Pacific Northwest. Native American legends also support to the timing of this last event.

SHOW Video: Ghost Forest

Quote from Oregon.gov website
"Oregon has the potential for a 9.0+ magnitude earthquake caused by the Cascadia Subduction Zone and a resulting tsunami of up to 100 feet in height that will impact the coastal area. There is an estimated 2-4 minutes of shaking or rolling that will be felt along the coast line with the strength and intensity decreasing the further inland you are.

The Cascadia Subduction Zone has not produced an earthquake since 1700 and is building up pressure where the Juan de Fuca Plate is subsiding underneath the North American plate. Currently, scientists are predicting that there is about a 37 percent chance that a megathrust earthquake of 7.1+ magnitude in this fault zone will occur in the next 50 years. This event will be felt throughout the Pacific Northwest.
With the current preparedness levels of Oregon, we can anticipate being without services and assistance for at least 2 weeks, if not longer, when the Cascadia Subduction Zone earthquake occurs. While this will be difficult to overcome, our citizens, businesses, schools, government, and communities can take steps to get prepared. Take action now by actively planning and preparing yourself and your community to be ready for two weeks for disasters." Oregon.gov

ASK: What is a subduction Zone?

Subduction zones form where a plate with thinner (less-buoyant) oceanic crust descends beneath a plate with thicker (more-buoyant) continental crust. Two parallel mountain ranges commonly develop above such a subduction zone – a coastal range consisting of sedimentary strata and hard rock lifted out of the sea (**accretionary wedge**), and a volcanic range farther inland (**volcanic arc**). Ancient magma chamber rocks can be exposed if subduction stops and the volcanoes erode away.

Where tectonic plates converge, the one with dense, thin **oceanic crust** subducts beneath the one with thick, more buoyant **continental crust**.

ASK: Are we really in the subduction zone?

Yes, the Cascade Mountains are a subduction zone. The Coast Range and Cascades are the two parallel mountain ranges that form the **Cascadia Subduction Zone** in the Pacific Northwest. The forearc basin is the Willamette Valley in Oregon and Puget Sound in Washington.

Cascadia Subduction Zone

The Pacific Northwest is an exciting place to observe geologic processes in action. National Park Service sites in the Coastal Ranges of Washington, Oregon and northern California contain rugged mountains of rocks that were manufactured in the ocean, then scraped off the plate and lifted out of the sea. But parks in the Cascade Mountains – within the same subduction zone – are dramatically different. They contain explosive volcanoes formed as fluids rise from the top of the subducting plate and generate magma as they melt their way to the surface. And as time ticks on, the region awaits sudden release of energy locked between the converging plates as a devastating earthquake.

The Cascadia Subduction Zone, extending from northern California through western Oregon and Washington to southern British Columbia, is a type of convergent plate boundary. Two parallel mountain ranges have been forming as a result of the Juan de Fuca Plate subducting beneath the edge of North America. Near the western edge of the continent, the Juan de Fuca Plate plunges downward and some of the layers of hard crust and ocean sediments are scraped off the top and squeezed upward as the Olympic Mountains and other coastal ranges. Farther east the Juan de Fuca Plate descends deeper and deeper. The rocks on top of the plate are metamorphosed due to the great temperatures and pressures at those depths. A by-product of the metamorphism is the release of hot fluids, especially water. The water rises and melts rock in its path. Some of the resulting magma makes it all the way to the surface and forms Mount Rainier, Mount Hood, Mount Shasta, and other spectacular volcanoes of the Cascade Range. The low region between the two mountain ranges is the Puget Sound area of Washington and the Willamette Valley in Oregon.

The Cascadia Subduction Zone is the Region where the Juan De Fuca and North American Plates Converge

- The Coast Ranges, including the Olympic Mountains, are made of oceanic sediments and hard rocks that were caught in the vise between the converging plates, uplifted, and added to the edge of the continent.
- Puget Sound and the Willamette Valley are areas near sea level between the coastal and volcanic mountain ranges.
- The Cascades form above the line where the subducting plate extends to depths where it heats up, dehydrates and causes magma to form. The line of active volcanoes, from Mt. Garibaldi to Lassen Peak, coincides with the north-to-south extent of the subducting plate boundary.

The two parallel mountain ranges influence many of the physical and cultural aspects of the Pacific Northwest. Storms coming in from the Pacific Ocean drop most of their moisture on the Coast Range and Cascades, leaving eastern Oregon and Washington high and dry. This affects not only plant and animal communities, but also human habitation and land use. The physical landscape was an important component of the practical and spiritual aspects of Native Americans' lives. Later, most of the settlers coming on the Oregon Trail continued past central Oregon and Washington to the lush farmland of the Willamette Valley and Puget Sound, the low-lying region between the two rising mountain ranges.

Subduction in the Pacific Northwest creates incredible beauty in the form of coastlines, mountains, and valleys—iconic features of the many National Park Service sites in the region. This beauty is part of the reason that residents and visitors have learned to tolerate, and develop ways to mitigate, the effects of earthquakes, tsunamis, and volcanic eruptions—beasts that are consequences of the same tectonic forces that create the region's beauty. Individual earthquakes can offset or lift the land a fraction of an inch or a few inches (centimeters) at a time. That may not seem like much, but when tens of thousands of earthquakes occur over a few million years, coastal ranges form. Likewise, individual volcanic eruptions may add only a thin layer to the surface. But thousands of eruptions over less than a million years have built Mount Rainier and other Cascade peaks to elevations of more than 10,000 feet (3,000 meters)!

A variety of earthquakes shake the Pacific Northwest due to plate-tectonic activity. The largest (locked zone earthquakes) occur where the Juan de Fuca and North American plates are stuck together, as they have been for the past three centuries. When the plates suddenly let go, a massive earthquake will shake the entire Pacific Northwest, a series of tsunami waves will pound the Coast, and landslides will make it difficult to reach some of those in need. These mega-earthquakes occur every 200 to 600 years or so, and the last one was in the year 1700. Visits to coastal National Park Service sites in the Pacific Northwest can help us appreciate the landscapes that develop over time because of these large quakes, and learn how we are preparing our homes, communities, and infrastructure for the next "Big One."

Cascade Range-

The North Cascade Range in Washington is part of the American cordillera, a mountain chain stretching more than 19,000 km (12,000 mi) from Tierra del Fuego to the Alaska Peninsula, and second only to the Alpine-Himalayan chain in height. Although only a small part of the Cordillera, mile for mile, the North Cascade Range is steeper and wetter than most other ranges in the contiguous United States.[12]

In geology, the range has more in common with the Coast Ranges of British Columbia and Alaska than it does with its Cordilleran cousins in the Rocky Mountains or Sierra Nevada. Although the peaks of the North Cascades do not reach great elevations (high peaks are generally in the 2,100 to 2,400 m (7,000 to 8,000 ft) range, their overall relief, the relatively uninterrupted vertical distance from valley bottom to mountain top, is commonly 1,200 to 1,800 m (4,000 to 6,000 ft).[12]

Rocks of the North Cascades record at least 400 million years of history. The record of this long history can be read in the many rock layers deposited over time through the forces of erosion, volcanic activity and plate subduction. These different forces have made a geologic mosaic made up of volcanic island arcs, deep ocean sediments, basaltic ocean floor, parts of old continents, submarine fans, and even pieces of the deep subcrustal mantle of the earth. The disparate pieces of the North Cascade mosaic were born far from one another but subsequently drifted together, carried along by the tectonic plates that make up the Earth's outer shell or were uplifted, eroded by streams, and then locally buried in their own eroded debris; other pieces were forced deep into the Earth to be heated and squeezed, almost beyond recognition, and then raised again to view.[12] Over time, the moving plates eventually accreted the various pieces of the mosaic onto the western side of North America.[12]

About 35 million years ago, a volcanic arc grew across this complex mosaic of old terranes. Volcanoes erupted to cover the older rocks with lava and ash. Large masses of molten rock invaded the older rocks from below. The volcanic arc is still active today, decorating the skyline with the cones of Mount Baker and Glacier Peak.[12]

The deep canyons and sharp peaks of today's North Cascades scene are products of profound erosion. Running water has etched out the grain of the range, landslides have softened the abrupt edges, homegrown glaciers have scoured the peaks and high valleys and, during the Ice Age, the Cordilleran Ice Sheet overrode almost all the range and rearranged courses of streams. Erosion has written and still writes its own history in the mountains, but it has also revealed the complex mosaic of the bedrock.[12]

Forming the Coast Range

The Coast Range (including the Olympic Mountains) consists of sedimentary rock layers and hard crust scraped off the ocean floor where the Juan de Fuca Plate begins to dive downward. The grinding action also produces devastating earthquakes, including some that result in giant tsunami waves.

Olympic National Park, Washington

Tilted layers of thick sandstone (pink) and thin shale (dark) along the coast at Olympic National Park reveal the enormous forces that lifted and deformed the oceanic layers as the Juan de Fuca and North American plates converged.

Show Cookie Demo (hand out cookies)

Ranger Jen's Oreo Demo

Jennifer Natoli was a seasonal ranger at Redwood National and State Parks in California. In her version of the Oreo® cookie demonstration, the creamy filling is the layers of sediment and basalt on the ocean floor. As the Juan de Fuca Plate (lower cookie) subducts beneath the North American Plate (upper cookie), the layers are scraped off the ocean floor and pile up as the Coast Range.

Human History:

Native Americans have inhabited the area for thousands of years and developed their own myths and legends concerning the Cascade volcanoes. According to some of these tales, Mounts Baker, Jefferson, Shasta and Garibaldi were used as refuge from a great flood. Other stories, such as the Bridge of the Gods tale, had various High Cascades such as Hood and Adams, act as god-like chiefs who made war by throwing fire and stone at each other. St. Helens with its pre-1980 graceful appearance, was regaled as a beautiful maiden for whom Hood and Adams feuded. Among the many stories concerning Mount Baker, one tells that the volcano was formerly married to Mount Rainier and lived in that vicinity. Then, because of a marital dispute, she picked herself up and marched north to her present position. Native tribes also developed their own names for the High Cascades and many of the smaller peaks, the most well known to non-natives being Tahoma, the Lushootseed name for Mount Rainier. Mount Cayley and The Black Tusk are known to the Squamish people who live nearby as "the Landing Place of the Thunderbird".

Hot springs in the Canadian side of the arc, were originally used and revered by First Nations people. The springs located on Meager Creek are called *Teiq*[15] in the language of the Lillooet people and were the farthest up the Lillooet River. The spirit-beings/wizards known as "the Transformers" reached them during their journey into the Lillooet Country, and were a "training" place for young First Nations men to acquire power and knowledge. In this area, also, was found the Blackstone chief's head pipe that is famous of Lillooet artifacts; found buried in volcanic ash, one supposes from the 2350 BP eruption of the Mount Meager massif.

Legends associated with the great volcanoes are many, as well as with other peaks and geographical features of the arc, including its many hot springs and waterfalls and rock towers and other formations. Stories of Tahoma – today Mount Rainier and the namesake of Tacoma, Washington – allude to great, hidden grottos with sleeping giants, apparitions and other marvels in the volcanoes of Washington, and Mount Shasta in California has long been well known for its associations with everything from Lemurians to aliens to elves and, as everywhere in the arc, Sasquatch or Bigfoot.

In the spring of 1792 British navigator George Vancouver entered Puget Sound and started to give English names to the high mountains he saw. Mount Baker was named for Vancouver's third lieutenant, the graceful Mount St. Helens for a famous diplomat, Mount Hood was named in honor of Samuel Hood, 1st Viscount Hood (an admiral of the Royal Navy) and the tallest Cascade, Mount Rainier, is the namesake of Admiral Peter Rainier. Vancouver's expedition did not, however, name the arc these peaks belonged to. As marine trade in the Strait of Georgia and Puget Sound proceeded in the 1790s and beyond, the summits of Rainier and Baker became familiar to captains and crews (mostly British and American).

With the exception of the 1915 eruption of remote Lassen Peak in Northern California, the arc was quiet for more than a century. Then, on May 18, 1980, the dramatic eruption of little-known Mount St. Helens shattered the quiet and brought the world's attention to the arc. Geologists were also concerned that the St. Helens eruption was a sign that long-dormant Cascade volcanoes might become active once more, as in the period from 1800 to 1857 when a total of eight erupted. None have erupted since St. Helens, but precautions are being taken nevertheless, such as the Mount Rainier Volcano Lahar Warning System in Pierce County, Washington.[16]

Conclusion:

When, (not if) the earthquake and tsunami happen, water, wastewater, food distribution, electricity, and natural gas will all be heavily impacted. Bridges, air transportation, rails, roadways, and seaports will be compromised. Some fire and police departments, hospitals, and schools will be heavily damaged. So will some homes. Most communication systems will be down. Some experts say that the only airports/runways that will be usable will be those on the east side of the Cascades, notably Klamath Falls and Redmond.

Daily life will look all but recognizable. Getting ready for that eventuality takes planning. You are smart and resourceful but being resourceful takes having access to resources. Those resources are plentiful now. **BUT** remember the toilet paper and cleaning product shortages after Covid-19 hit? If things play out as predicted we will not have a lot of resources at hand.

Learning about the possibility of a major earthquake and tsunami can be and is very scary. It is hard to prepare for something that can happen at any time and give us no immediate advance warnings. In reality it is best to be prepared for ANYTHING that may happen!

Be ready so that you do not become a victim in need of saving instead of someone who can help others. **Be ready** because for most of us the real risk will not be earthquakes and tsunamis. The real risk will be not being ready for the **AFTERMATH**!

It is important that we all do what we can to prepare. My preparation will look different than yours. Those of us living on the east side of the Cascade Range preparations will look a lot different than those living on the coast or the west side of the mountain range. **Just be ready!**

Discussion on handouts for preparedness if time

INDEX

EARTHQUAKE: A sudden shaking of the ground caused by the release of energy in the earth's crust.

CASCADIA SUBDUCTION ZONE: A 600-mile fault that runs from Northern California up to Columbia, about 70-100 miles off the Pacific coast shoreline.

FAULT: Fracture or a zone of fractures between 2 blocks of rock.

MAGNITUDE: Size of the earthquake.

OCEANIC CRUST: The relatively thin part of the earth's crust which underlies the ocean basins.

TECTONIC PLATES: Massive, irregularly shaped slabs of rock that make up the surface of the earth.

CONTINENTAL CRUST: The relatively thick part of the earth's crust that forms the large landmasses.

SEDIMENTARY STRATA: Horizontal layers, or beds, present in most sedimentary rocks (a type of rock that is made of compacted and consolidated sediment).

ACCRETIONARY WEDGE: Sediment that forms when oceanic and continental plates collide.

VOLCANIC ARC: A chain of volcanoes formed above a subducting oceanic tectonic plate in an arc shape.

TSUMANI: A series of fast moving waves caused by earthquakes, volcanic eruptions, and other factors.

References and Further Information

National Park Service-- Convergent Plate Boundaries—Subduction Zones
nps.gov

The Really Big One- **By Kathryn Schulz**
July 13, 2015- Published in the July 20, 2015, issue of the "New Yorker" magazine

Links to the information used and discussed

Survival Basics: WATER, Tips for Securing a Safe, Drinkable Supply

Low and No Cost Preparedness | Ready.gov

Cascadia Subduction Zone – Pacific Northwest Earthquake-Ready! (survivingcascadia.com)

15024_OEM_2WeeksReady_Seniors_2018 v2.pdf (oregon.gov)

OR-Alert : Emergency Notifications : State of Oregon (oralert.gov)

Oregon Department of Emergency Management : National Preparedness Month : Hazards and Preparedness : State of Oregon

ShakeAlert Messaging Toolkits – ShakeAlert