Times Standard

Not My Fault: What might a Cascadia earthquake be like?

Lori Dengler for the Times-Standard
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Ellie the earthquake preparedness elephant in the room – featured at the 2018 Earthquake-Tsunami room at the Humboldt County Fair.

"Lori, you are scaring me" said a longtime friend after reading my column last week. He may have been speaking in jest as this was nothing new to him and he knows very well that fear is never my intent.

Fear is a great way to sell newspapers and magazines and a terrible motivator for preparedness action. Don't take my word for it – my colleague Ana-Marie Jones did an exhaustive study of the topic a decade ago (https://pubmed.ncbi.nlm.nih.gov/23315253/) and concluded fear messaging is pervasive in our culture, ineffective, and there are better ways to promote action in our woefully unprepared public.

If not fear to get your attention, ignoring the elephant in the room won't work either. And there is no two ways about it; Cascadia is the elephant of earthquakes and tsunamis in our North Coast communities. So, no hyperbole here; reducing risk isn't glamorous but we can do it. And sometimes an inflatable elephant helps.

When I talk Cascadia, I mean an earthquake in the upper 8s to low magnitude 9 range and a fault rupture from Southern Humboldt County to Vancouver Island, Canada. Three things to emphasize: you will almost certainly survive, the area impacted will be enormous, and it will take many years to reach a new post-disaster normal.

Starting with scale. I've lived on the North Coast since 1978, felt many earthquakes, and studied many more. I am acknowledged as an 'earthquake expert' but for Cascadia-sized earthquakes, to paraphrase Joni Mitchell, I really don't know earthquakes at all.

It's hard to wrap my head around just how large an area will directly participate in a Cascadia earthquake. It will likely be strong enough to cause damage in California, Oregon, Washington, and British Columbia and felt in Nevada and Idaho. But the damage won't be uniform and downed roads and bridges means communities will be isolated from each other.

The West Coast has experienced a number of damaging earthquakes in the past fifty years but in all of them, the region of impact has been localized, leaving nearby areas relatively unscathed. Fire, police, and medical responders could reach most people who needed help within hours. Longtime North Coast residents are accustomed to being powerless and isolated for days at a time, but newer residents are finding this year's weather outages a surprise. Turn your days of outages into weeks (add in water and gas as well) and you get an idea of what could happen post Cascadia.

The ten-mile rupture in the December 20th earthquake put a lot of energy into the high frequency range. But the fault was too short to produce longer periods. A Cascadia rupture will extend several hundred miles, producing longer periods as well. And unlike the December 20th M6.4, it won't be over in ten seconds.

Frequency is important in earthquakes. The sharp short rupture in December produced vibrations most likely to affect single family homes and mobile homes. Longer periods affect big structures like tall buildings and bridges. The spectrum of vibrations is also important in liquefaction. Distance from the fault rupture also modifies vibrations, filtering out those high pitches the further you are away. Longer periods can also travel further, potentially casuing damage in Redding, Sacramento, and San Francisco.

Let me transport you back to 1964 for a taste of what it is like to be near ground zero of a Cascadia-sized earthquake. Robert Pate worked for a radio station and made a habit of carrying a portable radio with him and whenever anything of interest happened, he would turn it on and begin talking. He was at his home in Anchorage during the M 9.2 Alaska earthquake and had the presence of mind to turn it on a few seconds into the earthquake (https://rctwg.humboldt.edu/sites/default/files/march1964_alaska.mp3).

Several notable points about the Pate recording: he survived, he was uninjured, he was frightened, the shaking lasted a very long time, his house stood but falling items made it a shamble, the power was out, and he was able to make good decisions. What the recording doesn't include was the amount of time he was on his on afterwards. It took days to restore utilities and the region was reliant on airlifted aid for weeks and it took years for Anchorage and other communities in Southern Alaska to reach a new normal.

Anchorage had a population of 100,000 in 1964. There were only 15 deaths caused by shaking damage, most related to slope failures when permafrost liquefied. This was a time when many buildings weren't built to earthquake standards. But wood buildings are great at holding together in strong shaking and even is the foundation is damaged, they provide life safety.

Fast forward 48 years to 2011. March 11 marks twelve years from the Great East Japan earthquake and tsunami. We know far more about this earthquake than 1964; it is the most well-instrumented and analyzed earthquake in the M9 range in history. Strong motion and geodetic sensors onshore and a network of ocean bottom seismographs provided minute details of the rupture process.

But like Anchorage in 1964, ground shaking produced few casualties. The USGS estimates that over 2 million people experienced ground shaking comparable to what caused devastation in Turkey and Syria. Non-tsunami deaths were less than 0.3% of that exposed group. Buildings did not collapse; most of those shaking deaths were caused by fire and landslides.

Shaking wasn't the main culprit in 1964 and 2011. What killed people were tsunamis, especially a tsunami that was bigger than expected. The native populations in Alaska were well aware of tsunamis and many in remote communities recognized shaking as the warning to head to higher ground. But newer residents didn't have that mindset.

Everyone in Japan knows about tsunamis. I was at a tsunami meeting in Japan only six weeks before the 2011 earthquake where scientists, engineers and public officials explained how the system of sea walls, vertical evacuation shelters, evacuation drills, and tsunami notification were an example for the rest of the world. Unfortunately, their planning was based on a tsunami caused by magnitude 8 earthquake and the 9.1 swamped their estimates.

The North Coast tsunami maps are based on a Cascadia source and use the best currently available information on how high and how far the tsunami surges will penetrate. They include an extra factor of safety to be on the conservative side. The best way to remember 1964 and 2011 and confront the elephant in our room is to look at the maps and determine if you live, work, or visit a tsunami zone. It's easy to do at https://rctwg.humboldt.edu/tsunami-hazard-maps.

Note: In the spirit of perking interest without waving the fear flag, we made a series of PSAs with KEET our public television station. Three of the PSAs featured Ellie, an inflatable elephant. You can view them at https://kamome.humboldt.edu/taxonomy/term/7, just scroll down to the Elephant in the Room links.

Lori Dengler is an emeritus professor of geology at Cal Poly Humboldt and an expert in tsunami and earthquake hazards. The opinions expressed are hers and not the Times-Standard's. All Not My Fault columns are archived online at https://kamome.humboldt.edu/resources and may be reused for educational purposes. Leave a message at (707) 826-6019 or email rctwg@humboldt.edu for questions and comments about this column, or to request a free copy of the North Coast preparedness magazine "Living on Shaky Ground."