

## **Not My Fault: When there is no high ground**

Lori Dengler/For the Times-Standard

Posted February 27, 2022

<https://www.times-standard.com/2022/02/26/lori-dengler-when-there-is-no-high-ground/>

Three things are essential for successful tsunami evacuation: an alert, safe ground, and taking the action to evacuate before the water arrives. Nature provides the most important alert – feeling an earthquake that lasts a long time. Safe ground includes high spots or areas inland of the tsunami reach. Taking action is the critical piece – you need to recognize the danger and begin evacuating immediately. You may have no more than ten minutes to reach that safe spot.

What happens if there is no high ground nearby? I have heard many survival stories in my years of studying tsunamis. The most amazing was the mother who lived in the Sissano Lagoon area of Papua New Guinea. She climbed a palm tree with her newborn. She couldn't get high enough to be completely beyond the tsunami's reach so with each surge, gripping the tree with her legs, she held her daughter as high as she could and held her own breath. Hear her story in *The Wave* <https://www.youtube.com/watch?v=olPMKmYTijE>, filmed shortly after the tsunami.

Most of us would find tree climbing a challenge. A better option is the upper floors of a tall building. Hawaii has relied on vertical evacuation in high-rise hotels for decades. Tourists and beach goers are directed to upper floors by staff. The State encourages the hospitality industry to train staff in conducting vertical evacuation during their annual Tsunami Month every April.

Japan has taken vertical evacuation to the next level. With strict building codes for coastal structures to resist both earthquake shaking and forces from successive tsunami surges, most coastal cities and towns have designated buildings or constructed special structures to serve as community evacuation sites.

I was the US delegate to an international meeting held in Tokyo in January 2011. The Mayor of Kesennuma gave a presentation on how well prepared his city was to protect its citizens. He showed slides of the designated structures and recounted annual evacuation drills so that everyone

knew exactly which building to go to. All of the structures were at least three stories high and had wide external stairways to accommodate community access.

Twelve weeks after that meeting, I returned to Japan. This time to meet with friend and colleague Megumi Sugimoto to study the impacts of the March 11 tsunami. We visited Kesennuma along with other cities and towns in the hardest-hit areas of Iwate and Miyagi Prefectures. Unfortunately, the 2011 tsunami was larger than what had been planned for and nearly half of the designated vertical evacuation structures were overtopped.

The 2011 tsunami was sobering in many ways. Japan is the most tsunami-prepared country in the world and has put more resources into engineered mitigation methods such as sea walls and evacuation structures than any other place on the planet. Unfortunately, they planned for a magnitude 8 earthquake, not a 9 and the ensuing tsunami overtopped nearly all of the seawalls. In every place Megumi and I visited we saw the tragic results.

I recount the 2011 Japan experience to emphasize that vertical evacuation is a method of last resort. It is always better to get out of the inundation zone. Even when vertical evacuation works, being trapped on the upper floors of buildings for days can pose other risks, especially when inadequate food, water, medical or public safety is accessible.

There is a role for well-planned vertical evacuation structures when no other option is available. During our reconnaissance, Megumi and I visited a school in Yuriage where nearly a thousand people took refuge on the roof. This community was miles from high ground, and this was their only option. They were stuck atop that building for three days before the water receded enough for help to reach them. Without that building, most would likely have perished.

Japan is not unique in having a lack of high ground. The Pacific Northwest has similar problem areas. The most notable are Washington State's Long Beach Peninsula and low elevation land near the estuaries of Oregon and Washington rivers. One of these, Ocean Shores, a community of 6,700 on the Chehalis River estuary was featured in the New York Times <https://www.nytimes.com/2022/02/07/us/tsunami-northwest-evacuation-towers.html>.

What caught media attention was that a bond measure to help support tsunami evacuation towers was put before voters in Ocean Shores and neighboring communities on

February 8th. Vertical evacuation shelters aren't cheap. They need to be high enough and strong enough to resist both earthquake shaking and high-speed water flow. The bond measure was targeted primarily at protecting students at two schools in the district but would also provide some safety for community members.

Ocean Shores had been awarded federal funds to partially support the project but required a local match. The \$110 million bond was rejected by voters. After the defeat, School District Superintendent Andrew Kelly told KIRO Newsradio they will cut back on the proposal, "We'll come back with a scaled down version, but the part that will get cut is the tsunami refuges at the middle school, high school, and the other elementary school."

Washington estimates that the State needs to build at least 58 tsunami evacuation structures to protect vulnerable communities with no accessible high ground. Only one has been built to date – a dual purpose gym at Ocasta School in Westport. The Shoalwater tribe is currently constructing an evacuation tower on tribal lands in the Willapa River estuary near Tokeland.

What about California's North Coast? We are fortunate in having accessible high ground in most of our populated areas. The Samoa Peninsula had been an area of concern, especially south of Samoa. But the most recent State hazard maps show that dunes 45 feet and higher should provide enough elevation. But we've got a lot to do to provide better accessibility and continue community drills and outreach. The Manila community is the next on the list with a full-scale drill planned for March 19.

Note: blog posts of the 2011 Japan post tsunami survey are posted at [https://kamome.humboldt.edu/sites/default/files/Japan%20Post%20Tsunami%20Survey%20Blog\\_lo.pdf](https://kamome.humboldt.edu/sites/default/files/Japan%20Post%20Tsunami%20Survey%20Blog_lo.pdf)

-----  
Lori Dengler is an emeritus professor of geology at Cal Poly Humboldt (formerly Humboldt State University), 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](mailto: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."