

Pushing Against the Waves

Coastal Neskowin prepares for climate change and beach erosion, with help from Oregon Sea Grant

By Nathan Gilles

Bill Busch drives his car through the small Oregon coast town of Neskowin. He stops in the driveway of a shingle-sided house with large picture windows, some 30 feet from the beach. There's a portable basketball pole that's toppled over at the driveway's far end. We soon find out why. Busch, fellow Neskowin residents Alex Sifford and Guy Sievert, and I pile out of the car into a very wet, very windy, winter afternoon.

Following a small path along the house, we pass knee-high, American beachgrass peeking out of the foredunes all around us. Then we arrive at Neskowin's beach. Not far off, the Pacific Ocean's rough winter waves are pummeling the narrow shoreline. To my left is a heap of stones. To my right is open seashore.

"Is this where it ends?" I ask, pointing toward the rocks.

"Yeah," shouts Sifford above the wind.

I'm looking at an intentionally stacked assemblage of large, dark-brown rocks that form a seven-foot barrier in front of the house. Called riprap, the rocks are part of an engineering effort known as "armoring" or "hardening," intended to protect Neskowin's shoreside homes from the ravages of the Pacific Ocean.

Here in mostly low-lying Neskowin—just barely above

sea level—riprap of various heights stretch the length of the town from where we're standing to the bluffs overlooking Proposal Rock, a "haystack" formation that juts out of the beach some two miles to the south. This armoring—installed at homeowners' expense—is the first line of defense Neskowin has against some very real threats from the sea.

Over a mere three decades, Neskowin has lost roughly 2 meters of its beach per year to the Pacific. Over the recorded period from 1965 to 2000, this resulted in some 70 meters of erosion. Much of this loss has been due to a series of observed trends that includes growing wave heights, powerful El Niños, and surprisingly massive winter storms. It's not yet known whether these trends will persist into the future. Still, researchers conclude Oregon's coast can expect more erosion, collapsing hillsides, and increased flooding, with places like Neskowin acting as "hotspots" for these changes. Nonetheless, Neskowin's residents—Busch, Sifford, and Sievert among them—aren't standing idly by.

In 2009, Neskowin residents hoping to make their town more resilient in the face of these changes formed the Neskowin Coastal Hazards Committee, or NCHC. Through the NCHC and its numerous community meetings, Neskowin homeowners have been leading an effort to transform how their town responds to the Pacific Ocean's hazards.

Partnering with local elected leaders and local and state agency staff, Oregon State University scientists, and

Oregon Sea Grant, NCHC members drafted an ambitious 300-page document called the Neskowin Adaptation Plan that details the science of these changes. But this one-of-a-kind plan goes a step further. It suggests a series of far-reaching regulations that could determine how and where people can build in town.

Neskowin, like many small communities in Tillamook County, is unincorporated. This places lawmaking authority in the county's hands. As of this writing, the Neskowin Adaptation Plan was being reviewed by Tillamook County and state land-use planners. A commission vote is expected later this year.

For now, NCHC's adaptation strategies are limited to Neskowin only. However, the Neskowin Adaptation Plan could become the testing ground for a larger Tillamook County-wide plan, which will be voted on only after the Neskowin sub plan is first approved. And this reversal of order isn't the only way the Neskowin plan has been creating change from the bottom up. State land-use planners are also expected to use many of the sub plan's suggestions as a template for their own recommendations for the coast.

What follows is the story of how motivated citizens—with a little help from the right people, including Oregon Sea Grant—are leading Oregon's effort to stay resilient and save lives and property in the face of a changing and dangerous coastal environment.

The Pace of Change

Neskowin is tiny. Really, it's not much more than a strip of roughly 400 homes—most not occupied all year—tucked between Highway 101 and the Pacific Ocean. There's a restaurant. There's a sort of general store, called the Neskowin Trading Company. There's a golf course, which when I visited was so waterlogged it could've doubled as a wetland. And there's not much else.

My tour in Busch's car takes me down narrow, sleepy roads; past seemingly deserted homes, past a mixture of high-end getaways and older cottages and bungalows. Here and there are colorfully painted signs with acrylic flowers and words scrawled in children's handwriting asking drivers to "Please, slow down!" That's Neskowin's pace: slow. But that's not, says coastal researcher Peter Ruggiero, the pace of change on the town's beach.

"What I'm trying to do is quantify coastal hazards," says Ruggiero. "Before I learned about the Neskowin project, I wasn't always sure how to make my work usable. I thought about it a lot, but there wasn't usually a really good connection."

He says the NCHC changed that.

Ruggiero is one of a handful of scientists who has worked with NCHC members to inform them about the latest research on the coastal hazards they face. For the past decade, Ruggiero, an associate professor at the College of Earth, Ocean, and Atmospheric Sciences at Oregon State University, has been investigating how Oregon's beaches are changing. Much of his research runs headlong against a common misconception the general

public has about climate variability and change and their impacts: that they're overwhelmingly gradual processes.

Probably the biggest of these gradual processes that comes to our minds—especially when we think about anthropogenic climate change—is rising sea level. In the Pacific Northwest, our local sea levels are rising about one to two millimeters per year. That's lower than the world average of about three millimeters a year. The difference between our regional rates and the world's is largely due to the North American Plate's gradual rising, or uplifting. In some places this uplifting is faster than sea-level rise.

Depending on the climate modeling used, estimates of sea-level rise for the Pacific Northwest range from less than half a meter to as much as two meters by the year 2100. This, says Ruggiero, could lead to the ocean inundating our coastal land and communities by up to 50 meters or more. But Ruggiero says sea-level rise isn't the whole picture. He and his fellow researchers have noted several interesting—and, for coastal residents, alarming—trends that are happening right now.

Working with Jonathan Allan from the Oregon Department of Geology and Mineral Industries, or DOGAMI, and fellow OSU researcher Paul Komar, Ruggiero reviewed data collected from 1975 to 2005 by buoys along the Oregon and Washington coasts. They discovered our local waves are growing.

The researchers looked at what are called “mean wave heights”—think of these as your run-of-the-mill waves, not too big and not too small. After reviewing the three

decades of data, Allan, Komar, and Ruggiero concluded these mean wave heights have increased at a rate of approximately 1.5 centimeters per year. The trend was even more pronounced in the winter months. Winter wave heights, they found, had gone up by about 2 centimeters a year. If that doesn't sound like much, add it up: it's about one-half meter of growth over three decades. And that's just the "normal" waves.

Ruggiero, Allan, and Komar found that over the same period the biggest of the big waves also grew, and at a rate that's outpaced the mean waves. The height of these maximum winter waves has been increasing at about 10 centimeters a year. Do the math here and the biggest of the big waves have ballooned by about three meters over three decades.

If all that still seems a little abstract, Ruggiero says think of these increasing wave heights as they relate to storms. Big storms make big waves. So it's not too surprising then that the number and intensity of winter storms have also increased.

Whether this change results from anthropogenic climate change or is an as-yet-unobserved, decades-long pattern isn't known for sure. But Ruggiero says one thing is clear: bigger storms means more flooding and erosion for coastal communities like Neskowin.

El Niño, a Little Boy Behaving Badly

Back on the north end of Neskowin, Bill Busch, Guy Sievert, Alex Sifford, and I are squinting through the

winter haze at the Pacific Ocean's aggressive waters.

"There's a lot of sand here, right now," says Busch.

"I know. It's wonderful," responds Sifford.

The tide is just about half in, which gives us about 14 meters of beach before the waves start. My three tour guides tell me I'm getting a rare glimpse at a beach that lately has been disappearing.

Earlier at the Neskowin Trading Company, Sievert told me he first bought property in town in 1997. It turned out to be a fateful year. That year saw the largest, most powerful El Niño of the 20th century.

El Niño—which means "boy" or the "Christ Child" in Spanish, due to the weather pattern's tendency to show up around Christmas—is a periodic, above-average warming of the waters of the eastern tropical Pacific. These warm waters, which form along the coast of South America, eventually find their way to the Pacific Northwest. Because warm water is less dense than cold water, sea levels during El Niños can be tens of centimeters higher than during non-El Niño winters. For coastal towns like Neskowin, that means trouble.

Neskowin flooded extensively during the winter of 1997–98. Intense flooding also continued the following winter. (The 1998–99 winter flooding was pinned to high tides and heavy rains.) Locals remember ocean water rushing down Hawk Creek, which empties into the Pacific. The water came in a torrent over the Salem Avenue Bridge, which crosses the stream, carries utility lines into town, and, most importantly, is the only public vehicle

access to Highway 101 and safety.

In 1997, Sievert's place was a vacation home not far from the beach. He now lives in Neskowin full time, in a house on a bluff overlooking his low-lying neighbors, including Sifford, who lives just one house back from the beach.

Sievert says moving to the hilltop—and out of harm's way—was a very conscious choice, and one his wife insisted on, following the 1997–98 El Niño and the heavy storms that came the following winter. It was probably a smart move.

From 1977 to the late 1990s, El Niños, and the large storms and the flooding they bring, became more prevalent. Some recent marine-science journal articles have suggested the frequency of major El Niños might increase with climate change. But the jury is out on whether these changes will continue. Unfortunately, for places like Neskowin, much of the damage has already been inflicted. Far worse than the flooding of the late 1990s was the erosion, which, unlike more gradual processes such as sea-level rise, can happen virtually overnight.

“We had to ask, ‘What happened to the beach?’ Those two winters were amazing,” says Sievert. “It’s pretty dynamic. We can lose 10 feet in a weekend.”

Ruggiero, Allan, and Komar have been studying this erosion. Looking at a historical record running from 1967 to 2002, the researchers found Neskowin lost roughly 70 meters of its beach to the Pacific. But by far the largest

percentage of this loss happened in the late 1990s. Those years saw not only an El Niño but also four 100-year storms (so named because, based on past records, they have just a one-percent chance of occurring in any given year). The beach has never fully recovered.

“Those storms caused very extensive erosion in a number of communities. And Neskowin and Rockaway beaches were two areas in particular that were especially hardest hit,” says Jonathan Allan.

Allan, who introduced Ruggiero to the NCHC, has probably been the most influential scientist working with the group. Starting in 2004, Allan began documenting coastal change at multiple locations along the coast, including several on Neskowin’s beach. His research confirmed what many locals already suspected: their beaches were disappearing. NCHC members who spoke with Oregon Sea Grant for this story say Allan’s research has greatly influenced their group’s approach to coastal hazards. But his work has had an even more direct effect.

Allan’s day job with DOGAMI involves creating Oregon’s official hazard maps. Coastal hazards Allan has mapped include everything from flood and tsunami inundation zones to landslide threats. Allan’s maps documenting flooding and erosion zones became the basis for the NCHC’s new building rules. Enter the land planners.

How Science Becomes Policy

Laren Woolley is the coastal shores specialist for the Oregon Department of Land Conservation and

Development, or DLCD. Woolley's agency oversees how and where structures can be built in Oregon. He began working with the NCHC shortly after it formed.

"This was kind of an amazing process," says Woolley about the group. "You had all the right things coming together. And a motivated group of citizens who had an issue and a county that was willing to step up to the plate and listen to them."

Woolley's job—with citizen input and the help of a number of other planners—was to help take Allan's hazard's maps and turn them into new building codes for Neskowin.

What the NCHC and Woolley created was what's called a hazards overlay zone. It works like this: the overlay zone follows Allan's hazards maps. Legally, it exists on top of—or overlaying—the area's existing building zones and requirements. This means if building owners were to build or remodel in Neskowin's hazards overlay zone, they would be required to follow the specific zoning rules that apply there, as well as the statewide and county- or city-specific rules set by DLCD. Woolley says the idea behind the new rules is to keep people safe, not to penalize homeowners.

"It was very important to us and the community that we didn't try to regulate people out of their property," says Woolley. "So the zone doesn't address if you can build a house, but how you can develop."

The NCHC's overlay zone recommendations range from raising the elevation of buildings—meaning new

buildings will have to rest on stilts to avoid first-floor flooding—to limiting dense construction and requiring that structures are built on a property's safest spots.

Like other building requirements, the process would work through a series of “triggers,” where existing homes and other buildings would be grandfathered in. But if somebody wanted to do a renovation or build on an empty lot he or she owns, that would trigger the new rules. What's unique here is that homeowners themselves are asking for these potentially costly new rules.

“I think we want our community to survive,” Sievert says. “We live right next door to one of the greatest hazards, and we want Neskowin to survive. So we're going to do these building codes so if the water levels follow Peter's [Ruggiero's] probabilities, those homes will still be standing and we can keep going.”

What Makes Neskowin Different

Taking my tour and talking with Busch, Sifford, and Sievert, I get the impression Neskowin is different. As we drive around town following the riprap and climbing the hill to the bluff near Busch's house, we not only see the spectacular erosion that almost sent some of his neighbors' homes into the sea, but we also pass million-dollar and multimillion-dollar houses. These belong to some of Oregon's most influential residents.

There's Dan Wieden's house, of the Portland-based advertising giant Wieden+Kennedy. Governor John Kitzhaber used to have a home here. The owners of the

McMenamin pubs and breweries have homes here, too, as do the Widmer brothers of the brewing company with the same name. Neskowin also contains an inordinate number of Ph.Ds. Busch is one of them. He taught oceanography at the University of New Orleans before he left after Hurricane Katrina. In short, Neskowin is educated, largely affluent, and very motivated.

“It’s an intelligent community. So when they said, ‘We’re having a problem here and we’re wondering if the commissioners could come down and listen to our problems,’ well, we did,” says Tillamook County Commissioner Mark Labhart, who gave the NCHC the county’s blessing and later become its chair.

He, like others who spoke with *Confluence* for this story, described the Neskowin project as “bottom up,” “grassroots,” and “unique.” Oregon Sea Grant Extension Specialist Pat Corcoran agrees.

“I’ve worked on projects where we’ve identified a community as being vulnerable and offered to help them become more resilient,” says Corcoran. “But, often—despite some pretty innovative approaches and methods—the local circumstances weren’t ripe for a sustained effort.”

Corcoran says Neskowin was different.

“Right away,” he says, “folks in Neskowin were very interested. And they had already done their homework on the problem and they were focused on doing something about it. They sought us out!”

Corcoran’s job with Oregon Sea Grant is essentially to

give Oregon's coastal communities the bad news about the coastal hazards they face. Often this involves facilitating meetings and other exchanges between community stakeholders and ocean scientists. But Corcoran says as important as this education is, he's always looking for a policy hook, a way to make the science extend to and work for the stakeholders he works with. He says the folks in Neskowin made his job a lot easier. They not only wanted him there, but they also drove the process.

"It ended up being a classic Sea Grant model between the locals, scientists, and managers thinking their way through these problems," says Corcoran. "My role was to facilitate local involvement with OSU researchers and students, serve the NCHC with things such as meeting facilitation and data management. And since then, we've been sharing what we learned from the folks in Neskowin with other communities."

Looking to the Future

Along with recommending building reforms, the NCHC, with funding from the state, hired a coastal engineering firm to perform an analysis of the sorts of engineering methods that might be used to soften the Pacific's blows on Neskowin's beach. The firm's recommendations ranged from "beach nourishment," or adding more sand, to building structures such as sea walls and breakwaters. But after reviewing their options, Neskowin's residents got sticker shock.

“The bottom line,” says Labhart, “is even though we’ve got some great ideas about putting in sea walls and breakwaters and sand nourishment, all those types of things are clearly going to be too expensive.”

What’s more, ESA PWA, the firm that performed the study, found that even before Neskowin can start these big projects, the town must consider its existing riprap. The firm’s report concluded the town’s two miles of rock protection just isn’t tall enough—it’s about eight feet too short—to fight the incoming waves.

Only it’s not quite that simple.

The problem is this: the cost of putting in riprap—a whopping \$500 a linear foot—is placed entirely on the homeowner (although some towns and developments pool the burden). Riprap is also, at its heart, just a big pile of rocks. That means it can’t be built straight up forever; if you tried, it might come crashing down. Consequently, for every foot up you build, you have to build about twice as far out. You get the idea: the cost of maintaining Neskowin’s existing riprap could be a potential drain on future engineering efforts.

And there’s another concern.

Extending the town’s riprap would encroach on Neskowin’s beach, which is publicly owned. And armored beaches aren’t popular with the public. So for now, Neskowin’s bigger engineering plans will remain just plans.

But where engineering faltered, the Neskowin Adaptation Plan is expected to succeed.

As of this writing, the plan is now with the Tillamook County Planning Commission. The commission will review the document—which has already been looked over by a second county-blessed citizen committee—before sending it on to Labhart and Tillamook County's other two commissioners for a vote.

Busch, Sifford, and Sievert say they're hopeful their representatives will okay their efforts.