

Scientist warns of rising carbon dioxide levels, ocean acidification at Romberg talk

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Rising levels of carbon dioxide in the atmosphere are turning oceans into an acid bath that could threaten the health of marine ecosystems on the West Coast.

That was the message Tessa Hill, an associate professor in the Earth and Planetary Sciences Department at the University of California at Davis, delivered to a packed house of scientists, students and local residents April 5 at the Romberg Tiburon Center for Environmental Studies.

Hill's talk was part of a Romberg center lecture series sponsored by the Barbara and Richard Rosenberg Institute for Marine Biology and Environmental Sciences.

Ten years of research into the effects of carbon dioxide on ocean acidification have led Hill to predict that if carbon dioxide levels continue to rise, the coastal environment could become "acidic and corrosive and stressful for animals for much of the year."

Hill, who works with a team at the UC Davis Bodega Marine Laboratory in Bodega Bay, began her talk with a sobering look at the increase in carbon dioxide levels in the atmosphere since 1979. While carbon dioxide levels fluctuate naturally according to season and plant coverage, they have risen alarmingly overall in the past forty years, according to data collected by the National Oceanic and Atmospheric Agency at monitoring stations across the globe. In 2010, carbon dioxide levels passed 400 parts per million and have not gone back since. Samples of ancient ice cores in the Antarctic show that the current level of carbon dioxide is the highest on Earth in 4 million years, Hill said.

"I've been studying climate change for

some time, but I cannot show this without feeling sobered (by it)," she said. "This is the context that we live in. This is the problem that we have to solve."

Ocean acidification is the "evil twin" of climate change, Hill said. Seawater absorbs carbon dioxide like a sponge, she said, taking up 30 percent of the carbon dioxide in the atmosphere. The amount of carbon dioxide in the world's oceans has risen on a similar slope to atmospheric carbon dioxide, she said.

But when carbon dioxide is added to seawater, it changes the water's chemistry, she explained, decreasing the water's pH level and making it more acidic.

That phenomenon adds to the already seasonal acidic conditions along the West Coast, Hill said, where seasonal winds contribute to the rise of cold, nutrient-rich water from the deep ocean that is also rich in carbon dioxide from decaying animals. That creates a patchwork of acidic areas along the coast that changes with the seasons.

Hill and her colleagues have been sampling the pH in shoreline waters along the West Coast every six months for five years, she said, "not enough time to separate the signal of natural versus human change on this system," she said in an interview. But scientific models predict that acidified areas will grow significantly in the coming years.

"What we predict, by 2050, because of human influence on the system, we will see those acidic waters bathing the coast for over half of the year," she said.

High carbon dioxide concentrations may actually favor some plant organisms, such as algae and sea grasses, which use it for photosynthesis, Hill said. But small shelled animals, such as oysters, mussels, limpets and tiny krill, cannot build strong shells

in acidic conditions because the seawater lacks the level of carbon ions they need. Laboratory experiments have shown that juvenile Olympia oysters exposed to acidic seawater are 30-40 percent smaller than ones grown in normal conditions, she said.

These animals form the base of the food chain for the coastal web of life, Hill said. For example, krill is the favorite food of whales, and sea otters eat mussels and urchins.

There will be winners and losers with ocean acidification, Hill said.

"The ones that we know so far who will be losers are the ones we care deeply about," she said.

Hill said there's a lot that can be done to tackle the problems of carbon dioxide and ocean acidification.

One innovative idea, she said, would be to harness the photosynthetic powers of sea grasses and salt marches that pull carbon dioxide out of the water.

However, those solutions would only "buy us some time," not solve the larger problem, she said.

"Implicit in this is that the problem is caused by climate change by greenhouse-gas emissions," she said.

Hill urged her audience to become part of the solution to climate change and ocean acidification.

"Every day, we make decisions that influence the trajectory of this problem," she told the crowd. "When we drive to work, the foods we eat. This problem is solvable by us, by the decisions we make."

Hill urged her listeners to take a stand for the support of evidence-based science in the face of climate-change deniers like President Donald Trump and members of his administration that have threatened budget cuts for federally backed climate research.

The Trump administration has proposed a total of \$126 million in cuts to the NOAA's Office of Oceanic and Atmospheric Research, including cuts to many programs that study sea-level rise and atmospheric climate change.

Hill said that some of the research she presented during the talk had come from the agency's California Sea Grant program, which would be eliminated under the Trump administration's proposed budget.

"Those agencies have been under threat ... that there will be decreases in their budget. But that is not set in stone. People should be speaking up for the importance of supporting science in this country," she said.

Meanwhile improving the coastal environment will build "resilience" to the inevitable changes in our oceans.

"This is like a train coming down the track, and we should be thinking about building resilience along the coast," she said. "We should be making smart decisions" including managing fisheries and pollution heading to the coast and tackling the fossil-fuel problem.

Hill said she remains hopeful a solution can be found, for the wellbeing of this generation and the next.

"I can't stand in front of a room of 18-20-year-old students," she said, "and tell them about this and not say clearly we are going to fix this, because we can't leave it the way it is."

Contributing writer Gretchen Lang of Belvedere covers the environment. She spent 15 years abroad writing for newspapers including the Boston Globe and the International Herald Tribune.