Our Ocean Backyard

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Can We Solve our Climate Crisis?

I try occasionally to write about good news about the ocean and the Earth, but depending upon what news sources you pay attention to, there are usually a lot more depressing environmental stories out there than encouraging ones.

I think it’s important to ask what sorts of information or presentations encourages or motivates people like you and I to act, to change our habits, reduce our consumption, and lower our use of energy in order to slow down this train we are on that is continuing to move us faster and closer to the edge of one climate disaster or another.

While we are surrounded by a multitude of indicators and warning signs of a changing climate, it’s difficult for most of us to truly understand the magnitude of these threats and the reality of where we are heading because we haven’t been there before. Then there are those who believe that the climate has always been changing (true), and that the eight billion people on the planet have nothing to do with it (not true - we have a lot to do with it).

My natural inclination as a scientist is to use facts and figures to convince people that we are in trouble; hit them in the head with data. As it turns out, this isn’t always particularly effective. We have truckloads of data, but this doesn’t impact some people’s thinking. People tend to be more affected when it hits them in the heart or in the gut - how the climate changes we are experiencing are going to affect them as well as their family and friends, if not already, in the near future.

A common response, and this is a big part of the problem, is why should I sacrifice my lifestyle and make changes if everyone else isn’t? To be clear, putting in energy saving LED light fixtures, in and of itself, isn’t going to save the planet. However, it’s a start, and California is a state with an outsized influence on environmental legislation and standards. Many other states and nations look to us to see what we are doing and often follow our lead. If we were a country, we would be the 5th largest economy on the planet. What we do here matters and reaches well beyond our borders.

Then there are those who are waiting for a technological fix and who believe scientists and engineers will fix all of our climate-related problems. We have created some massive challenges for ourselves, however, on such a huge scale that we are nowhere near having the capabilities or capacity to resolve these with technology.

To provide two examples of the magnitude of these problems. We have now increased the amount of carbon dioxide, the greenhouse gas that has the biggest impact on global warming, by about 50% since the Industrial Revolution in the late 1800s. Over this time period, roughly 150 years, we have emitted more than 2,000 gigatons of carbon dioxide into the atmosphere. That sounds like a lot - how much is a gigaton? One billion metric tons – in short, a lot of carbon dioxide. And we continue to add to that every year with 37 gigatons more emitted in 2021. The USA has about 4.2% of the world’s population, and perhaps not surprising, we emitted 14% of the planet’s carbon dioxide in 2021- way more than our share.

Are there mechanisms for removing some of that carbon dioxide to get Earth’s temperature under control? There are, both natural mechanisms, forests and farm fields, and plants in the ocean, are among the most important. But they need a lot of help, and on a global scale, we seem to be cutting down more trees than we are planting every year.

The technology also exists to chemically remove carbon dioxide from the atmosphere and ideally sequester it underground in rocks or in concrete. This is known as direct air capture. Power plants can do this on a modest scale. Cost estimates vary, but generally range from about $100 to over $600 per metric ton of carbon dioxide. And we emitted 37 gigatons or 37 billion metric tons of this greenhouse gas in 2021. At the lowest price of $100 per metric ton, it would cost $3.7 trillion to remove just what we emitted in 2021; at the higher cost this would cost over $22 trillion. Who is going to pay for this? And if we could somehow come together as a planet to do this, we still wouldn’t have touched the 2,000 gigatons of carbon dioxide that is already in the atmosphere.

It's also important to keep in mind that the atmosphere is huge, about 60 miles thick and has a total volume of roughly one billion cubic miles. Can’t we just stick hoses or pipes up there and suck that carbon dioxide out of the atmosphere? I don’t want to throw a wet blanket on this, but we also need to be realistic.

About 25% of all of the carbon dioxide humans have emitted has been taken up by the ocean, and there are a few chemical reactions that occur between carbon dioxide and water. The upshot or end result of these reactions is an increase in free hydrogen in the water. This process is termed ocean acidification, or OA for short, and makes seawater more acidic.

The effects of a more acidic ocean are now being observed and studied and none of the changes are good ones. A number of key species of plankton that form the base of the oceanic food chains make shells out of calcium carbonate, as do shellfish and crustaceans like clams, oysters, mussels, crabs and lobsters. And calcium carbonate dissolves in acidic conditions, even mildly acidic. Coral reefs consist almost entirely of calcium carbonate, which are beginning to be affected.

The more carbon dioxide in the atmosphere, the more of that gas enters the ocean and the more acidic that seawater becomes. This spells survival problems over time for all of those marine organisms that make their shells of calcium carbonate, and for all of the marine life higher in the food chain that depend on these organisms.

Can’t we somehow remove the carbon dioxide out of the ocean, or add something to return seawater to its original or natural chemistry or pH? There is a scale problem again, like with the atmosphere. The oceans of the world hold about 320,000,000 cubic miles of seawater and their average depth is 12,000 feet. That is an immense volume of water to somehow treat to return it to its pre-human chemistry. Again, we need to be realistic.

There is a much simpler, more practical, workable, and affordable approach to begin to reduce the human impacts on both atmospheric and ocean chemistry. And we already have the technology and have begun this process. We need to move to renewable sources of energy now, primarily wind and solar, and perhaps small-scale nuclear will also have a role. We know the impacts of these energy sources and we need to minimize them, but we can’t get caught up in paralysis by analysis and simply continue our dependance on fossil fuels. The longer we wait, the more expensive it will become, and the greater will be the impacts on the life on the planet and in the sea, which includes us and our families and friends. We all are involved and have a role and responsibility in this challenge, and there is no Planet B or C to move to.