

Our Ocean Backyard — *Santa Cruz Sentinel* columns by Gary Griggs, Director, Institute of Marine Sciences, UC Santa Cruz.

#212 June 12, 2016

The Limits of the Earth

Our ocean backyard is a huge climate moderator, usually making the temperatures here in Santa Cruz much more comfortable than just over the hill. Friday the 3rd of June I left Santa Cruz at a comfortable 81 degrees in mid-afternoon and when I hit Los Gatos it had climbed to 102 degrees.

The ocean has also moderated climate on a much larger global scale, not only by absorbing heat from the atmosphere, but also by taking up carbon dioxide that would have otherwise gone into the atmosphere, thereby compounding the greenhouse effect and raising temperatures further.

About a million tons of carbon dioxide from burning fossil fuels goes into the ocean every hour, which is slowing the rate of atmospheric warming a bit. But it's also having impacts on the oceans, primarily by making it more acidic, which has negative effects on certain marine life.

Humans have had to adapt to climate change throughout their entire existence on Earth. Ice ages or glacial periods have alternated with warmer interglacial periods throughout the past several million years, and early humans survived through migration and learning how to adapt to a changing climate.

A colder climate and the related drop in sea level during the last ice age allowed early humans to migrate from Asia to the Americas when there was a land bridge across the Bering Strait between Siberia and Alaska. Whether this migration and gradual southward advancement was by sea or land, or some combination, is still not clear, but they managed to reach Santa Rosa Island off the Santa Barbara coast by at least 13,000 years ago. They also either had constructed some sort of boat by that time or were really good swimmers.

The challenges civilization faces today from climate change, however, are far greater than early humans had to deal with. Two very important differences today are that the planet has well over seven billion more people to support, and that

most of these people are consuming far more resources, whether food, water, energy or minerals, than our ancestors did.

What has become clear in recent years is that it is physically impossible for the Earth to support the present population at anything like our own American life style and standard of living. There simply aren't enough resources to go around. Humanity today uses the equivalent of 1.6 Earths, and as a result, resources are being depleted at far greater rates than they are being replaced.

Groundwater is one example. Globally we are pumping water out of aquifers faster than rainfall is replenishing them, and California is no exception. Today about 660 million people around the world (1 in 11) lack access to safe drinking water, and with climate changing, existing fresh water shortages are expected to worsen. Treating waste water or making fresh water from the ocean may soon start to look better.

About 800 million people (1 in 9) don't have enough food today to lead a healthy active life. Yet soil is eroding in many places significantly faster than it is being replenished, which combined with the expected lower crop yields of wheat, rice and corn from a changing climate will make feeding an increasing population even more difficult.

If all 7.5 billion human beings on the planet were to enjoy a European standard of living, which is about half of the consumption of the average American, the Earth could only sustainably support about 2 billion people. If they were to enjoy our standard of living in the USA, it would take about four Earths. But we don't have four Earths.

Our ancestors were small in numbers and lived in places with enough natural resources to provide them with what they needed. It's a very different picture today and we all need to realize real soon that the longer the global population continues to increase and the longer that we consume more resources than the Earth can sustainably supply, the less able the Earth will be able to meet our future resource needs and the fewer people the planet can support long term.

There are two ancient proverbs that come to mind: No matter how far you have gone down the wrong road, turn around; and: dig a well before you get thirsty.