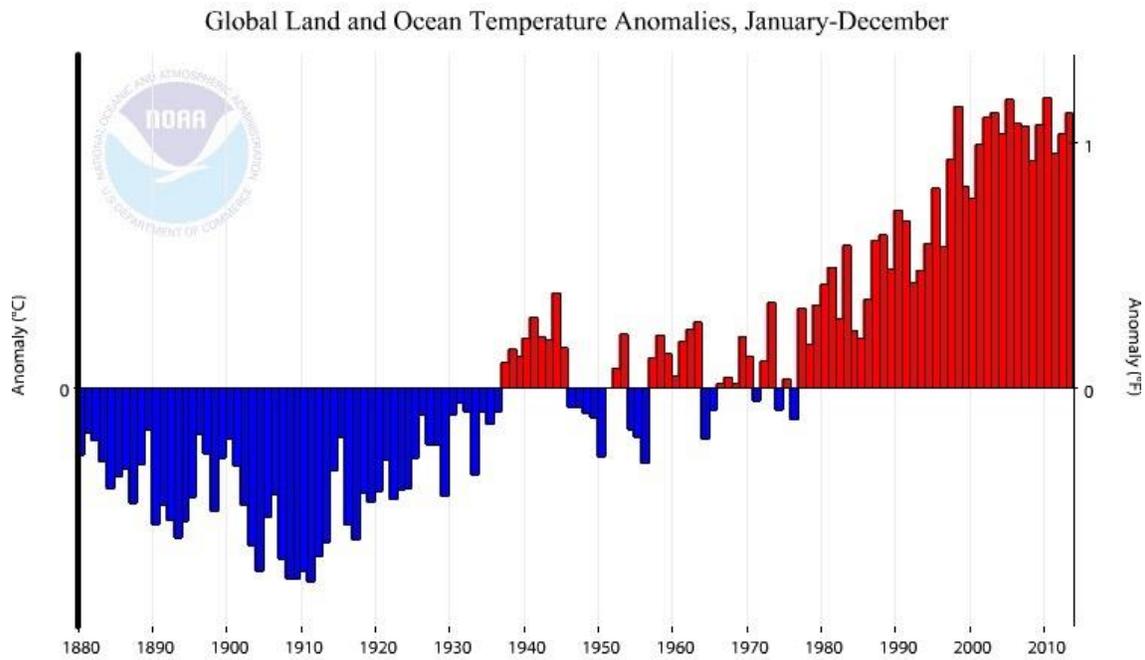


Our Ocean Backyard — *Santa Cruz Sentinel* columns by Gary Griggs, Director, Institute of Marine Sciences, UC Santa Cruz.

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Global Changes



I was looking back at some of my earliest columns written 8 years ago, and even in this short time period there have been some significant changes on the planet. The world population increased by about 800 million, growing from 6.6 billion back in 2008 to 7.4 billion in 2016.

In these 8 years we added the equivalent of the combined populations of Brazil, Pakistan, Nigeria, Bangladesh and Colombia, and we continue to add another 200,000 new people to the planet every day, or about 75 million every year. This concerns me a lot.

All those people are using energy, in fact more energy each year. And despite some good intentions and an increasing use of renewable energy, we are still

dependent on fossil fuels (coal, oil and natural gas) for about 83% of all of our global energy.

In 2015, the global population emitted about 11 billion tons of carbon dioxide, twice as much as 1980. It's a bit difficult to imagine a ton of carbon dioxide, much less 11 billion tons, but suffice to say, this is a very large volume.

Forty-four percent of that carbon dioxide came from just two countries, China and the USA. China has the dubious distinction of now being the largest emitter of carbon dioxide on the planet, generating 28% of the total, with the USA second with 16%. The entire European Union generates just 10%; India and the Russian Federation each produce 6%, Japan 4%, and all the other nations generate the remaining 30%.

Of that 11 billion tons, about 44% goes into the atmosphere, 30% is taken up by vegetation, and 26% is absorbed by the ocean. Since my earliest columns were written in 2008, the carbon dioxide content of the atmosphere has increased from 386 parts per million to 405 parts per million, and it's rising at an increasing rate.

We now have over 40% more carbon dioxide in the Earth's atmosphere than we did in the mid-1800s, when the industrial revolution was ramping up and we were just starting to burn increasing amounts of coal, oil and gas.

The analysis of long ice cores from Antarctica, which contain a record of the pre-historic atmospheric carbon dioxide concentrations, shows we are now experiencing the highest atmospheric concentration of carbon dioxide in at least the past 850,000 years. This also concerns me a lot.

Carbon dioxide molecules don't have political affiliations. They all trap heat, and their impacts have become even more evident since 2008. According to the official record keepers, NOAA and NASA, 2014 was the warmest year on record globally since we started keeping track in 1880; but 2015 surpassed 2014.

Fifteen of the 16 warmest years on record have occurred since 2001. In 2015, global temperatures tied or broke existing monthly records for all but two months of the year.

On the positive side, however, the U.S. carbon dioxide emissions actually peaked in about 2008 and have begun to slowly decline. So our efforts to reduce use of coal, increase construction of solar and wind plants, build more fuel-efficient cars,

and reduce our use of energy, including fossil fuels, is having an impact in the United States.

Also on the positive side, according to the U.S. Energy Information Administration, renewable energy is becoming the fastest growing energy source, but we have a long ways to go.

Climate change is very real and we can measure how fast it's taking place, whether increasing global temperatures, the acidification of the ocean, the melting of polar ice, extreme weather events, or migration and changes in the distribution of marine and terrestrial life. We haven't got any time to waste if we are going to slow down this train.