

Green Scene: The Acidifying Ocean

by Elaine Golds

(published by the TriCity News – January 11, 2013)

When the 18th United Nations Conference on Climate Change concluded on Dec 8, the 15 year old Kyoto Protocol was kept alive albeit in a much weakened state. An impressive number of 200 nations agreed to extend the agreement until 2020. However, given that the protocol covers only industrialized nations and some, including Canada, have already pulled out, the renewed protocol now covers only 15% of global greenhouse gas emissions. Nonetheless, these countries agreed to reduce their emissions 18% below their 1990 level by some time before 2020. Canada, which took the backwards step of pulling out of Kyoto a year ago, has been put to shame by these more progressive nations.

British Columbia has already been hit hard by the impacts of global warming and it's about to get far worse. Historically, we have relied on fish and forestry to sustain the economy of this province. The beetle outbreak, caused by winters that are no longer cold enough to kill beetle larvae, has hugely impacted forests across most of the province. Because beetle-killed wood is still being harvested, the full economic impacts of this timber loss have not yet been felt. However, by 2018, 16 major sawmills are expected to close in BC and lumber exports to the USA are predicted to drop by 50%. Following hard on the heels of our forests, our coastal marine environment appears to be next on the hit list of impacts from global warming.

Not all of the carbon dioxide from the burning of fossil fuels remains in the atmosphere where it traps heat. Luckily for us, approximately half of it has been removed thanks to natural processes, some of the so-called ecosystem services of nature. Of this half, about 20% has been taken up by terrestrial plants as they grow. (There is still no better way to remove carbon dioxide from the atmosphere than the simple act of planting a tree which sequesters carbon in the form of wood). The remaining 30% of this carbon dioxide has been removed by the oceans. However, as this carbon dioxide dissolves in the ocean, it reacts with water to form carbonic acid. As a consequence, the ocean has become more acidic. To date, the pH of the ocean has dropped by 0.1 units because of fossil fuel emissions. This may not seem like much but pH is calculated on a logarithmic scale. This drop in pH thus represents about a 30% rise in the concentration of hydrogen ions.

This increase in acidity is not uniformly distributed in the ocean; rather, it is concentrated in areas where deep waters upwell along some coasts. These upwelling waters also carry nutrients to the surface and thus create some of the most biologically productive areas in the ocean. One such area of upwelling is along the west coast of BC and the USA. The increasing acidity of the ocean here is now beginning to have an impact on the development of shelled organisms such as oysters, clams, scallops and mussels. That's because the increasing acidity of our oceanic waters is decreasing the concentration of carbonate in water; this carbonate is a critical compound required by all marine organisms with shells because they incorporate the carbonate into their shells. In a more acid ocean, their shells will essentially dissolve.

In the state of Washington, oyster growers are already reporting problems raising their larvae because of acidic waters. However, it is not simply the shellfish that people eat which are threatened by an increasingly acidic ocean. The food chain in the ocean is utterly dependent on a larger number of much smaller shelled creatures; these include copepods, pteropods and phytoplankton such as coccolithophores that form the basis of the food chain which sustains most fish species, including salmon and all marine mammals. If zooplankton and phytoplankton can no longer make their shells, they will die. If they disappear, then the fish and marine mammals that feed on them will starve. In tropical waters, coral reefs which account for much of the biodiversity of the ocean also require carbonate for their formation and are, thus, also under threat.

A more acidic ocean has been identified as an outcome of increased concentrations of atmospheric carbon dioxide for many years. What has stunned scientists is how quickly this problem has developed. Personally, I cannot image our ocean without salmon, whales or coral reefs. But estimates are the ocean will be dangerously acidic by 2050. I have never heard of a more compelling reason for us to reduce our greenhouse gas emissions than imagining an empty ocean bereft of its marine mammals, fish and reefs. Surely, we have an obligation to future generations to reduce our greenhouse gas emissions and stop this ecological catastrophe from unfolding.