Carbon Footprint

By Bonnie McKenna

In my last article, I discussed the connection between carbon dioxide (CO2) and the shells of the tiniest mollusks in the deepest ocean. The more I thought on the subject, the more I realized I wanted to learn more about my 'carbon footprint,' and its connection to our warming seas.

The concept of the name 'carbon footprint' originated from the term 'ecological footprint,' which was developed by Willian E. Rees and Mathis Wackernagel in the 1990s. The original footprint compared how much people demand as compared to what the planet can renew. In 2007, the name 'carbon footprint' was first used as a measure of carbon emissions when developing an energy plan for a city in the state of Washington. Today, the term is focused on the gases that are implicated as the cause of warming oceans and climate change.

Most of my research, and it is no means complete, comes through the world-wide-web; where a plethora of information can be found. Unfortunately, not every source includes the date of submission, but both www.eia.gov/energyexplained and www.epa.gov/ghgemissions have the most current information and a number of links to follow if you are interested.

'Carbon footprint' is the total amount of greenhouse gases (GHGs) produced directly or indirectly by any activity to fulfill a human need that requires energy that emits CO2. A 'carbon footprint' is measured in tons of CO2 equivalent (tCO2e) that is calculated by multiplying the emissions of each of the GHGs by its 100-year global warming potential (GWP).

Carbon dioxide, or **CO2**, is a natural, colorless and odorless GHG that is emitted when fossil fuels (i.e., natural gas, oil, coal, etc.) are burned. **CO2e** allows other GHG emissions to be expressed in terms of **CO2** based on their relative global warming potential (GWP).

Global Warming Potential (**GWP**) was developed to allow comparisons of the **global warming** impacts of different gases. Specifically, it is a measure of how much energy the emissions of 1 ton of a gas will absorb over a given period of time, relative to the emissions of 1 ton of carbon dioxide (CO_2).

Many of the chemicals found in the earth's atmosphere act as GHGs. Interestingly, without naturally occurring GHGs, the earth would be too cold to support life. The temperature would be approximately -2F or -19C.

When sunlight strikes the earth, some of it radiates back into the atmosphere as infrared radiation in a process called radiative forcing. GHGs absorb this infrared radiation and trap its heat in the atmosphere, creating what is termed the greenhouse effect. The result of this effect is believed to lead to global warming and climate change.

The major GHGs that are included in U.S. and International estimates:

- Carbon Dioxide (CO2) produced by burning fossil fuels for energy.
- Methane (CH4) comes from landfills, coal mines, agriculture, oil, and natural gas operations.
- Nitrous oxide (N2O) using nitrogen fertilizers, waste management and burning fossil fuels.
- Industrial gases are high GWP gases, which are human-made.
    - Hydrofluorocarbons (HFCs)
    - Perfluorocarbons (PFCs)
    - Sulfur hexafluoride (SF6)
    - Nitrogen trifluoride (NF3)

Other GHGs not counted by the U.S. include:

- Water vapor
- Ozone – technically a GHG because it has an effect on global temperature, but at higher elevations in the atmosphere ozone blocks ultraviolet light from reaching the earth's surface.

Scientists know with certainty that increasing GHG concentrations tend to warm the planet. The excess energy is absorbed by the oceans. As the oceans warm up, sea levels rise because warmer water takes up more room than cold water; not the melting ice caps.

As divers, we have seen one of the most visually dramatic effects on the marine ecosystem, coral bleaching; a stress response to warming ocean water temperatures that can lead to coral death. Many marine species, including plankton that forms the basis of the oceanic food chain for mollusks, corals, fish, and indirectly polar bears, penguins, and sea birds are altered as the species change location in search of ideal water temperature.

Rising temperatures are also suspected of directly affecting the metabolism, life cycle, and behavior of marine species. For many species, temperature serves as a cue for reproduction.

Temperature affects the number of male and female offspring for marine turtles, as well as some fish and copepods (tiny shrimp-like animals on which many other marine animals feed). Changing climate could, therefore, skew sex ratios and threaten population survival.

Warming waters could, therefore, be the knock-out punch for many species which are already under stress from overfishing and habitat loss.

Some scientists feel the most significant climate change challenge is to mangrove ecosystems. The amount of light reaching marine plants and algae dependent on photosynthesis is affected by the rising sea temperatures and levels.

An additional, but hidden consequence of the warming oceans is a multitude of marine animals are being deprived of oxygen. Less obvious than rising seas and coral bleaching – it is no less dangerous to marine life. According to the Scripps Institution of Oceanography, seventy percent of the planet is being changed in invisible ways that will have synergetic impacts on the marine ecosystems.

Just as humans have the power to wreak havoc with marine life, we can also mitigate global warming by reducing greenhouse gas emissions. Everyone can help slow global warming by reducing our 'carbon footprint.' Power down, make little changes to reduce energy use – and carbon emissions.

If you are interested in learning about your 'carbon footprint,' go to www.epa.gov/carbonfootprint-calculator.

Remember: Reduce, Reuse, Recycle, Refuse.

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