Useful Conversions and Relationships

Carbon Dioxide (CO_2), **Carbon** (C) and **Soil Organic Matter** (SOM) are **different.**

- One carbon dioxide molecule weighs 3.67 times as much as a carbon atom, and carbon weighs .273 times as much as CO_2.
- 1 CO_2 = 3.664 x C and 1 C = 0.273 x CO_2
- SOM contains roughly 55-60% Carbon by mass.
- A common conversion is SOM is 58% C and SOM x 0.58 = C
- 1 Gigatons (Gt) = 1 Petagram (Pg) = 1 billion metric tonnes = 10^{15}g
- One part per million (1ppm) of CO_2 in the atmosphere is equal to 7.8 gigatons (Gt or billion tonnes) of CO_2 or 2.125 Gt of solid carbon (for illustration, this is about a cubic kilometer of graphite)
- 1ppm by volume CO_2 in atmosphere = 7.80432 Gt CO_2 (2.125 GT of C)

Methane: This is a gas with the chemical formula of **CH_4** . It is the main component of natural gas and a potent greenhouse gas (GHG), more potent but shorter-lived in the atmosphere than carbon dioxide. It is produced by anaerobic respiration from bacteria, termites, and in the rumens of ruminant animals such as cattle. [CH_4 is roughly 30-100 times more potent a GHG than CO_2, depending on what time frames are being analyzed and what sources are being used.]

Nitrous Oxide: This is a gas with the chemical formula of **N_2O**. It is known as "laughing gas" due to the euphoric effects of inhaling it. Nitrous oxide gives rise to NO (nitric oxide) on reaction with oxygen atoms, and this NO in turn reacts with ozone. [N_2O is almost 300 times more potent a GHG than CO_2 over 100-year time frames.]

Note: When encountering calculations involving Methane and Nitrous Oxide, some writers will automatically convert them into their CO_2 greenhouse gas equivalents or CO_2e . It's important to consider what conversion factors and time frames are being used when reading articles that refer to CO_2e (although that information is not always included).

Note also: There is added confusion about determining percent of SOM or C in soil because it is frequently measured differently. Some samples are taken of the top 6 inches, some are taken to 30cm depth and some even deeper. This makes it difficult to compare scientific reports.

Additional items of interest:

- 1 acre = 0.405 hectare and 1 hectare= 2.47 acers
- Water holding capacity of soil roughly doubles for every 1% increase in SOM
- 11%-30% global GHG emissions come from the agriculture sector, especially when conversion of rainforest to agricultural land is considered. Greenhouse gas estimates attributable to agriculture could be significantly higher if food packaging, shipping, retail and food waste are also included in the calculations.

In short, current food and agriculture practices are a significant part of the climate crises.

Links: http://bio4climate.org/scenario-300/, https://www.facebook.com/bio4climate and @Bio4Climate

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