Spotlight on Climate

Do We Affect Climate? …and how!

As mentioned in our last column, we have known about the greenhouse effect since 1824. We know that our burning fossil fuels produces carbon dioxide (CO_2), which is a greenhouse gas, but is there more to the story? It turns out that we affect climate in many ways, and we need to understand them if we want to stop global climate change.

Since the Industrial Revolution we have produced about 2.4 trillion tonnes of CO_2. Despite the huge size of Earth's atmosphere, this has been enough to increase CO_2 concentrations from 280 parts per million to more than 420. Is this all from driving cars and burning coal?

Sure, most of our carbon footprint has been from burning fossil fuels, but other things we do also produce greenhouse gases. About one third of our carbon emissions come from "land use." You might ask, "How does using land result in emissions?" Well… it all comes back to life on Earth being made up of carbon. So, when we "clear" a patch of rainforest by burning it, we release lots of CO_2 into the atmosphere. When we remove a patch of sagebrush to build a parking lot, the sagebrush dies and decomposes, releasing CO_2. Same goes for any natural habitat that we replace with anything that contains less life. The carbon from those plants and animals ends up in the atmosphere.

One thing we think about less often: soil, itself, is a natural habitat with huge amounts of carbon. All that dead and decaying plant material, all those roots, worms, insects, fungi, and bacteria represent a lot of carbon. Soils take on more carbon when they absorb dead animals and dead leaves, and soils give off carbon as these dead materials decay. With industrialized agriculture, when we till the soil, we mix in oxygen, which speeds the decay of dead materials, thereby speeding up the release of CO_2.

Some farmers are working to reduce their CO_2 emissions by using low-till or even no-till and permaculture crops and practices. "Regenerative agriculture" is where farmers' put more carbon back into the soil than they release. In Germany, many farmers ferment crop byproducts like wheat straw, husks, and leaves and then mix this "compost" back into the soil. This not only stores carbon, but also feeds the community of soil organisms that build soil fertility. Improved fertility also reduces farmers' costs because they can apply less artificial fertilizer. This provides another climate change benefit because artificial fertilizers often release nitrous oxide (N_2O), another greenhouse gas.

Methane is another important greenhouse gas. While we produce much less methane than CO_2, it is actually a much more potent greenhouse gas than CO_2 on a gram for gram basis. We produce methane from growing rice, sewage treatment, and animal agriculture. Yes, cow burps and manure. We also release a lot of methane that escapes during fossil fuel extraction and from the decay of carbon materials that we place in our landfills. When we dump carbon-rich materials into our landfills, they use up available oxygen as they begin decaying. Once the oxygen is gone, all remaining decay produces methane instead of CO_2. This kind of decay in landfills currently produces more than 800 million tonnes of methane every year. Since methane is a more potent greenhouse gas, this is equivalent to about 19.2 billion tonnes of CO_2 per year.

By adding these greenhouse gases to the atmosphere, we have already increased the Earth's average temperature by 1.2 °C (= 2.2 °F). Among other things, these higher temperatures have already begun thawing the permafrost. Like soil, permafrost, is another massive repository of carbon. "Thawing permafrost has the potential to release 150 billion tonnes of additional carbon in the form of methane and CO_2 to the atmosphere by the end of the century if the Earth continues to warm.", says Regents Professor Ted Schuur at NAU's Center for Ecosystem Science and Society ($ECOS^S$). "It's likely that this release is already underway as documented by our research in Alaska. On the order of a third of a billion tonnes of additional carbon per year, and that level is expected to increase."

So, what can we do? Stay tuned, future ***Spotlight on Climate*** columns will address climate change solutions in detail.

Dr. Stefan Sommer, Stefan.Sommer@nau.edu
Center for Adaptable Western Landscapes
at Northern Arizona University
and the
Northern Arizona Climate Change Alliance (NAZCCA.org)

Larger logo: