

The Carbon Cycle: How Mother Nature Recycles Everything

With a lot of news lately about global warming and fossil fuels, so I thought it would be helpful to discuss the carbon cycle. The carbon cycle is a very important natural recycling process which we should all understand.

The carbon cycle is best described in two stages; the first being the purely natural process that has been taking place for eons before mankind came along, and the second is the effects that industrialized man has had on that cycle.

The natural carbon cycle begins with the fact that there are huge amounts of carbon in the atmosphere in the form of carbon dioxide, even though on a percentage basis it makes up a very small percentage of the air. And we cannot use any of the carbon dioxide in the air to build and fuel our bodies.

We have to rely on other forms of life to make that carbon available to us. And that, of course, takes place when green plants undergo photosynthesis in which the carbon in the carbon dioxide in the air is transformed into carbohydrates and from there into proteins, fats and all of the other components of plant and animal tissues. We are all, as Star Trek fans know, “carbon-based life forms”.

The photosynthesis process converts carbon dioxide and water into carbon-based compounds. And when we use these compounds to fuel our bodily processes, to build tissues and to do work, these compounds are said to be “burned” and they indeed are then converted back into carbon dioxide and water, as in any other “fire”. This is part of the carbon cycle.

Another part of the carbon cycle takes place in the ocean. Carbon dioxide dissolves in the ocean and there marine plants carry out the same photosynthesis as do land plants. And marine animals get their carbon by eating marine plants or other animals.

But in addition to that part of the cycle, carbon dioxide also becomes part of the mineral content of the ocean and becomes part of many marine organisms (oyster, mussel and clam shells, coral, etc.) as calcium carbonate. When these carbonate-containing animals die, they become part of the sediment at the bottom of the oceans. This is the process which, millions of years ago, formed the limestone over which all of us in the Hill Country live.

When plants and animals die, their tissues eventually degrade and return back to carbon dioxide which returns to the air, thus completing the carbon cycle. Also, when plants burn in natural forest or grass fires, the carbon is returned to the air as carbon dioxide. Some dead organisms settle into deep ocean areas and other places where there is little or no oxygen, and over eons of time and after being covered with deep

sediments, the carbon in these plant and animal tissues is converted to hydrocarbons: coal, oil and methane.

Mankind has introduced another pathway for organic carbon to be returned to the air as carbon dioxide: burning forests and fields to make new cropland, and burning the fossil fuels which were formed millions of years ago. These activities, which have greatly accelerated since the industrial revolution, are increasing the amount of carbon dioxide in the atmosphere. Carbon dioxide, methane and other gasses which strongly absorb infrared radiation capture the heat radiating from the Earth that would otherwise be lost to space, and thus contribute to increasing Earth's temperature.

For most of mankind's existence, we burned things to give us heat and to do work like powering our cars, and the burning produces carbon dioxide.

The newer "non-fossil fuel" sources are basically non-combustion processes that use the energy from the sun directly, to generate electrical energy or by capturing wind energy which is also directly formed from the sun's energy.

Efforts, worldwide, to reduce the destruction of forests and to reforest cut-over land help to capture large amounts of carbon dioxide in the cellulose of the new trees. This is called "carbon sequestration" and it traps carbon from the air and holds it in the trees until they die or are burned, thus reducing the amount of carbon dioxide in the air for a time. It is not clear if these efforts are making a significant difference.

Farmers, gardeners and anyone managing land have another reason to want to capture as much carbon as possible. Especially in the Hill Country, our soil is generally lacking in the amount of humus, or organic matter in general, and it is largely this soil organic matter which contributes to the soil health by feeding soil organisms, capturing and holding water, and generally making the soil more productive.

So grow more plants and return organic matter to the soil. You will be better off and so will our atmosphere.

Until next time...

Jim Stanley is a Texas Master Naturalist and the author of the books "Hill Country Ecology," "Hill Country Landowner's Guide" and "A Beginner's Handbook for Rural Texas Landowners." He can be reached at jstmn@ktc.com. Previous columns can be seen at www.hillcountrynaturalist.org.