Eco-Link

Linking Social, Economic, and Ecological Issues

Volume 10, Number 2

Global Climate Change

Our climate has been changing for millions of years with the advance and retreat of glaciers, volcanic eruptions and other natural disturbances. However, recent concerns are that for the first time, human activity may be having a significant impact on the climate. The global mean temperature seems to have risen by .5 degrees Celsius (.9 Fahrenheit) over the past 100 years. This has been attributed to global warming, caused by "greenhouse gases," which trap infrared radiation reflecting from the earth's surface. Carbon dioxide is considered the major culprit, since the burning of fossil fuels (hydrocarbons) releases billions of tons of carbon into the atmosphere annually.

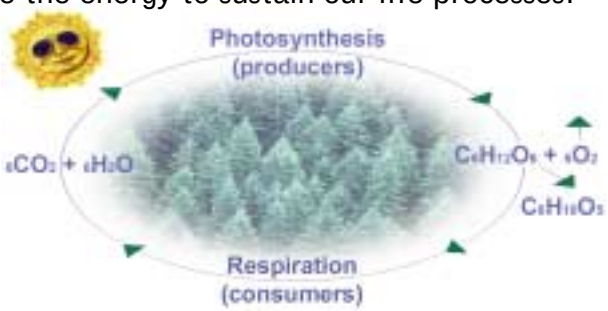
While there is still much debate about global warming, there is not much debate about the dramatic increase of carbon in the atmosphere. What we know for sure is that trees need carbon to grow, that they take carbon out of the atmosphere and that they produce oxygen. We also know that 90% of the world's energy is produced by burning hydrocarbons such as coal, oil and gasoline and that there is no short-term alternative that will significantly change this picture. However, forests can play a major role in sequestering carbon and improving air quality. Carbon is also sequestered in the wood products we use. It takes far less energy to produce wood than substitute materials, making wood the most energy efficient and environmentally sound building material.

While we are not sure how much of the current Global Warming is caused by human activity, we do know that it is occurring. We also know that climate changes have altered human history many times with droughts, Global Cooling, crop failure, disease and the collapse of great societies. Any rational person should be concerned about air quality, climate change and the potential impact on future generations.

Eco-Link is a quarterly publication of the Temperate Forest Foundation

Atmosphere

Ever since life began on Earth, the atmosphere has been an important resource for chemical elements and a medium for the deposition of wastes. It is a dynamic system, changing continuously. The physical movement of air masses, each with a different temperature, pressure, moisture, and aerosol content, produces weather and climate. Many complex chemical reactions take place in the atmosphere. These reactions change from day to night and with the chemical elements available in any given part of the atmosphere. The earlier plants that carried out photosynthesis released oxygen (the element that was their waste) into the atmosphere. The long-term increase in atmospheric oxygen, in turn, made possible the development and survival of higher life forms. For our biological ancestors and ourselves, oxygen became a necessary resource for respiration, the process by which we burn our internal biological fuels and provide the energy to sustain our life processes.



Serious consideration is being given to the possibility that global warming is in fact occurring as a result of increased emissions of gases that tend to trap heat in the atmosphere, or that global cooling is occurring as a result of increased particulate emissions from burning coal that reflect incoming solar radiation back to space.

The mean annual temperature of the earth has swung up and down by several degrees Celsius over the past two million years. Temperature has gone up and down with the glacial periods. Global climate has changed over time scales shorter than that of glacial-interglacial periods.

The sunlight that reaches the Earth warms both the atmosphere and the surface. The Earth's atmospheric system then reradiates the heat as infrared radiation. Water vapor and several other gases, including carbon dioxide, warm the Earth's atmosphere because they absorb and re-emit radiation. The trapping or warming is called the "greenhouse effect."

Threat

Clearly the greatest threat to our planet is global climate change. On the first Earth Day in the early seventies, there was a fear of Global Cooling. Using much of the same data, the fear now is Global Warming. The global temperature of the Earth depends mainly on the amount of sunlight received, the amount of sunlight reflected into space and the extent to which the atmosphere retains heat. The extent and speed at which humanity changes the climate depends to a large extent on the rate at which society adds additional greenhouse gases to the atmosphere.

During the major warming trend from 800-1200 CE, the Vikings colonized Iceland, Greenland, and North America. When glaciers advanced during the cold period around 1400, the Viking settlements in North America and parts of Greenland were abandoned.

Burning of fossil fuels instantly transforms sequestered carbon into the atmospheric carbon dioxide. Forests absorb carbon dioxide and release oxygen through photosynthesis, a process which reverses itself through decomposition and burning.

Approximately 200 billion metric tons of carbon in the form of carbon dioxide enter and leave the Earth's atmosphere each year as a result of a number of biological and physical processes. Therefore, current concern is about the burning of fossil fuels, which adds six billion metric tons of carbon to the atmosphere each year increasing the concentration of atmospheric carbon dioxide, and human activities, which emit other greenhouse gases such as CFC's, ozone, methane, and nitrous oxides.

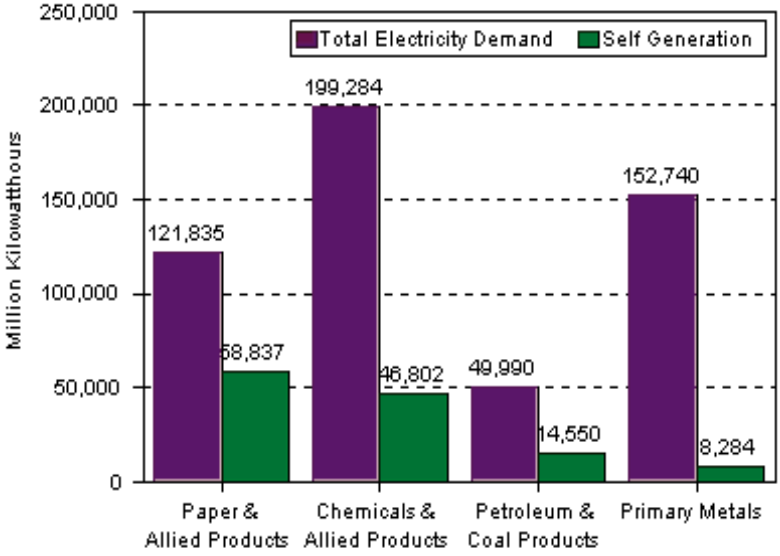
It is clear that carbon dioxide concentrations in the atmosphere have increased significantly since the industrial revolution. It is a reasonable hypothesis that these increases will continue to contribute to Global Warming via the greenhouse effect.

Carbon Dioxide is a greenhouse gas. It is essential to life on earth. However, adding billions of tons to the atmosphere annually may have undesired consequences.

Solution

One major goal for earth's environmental future is to reduce energy consumption. Energy use not only taxes non-renewable resources such as coal and oil, it also is the most significant contributor to global warming, or the greenhouse effect.

Forests and forest products play a critical role in reducing energy consumption and producing clean air. While there are environmental impacts associated with producing any material, wood has distinct advantages over others in three main areas: energy efficiency, carbon sinking, and its easy renewability through replanting. Wood is produced by trees right in the forest using free solar energy. Far less carbon dioxide is created when producing wood products as compared to non-wood substitute products. The forest products industry produces approximately 50% of its own energy requirements by converting waste wood into steam and electricity (co-generation). A typical sawmill produces enough energy from woodwaste to exceed its own energy requirement of 113 kilowatt hours per ton of wood produced.



The Largest U.S. Electricity-Consuming Industries and Their Generation, 1994.
Energy Information Administration

Wood is an excellent insulator and plays a major role in conserving energy. When trees are processed the carbon remains captured in wood products, which can last for decades or even centuries when treated properly. In addition, wood is biodegradable, reusable and recyclable.

To grow a pound of wood, a typical healthy tree uses nearly a pound and a half of carbon dioxide and gives off more than a pound of oxygen, helping to offset the greenhouse effect. However, the process reverses itself in an old forest with more wood decaying than growing: for every pound of wood decaying, a pound of oxygen is used and nearly a pound and a half of carbon dioxide is released back into the air. Wildfires emit millions of tons of carbon dioxide in the atmosphere, annually. Approximately 40 million acres of our national forests are at high risk of catastrophic forest fires.

The Forest Service's single most effective tool for maintaining forest health, reducing the risk of forest fires and limiting the spread of forest insects and disease is science-based, active forest management. Active management uses thinning, a full variety of scientific harvesting techniques, and prescribed burning to restore forest health, reduce the risk of catastrophic wildfire, and generate a wide range of forest uses, including fish and wildlife habitat. We need to support programs that address forest health issues, allow forests to be managed properly to prevent catastrophic fire and support continued access to forest lands to allow restoration to begin. Business, government and individuals all have an important role to play in solving these problems, and lasting improvements are now possible with the strong public support for sustainable forestry that has been established.

Man Shapes himself through decisions that shape his environment. *Rene Dubois*

Summary

A 1997 paper published by the University of Washington (Garcia, Oliver, Lippke) explains how forests can help reduce carbon dioxide emissions to the atmosphere. "Carbon exists in several forms (a.k.a. pools) such as in limestone rocks, fossil fuels (oil & coal), forest wood and carbon dioxide in the atmosphere. Carbon can move from one pool to another. The concern is that carbon is moving into the atmosphere very rapidly in the form of carbon dioxide emissions." The authors suggest three approaches to help reduce carbon dioxide emissions:

1. Allow the growing forest to absorb carbon (photosynthesis) and store it as wood in the forest.
2. Harvest the forest before it burns or decomposes and store the carbon in less rapidly decomposing forest products.
3. Use wood products as substitutes for aluminum, steel, concrete, brick, and other products that consume much greater quantities of fossil fuels (and release more carbon) in their manufacture.

It doesn't take long to convert the carbon in fossil fuels to atmospheric carbon dioxide, but it takes millions of years to create the fossil fuels. Perhaps we should find ways to rely more on renewable resources as we strive to build a sustainable society.

Glossary

I t's hard to make predictions, especially about the future.

Yogi Berra

Atmosphere - The thin layer of gases that envelope the earth. Is a great resource to all living things on the planet. Composed of gas molecules held close to the earth's surface by a balance between gravitation and thermal movement of air molecules. A force per unit area.

Biosphere - That component of the Earth system that contains life in its various forms, which includes its living organisms and derived organic matter (e.g., litter, detritus, soil).

Carbon Credits - The idea of putting carbon sequestration in the form of a commodity so we have a measurable uniform unit of that commodity to sell. Carbon is measured in metric tons (2,205 pounds). Can create partnerships between forest landowners and industry, while slowing down the accumulation of carbon in the atmosphere. Carbon sequestration credits are sold to industry as an offset for carbon emissions.

Cryosphere - The portion of the climate system consisting of the world's ice masses, sea ice, glaciers, and snow deposits. Snow cover on land is largely seasonal and related to atmospheric circulation. Glaciers and ice sheets are tied to global water cycles and variations of sea level, and change over periods from hundreds to millions of years. The ice sheets of Greenland and the Antarctic, which can be considered quasi-permanent topographic features, contain 80% of the existing fresh water on the globe, thereby acting as a long-term reservoir in the hydrological cycle. Any change in their size will therefore influence the global sea level. The breadth of the cryosphere also influences the amount of radiation reflected from the Earth's surface back into space.

Greenhouse Gases - Include carbon dioxide, chlorofluorocarbons (CFC's), methane, nitrous oxide, and ozone.

Pressure - Atmospheric pressure is 14.7 lb./in^2 at sea level. It decreases as altitude increases because there is less weight from the over-lying air.

Temperature - Refers to the relative hotness or coldness of materials such as air, water, soil, and living organisms. In a qualitative sense, temperate is a measure of thermal energy (heat). $^oC=5/9$ (F-32) C=Celsius F=Fahrenheit

Web links

NOVA/Frontline's What's up with the weather? - www.pbs.org/wgbh/warming
Pew Center on Global Climate Change - www.pewclimate.org
Time's Fixing Global Warming - www.time.com/time/reports/earthday2000/globalwarming.html
EPA Global Warming - www.epa.gov/globalwarming
Intergovernmental Panel on Climate Change - www.ipcc.ch
Global Change Homepage - www.globalchange.org/default.htm
NASA's Global Change Master Directory - gcmd.gsfc.nasa.gov
UN System-Wide Earthwatch Assessments - www.unep.ch/earthw/assess.htm
The Greening Earth Society - www.greeningearthsociety.org
National Center for Policy Analysis - www.ncpa.org/hotlines/global/gwhot.html

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