WOOD to ENERGY

Fact Sheet

Climate Change and Carbon

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Most scientists agree that our climate is changing as a result of human activities, particularly burning fossil fuels for power and transportation. Climate change includes alterations to weather patterns, such as extended changes in temperature, precipitation, or wind and is due to several factors, one of which is human-produced greenhouse gases (U.S. EPA 2007). Fossil fuels—coal, natural gas, and oil—are ancient deposits of carbon that have been buried beneath the earth's surface for millions of years. The combustion of fossil fuels releases greenhouse gases, such as carbon dioxide, which trap heat in our atmosphere and contribute to global climate change (UNEP 1997). Currently, using fossil fuels to generate energy is commonplace, but if we choose to use energy sources that release fewer greenhouse gases into the atmosphere, we can begin to positively affect our future. Wood is one energy source that is renewable and does not significantly contribute to an increase in atmospheric carbon dioxide.

Greenhouse Gases and Climate Change

Greenhouse gases, such as carbon dioxide, nitrous oxide, methane, and water vapor are naturally present in the atmosphere and allow visible light from the sun to warm the earth. These gases trap some heat inside our atmosphere to maintain temperatures that support life on Earth. The temperature of Earth is maintained by incoming solar radiation and heat loss to space. When additional greenhouse gases are added to the atmosphere, less heat is released, and Earth's surface is warmed. This process is commonly known as global warming and results in a gradual increase in average global temperature (U.S. EPA 2007). To better understand how this works, think about your car with its windows two-thirds open sitting in a parking lot on a sunny day. Some heat will escape through the open windows, while some heat will remain trapped inside. The car is warm when you come back, but not stiflingly hot. On the other hand, if the windows are cracked only one-third open, most of the heat cannot escape and becomes trapped inside the car. When you open up the door, the inside of the car is hotter than the outside temperature. The first scenario is similar to what happens with normal levels of greenhouse gases in the atmosphere; the second is what happens when there is a build up of greenhouse gases in the atmosphere. Of all the greenhouse gases, levels of carbon dioxide have increased the most in recent years, and scientists credit this rise as the largest contributing factor in global climate change (UNEP 1997). Reducing carbon dioxide emissions is an important part of slowing global climate change.

The Carbon Cycle

Carbon cycles continuously through all plants and animals, soils, oceans, and the atmosphere (Figure 1). This cycle results in a natural balance of carbon dioxide levels. Carbon is a major part of the makeup and function of all living organisms. Humans get carbon from food. Green

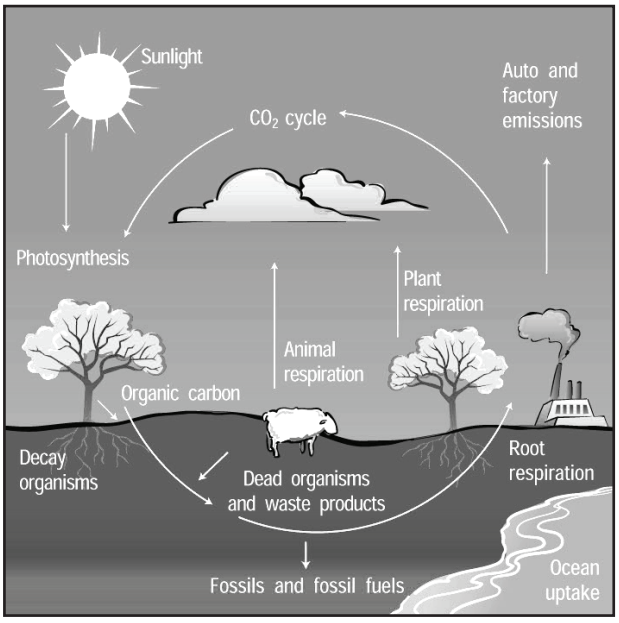

Figure 1. *Carbon continuously cycles through living organisms, soils, oceans, and the atmosphere.* Illustration courtesy of Windows to the Universe, http://www.windows.ucar.edu.

plants absorb carbon from the atmosphere during photosynthesis. In addition, living plants and animals store carbon as they grow and release carbon as they decompose (U.S. EPA 2007). The growing of trees and decomposition of wood represents a short-term carbon cycle, where growing trees convert carbon dioxide to wood and decomposing trees release carbon dioxide back into the atmosphere. Whether trees naturally decompose or are burned, carbon dioxide is emitted back into the atmosphere, replacing the carbon that was recently absorbed.

Conversely, fossil fuels are ancient carbon deposits that have not been part of the short-term carbon cycle for millions of years. When fossil fuels are burned, carbon dioxide is added to the atmosphere, not all of which can be absorbed by living organisms into the carbon cycle (Matthews and Robertson 2005). Uptake of carbon dioxide by land plants and oceans is not fast enough to prevent an increase in the overall amount in the atmosphere. Planting more trees to compensate for burning more fossil fuels, although helpful, is not a sustainable solution to global climate change. We do not have enough land area to continually plant enough trees to absorb and store the additional carbon emitted from burning fossil fuels.

Using Wood is Carbon Neutral

Unlike fossil fuels, wood represents a carbon-neutral source of energy. This means that using energy from biomass will not increase the overall amount of carbon dioxide in the atmosphere, if the production of the trees is managed on a sustainable basis (Matthews and Robertson 2005). This fact may sound surprising since combusting wood releases carbon dioxide into the atmosphere; however, the process of growing trees removes carbon dioxide from the atmosphere. Therefore, the carbon emitted from burning wood is reabsorbed as new trees grow. As long as we grow as many or more trees than we burn, woody biomass use contributes less to global climate change than using fossil fuels for energy generation (Box 1 and Figure 2).

Currently, at some level all renewable energy sources such as solar, wind, water, and wood require the input of fossil fuels. Planting, harvesting, transporting, and processing woody biomass currently uses fossil fuels. However, we could lessen the overall contribution of carbon dioxide into the atmosphere if the energy needed for these processes were to come from renewable sources. For example, biodiesel, a renewable fuel with low emissions, can be used in place of diesel fuel in many diesel engines.

Box 1. *How Is Wood Carbon Neutral?*

> Think of atmospheric carbon like a bathtub full of water, where burning wood represents the faucet and growing trees represents the drain. Wood is carbon neutral as long as we do not consume wood (run the faucet) at a faster rate than we grow trees (drain the water). Conversely, since we are not currently creating fossil fuels, burning fossil fuels represents running a faucet without a corresponding drain. As we all know, running a faucet without a drain will cause the water level to rise. The same thing happens with fossil fuels and atmospheric carbon. And when atmospheric carbon rises, climate change is accelerated. This is true for all fossil fuels, including natural gas.

Wood Is Renewable if Forests Are Replanted

Wood is a renewable resource that can be used as a fuel to produce energy. In managed forests, harvested trees are replanted through sustainable practices that

Figure 2. *Young trees sequester carbon from the atmosphere.* Photo Courtesy of the USDA Forest Service.

promote long-term forest health and productivity. If land is cleared for development and other uses, trees are not replanted in the same density as the original forest. This type of land conversion, called deforestation, contributes to global climate change because fewer trees are available to absorb and store, or sequester, carbon dioxide. Young, growing trees sequester additional carbon from the atmosphere. Old forests have some dead and dying trees that release carbon, and while large old trees represent carbon storage, they are not as effective as young trees at taking up carbon (Matthews and Robertson 2005). Thus, the cycle of growing, harvesting, and replanting trees can provide renewable sources of energy and sequester carbon dioxide from the atmosphere.

Landowners that practice sustainable forestry can receive a steady income through timber sales. Using trees for energy production provides landowners with an alternative market, and this economic incentive is another way to keep land forested rather than converted into development. Since growing trees sequester carbon dioxide, keeping land forested is another strategy for slowing global climate change. In fact, carbon credit systems are becoming more common and may help pay landowners to grow trees. In these systems, money is paid to forest owners for the amount of carbon their forest can absorb and store by those who are emitting carbon dioxide.

Summary

As the population continues to grow, we will need to find new solutions for our increasing energy needs. One important piece of this solution will be to reduce the overall amount of energy each person needs through conservation and increased efficiency. Options other than fossil fuels should be sought because increased amounts of carbon dioxide in the atmosphere from fossil fuels will escalate climate change. Communities should consider a variety of energy sources and decide how they can best plan for a sustainable future. Using wood to generate energy may be part of this discussion in some communities.

References

Matthews, R. and K. Robertson. 2005. Answers to ten frequently asked questions about bioenergy, carbon sinks and their role in global climate change. IEA Bioenergy, Task 38. http://www.ieabioenergy-task38.org/publications/faq/ (accessed on May 8, 2006).

United Nations Environment Programme, World Meteorological Organization. 1997. Common questions about climate change. http://www.gcrio.org/ipcc/qa/index.htm (accessed May 8, 2007).

U.S. Environmental Protection Agency. 2007. Climate change. http://www.epa.gov/climatechange/index.html (accessed May 8, 2007).

For More Information

To learn more about climate change visit http://www.epa.gov/climatechange and http://www.climatechange.unep.net. For more information about woody biomass and climate change, see the IEA Bioenergy's "Answers to ten frequently asked questions about bioenergy, carbon sinks, and their role in global climate change" at http://www.ieabioenergy-task38.org/publications/faq/.

For more information about using wood to produce energy, visit http://www.interfacesouth.org/woodybiomass and read other fact sheets, community economic profiles, and case studies from this program, or http://www.forestbioenergy.net/ to access a number of other resources.

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