Climate Change and Carbon Sequestration*

Environmental Effects of Woody Biomass:

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Background

The use of biomass for energy is becoming increasingly important as a resource to reduce greenhouse gas (GHG) emissions into our atmosphere (air) by replacing fossil fuels such as coal. Our atmosphere sustains life on Earth, maintains warmth, and shields the Earth from harmful radiation emitted by the Sun. With the advent of the Industrial Revolution, the mixture of gases and particles in our atmosphere began to change. While the primary gases in our atmosphere are nitrogen (N_2) and oxygen (O_2), the greenhouses gases water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (NOx), and ozone act like a heat blanket and are important in insulating Earth's surface.

The burning of fossil fuels has considerably increased atmospheric carbon and other GHGs since the beginning of the Industrial Revolution. When burned, coal and other fossil fuels release CO_2 and other gases into the Earth's atmosphere where they trap and reflect more heat than would normally occur, thus, affecting climate change. Because this carbon came from fossilized storage (carbon that was produced and stored millions of years ago), it represents a net addition into the atmosphere and more than can be sequestered (stored) by today's plants, soils, and oceans.

The buildup of human-caused GHGs in our atmosphere from burning fossil fuels can be mitigated through the process of carbon sequestration, or removing CO_2 from the atmosphere into long-lived carbon pools such as trees. The process of photosynthesis combines atmospheric CO_2 with water, releasing oxygen into the atmosphere and incorporating the carbon atoms into the plant cells. As a result, this carbon neutral process can help displace CO_2 emissions from burning fossil fuels (Figure 1). Finding sustainable ways to meet growing energy needs while reducing GHG emissions is one way to address the threat of climate change. While wind and solar power are increasing in popularity and prevalence, so is biomass. Versatile enough to provide heat, power, electricity, transportation fuels, and other products, woody biomass can be used to produce energy on a larger scale than solar and wind, in many cases. It is probable that a successful and sustainable short- and mid-term response to the threat of climate change will be comprised of a suite of renewable energy options that includes woody biomass.

Benefits

Woody biomass emits less GHG emissions than fossil fuels and if sources are replanted on a sustainable basis, the process of using woody biomass is essentially carbon-neutral (Figures 1). For every British thermal unit (Btu) produced by cellulosic ethanol from wood, grasses, or the non-edible parts of plants rather than gasoline, there is a total lifecycle greenhouse gas reduction of 90.9% (Malmsheimer et al., 2008). About 40 million dry tons of logging residues are available for bioenergy production in the United States annually. Utilizing these residues would displace about 17.6 million tons of carbon annually, or 3% of the total current

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carbon emissions from the electrical sector (Gan and Smith 2006). The cost of using logging residues for carbon displacement is $60 to $70/ton, considerably less than other mitigation options of $83 to $164/ton (IPCC, 2001).

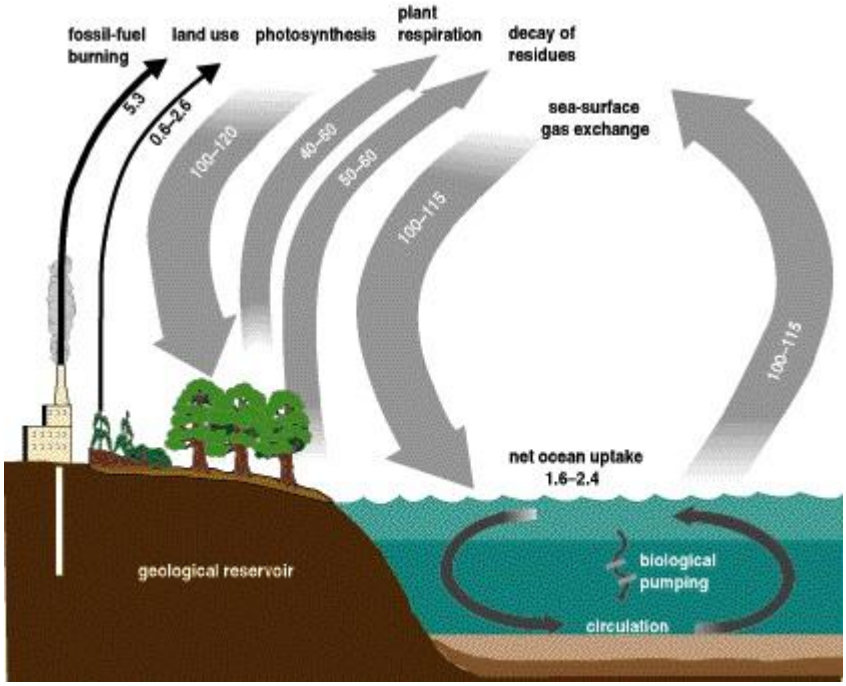

Figure 1. Burning biomass is a carbon neutral process. Oakridge National Laboratory

References

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