FOREST FACTS

Forests Not Fuel: Burning Trees for Energy Increases Carbon Pollution and Destroys Our Forests

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Forests cover 30 percent of the Earth's surface. They purify our air and water, control soil erosion, foster biodiversity, serve as habitat for wildlife, and provide us with places to hike, fish, hunt, camp, and enjoy undisturbed environments. Forests also serve as carbon "sinks," absorbing and storing vast amounts of carbon, making them one of our best defenses against global warming. In the U.S., we rely on the expansion of forest carbon sinks to offset approximately 13 percent[1] of our global warming pollution every year.

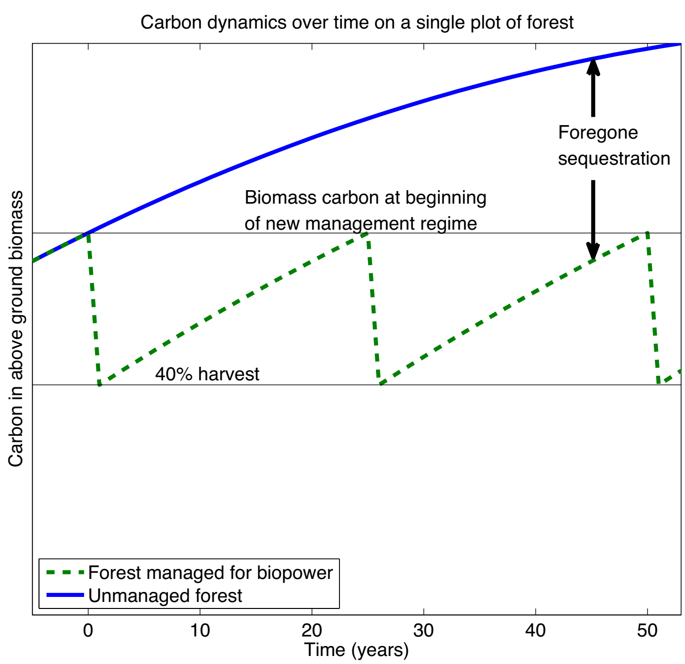
Power companies, facing pressure to find alternatives to fossil fuels like coal, are increasingly proposing to burn whole trees for energy instead. They are doing so under the mistaken assumption that, because trees can grow back, they are a "carbon neutral" fuel source, one that completely balances the production and use of carbon, resulting in zero net emissions. But just like coal, when trees are burned in power plants, the carbon they have accumulated over long periods of time is released into the atmosphere. Unlike coal, however, trees will continue to absorb carbon if left alone. So burning forests for energy not only emits a lot of carbon, but also degrades our carbon sinks.

NRDC believes we must quickly transition from burning dirty fossil fuels like coal for energy to renewable resources like wind, solar, and low-carbon biomass. But burning the worst forms of biomass, such as whole trees, will increase carbon pollution for decades at a time when we can least afford to. We need bioenergy policies that differentiate between biomass that delivers carbon benefits soon—for example, sustainably produced energy crops like switchgrass grown on non-forested land—and unsustainable biomass sources, such as whole trees. Only biomass that is carefully chosen, grown responsibly, and efficiently converted into energy can reduce carbon pollution and other emissions compared to fossil fuels.

BURNING FORESTS FOR ENERGY INCREASES CARBON POLLUTION AND DESTROYS ONE OF OUR BEST DEFENSES AGAINST GLOBAL WARMING

There are two main reasons why whole trees are a high carbon fuel source for electricity production. First, because freshly cut wood is nearly half water by weight, burning this wood emits about 40 percent more carbon pollution than burning coal to produce an equivalent amount of energy. So when wood is burned in power plants, a lot of energy goes into boiling off this water before useful energy can be generated. This makes biomass facilities far less efficient than fossil fuel plants, and lower efficiency means more wood must be burned to generate the same amount of electricity, increasing carbon pollution at the smokestack.

Figure 1: Aboveground carbon dynamics on unmanaged acre vs. acre managed for biopower[3]



Second, cutting down trees for energy production disrupts vital carbon sinks and impedes ongoing forest carbon sequestration. Even if replanted immediately, trees take decades to reach maturity. Young trees grow faster than old trees, absorbing carbon more quickly from the atmosphere. But a forest that is cut and replanted may not catch up to the carbon levels it would have achieved if left unlogged for many centuries, if ever. Taken together, this initial increase in carbon pollution at the smokestack and the lost sequestration add up to a large "carbon debt" that it can take new trees decades to repay.

UNDERSTANDING THE FOREST CARBON CYCLE IS KEY TO PROTECTING OUR FORESTS FROM BEING BURNED FOR ENERGY

In general, trees will continue to grow and absorb carbon if left untouched. When we account for the carbon impacts of bioenergy systems fueled by whole trees, we must account for this lost sequestration.

Let's consider what happens on a single forest acre under two management scenarios. In one, a forest manager chooses to leave the acre untouched. His trees continue to grow and absorb carbon out of the atmosphere, but the local power plant continues to use coal to generate electricity. In the second, the manager cuts his trees and sells the harvested wood to the nearby electric company to produce electricity, displacing coal.

Figure 1 shows what happens to carbon stocks under both scenarios. The unmanaged acre continues to absorb carbon out of the atmosphere, though at a slower rate over time, as shown by the blue curve. The acre managed for biopower takes about 25 years to re-grow to its initial carbon density.[2] This means that cyclical harvests—and therefore electricity production using the acre's trees—could happen once every 25 years, as shown by the dotted green line. In any year, the difference in carbon levels between the unmanaged acre and the acre managed for biopower is the carbon sequestration we lose by using trees for energy production instead of carbon storage.

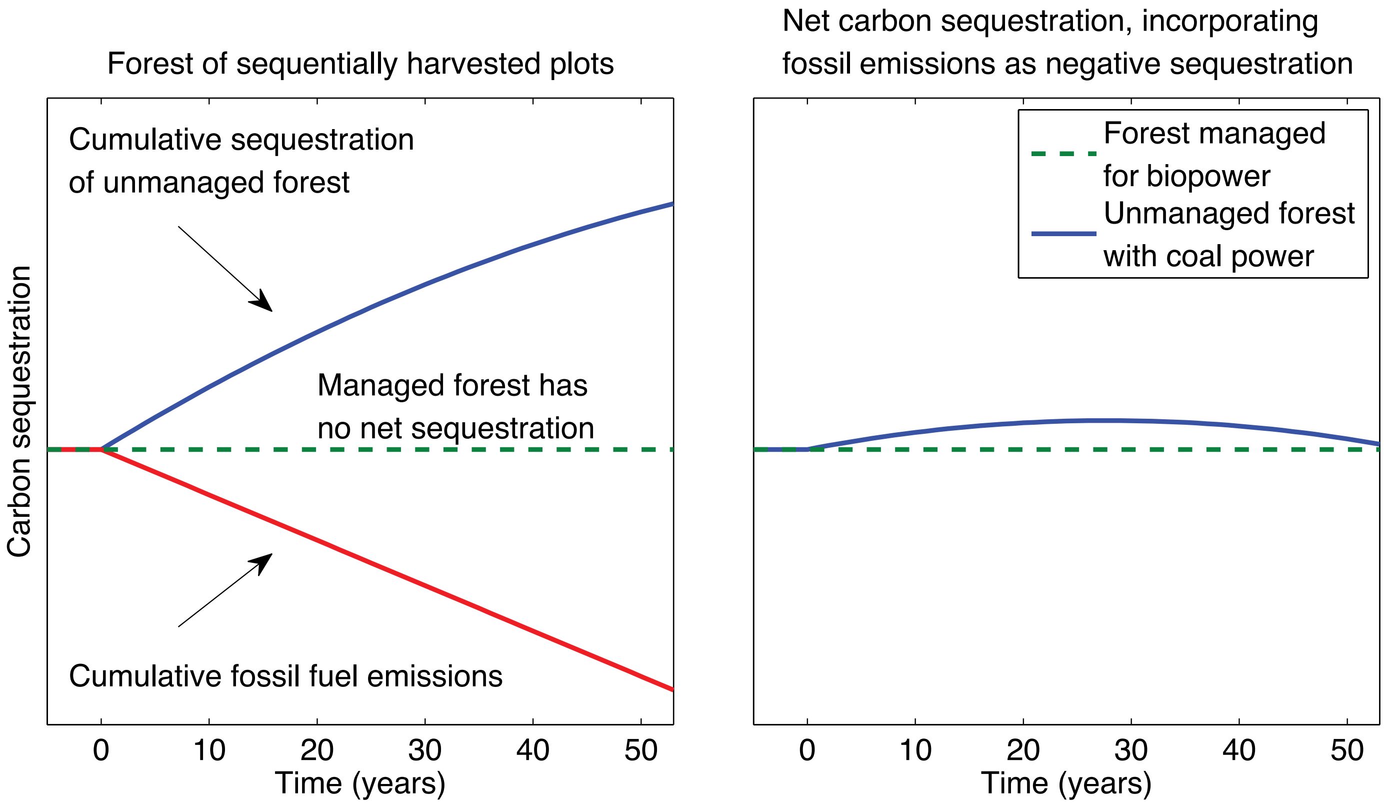
BURNING WHOLE TREES FOR ENERGY LEAVES MORE CARBON POLLUTION IN THE AIR FOR DECADES

Looking at carbon levels across the whole forest area used to supply fuel for a biopower facility, known as the "fuel shed", shows how long it takes a biopower system fueled by whole trees to break even with coal in terms of carbon emissions. The left panel in Figure 2 compares two possible scenarios for a 25-acre forest: one in which the forest is left unmanaged and one in which the forest is sequentially harvested to supply biomass for energy production, displacing coal.[4] The blue curve shows cumulative carbon sequestration over time in the unmanaged forest, equal to the sum of the carbon sequestered over all 25 acres. In the managed forest, 40 percent of the aboveground biomass—and, therefore, 40 percent of the carbon—on the most mature acre in the fuel shed is harvested each year. As shown by the dotted green line, the fuel shed as a whole maintains a constant level of carbon as harvesting on one acre is offset by growth and carbon sequestration on the other acres. The distance between the blue and green dotted lines shows the sequestration lost in any year as a result of shifting from coal to woody biomass as a fuel source for energy production.

The freshly cut trees from the managed forest are less energy dense than the coal they will replace. A power plant burning these whole trees would emit about 40 percent more carbon pollution than it would from coal combustion to produce the same amount of energy.[5] The red line in the left panel of Figure 2 shows total carbon pollution from coal combustion over time as a reduction in carbon sequestration. However, because the forest is left standing, the carbon it absorbs out of the atmosphere more than compensates for the carbon pollution from coal combustion.

The right panel in Figure 2 compares the net impact of the two scenarios on carbon pollution, including the combined effect of offsetting the carbon emitted from coal combustion with carbon sequestration in the unmanaged forest. Even after 50 years, the system in which the forest is left standing and the power plant continues to rely on coal is doing better in terms of carbon pollution. So not only is burning whole trees not a carbon neutral alternative to burning coal, but it results in increased carbon pollution in the atmosphere for decades.

Figure 2: Incorporation of carbon sequestration and emissions (left panel) into net cumulative sequestration over time (right panel)



DIFFERENT TYPES OF BIOMASS HAVE DIFFERENT IMPACTS ON CARBON POLLUTION

We cannot afford to wait more than 50 years for biopower systems to start delivering carbon benefits. Some forms of biomass, like whole trees, will increase carbon pollution for decades or longer, and cannot be considered sustainable. By contrast, short rotation energy crops like switchgrass, grown on non-forested lands, do not result in foregone aboveground carbon sequestration, and so can reduce carbon pollution or achieve carbon neutrality within 1 to 3 years.

For example, an unmanaged grassland does not become more dense aboveground, so while burning grass for energy still releases carbon in the first year, as new grass grows it sequesters carbon and the system quickly achieves carbon neutrality. Other examples of biomass that have the potential to quickly reduce carbon pollution include landfill gas, forest and crop residues that would otherwise be burned in the field (so that burning them for energy does not result in additional near-term carbon emissions), and annual crop residues that are not needed to preserve soil carbon stocks.

We need to develop low-carbon sources of biomass that can scale up sustainably and deliver real carbon savings compared to fossil fuels. Burning whole trees to produce energy is not the answer.

[1] Every year over 2005 through 2009, forest lands have resulted in a net sequestration of about 13 percent of net greenhouse gas emissions in the United States. See the U.S. Environmental Protection Agency's Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1999-2009; visit http://gov/climatechange/emissions/usinventoryreport.html

[2] Assumes ~40 percent of the aboveground biomass is harvested every 25 years. The example is meant to be illustrative of the carbon impacts of burning green wood to displace coal. Although calculations are based on one stylized case, the carbon dynamics presented apply in any circumstance where standing forest carbon is placed into a cycle with the atmosphere in this manner.

[3] Based on Manomet Center for Conservation Sciences Biomass Sustainability and Carbon Policy Study, June 2010. Assumes we start with ~32Mt of carbon in aboveground biomass at time = 0, and that if left unmanaged, the forest grows at a rate typical of Northeast forests.

[4] Before time=0, assumes the two forests are exactly the same, with all 25 acres managed for other wood products and so staggered in age, each acre one year older than the next.

[5] Assumes CO_2 emissions relative to energy produced of 899 lbs-CO_2/MMBtu for green wood and 642 lbs-CO2/MMBtu for coal, based on Manomet, June 2010. Also assumes 24 percent efficiency for biomass plants and 32 percent efficiency for coal plants.

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